

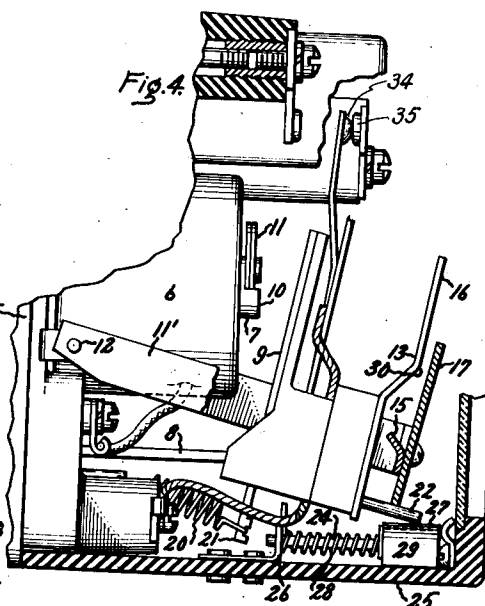
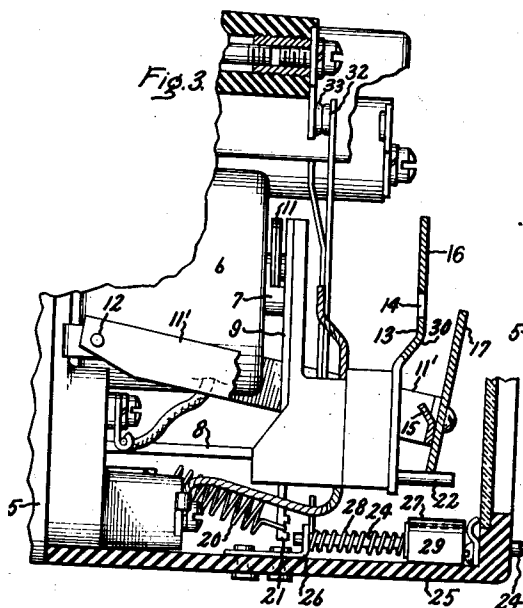
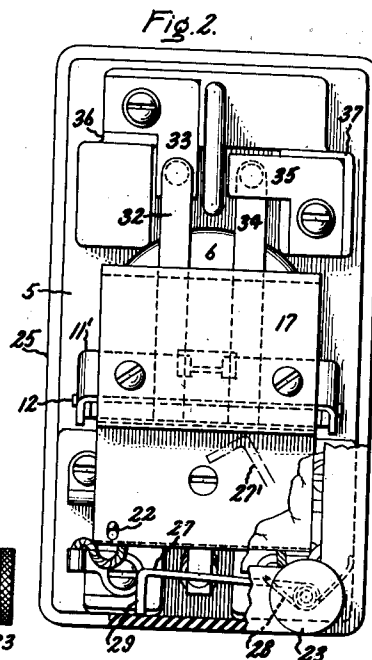
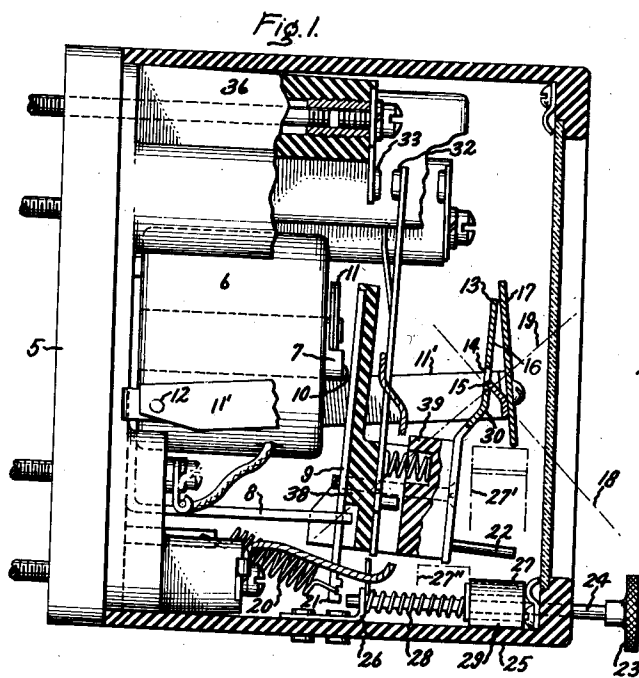
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RELAY

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2,253,142

RELAY

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8 Claims. (Cl. 200—87)

My invention relates to improvements in relays and more particularly electromagnetic relays for use in control systems to insure a single cycle of operations and then render itself inoperative to repeat such cycle without human supervision even though subsequently energized, as it was, to start the cycle.

It is frequently desirable to have a control arrangement for effecting a single cycle of operations on a sort of trial and error basis such that, if anything is wrong, the cycle will not be repeated. Thus, as disclosed in United States Letters Patent 1,943,096, dated June 9, 1934, a circuit breaker, opening in response to a fault, is automatically reclosed substantially instantaneously. If the circuit breaker reopens because the fault condition still exists, then it remains open subject to subsequent human supervision. This single cycle is controlled by a relay, examples of which are schematically illustrated in the several figures of the aforesaid patent.

My invention particularly relates to improvements in the relay shown in Fig. 3 of this patent, although its application is not limited to circuit breaker reclosing arrangements. As disclosed in this figure of the patent, the armature of the relay is held in an intermediate or latched position from which it is attracted upon energization of the relay winding. In the pick up movement of the armature the latch is released and moves out of the way of the armature so that, when the relay winding is deenergized, the armature falls back to a final position in which it is farther from the pole face than its original intermediate or latched position. In this final position the pick up current necessary to move the armature to the attracted position is greater than that which is normally expected to be available in the relay winding. Practically, this structure is reasonably satisfactory if the voltage of the station battery remains approximately constant at the value for which the relay coil is designed to provide the desired operation. However, the voltage of station batteries is not constant. Usually, due to the importance attached to such batteries, their voltage is maintained above the normal voltage. But sometimes the battery voltage is considerably below normal. Because of this wide range of voltages, it is difficult to encompass economically in a small space a single winding relay which will not, upon subsequent re-energization, reattract its armature from the final position even in spite of the increase in the air gap. Moreover, when such relays are used in alternating current control cir-

uits, the decreased reactance due to the greater air gap in the final position causes an increased current to flow in the relay winding which tends to cause movement of the armature to the attracted position in spite of the increased air gap. Of course, this difficulty can be overcome by the use of current limiting devices, such as a resistance in series with the winding of the relay, to limit the increase in current in the final position of the armature. Obviously this adds materially to the cost as well as increasing the space requirements for the relay mounting.

One object of my invention is to provide a relatively simple and economical relay whose armature is, when in the final position, subjected to a bias increment which is not based on an increase in air gap between the armature and its cooperating pole face whereby to obtain satisfactory operation over a wide range in current values whether direct or alternating without the use of current limiting devices and without danger of false operation while the armature is in the final position. Another object of my invention is to provide a simple and economical construction which embodies a target uncovering or disclosing arrangement and which functions to furnish the bias increment as well as to hold the armature in the intermediate position. A further object of my invention is to provide a simple arrangement for moving the armature from the intermediate position to the attracted position and also for moving the armature holding mechanism to the holding position and the armature from the final position to the intermediate position for engagement by the holding mechanism. These and other objects of my invention will hereinafter appear in more detail.

In accordance with my invention, I provide a relay whose armature is maintained in an intermediate position by means comprising a drop which is so arranged as to be released when the armature is moved to the attracted position from the intermediate position to uncover a target carried by the armature and further to increase the bias on the armature in the final position thereof. Also, in accordance with my invention, I provide two sets of contacts which are arranged to be controlled by the positioning of the armature such that in the intermediate position both sets of contacts are open; in the attracted position one set of contacts is open and the other set is closed; and in the final position vice versa. Also, in accordance with my invention, I provide a manually operable device

which can be operated from the exterior of the relay housing to effect movement of the armature to any one of its three positions.

My invention will be better understood from the following description when considered in connection with the accompanying sheet of drawings, and its scope will be pointed out in the appended claims.

In the accompanying sheet of drawings Fig. 1 illustrates a side elevation partly in section of a relay embodying my invention with the armature in the intermediate position; Fig. 2 is a front elevation partly in section of the embodiment of my invention shown in Fig. 1; Fig. 3 is a partial side elevation similar to Fig. 1 showing the armature in the attracted position; and Fig. 4 is a view similar to Fig. 3 showing the armature in the final position.

The relay shown in the drawing for the purpose of illustrating my invention comprises a base 5 of insulating material and for simplicity and economy preferably of moulded insulation, as shown. Suitably secured to the base 5 by means not shown is an electromagnet comprising a winding 6, a central magnetic core 7, an external magnetic member 8 and an armature 9 pivotally supported thereon. When the relay is to be operated from an alternating current source, the pole face 10 of the core 7 is preferably provided with a short-circuited winding 11 to maintain the attractive effect reasonably uniform during cycle variation of the energizing current.

For holding the armature 9 in the intermediate position shown in Fig. 1 with an air gap between the armature and a pole face 10 such that a predetermined current in the winding 6 will cause movement of the armature to the attracted position shown in Fig. 3, I provide a movable member, such as a yoke 11', which, as shown, is pivotally supported on the base 5 as at 12. This yoke is arranged to engage the armature and hold it in the intermediate position but to be releasable on movement of the armature to the attracted position. For this purpose the armature 9, as shown, carries a holding element 13, which is provided with a slot 14, engageable by a tongue 15 on the yoke member, as shown more clearly in Fig. 1.

In accordance with my invention, the holding member 13 is also arranged to function as a target to indicate an operation of the relay. For this purpose the outer upper portion or face 16 of the holding member 13 may be suitably painted or colored and arranged to be covered by a drop 17 which, in accordance with my invention, is arranged to be carried by the yoke 11' so that, when the armature is moved to the attracted position, the yoke falls to the position shown in Fig. 3 with the drop 17 uncovering the target 16.

In accordance with my invention, the holding or latching arrangement of the yoke 11' relatively to the armature 9 is such that the weight of the yoke and the parts carried thereby produces substantially no biasing effect on the armature while it is in the intermediate position. For this purpose, the angle of the tongue 15 in the armature holding position, shown by the dash and dot line 18 in Fig. 1, is such that the dash and dot line 19 through the armature fulcrum and the point of engagement of the tongue 15 with the target 16 is perpendicular to the line 18. With this arrangement, the weight of the yoke 11' and the parts carried thereby is resolved into two components, one of which is a direct thrust

on the armature fulcrum in the direction of the dash and dot line 19 and the other of which is a pull on the yoke pivot 12. Accordingly, the only possible bias the yoke and the parts carried thereby can produce on the armature, while in the intermediate position, is the frictional resistance at the latching point. For all practical purposes, this frictional resistance is negligible.

The armature 9 is biased from the attracted position by the weight of the armature and the parts associated therewith and a biasing spring 20, which is secured to the base at one end and has the other end adjustably positioned on an extension 21 of the armature, in order to provide for changes in the pick-up current necessary to actuate the armature from the intermediate position to the attracted position. Further, in accordance with my invention, I provide means for increasing the bias on the armature without changing the position of the spring 20 such that in the final position of the armature the current necessary to attract the armature from the final position is increased by a given percentage of the current which is sufficient to move the armature from the intermediate position to the attracted position so as to provide a wide range of current values without false operation of the armature from the final position. For this purpose I provide an arrangement for adding the suspended weight of the yoke 11' and the parts carried thereby to the armature 9 in the final position. Thus I provide the armature with a projecting member, such as a stop 22, which is so arranged in the path of movement of the yoke 11' or a part thereon, such as the drop 17 for example, as to receive the weight of the yoke and its associated parts after the armature has been moved to the attracted position and especially when the armature is in the final position. In this final position all of the weight of the yoke and the parts carried thereby except a slight component of pull on the pivot 12, due to the position of the yoke below the horizontal, is freely supported on the armature 9. This additional weight so increases the bias on the armature as materially to raise the pickup value of the relay and thus prevent undesired operation thereof.

Further, in accordance with my invention, I provide means for moving the yoke member to its armature holding position and at the same time to effect the movement of the armature to the intermediate position. As shown, this means comprises a manually operable knob 23 on a shaft 24 which extends inwardly through the front of the relay housing or cover 25 and is supported within the housing on a bearing bracket 26. Mounted on the shaft 24 so as to move therewith is an arm or crank 27 which is normally positioned vertically under the drop 17 and biased counterclockwise by suitable resilient means, such as a spring 28, to a position such that a bent-over portion 29 of the crank rests against the lower side of the relay cover 25. If the knob 23 is turned clockwise, as viewed in Fig. 2, the crank 27 is raised to the position 27' as shown in dot and dash lines in Figs. 1 and 2. During this clockwise movement of the crank 27, it engages the lower edge of the drop 17 and raises it until the arm 15 of the yoke 11' contacts the bent portion 30 of the armature target 16 whereupon the armature 9 is lifted slightly and the arm 15 slides across the face of the target 16 until the armature latching position is reached as shown in Fig. 1.

Since it may be desirable at the control of the

operator to place the relay in its lockout position shown in Fig. 4, I also provide means for accomplishing this result. As shown, this may be done by the same operating shaft and knob 23 and 24 as is used to reset the armature to the latched position. Thus, for example, the biasing spring 28, for turning the crank 27 counter-clockwise, may extend longitudinally of the shaft 24 as a compression spring between the bearing bracket 26 and the crank 27 whereby to bias the crank toward the front of the housing cover 25 and at the same time permit moving the crank toward the rear of the cover to a position 27' shown in dot and dash lines in Fig. 1. In this inner position the crank 27 lies under the target 16, which is secured to the armature, so as to move therewith so that, upon clockwise movement of the knob 23 and the shaft 24, the crank 27 turns the armature counter-clockwise, as viewed in Fig. 1, to the attracted position whereby to release the yoke 11' which can then drop to the position shown in Fig. 3. Then, upon release of the knob 23, the spring 28 turns the crank 27 counter-clockwise and moves it toward the front of the relay housing cover 25, as shown in Fig. 4. Thereupon, the armature drops to the final position with the weight of the yoke 11' and the parts carried thereby resting on the armature stop 22 so as to add an incremental bias which raises the pick-up point of the armature.

Relays embodying my invention are particularly adapted for controlling two sets of contacts 32, 33 and 34, 35, such that both sets are open when the armature 9 is in the intermediate position shown in Figs. 1 and 2; one set 32, 33 is closed and the other set 34, 35 open when the armature is in the attracted position shown in Fig. 3 and vice versa when the armature is in the final position shown in Fig. 4. For this purpose, the contacts 32 and 34 may be so mounted for movement by the armature 9 as to engage with their cooperating contacts 33 and 35, respectively, which are respectively secured to projecting portions 36 and 37 on the base 5. The movable contacts 32 and 34 may be resiliently supported in a cradle structure carried by the armature 9 and comprising insulating members 38 and 39, against the latter of which the lower portion of the target member 16 abuts.

While I have shown and described my invention in considerable detail, I do not desire to be limited to the exact arrangement shown, but seek to cover in the appended claims all those modifications that fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A relay comprising a winding, a pivoted armature movable in one direction to the attracted position and biased for movement in the opposite direction to a final position such that a predetermined current in said winding cannot effect movement of the armature to the attracted position, a target carried by said armature, a pivoted member for holding said armature in a position intermediate said attracted and final positions such that said predetermined current in said winding effects movement of the armature to the attracted position and the release of said member, a drop carried by said member for covering said target when the armature is in the intermediate position and for disclosing the target when the armature is in the attracted and final positions, a stop on said armature engage-

able by said member on movement of the armature to the attracted position for limiting the movement of said member and for increasing the bias on the armature by the weight of said member and said drop whereby to raise the value of the current necessary to attract the armature from said final position by a given percentage of said predetermined current, and two sets of contacts so controlled by the movement of said armature that both sets are open when the armature is in the intermediate position and one set is closed and the other open when the armature is in the attracted position and vice versa when the armature is in the final position.

2. A relay comprising a winding, a pivoted armature movable in one direction to the attracted position and biased for movement in the opposite direction to a final position such that a predetermined current in said winding cannot effect movement of the armature to the attracted position, a target carried by said armature, a pivoted member for holding said armature in a position intermediate said attracted and final positions such that said predetermined current in said winding effects movement of the armature to the attracted position and the release of said member, a drop carried by said member for covering said target when the armature is in the intermediate position and for disclosing the target when the armature is in the attracted and final positions, a stop on said armature engageable by said member on movement of the armature to the attracted position for limiting the movement of said member and for increasing the bias on the armature by the weight of said member and said drop whereby to raise the value of the current necessary to attract the armature from said final position by a given percentage of said predetermined current, two sets of contacts so controlled by the movement of said armature that both sets are open when the armature is in the intermediate position and one set is closed and the other open when the armature is in the attracted position and vice versa when the armature is in the final position, and manually operable means for moving the armature from the intermediate position to the attracted position whereby to release the pivoted member from its armature holding position.

3. A relay comprising a winding, a pivoted armature movable in one direction to the attracted position and biased for movement in the opposite direction to a final position such that a predetermined current in said winding cannot effect movement of the armature to the attracted position, a target carried by said armature, a pivoted member for holding said armature in a position intermediate said attracted and final positions such that said predetermined current in said winding effects movement of the armature to the attracted position and the release of said member, a drop carried by said member for covering said target when the armature is in the intermediate position and for disclosing the target when the armature is in the attracted and final positions, a stop on said armature engageable by said member on movement of the armature to the attracted position for limiting the movement of said member and for increasing the bias on the armature by the weight of said member and said drop whereby to raise the value of the current necessary to attract the armature from said final position by a given percentage of said predetermined current, two sets of contacts so controlled by the movement of said armature

that both sets are open when the armature is in the intermediate position and one set is closed and the other open when the armature is in the attracted position and vice versa when the armature is in the final position, and manually operable means for moving the armature from the final position to the intermediate position to be held by said pivoted member and for moving the armature from the intermediate position to the attracted position whereby to release the pivoted member from its armature holding position.

4. A relay comprising a winding, an armature movable in one direction to the attracted position and biased for movement in the opposite direction to a final position such that a predetermined current in said winding cannot effect movement of the armature to the attracted position, a movable member for holding said armature in a position intermediate said attracted and final positions such that said predetermined current in said winding effects movement of the armature to the attracted position and the release of said member, a stop on said armature engageable by said member on movement of the armature to the attracted position for limiting the movement of said member and for increasing the bias on the armature by the weight of said member whereby to raise the value of the current necessary to attract the armature from said final position by a given percentage of said predetermined current, and two sets of cooperating contacts actuated by said armature comprising contact means carried by the armature operative to open both sets of contacts when the armature is in the intermediate position and to close one set and to open the other set when the armature is in the attracted position and vice versa when the armature is in the final position.

5. A relay comprising a winding, an armature movable in one direction to the attracted position and biased for movement in the opposite direction to a final position such that a predetermined current in said winding cannot effect movement of the armature to the attracted position, a movable member for holding said armature in a position intermediate said attracted and final positions such that said predetermined current in said winding effects movement of the armature to the attracted position and the release of said member, and means on said armature engageable by said member on movement of the armature to the attracted position for limiting the movement of said member and for increasing the bias on the armature by the weight of said member whereby to raise the value of the current necessary to attract the armature from said final position.

6. A relay comprising a winding, a pivoted armature movable in one direction to the attracted position and biased for movement in the opposite direction to a final position such that a predetermined current in said winding cannot effect movement of the armature to the attracted position, a target carried by said armature, a pivoted member for holding said armature in a position intermediate said attracted and final positions such that said predetermined current in said winding effects movement of the armature to the attracted position and the release of said member, a drop carried by said member for covering said target when the armature is in the in-

termediate position and for disclosing the target when the armature is in the attracted and final positions, a stop on said armature engageable by said member on movement of the armature to the attracted position for limiting the movement of said member and for increasing the bias on the armature by the weight of said member and said drop whereby to raise the value of the current necessary to attract the armature from said final position by a given percentage of said predetermined current, two sets of contacts so controlled by the movement of said armature that both sets are open when the armature is in the intermediate position and one set is closed and the other open when the armature is in the attracted position and vice versa when the armature is in the final position, and manually operable means for moving said pivoted member into position to engage and raise the armature to the intermediate position for latching by the member.

7. A relay comprising a winding, an armature movable in one direction to the attracted position and biased for movement in the opposite direction to a final position such that a predetermined current in said winding cannot effect movement of the armature to the attracted position, a target carried by said armature, a movable member for holding said armature in a position intermediate said attracted and final positions such that said predetermined current in said winding effects movement of the armature to the attracted position and the release of said member, means carried by said member for covering said target when the armature is in the intermediate position and for disclosing the target when the armature is in the attracted and final positions, and means on said armature engageable by said member on movement of the armature to the attracted position for limiting the movement of said member and for increasing the bias on the armature by the weight of said member whereby to raise the value of the current necessary to attract the armature from said final position.

8. A relay comprising a winding, an armature movable in one direction to the attracted position and biased for movement in the opposite direction to a final position such that a predetermined current in said winding cannot effect movement of the armature to the attracted position, a movable member for holding said armature in a position intermediate said attracted and final positions such that said predetermined current in said winding effects movement of the armature to the attracted position and the release of said member, means on said armature engageable by said member on movement of the armature to the attracted position for limiting the movement of said member and for increasing the bias on the armature by the weight of said member whereby to raise the value of the current necessary to attract the armature from said final position, and a plurality of contacts so controlled by the movement of said armature that all contacts are open when the armature is in the intermediate position and certain contacts are closed and others open when the armature is in the attracted position and vice versa when the armature is in the final position.

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