Jan. 28, 1936. H. M. STEVENS 2,029,137

ELECTRORESPONSIVE DEVICE

Original Filed Oct. 4, 1933

Fig. 1.

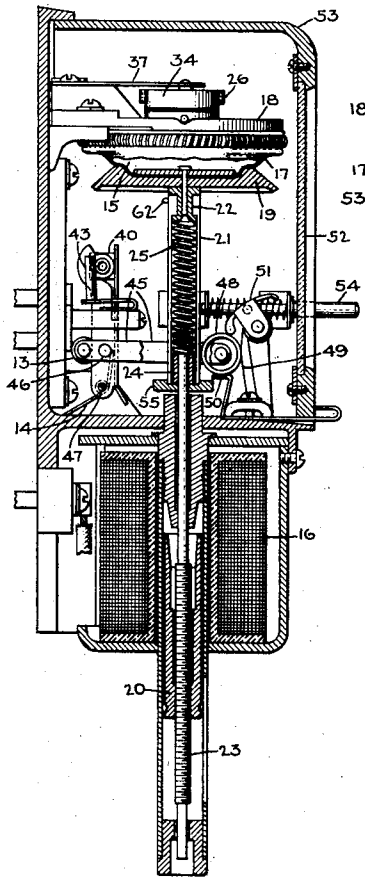


Fig. 2.

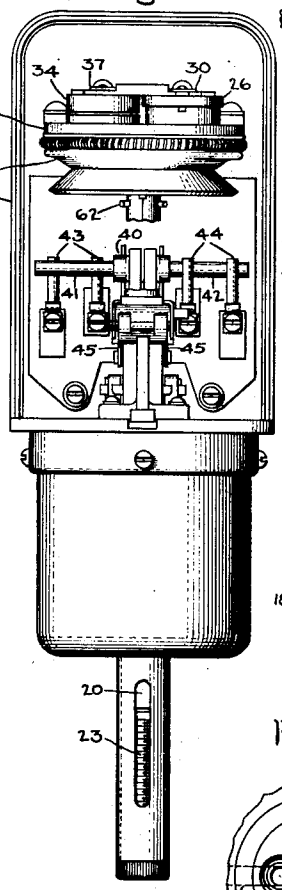


Fig. 3.

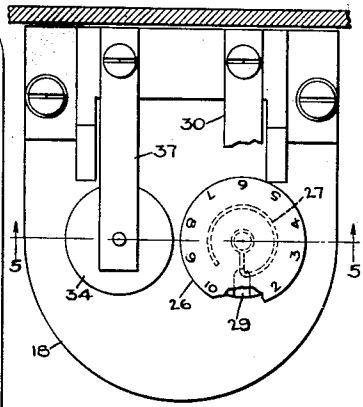


Fig. 5.

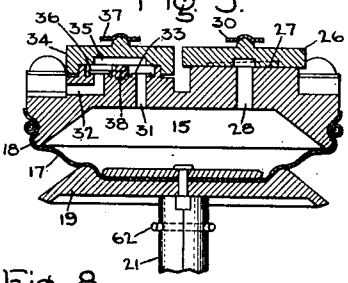


Fig. 8.

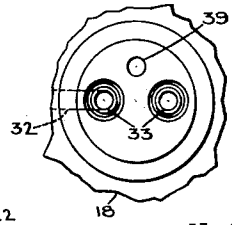


Fig. 9.

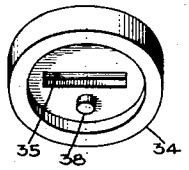


Fig. 4.

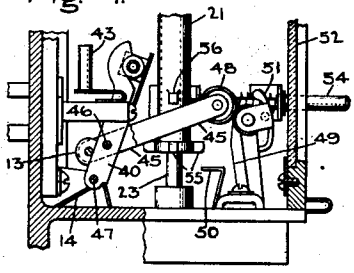


Fig. 10.

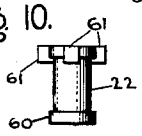


Fig. 11.

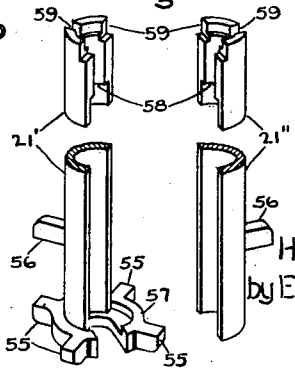


Fig. 6.

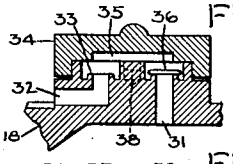
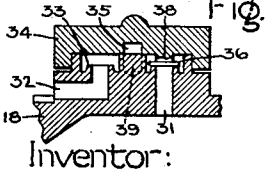


Fig. 7.



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by Harry E. Dunham
His Attorney.

Patented Jan. 28, 1936 2,029,137

UNITED STATES PATENT OFFICE

2,029,137

ELECTRORESPONSIVE DEVICE

Harry M. Stevens, deceased, late of Schenectady, N. Y., by Emmazean Stevens, executrix, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York.

Original application October 4, 1933, Serial No. 692,112. Divided and this application May 3, 1935, Serial No. 19,633

5 Claims. (Cl. 200—97)

This invention relates to improvements in electroresponsive devices and particularly relays which have a time action based on the flow of a fluid and which are adapted to a variety of functions. More particularly the invention relates to improvements in relays of the type disclosed in United States Letters Patent 1,532,003, issued March 31, 1925. One object of the invention is to provide an improved and simple unitary relay structure such that by a simple rearrangement of only a few of its parts the relay can function, when its drop-out occurs, either to leave its contacts in the circuit controlling position effected by the pick-up operation or automatically to restore its contacts to the circuit controlling position existing before the pick-up operation.

This application is a division of application Serial No. 692,112, filed October 4, 1933, for a Time element device.

The invention will be better understood from the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the accompanying drawing, Fig. 1 is a longitudinal sectional view, partly in side elevation, of a relay embodying the invention with the contact controlling mechanism in one circuit controlling position; Fig. 2 is a front elevation of the relay shown in Fig. 1 with the cover removed; Fig. 3 is a top plan view of the relay shown in Fig. 1; Fig. 4 is a part side elevation similar to Fig. 1 showing the contact controlling mechanism in another circuit controlling position; Fig. 5 is a sectional elevation on the line 5—5 of Fig. 3 showing the timing mechanism arranged for time delay pick-up and instantaneous drop-out; Fig. 6 is a sectional view similar to Fig. 5 of a part of the timing mechanism arranged for instantaneous pick-up and time delay drop-out; Fig. 7 is a sectional view similar to Fig. 5 of a part of the timing mechanism arranged for time delay pick-up and time delay drop-out; Fig. 8 is a top plan view of the control valve compartments of the timing mechanism; Fig. 9 is a perspective view looking into the cover for the control valve compartments; and Figs. 10 and 11 show respectively in elevation and perspective details of structural parts whereby the relay can be arranged for either manual reset or automatic reset.

In order to illustrate the invention, there is shown a relay having a time element mechanism of the type wherein a fluid containing chamber 15 of variable volume is provided with means including an electromagnet 16 for changing its volume. The chamber 15 is illustrated as of the bellows type wherein a flexible element or bellows 17 of any suitable material is secured to and between a support or head 18 and a disk 19 movable into the hollow of the head to collapse the bellows. The disk 19 is connected to the moving element or armature 20 of the electromagnet through an energy storing means illustrated as including a tubular member or sleeve 21 secured to the disk by a stem 22, an operating rod 23 adjustably positioned with respect to the armature 20 and provided with an enlarged end or plunger 24 within the lower end of the sleeve 21 and a spring 25 within the sleeve and between the stem 22 and the plunger 24. While, in so far as the invention is concerned, any suitable fluid may be used in the chamber 15, obviously air will be the more usual and convenient.

In order to control the time action of the relay, the chamber 15 is provided with a restricted passage for the admission and emission of fluid at a predetermined rate. This passage includes a timing valve 26 having a channel 27 of tapering cross-section extending between a port 28 into the chamber 15 and a port 29 into the air outside. In order to vary the extent of the opening between these ports and thus the time action of the relay, the valve 26 is preferably adjustably positioned on its seat on the head 18. For this purpose, it may be held in position by suitable means, such as a leaf spring 30.

The chamber 15 is provided with a relatively unrestricted passage and valve means for so controlling the flow of fluid in this passage that there may be a free flow of fluid either from or to the chamber or no flow at all. This unrestricted passage includes a port 31 into the chamber 15 and a port 32 into the air. Each of these ports terminates in adjoining valve compartments provided with valve seats 33 and a valve cover 34 which has a channel 35 to interconnect the two valve compartments under certain desired conditions, as shown in Figs. 5 and 6. The valve means further includes a valve or poppet 36 which may be placed on the valve seat in either compartment according to the action desired. In order that the position of the valve may be readily changed, the valve cover 34 is preferably removably positioned on the head 18. For this purpose it may be held in place by a leaf spring 37 in a manner similar to the arrangement used for the timing valve 26.

Assuming that it is desired to have the relay operate with a time delay pick-up and instan-

taneous drop-out, then the parts will be positioned as shown in Fig. 5. Now, if the relay is sufficiently energized to pick up its armature 20, the spring 25 will be compressed and the energy stored therein gradually released to force the disk 19 into the head 18 and thereby collapse the bellows 17. Under these conditions no air will be able to escape through the unrestricted passage because the valve 36 will be forced against the seat in its compartment. Consequently, the air has to escape through the timing valve 26 at a rate dependent upon the setting thereof.

Assuming now that it is desired to have a relay with an instantaneous pick-up and a time delay drop-out, then the valve cover 34 will be removed and the valve 36 shifted to the valve seat in the other compartment, as shown in Fig. 6. The valve cover 34 is then replaced with its channel 35 again extending between the valve compartments. Now, when the electromagnet 16 is energized sufficiently to pick up its armature 20, air can escape freely through the valve 36 and there will be no time delay action in the collapsing of the bellows. However, upon de-energization of the electromagnet 16 the expansion of the bellows will hold the valve 36 closely down on its seat thereby preventing any emission of air through the unrestricted passage. Consequently, whatever air enters the bellows will have to come through the timing valve 26 and the drop-out time of the relay will be dependent upon the position of this valve.

Assuming now that the relay is to operate with a time delay pick-up and a time delay drop-out, then the valve 36 is left on the valve seat in the right-hand valve compartment, as shown in Fig. 7. In this case, however, the valve cover 34 is turned in a direction such that its channel 35 does not connect the valve compartments. For an added safety feature to make sure that the valve is securely held on its seat, the valve cover may be provided with a lug 38 so positioned as to abut the upper side of the valve 36 when the channel 35 extends transversely of a line joining the valve compartments. Under these conditions, when the electromagnet 16 is sufficiently energized to attract its armature 20, the valve 36 does not permit the escape of any air from the bellows. Consequently, all air must escape through the timing valve 26 with a time action dependent upon the setting of this valve. Also when the electromagnet 16 is sufficiently deenergized for its armature to drop, no air can enter through the valve 36. All air, therefore, must enter through the timing valve 26 so that the drop-out is dependent upon the setting of this valve. The head 18 may be provided with a pocket 39 to receive the lug 38 when the valve cover is positioned as shown in Figs. 5 and 6.

The up and down movements of the armature 20 effect circuit controlling actions of contacts which may be circuit closing on the upward movement and circuit opening on the downward movement and vice versa or a combination of both. Thus, as shown in Fig. 2, a movable circuit controlling member 40 is provided with bridging contacts 41 and 42 which are arranged to control relatively stationary pairs of contacts 43 and 44 respectively so as to close contacts 43 and open contacts 44 on the upward movement of the armature 20 and vice versa on the downward movement. The circuit controlling member 40 is suitably biased for clockwise rotation by a spring 14.

For controlling the circuit controlling member 40 by the movement of the armature 20, there is provided a collapsible mechanism shown as of the toggle type. One arm of this mechanism may be formed by two spaced substantially parallel links 45, which are pivoted at 46 to the member 40 above its pivotal support 47. The free ends of the links 45 carry a roller 48 which engages an abutment 49 at such an angle as to hold the mechanism rigid. Overtravel of the links 45 beyond the reset or rigid condition position is prevented by a shelf 50 on which the roller 48 rests. Upward movement of the roller 48 is arranged to move the target 51 clockwise into the position shown in Fig. 4 where it is visible through the window 52 of the relay case 53 to show an operation of the relay. The target and the circuit controlling member 40 may be reset to the position shown in Fig. 1 by a manually operated push rod 54.

For collapsing the contact operating toggle mechanism to effect movement of the contact controlling member 40, there is provided one or more projections 55 on the sleeve 21 and preferably the sleeve is arranged intermediate the links 45 so that these projections will engage the links in the upward movement of the sleeve.

In accordance with the invention, the sleeve 21 is provided with one or more projections 56 extending transversely of the links 45 in one position of the sleeve so as to engage the links on downward movement of the sleeve whereby to reset the collapsible mechanism and restore the contacts to their initial circuit controlling position. Further, in accordance with the invention, the sleeve 21 is so arranged that it can readily be turned in a direction transverse to its longitudinal movement to permit the sleeve projections 51 to pass by the links 45 without any resetting action. For this purpose and in order to simplify the assembly of the relay and also the changeover, the sleeve 21 may be made as a split sleeve having two parts 21′ and 21″, as shown in Fig. 11. The right half 21″ slips into the base of the left half 21′ where it is locked around the operating rod plunger 24 by the flange 57. In order to prevent undesired rotation and longitudinal movement of the sleeve relatively to the other parts, both halves of the sleeve have recessed portions 58 and 59 for engaging projections 60, 61 on the disk stem 22 which is suitably secured to the disk 19. The two halves of the sleeve may be maintained in the assembled condition by any suitable means such as a spring lock ring 62, as shown in Figs. 1 and 2.

In the illustrated embodiment of the invention, the sleeve projections 56 are shown as extending in the path of movement of the links 45 so that the relay is arranged for automatic reset. To change to manual reset, the spring wire clip 62 is removed and the two halves 21′ and 21″ of the sleeve separated and turned 90° so that the projections 56 are no longer in the path of movement of the links 45. They are then put together and locked by the clip 62. In other words, they are now in a position where the projections 56 are between the links 45 so that on downward movement the sleeve does not engage these links to reset the toggle mechanism.

It will be observed that in relays embodying the invention one unitary structure serves to provide a wide latitude in choice of relay operations both as to time action and contact resetting, all without the necessity for any loose or substitute parts which may be readily lost and also practically without the need of any tools.

The invention has been explained by illustrating and describing a certain embodiment thereof, but it will be readily understood by those skilled in the art that it may be embodied in other forms than that shown and described. The invention should, therefore, not be restricted to the particular form of construction disclosed herein by way of example for the purpose of setting forth the invention in accordance with the patent statutes. The terms of the appended claims are, therefore not restricted to the precise structure disclosed, but are intended to cover all changes and modifications within the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A relay comprising relatively movable cooperating contacts, actuating means therefor including a collapsible mechanism, means for maintaining said mechanism rigid to hold said contacts in one position, means for collapsing said mechanism including a movable operating member, a projection on said operating member extending in the path of movement of said mechanism and engageable therewith on longitudinal movement of the operating member in one direction while the mechanism is collapsed to restore it to the rigid condition, said operating member being rotatable to a position such that said projection is out of the path of movement of said mechanism whereby longitudinal movement of the operating member in said direction while the mechanism is collapsed is ineffective to reset the mechanism.

2. A relay comprising relatively movable cooperating contacts, actuating means therefor including a toggle mechanism, means for collapsing said toggle mechanism including a movable operating member, a projection on said operating member extending transversely of one arm of said toggle mechanism in one position of the operating member and engageable with said arm on longitudinal movement of the operating member in one direction while the toggle mechanism is collapsed to reset the toggle, said operating member being rotatable to a position such that said projection can pass by said toggle arm whereby longitudinal movement of the operating member in said direction while the toggle mechanism is collapsed is ineffective to reset the toggle mechanism.

3. A relay comprising relatively movable cooperating contacts, actuating means therefor including a toggle one arm of which comprises two spaced members, means for collapsing said toggle including a movable operating member and a rotatably mounted split sleeve associated therewith and movable between said toggle members, projections on said sleeve extending transversely of said toggle members in one position of the sleeve and engageable with said toggle members on longitudinal movement of the sleeve in one direction while the toggle is collapsed to reset the toggle, said sleeve being rotatable to a position such that said projections can pass between said toggle members whereby longitudinal movement of the sleeve in said one direction when the toggle is collapsed is ineffective to reset the toggle.

4. A relay comprising a movable contact and actuating means therefor including a movable operating member for effecting a given movement of said contact when said member is moved in one direction, a segmental tubular member embracing said operating member movable therewith and rotatable relatively thereto and a projection on said tubular member operative in one position of the tubular member to effect a different movement of said contact when the operating member is moved in the opposite direction and in another position of the tubular member to effect no movement of the contact when the operating member is moved in said opposite direction.

5. A relay comprising a movable contact and actuating means therefor including a movable operating member for effecting a given movement of said contact when said member is moved in one direction and adjustably positioned means associated with said member operative in one position to effect a different movement of said contact when said member is moved in the opposite direction and in another position to effect no movement of said contact when the operating member is moved in said opposite direction.

EMMAZEAN STEVENS,
Executrix of the Estate of Harry M. Stevens, Deceased.