May 9, 1933. V. DURBIN 1,908,589

TIME RELAY

Filed March 21, 1929 2 Sheets-Sheet 1

Fig. 1

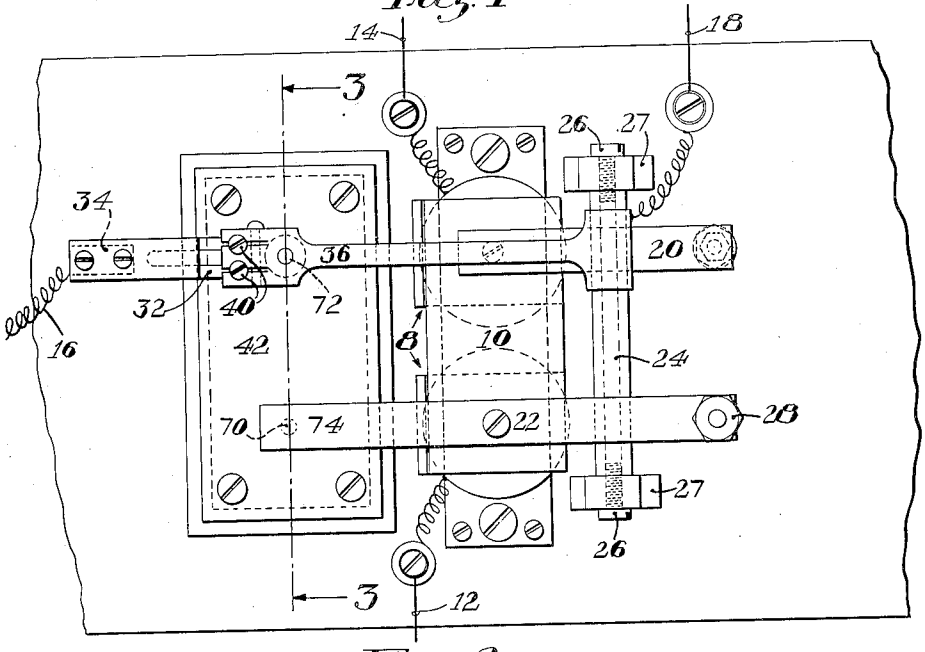
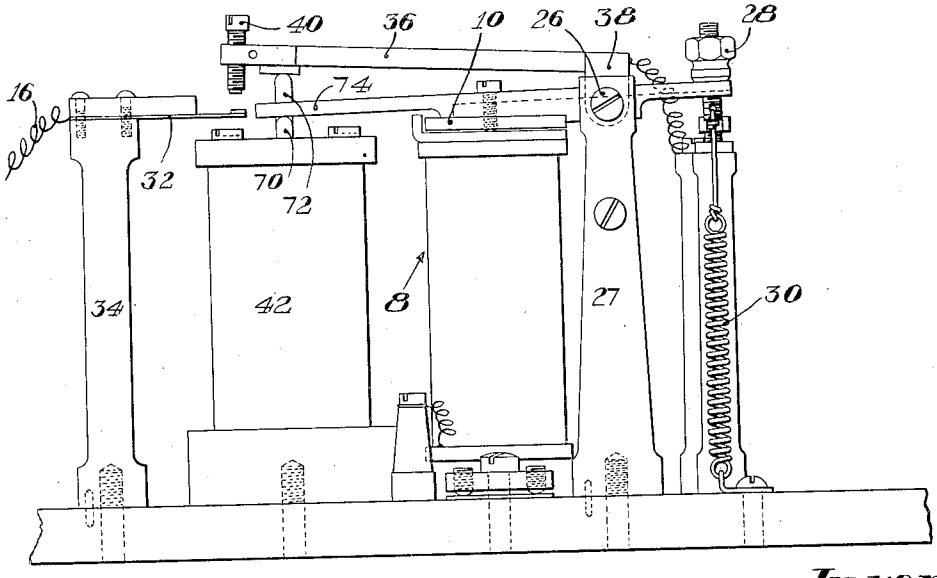


Fig. 2



Witness
George O. Ryby

Inventor
Vernon Durbin
by Van Everen Fish
Hildreth Keary Attys.

May 9, 1933. V. DURBIN 1,908,589

TIME RELAY

Filed March 21, 1929 2 Sheets-Sheet 2

Fig. 3

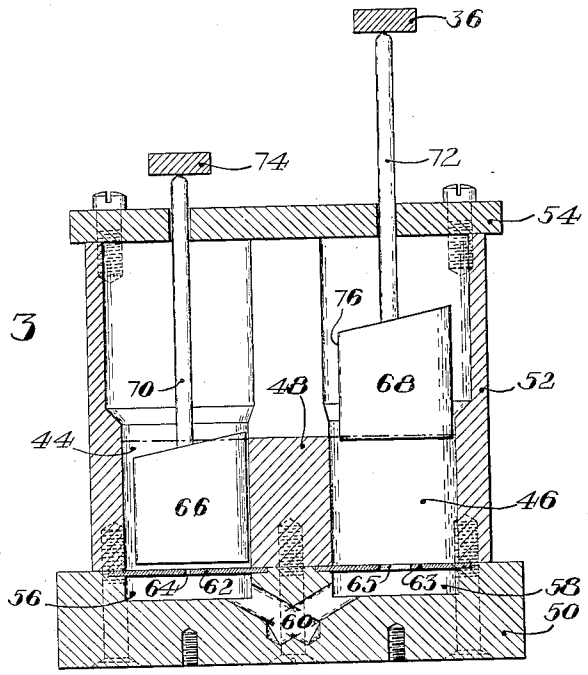


Fig. 5

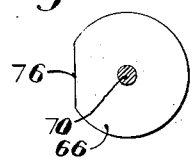
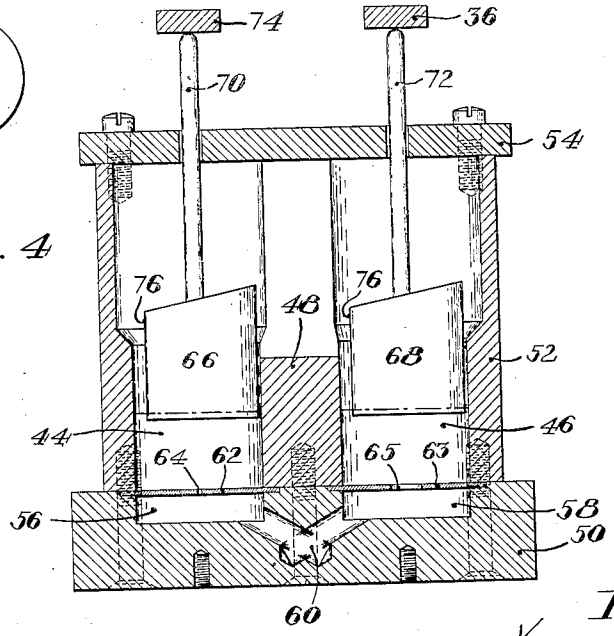


Fig. 4



Witness
George O. Rigby.

Inventor
Vernon Durbin
by Van Everen Fish
Hildreth Heavy Attys.

Patented May 9, 1933 1,908,589

UNITED STATES PATENT OFFICE

VERNON DURBIN, OF NEWTON, MASSACHUSETTS, ASSIGNOR TO THE HOLTZER-CABOT ELECTRIC COMPANY, OF ROXBURY, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

TIME RELAY

Application filed March 21, 1929. Serial No. 348,396.

The present invention relates to time relays and more particularly to that class of relays in which conditions in an auxiliary circuit are changed at a predetermined time after the opening or closing of a main circuit.

The object of the present invention is to provide a time relay which is simple in construction and positive in operation and to this end the present invention consists of the time relay hereinafter described and particularly defined in the claims.

In the accompanying drawings illustrating the preferred form of the present invention, Fig. 1 is a plan view of the relay; Fig. 2 is a side elevation; Fig. 3 is a section on line 3—3 of Fig. 1; Fig. 4 is a view similar to Fig. 3 but showing the relay in circuit closing position; and Fig. 5 is a plan view of one of the floats.

The illustrated embodiment of the invention comprises an electro-magnet 8 having a pair of coils to attract an armature 10. The electro-magnet is energized by current flowing in the circuit indicated by the wires 12 and 14, which may be termed the main circuit. As shown in the drawings, the normal position of the armature is the attracted position, that is, the main circuit 12, 14 is a normally closed circuit. The construction is such that if the circuit remains open for a time longer than a predetermined interval, another circuit wil be closed. This other circuit, which may be termed the auxiliary circuit, is indicated by the wires 16, 18.

The armature is supported by means of bars 20 and 22 which are pivotally mounted on a shaft 24, the shaft being journaled in adjustable screws 26 mounted in standards 27. The armature support 22 is extended rearwardly beyond the shaft to receive a spring mounting 28. A spring 30 is connected between the spring mounting 28 and the base in order to urge the armature normally into retracted position.

The auxiliary circuit which is adapted to be closed after the main circuit is opened for a predetermined time comprises the wire 16 which is connected with a fixed spring contact 32 mounted in a standard 34 and a movable contact arm 36 which at its rear end is provided with a web 38 freely pivoted on but insulated from the shaft 24. The forward end of the contact arm 36 carries an adjustable contact screw 40 normally maintained out of engagement with the contact spring 32.

Provision is made for permitting the contact arm 36 to drop toward circuit closing position when the armature 10 is released. This means comprises a casing 42 having two internal circular chambers 44 and 46 separated by a partition 48. The casing is constructed with a base 50 to which is secured the chamber portion 52, the latter being closed by a cover 54. The base is recessed at 56 and 58 directly below the chambers 44 and 46 respectively. Drill holes 60 connect the recesses 56 and 58. Between the chambers and the base are mounted two plates 62 and 63 to retard free communication between the chambers. The plate 62 has a small hole 64 preferably about 0.010 to 0.015 inches in diameter, while the plate 63 has a considerably larger opening 65. The chambers are adapted to be supplied with mercury or other heavy slow-flowing liquid. In the chamber are floats 66 and 68 having upstanding actuating rods 70 and 72 respectively secured thereto. The rod 70 is normally depressed by the forward end 74 of the armature supporting arm 22, while the rod 72 normally bears against the bottom of the contact lever 36 and holds it in elevated position out of engagement with the spring contact 32. The floats 66 and 68 are generally of cylindrical shape fitting loosely within the chambers 44 and 46. Each is provided with an inclined top to prevent the collection of mercury which might be splashed onto it. Moreover, each float has a slabbed vertical surface 76 which provides sufficient space to permit free flow of mercury from the inclined top. The floats are preferably of light material such as bakelite, which is unaffected by contact with the mercury.

In normal position, the floats are arranged as shown in Fig. 3. The mercury fills the chambers to approximately the height of the partition 48, as shown by the dot-and-dash lines of Fig. 3. The float 66 is held de-

pressed by the armature and displaces most of the mercury from its chamber. The float 68 floats on the top of the mercury and holds the contact lever 36 in elevated position. If now the main circuit 12, 14 is opened, the armature is released and the float 66 immediately rises to a height determined by the quantity of mercury in the chamber 44. The float 68 starts to fall slowly, its time of descent being determined by the rate of flow of the mercury from the chamber 46 to the chamber 44 through the small opening 64 in the plate 62. The float 66 then continues to rise slowly as the float 68 falls. If the main circuit is again closed before the float 68 has completed its descent, the armature immediately depresses the float 66 to its original position. The mercury displaced by the depression of the float flows over the partition 48 into the chamber 46, thereby again lifting the float 68 to its original position. However, if the main circuit remains open for a sufficient time, the contact lever 36 will gradually drop until the screw 40 engages the contact spring 32, the mercury levels being then as shown in Fig. 4. This closes the auxiliary circuit 16, 18. Upon subsequent closing of the main circuit, the float 66 is again depressed by the armature and the mercury thus displaced flows over the partition 48 and again raises the float 68 immediately to its original position.

The closing of the auxiliary circuit may be employed to perform any useful function. A relay of this type is especially useful in fire alarm systems such as that described in the co-pending application of Durbin, filed of even date herewith, wherein the time relay is employed for operating protective devices in case a box circuit is opened for a time longer than a predetermined interval.

The casing which contains the mercury is preferably of cast iron which is not attacked by the mercury. It will be seen that the relay is reliable in operation because any dirt which may collect on the mercury will float on the surface and cannot plug the small hole 64.

The time interval in which the relay operates may be adjusted by the screw 40 or by changing the plate 62 for one with a larger or smaller opening.

It will be seen that one of the principal features of the invention comprises the provision of a pair of floats with means for permitting slow communication between the chambers when one of the floats is released, while also permitting immediate return flow of mercury between chambers over the partition when the float is again depressed. This provision for immediate return flow is especially important in connection with fire alarm systems. In normal operation of the system, the main circuit is rapidly opened and closed in synchronism with the opening and closing of an active box circuit. Upon each opening of the main circuit, the contact arm slowly falls, but upon closing of the main circuit, the float 68 is raised without delay to its original position, thus placing it in readiness to go through its proper time interval operation, should the box circuit open and then fail to close within the specified time.

The invention having been thus described, what is claimed is:

1. A time relay having, in combination, two chambers containing a liquid, a float in each chamber, means for normally maintaining one of the floats depressed, a passage below the chambers permitting slow communication of liquid between the chambers upon release of said float to permit the other float to drop slowly, and means permitting rapid return flow of liquid across the top of the chambers upon again depressing the first-mentioned float.

2. A time relay having, in combination, two chambers adapted to contain a liquid, floats in the chambers, means for normally maintaining one of the floats depressed to displace the liquid in its chamber, the other float being supported in elevated position, means to permit slow communication of liquid between the chambers when the normally depressed float is released, and means permitting immediate return flow of liquid when the float is again depressed.

3. A time relay having, in combination, two chambers, a partition between the chambers, a passage connecting the chambers having provision for retarding the flow of liquid from one chamber to the other, a normally depressed float in one chamber acting to displace liquid therefrom, whereby when said float is released, the level of liquid in the other chamber slowly falls, the partition being constructed and arranged to permit rapid return flow of liquid when the float is again depressed.

4. A time relay having, in combination, two chambers adapted to contain a liquid, means permitting slow communication between the chambers, a float in one of the chambers, means for normally holding the float depressed to displace liquid from the chamber, means for releasing the float whereby the liquid level in the other chamber slowly falls, and means permitting immediate return flow of liquid when the float is again depressed.

5. A time relay having, in combination, two communicating chambers, a float in each chamber, the chambers being adapted to contain liquid and having provision for slow communication between the chambers in one direction and for rapid communication between the chambers in the opposite direction, a magnet adapted to be connected into a

main circuit and having an armature, connections from the armature to one of the floats for normally holding the float depressed and adapted to release the float upon change of circuit conditions in the main circuit, and an auxiliary circuit contact arm maintained elevated by the other float.

6. A time relay having, in combination, two chambers connected by a passage having provision for permitting slow communication of liquid between the chambers, an electro-magnet adapted to be connected into a main circuit and having an armature to maintain the float normally depressed to displace liquid from its chamber, means acting upon change of circuit conditions in the main circuit to release the armature and permit the float to rise, whereby the liquid level falls slowly in the other chamber, auxiliary circuit contacts adapted to be closed when the liquid level in the second chamber falls to a predetermined point, and means for permitting rapid return flow of liquid when the float is again depressed upon restoration of circuit conditions in the main circuit to normal.

7. A time relay having, in combination, two chambers, a partition separating the chambers, a passage below the chambers to permit flow of liquid between them, means for retarding flow of liquid between the chambers through the passage, and an electro-magnet having an armature, a float in one of the chambers, connections from the armature to the float to hold the latter normally depressed, the chambers being normally filled with liquid to the height of the partition, a float in the second chamber normally held in elevated position by the liquid, an auxiliary circuit contact arm supported by the elevated float whereby when the armature is released the normally depressed float rises and the other float slowly falls and when the first float is again depressed, the liquid flows rapidly over the partition to restore the second float to its original position.

8. A time relay having, in combination, two chambers adapted to contain a liquid, a fluid displacing member in one chamber and a float in the other chamber, a main magnet adapted to be connected into a main circuit and having an armature to normally hold the fluid displacing member in its chamber and to permit movement of the member outwardly of its chamber upon a change of circuit conditions, means permitting slow communication between the chambers to cause the float to descend when the fluid displacing member is moved outwardly, means for permitting rapid return flow of liquid to raise the float when the fluid displacing member is again moved inwardly, and contacts controlled by the float.

9. A time relay having, in combination, two chambers adapted to contain a liquid, a fluid displacing member normally depressed and substantially filling one of the chambers, a float member floating on the liquid in the other chamber, means permitting slow flow of liquid between the chambers when the fluid displacing member is moved outwardly of its chamber, and means for causing rapid return flow of liquid when the liquid displacing member is restored to normal depressed position.

10. A time relay having, in combination, two chambers adapted to contain a liquid, a partition separating the chambers, a fluid displacing member normally substantially filling one of the chambers, a float member floating on the liquid in the other chamber, and a restricted passage between the chambers to permit slow communication between them when the liquid displacing member is moved outwardly of its chamber, the liquid being adapted to flow rapidly over the partition when the fluid displacing member is restored to normal position.

In testimony whereof I have signed my name to this specification.

VERNON DURBIN.