March 31, 1925.

1,532,003

O. C. TRAVER

RELAY DEVICE

Filed May 26, 1920

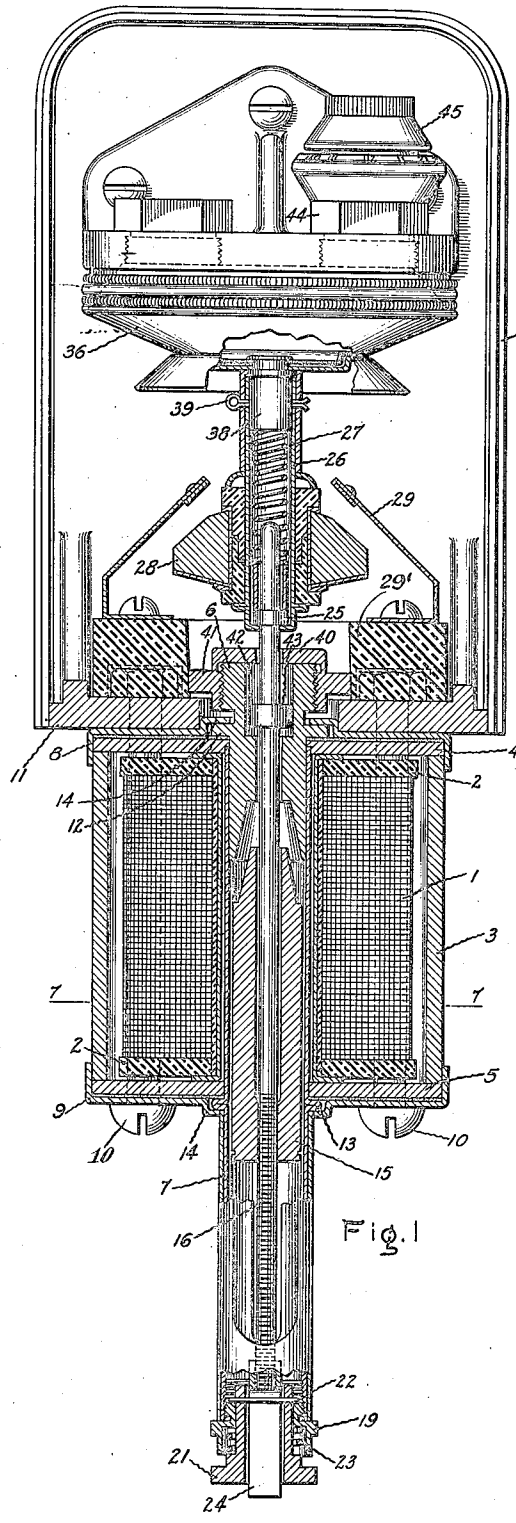


Fig. 1

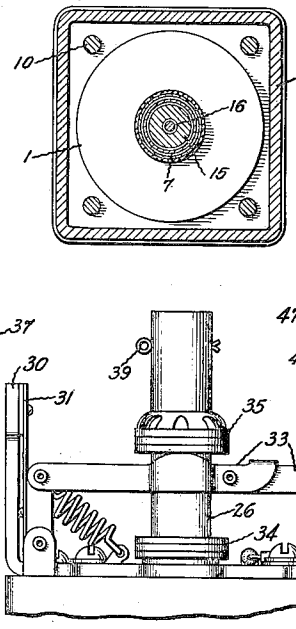


Fig. 2.

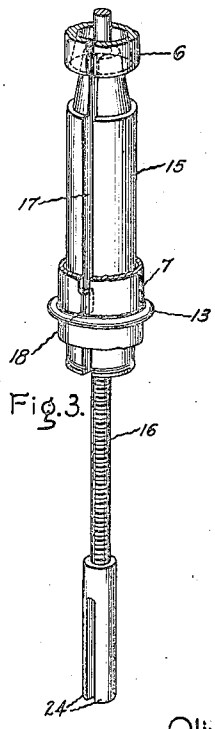


Fig. 3.

Fig. 7.

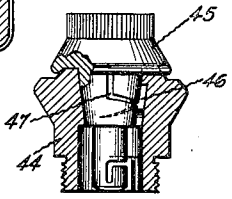


Fig. 4.

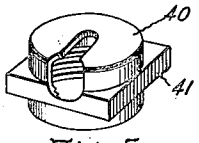


Fig. 5.

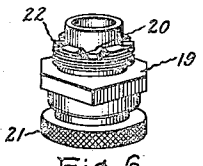


Fig. 6.

Inventor:
Oliver C. Traver,
by Albert G. Davis
His Attorney.

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UNITED STATES PATENT OFFICE.

OLIVER C. TRAVER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RELAY DEVICE.

Application filed May 26, 1920. Serial No. 384,338.

To all whom it may concern:

Be it known that I, OLIVER C. TRAVER, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Relay Devices, of which the following is a specification.

My invention relates to relay devices and has for its object to provide a relay device which can be easily assembled from unit parts, which is adapted to operate either instantaneously or with time limit characteristics. Another object is to provide an improved valve for regulating the flow of fluid in time delay devices using fluids, and still another object is to provide a relay which in details of structure to be hereinafter described is a marked improvement in similar devices heretofore known in the art.

The novel features which I believe to be characteristic of my invention will be definitely indicated in the claims appended hereto, while the features of construction and mode of operation will be understood by reference to the following description taken in connection with the accompanying drawing which shows the preferred embodiments of my invention and in which:

Fig. 1 shows in sectional elevation a relay device embodying the features of my invention, Fig. 2 is a modified form of contact operating structure; Figs. 3, 4, 5 and 6 are detailed views of parts of the structure shown in Fig. 1; and Fig. 7 is a sectional view taken along the line 7—7 of Fig. 1.

In Fig. 1, I have shown a relay comprising an actuating winding or solenoid coil 1 on the usual form of spool 2, and inclosed in a casing or housing. This housing is made up preferably of punched parts, and comprises a main body or tubular shell 3 surrounding the coil 1 and top and bottom plates 4 and 5 for closing the ends of the shell 3. Extending, and preferably slidable, through the top plate 4 into the coil 1, is a pole piece 6, and extending through the bottom plate 5 into the coil is a tubular member 7. This tubular member is slidable into the coil 1 and extends preferably through the coil to surround the end of pole piece 6.

According to my invention, I provide a simple means for rigidly holding pole piece 6 and tube 7 in position and at the same time securing the members of the housing together. This means comprises clamping plates or members, an upper plate 8 adjacent the top member 4 of the housing and a lower plate 9 adjacent the bottom member 5 of the housing. These plates have their edges bent at right angles to extend over the ends of the top and bottom members 4 and 5 and slightly along the sides of the body member 3 to form a sort of cap. These plates 8 and 9 are rigidly secured to the top and bottom members 4 and 5 and to the body member 3 by fastening means such as the screws or bolts 10, which extend through the clamping members and housing into a support 11. In order to utilize the same means for holding the pole piece 6 and tube 7 in position, I provide the pole piece and tube with flanges or shoulders 12 and 13 respectively, and the clamping members 8 and 9 are provided with cooperating offset portions 14. The shoulder 12 of pole piece 6 and shoulder 13 of tube 7 are engaged by the offset portions 14 of clamping members 8 and 9 respectively and firmly held in position between said portions 14 and the top and bottom members 4 and 5 respectively. The screws 10 and members 8 and 9 thus not only hold the housing members together but also hold the pole piece 6 and tube 7 fixed in position and supported by said housing.

Movably positioned within the tube 7 is an armature or plunger 15 controlled by the coil 1 and adjustably positioned relatively to the coil and pole piece 6 whereby varying amounts of current through the coil is required to raise the plunger. Movable by the plunger 15 is a rod 16 which extends freely through the tube 7 and pole piece 6. The plunger 15 is carried on rod 16 and is preferably threaded thereon and so arranged that rotation of the rod 16 with the plunger 15 held stationary causes the plunger to be raised or lowered in the tube 7. As a means for holding the plunger 15 against rotation, I provide the plunger, as best shown in Fig. 3, with a longitudinal slot 17 into which extends a tongue 18 carried by the tube 7. The tongue 18 in engagement with slot 17 holds the plunger 15 against rotation when the rod 16 is rotated to adjust the position of the plunger. In order to rotate the rod 16, and thereby adjustably position the plunger 15 in the tube 7, I provide a rotating or adjusting means

carried at the end of the tube 7. This means consists of a member 19 adapted to be screwed into the lower end of the tube and having a plurality of notches 20, as best shown in Fig. 6. Carried by the member 19 and concentric therewith is a cooperating rotatable member 21 carrying a pin 22 extending through the upper end of the member and engageable with notches 20 of member 19 to lock the member 21 against rotation. Member 21 is biased to locking position by a spring 23. In order to adapt the rod 16 for rotation in response to member 21, I preferably provide the rod with a bifurcated terminal portion 24 which straddles the pin 22 and extends through a central opening provided in member 21, as best shown in Fig. 3. Normally pin 22 is in engagement with notches 20 of locking member 19 and the adjusting member 21 is locked against rotation. By moving member 21 to releasing position, which is accomplished by pushing on the member, the pin 22 is moved out of slots 20 whereupon the member 21 is free to rotate the rod 16 and thereby adjust the position of the plunger 15. Tube 7 is provided with a cutaway portion and is provided with a scale so that the plunger 15 can be readily set to pick up at any predetermined current through the coil 1.

For actuating the circuit controlling contacts of the relay, the rod 16 carries near its upper end a collar 25 which slides in a cylindrical casing 26. In the casing is an energy storing means such as spring 27 which due to collar 25 is compressed when the rod 16 is moved upwardly by the plunger. The downward movement of the rod returns the casing 26 to its original position due to its engagement with collar 25. A movable bridging contact 28 in the form of a carbon cone is mounted on and insulated from the casing, and cooperates with fixed contacts 29 mounted on an insulating base 29′ to control an electric circuit. Instead of the arrangement of contacts as shown, the contacts may be of toggle operated type as shown in Fig. 2. In this arrangement the cooperating contacts 30 and 31 are held in engagement by the toggle members 33. The casing 26 carries two members 34 and 35, and in moving upward member 34 operates to trip the toggle members 33 and cause the contacts to open. In the downward movement of the casing 26, member 35 acts to automatically reset the toggle members 33 and close the contacts. If the contacts are to be reset by hand, the member 35 may be omitted.

According to the interrelation of unit parts, I am able to operate the contacts 28 and 29 of Fig. 1 either instantaneously or with a time delay as desired. In the arrangement shown in Fig. 1, the relay is adapted for time delay operation. The time delay is obtained by detachably connecting to the upper end of casing 26 a time delay device of unit construction such as the well known type of collapsible bellows 36. This bellows device is detachably secured as a unit to the base 37 and carries a depending pin 38 which extends into the end of casing 26 and is detachably secured thereto by a cotter pin 39. In this type of relay device, the upward movement of rod 16 by the plunger 15 stores energy in the spring 27 which thereupon exerts its energy in lifting casing 26 and contact 28 against the action of the time delay device 36.

To limit movement of rod 16, I provide an adjustable stop in the path of movement of the rod, and the particular structure used comprises a cap or stop member 40, best shown in Fig. 5, which is threaded upon the top or head of pole piece 6. This cap member 40 is provided with a plural sided flange portion 41 adapted to cooperate with a similar shaped portion cut out of base 29′, so that with the member 40 adjusted and in position in the base 29′ it is locked against rotation. The head of the pole piece 6 is counterbored to provide a recess 42 which is closed at the top by the adjustable stop member 40. Rod 16 carries a collar 43 which is movable in this recess 42, the extent of upward movement of rod 16 being limited by the engagement of collar 43 and stop 40. By the use of this adjustable stop member 40 and varying tensions of spring 27, I am able to provide a means for controlling the time current characteristics of my relay device as desired so that a relay which is wholly inverse time or wholly definite time or any combination of the two may be obtained. As stop 40 limits the distance which the rod 16 can travel, it correspondingly limits the amount of energy which can be stored in spring 27. Consequently independent of the amount of overload, rod 16 only moves a fixed distance and therefore a constant amount of energy is stored in the spring 27 thereby causing the contacts 28 to be carried into circuit closing position with a substantially constant amount of energy opposing the time delay device 36. The result is that with a comparatively light spring 27 and the stop 40 screwed down against pole piece 6, a relay is obtained with definite time limit operating characteristics. Such a relay is shown in Fig. 1. As the stop 40 is raised to increase the travel of rod 16, a greater compression of spring 27 can be obtained and the definite time effect is a little less pronounced and the characteristics a little more of the inverse time character. It is apparent therefore that, as the stop 40 is raised, the relay characteristics become more inverse and less definite. In order to obtain

a purely inverse time limit relay, a heavier or stronger spring 27 is used and the stop 40 raised to its limit or even removed, if desired. It is then apparent that the rod 16 is free to move and compress spring 27 by a greater amount whereby casing 26 and contact 28 having a correspondingly greater force to overcome the time delay device are raised with greater rapidity. It is thus apparent that a time limit relay is obtained by the use of the time delay unit 36 which is detachably secured to the relay and means is provided whereby the time current curve or characteristics can be shaped as desired. The shape of the time current curve of the definite time delay relay can be altered to a certain extent by the adjustable stop 40 alone. This stop also makes it possible to obtain a definite minimum time on high currents on the time current curve of the inverse time delay relays. If an instantaneous operating relay is desired, the time delay device 36 is removed and a pin similar to pin 38 is inserted in the end of casing 26. Spring 27 is sufficiently strong so that the lifting of the rod 16 directly operates the casing 26 and contact 28 so that the operation is substantially instantaneous.

For use with the bellows device 36, I have shown a form of air release valve which consists, as best shown in Fig. 4, of two concentrically disposed members 44 and 45. Member 44 is adapted to be screwed into the top of the bellows device 36 and is provided with a port 46 connected to the bellows. The inner or cone shaped member 45 is rotatably positioned and carries a spiral slot 47, the depth of which varies from a minimum to a maximum. With member 45 in one position, the port 46 is closed and no air can escape from the bellows. As member 45 is rotated, the shallow portion of slot 47 communicates with port 46 to permit a small exit of air and upon further rotation the depth of slot 47 increases thereby increasing the exit area for the air from the bellows. By suitable calibration the position of member 45 can be readily ascertained for any time delay desired and at the same time this type of valve permits of very easy and accurate adjustment.

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

1. In a relay device, the combination with an actuating winding, a casing for said winding comprising a shell and top and bottom members cooperating therewith to form an enclosure, a tubular member extending through said bottom member into said winding, a pole piece extending through said top member into said winding, and means comprising clamping members arranged to embrace said top and bottom members respectively and said shell and serving to secure said pole piece and said tubular member rigidly to said casing and to hold the members comprising said casing firmly together.

2. In a relay device, the combination with a solenoid coil, a housing for said coil comprising a main enclosing member and end members, a tubular member slidable into said coil through the bottom of said housing and having a shoulder for limiting the movement of said tubular member into said coil, a pole piece slidable into said coil through the top of said housing and having a shoulder for limiting the movement of said pole piece into said coil, clamping members adjacent the end members of said housing adapted to hold the members of said housing together and shaped to engage the shoulders on said tubular member and pole piece to hold them rigidly in position.

3. In a relay device the combination with a solenoid coil, a housing for said coil comprising a body member, and cooperating top and bottom members, clamping plates adjacent said top and bottom members having their edges bent over the ends of said top and bottom members extending along said body member as a cover, a pole piece extending into said coil and held in position by said top clamping plate, a tubular member extending through the bottom member into said coil and held in position by said bottom clamping plate, and means for securing said clamping plates together to hold the members of said housing together and said pole piece and tubular member rigidly secured thereto.

4. In a relay device, the combination with a solenoid coil, a housing for said coil of punched parts comprising a body member, and top and bottom members, a pole piece slidable through said top member into said coil and provided with a shoulder portion engaging the top member to limit its movement into the coil, a tubular member slidable through said bottom member into said coil and provided with a shoulder portion which engages the bottom member to limit the movement into the coil, clamping plates adjacent said top and bottom members and extending over the ends of said top and bottom members and provided with means adapted to engage the shoulder portions of said pole piece and tubular member, and means for securing said clamping plates together to support the members of said housing and rigidly secure said pole piece and tubular member.

5. In a relay device, the combination with a solenoid coil, a housing for said coil comprising a main body, and top and bottom members, upper and lower plates adjacent said top and bottom members having their edges bent over and extending along the body member to form covers, a pole piece

slidable through the upper plate and top member into said coil and adapted to be held in position between said upper plate and top member, a tubular member relatively slidable in said lower plate and slidable through said bottom member into said coil and adapted to be held in position between said lower plate and said bottom member, an insulating support adjacent said upper plate, and fastening means extending from said lower plate through said housing into said support to hold the members of said housing together and the pole piece and tubular members secured to said support.

6. In a relay device, the combination with a solenoid coil, a movable rod extending through said coil, a plunger controlled by said coil adjustably positioned on said rod, a pole piece extending into said coil through which said rod passes, said pole piece having a recessed portion, a collar on said rod engaging the bottom of said recess to limit the movement of the rod in one direction, and a member adjustably secured to said pole piece and surrounding said rod to engage said collar and limit the movement of said rod in the opposite direction.

7. In a relay device, the combination with a solenoid coil, a pole piece extending into said coil having a recessed portion, a movable rod extending freely through said coil and pole piece, a plunger controlled by said coil adjustably positioned on said rod, a collar on said rod positioned within the recessed portion of said pole piece, and a cap member adjustably secured to said pole piece engageable by said collar and serving as an adjustable stop to vary the distance of travel of said rod.

8. In a relay device, the combination with a coil, a pole piece extending into said coil, a rod movable freely through said coil and pole piece, a collar carried by said rod, a plunger controlled by said coil and adjustably positioned on said rod, and means cooperating with said collar to vary the extent of movement of said rod.

9. In a relay device, the combination with a coil, a pole piece extending into said coil, and having a recessed portion, a rod movable freely through said coil and pole piece, a plunger controlled by said coil and adjustably positioned on said rod to move said rod, a cap member adjustably secured to said pole piece to cover said recessed portion, a collar on said rod within the recessed portion of said pole piece engageable with said pole piece to limit the movement of the rod in one direction and engageable with said adjustable cap member to limit the movement of the rod in the opposite direction.

10. In a relay device, the combination with a coil, a pole piece for said coil, a rod movable freely through said coil and pole piece, a plunger controlled by said coil and adjustably secured to said rod for moving the same, a collar on said rod, an adjustable stop carried by said pole piece and cooperating with said collar to limit the movement of said rod.

11. In a relay device, the combination with a coil, a movable rod, a plunger controlled by said coil and adjustably positioned on said rod, said plunger being provided with a slot throughout its length, a tube extending through said coil and enclosing said rod and plunger, a tongue carried by said tube and extending into said slot, and means for rotating said rod whereby said plunger is raised or lowered in said tube.

12. In a relay device, the combination with a coil, a tubular member extending into said coil, a rod movable within said tube, a plunger controlled by said coil and threaded on said rod, means carried by said tubular member for locking said rod against rotation but movable to unlocking position to rotate said rod, and means whereby rotation of said rod causes the plunger to be adjustably positioned on said rod.

13. In a relay device, the combination with an actuating coil, a plunger controlled thereby, a rod carrying said plunger and movable thereby, means in which energy is stored by the movement of said rod, an adjustable stop for limiting the movement of said rod, a circuit controlling means operative by said energy storing means to control an electric circuit, and a time delay device cooperating with said circuit controlling means, said energy storing means and said stop cooperating to control the time current characteristics of said relay.

14. In a relay device, the combination with an actuating coil, a plunger movable thereby, a rod controlled by said plunger, means in which energy is stored by the movement of said rod in response to said plunger, relatively movable cooperating contacts controlled by the energy stored in said means, and an adjustable stop in the path of said rod to limit the movement thereof.

15. In a relay device, the combination with an actuating winding, a plunger movable thereby, a rod controlled by said plunger, contacts rendered operative in response to movement of said rod to control an electric circuit, means operative to introduce a time delay between the movement of said rod and the operation of said contacts, and a readily detachable connection between said means and one of said contacts whereby said means can be removed as a unit to permit said rod to effect a substantially instantaneous operation of said contacts.

16. In a relay device, the combination with an actuating winding, an armature movable thereby, a rod controlled by said armature, a spring compressed by said rod, a member movable by said spring with time delay, contacts controlled by said member, and an adjustable stop to limit the path of movement of said rod whereby the time interval required for operating said contacts may be definite or inverse.

17. In a relay device, the combination with an actuating winding, an armature movable thereby, a rod controlled by said armature, a movable casing surrounding one end of said rod, circuit controlling means carried by said casing, a spring within said casing in which energy is stored by the movement of said rod, the energy of said spring being used to move said casing to circuit controlling position, and means for delaying the movement of said casing, and a connection between said delaying means and said casing comprising a member depending from said delaying means and arranged to extend into said casing and a removable member for securing said member to said casing, whereby said delaying means can be removed as a unit to permit a substantially instantaneous movement of said casing.

18. In a relay device, the combination with an actuating winding, a member movable thereby, means in which energy is stored by the operation of said member, contacts controlled by said means, means operatively related to said energy storing means for causing the operation of said contacts with a time delay, and means for varying said time delay from a definite time interval to an inverse time interval.

19. A relay of the class described, wherein relatively movable cooperating contacts are controlled by an electro-magnetic device comprising a movable member arranged to effect the operation of said contacts, and wherein a retarding device is provided for controlling the time of operation of the relay, and wherein a spring is provided between said movable member and said retarding device characterized by the fact that means are provided whereby said movable member may upon a predetermined movement transmit motion positively to said retarding device, and by the fact that means are provided for adjusting the limit of movement of said movable member whereby with said means adjusted for one limit of movement the relay will be a definite time limit relay, the time being controlled by the rate of actuation of said retarding device by said spring, and whereby with said means adjusted for another limit of movement of said movable member the relay will be an inverse time limit relay, the time being controlled by the rate of actuation of said retarding device by the positive movement thereof by said movable member, and whereby with said means adjusted to intermediate positions, the time-current characteristic of the relay may comprise different combinations of definite time and inverse time intervals.

20. A relay comprising relatively movable cooperating contacts, and means for operating said contacts comprising an electromagnet and a member movable thereby, a retarding device for controlling the time of operation of the relay and means for transmitting motion from said movable member to said retarding device comprising a casing and a spring carried thereby, said spring being arranged to be engaged by said movable member so that upon movement thereof motion may be transmitted from said movable member to said retarding device through said spring, and means whereby said movable member may upon a predetermined movement positively actuate said retarding device, and means for changing the time-current characteristic of the relay comprising relatively adjustable members for limiting the extent of movement of said movable member.

21. A relay comprising relative movable cooperating contacts, an electromagnet, a member movable thereby to control said contacts, a retarding device for controlling the time of operation of the relay, a casing adapted to transmit motion to said retarding device movable relatively to said movable member, said movable member projecting into said casing and being adapted upon a predetermined movement to actuate said retarding device positively, a spring carried by said casing and interposed between said movable member and the casing whereby said movable member may actuate said casing through said spring, a collar on said movable member, and an adjustable stop in the path of movement thereof whereby with said stop in one position said movable member may transmit motion positively to said retarding device and the time-current characteristic of the relay will be inverse, and with said stop in another position said movable member may transmit motion to said retarding device through said spring and the time-current characteristic of the relay will be definite, and whereby with said stop in intermediate positions, different combinations of inverse and definite time-current characteristics may be obtained.

In witness whereof, I have hereunto set my hand this 25th day of May, 1920.

OLIVER C. TRAVER.