

May 16, 1939.

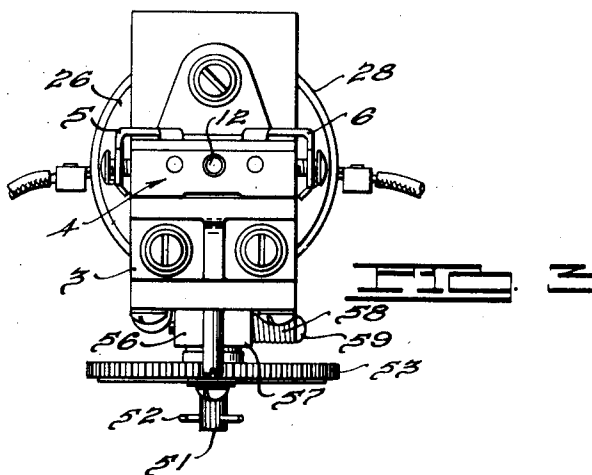
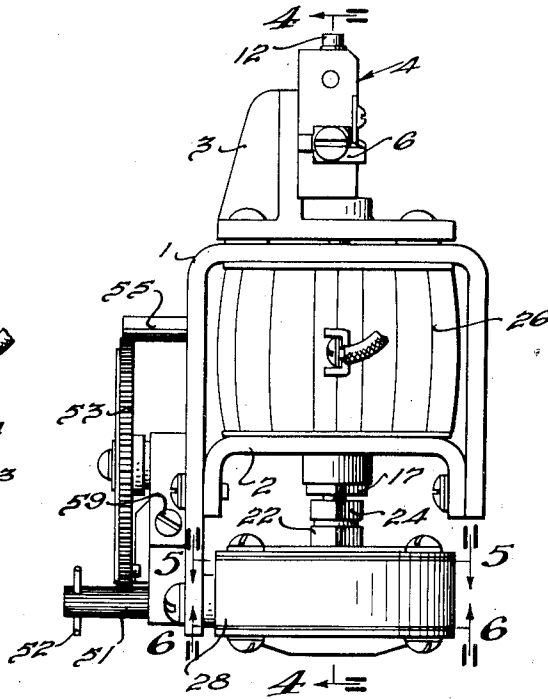
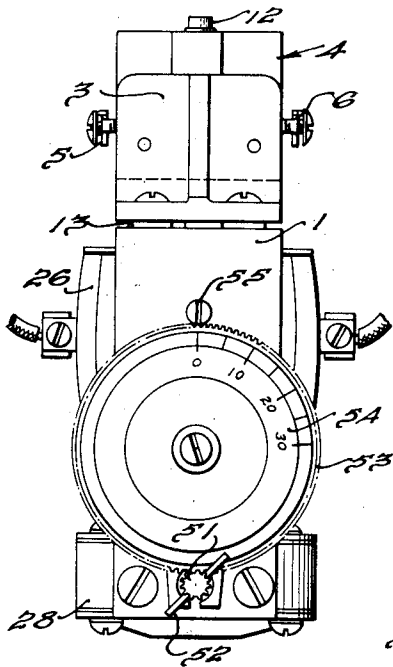
H. A. WILHELM

2,158,346

TIMING RELAY

Filed Nov. 13, 1936

2 Sheets-Sheet 1



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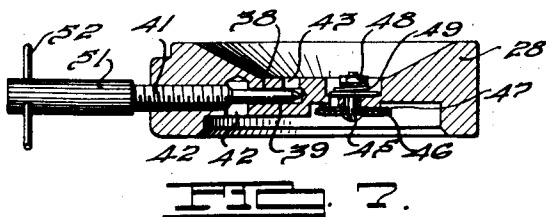
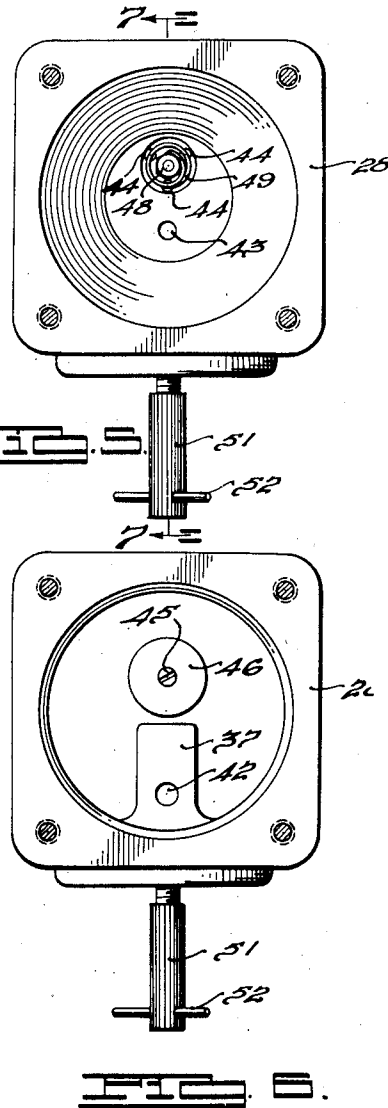
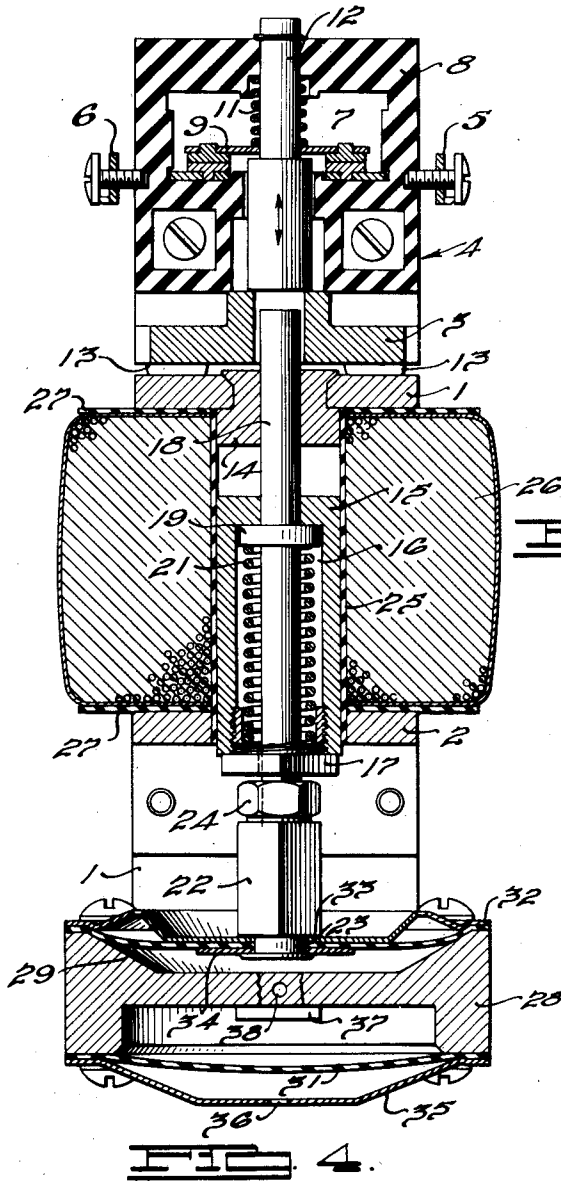
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TIMING RELAY

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2 Sheets-Sheet 2



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TIMING RELAY

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tion of Michigan

Application November 13, 1936, Serial No. 110,724

10 Claims. (Cl. 200—97)

This invention relates to automatic electric relays having an adjustable time delay means for varying the time of operation of the relay.

One object of the present invention is the provision of an improved form of automatic timing relay providing a wide range of timing periods.

Another object of the invention is to provide an automatic timing relay having a dashpot time delay with improved valving means for controlling the flow of fluid in the dashpot.

Another object of the invention is to provide an automatic timing relay with an improved means for adjusting and indicating the timing period.

Other objects and features of the invention will be readily apparent to those skilled in the art from the following specification and appended drawings illustrating certain preferred embodiments of the invention in which:

Figure 1 is a front elevation view of the relay of the present invention.

Figure 2 is a side elevational view of the relay.

Figure 3 is a top plain view of the relay.

Figure 4 is a vertical sectional view on the line IV—IV of Figure 2.

Figure 5 is a detailed sectional view on the line V—V of Figure 2.

Figure 6 is a detailed sectional view on the line VI—VI of Figure 2.

Figure 7 is a detailed sectional view on the line VII—VII of Figure 5.

The relay according to the present invention comprises a supporting frame formed by a pair of inverted U-shaped members 1 and 2 secured together by means of studs as shown. Upon the upper surface of the member 1 is mounted a supporting frame 3 carrying an electric switching device generally denoted at 4 comprising contact terminals 5 and 6 carrying stationary contact surfaces disposed within a generally central chamber 7 in an insulating block 8. A bridging contact piece 9 is disposed within the chamber 7 and is biased into bridging relation with the stationary contact surfaces by a compression spring 11. A switch actuating member of the push button type 12 extends through the bridging contact plate 9 and the compression spring 11 and is adapted to move the bridging contact into separated position. The bracket 3 is preferably mounted on the member 1 through the medium of rubber washers 13 which lessen vibration in the switching parts.

Rigidly mounted in a control opening in the top of the member 1 is a magnetic button 14 which cooperates with the members 1 and 2,

also of magnetic material, to strengthen the magnetic field attracting a solenoid armature 15. This armature is of cylindrical form and is provided with a central opening 16 adapted to be closed by a nut 17. The bracket 3, button 14, armature 15 and nut 17 are provided with aligned openings loosely receiving a rod 18 adapted to actuate the switching plunger 12. The rod 18 is provided with a flange portion 19 adapted to engage the upper end of the chamber 16 in the armature 15 and is biased into this position by a compression spring 21 disposed within the chamber 16 and about the rod 18. The lower end of the rod 18 is threaded into a nut 22 which is in turn secured to a stud 23. A locking nut 24 may be provided. A rigid cylinder 25 of insulated material surrounds the armature 15 and is located in position by receiving the button 14 at its upper end and being received in the opening in the member 2 at its lower end. This cylinder forms a guiding means for the armature and a supporting and centering means for an energizing coil 26 disposed between the supporting members 1 and 2. Discs 27 of insulated material may be disposed between the top and bottom surfaces of the coil 26 and the members 1 and 2.

Mounted upon the extended front leg of the member 1 is a timing device including a chamber separating and valve containing member 28 having sealably connected to its top and bottom edges flexible diaphragms 29 and 31. The diaphragm 29 is sealably secured to the upper edge of the member 28 by means of a rigid metallic rim member 32. The central portion of the diaphragm 29 is attached to a pair of disc washers 33 and 34 through which extend the pin 23 and which are rigidly engaged with the central portion of the diaphragm by means of the pin 23 and the nut 22. The lower diaphragm 31 is sealably secured to the bottom edge of the member 28 by means of a shield 35 having a relatively large opening 36 therein leading to the external air. The member 28 is formed, as shown, of double cup shape and in the lower cup is provided with a projection 37 in which is disposed the valve controlling the timing operation. This comprises a cylindrical opening 38 which receives a pin 39 rigid with a portion 41 threaded into the member 28. A pair of openings 42 and 43 communicate in opposite directions with the opposite ends of the opening 38. The openings 38 and the pin 39 are provided with a relative taper of about a half degree. This is most easily done by forming the opening of a constant diameter

and placing the half degree taper on the pin. This valve means provides for the controllable passage of air between the two chambers formed by the diaphragms 29 and 31 and the member 28 upon movement of the rod 18 in the upper direction. It is desired that this rod move quickly in the downward direction and for this reason a check valve is provided constituted by a plurality of openings 44 through the member 28 forming ducts for the passage of the air or other fluid between the chambers. In the center of these openings is disposed a working opening receiving a pin 45 carrying at its under side a relatively large rigid washer 46 backing up a flexible sealing washer 47. The upper end of the pin 45 is provided with a nut 48 bearing against a compression spring 49 which biases the pin 41 upwardly and resiliently forces the sealing disc against the openings 44.

The member 41 terminates externally of the member 28 in a pinion gear 51 through which extends a manipulating pin 52. Mounted on the front face of the member 1 is a relatively large gear wheel 53 bearing an indicia plate 54 on its face and meshing with the pinion gear 51. A pin 55 is also rigidly mounted on the front face of the member 1 and is provided with an indicating mark for use in cooperation with the indicia on the plate 54. To maintain the timing valve in adjusted position there is provided a double split bearing formed of portions 56 and 57 which receive the pinion gear 51 and the hub of wheel 53 and are biased together by a compression spring 58 adjustable by means of a stud 59.

The operation of the parts will now be described:

As viewed in figure 4 the parts are in the de-energized position with the contact plate 9 in bridging position. Upon energization of the coil 26 the armature 15 will quickly move upwardly into engagement with the button 14, thus compressing spring 21 and biasing the rod 10 also into its upper position. Such movement of the rod 18 is, however, retarded by the vacuum which would otherwise be formed in the upper fluid chamber and this rod will move up at a controllable rate dependent upon the passage of air or other fluid through the adjustable valve from the lower to the upper fluid chamber. As the rod 18 engages the plunger 12 it will force the bridging contact 9 into a separated position. Upon subsequent de-energization of the coil 26, armature 15 and rod 18 will quickly move to their bottom position under the action of gravity. In this movement the fluid in the upper chamber quickly passes into the lower chamber through the check valve openings 44. As rod 18 moves downwardly the plunger 12 will also move downwardly and permit plate 9 to bridge the stationary contact surfaces. It is seen that the diaphragm 29 is really the working diaphragm and that the diaphragm 31 is simply an idle diaphragm. The purpose of the lower diaphragm is to maintain the valve free of moisture and dust by excluding outside air from the valve. It is noted with the present construction the same air or other fluid is always passed back and forth through the valve as the diaphragm 29 is raised and lowered. The large opening 36 is for the purpose of preventing formation of a vacuum between the shield 25 and the diaphragm 31. With the valve means herein disclosed using a relatively long tapered pin in a closely fitting chamber a high degree of accuracy has been obtained varying from a matter of one or two cycles at 60 cycle frequency up

to several minutes. The check valve disclosed is also believed to be an improved form and operates quickly and positively in response to fluid pressure thereon.

While certain preferred embodiments of the invention have been specifically disclosed, it is understood that the invention is not limited thereto as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What is claimed is:

1. An automatic timing relay comprising an actuating coil, a solenoid armature movable thereby, a switch operating rod extending through said armature and having a lost motion connection therewith, a spring within said armature about said rod and forming a part of said connection, and time delay means connected to said rod to delay its movement in at least one direction.
2. An automatic timing relay comprising an actuating coil, a solenoid armature movable thereby, switching means mounted above said coil and having operating means aligned with said armature, a rod extending through said armature and movable relative thereto, spring means within said armature and biasing said rod in an upward direction with respect to said armature, and time delay means below said coil and connected to said rod to delay its movement under said spring bias in response to movement of said armature.
3. In an automatic timing relay, an actuating coil, a hollow solenoid armature movable thereby, switching means, a switch actuating rod extending axially through said armature, time delay means connected to said rod, and spring means mounted within said hollow armature and biasing said rod to a definite position with respect to said armature, movement of said armature tensioning said spring to move said rod into switch actuating position in a timing interval determined by said time delay means.
4. An automatic timing relay comprising a rectangular frame having at least one depending leg, an actuating coil disposed in said frame, switching means disposed on the top face of said frame, switch operating means including a solenoid armature reciprocable within said coil, time delay means mounted on said leg beneath said coil and connected to said switch operating means, and means mounted at the front face of said frame for adjusting and indicating the timing interval of said time delay means.
5. An automatic timing relay comprising a pair of inverted U-shaped members connected to form a supporting frame of rectangular shape having at least one depending leg, an actuating coil disposed within said frame, a solenoid armature within said coil, switching means mounted on the top face of said frame, an operating rod extending through said armature and frame and adapted to operate said switching means, time delay means supported on said depending leg beneath said frame and having operative connection with said rod, spring means biasing said rod to a definite position with respect to said armature, movement of said armature tensioning said spring to move said rod into switch operating position in a time interval determined by said time delay means.
6. An automatic timing relay comprising a pair of inverted U-shaped members connected to form a supporting frame of rectangular shape having at least one depending leg, an actuating coil disposed within said frame, a solenoid arma-

ture within said coil, switching means mounted on the top face of said frame, an operating rod extending through said armature and frame and adapted to operate said switching means, time delay means supported on said depending leg beneath said frame and having operative connection with said rod, spring means biasing said rod to a definite position with respect to said armature, movement of said armature tensioning said spring to move said rod into switch operating position in a time interval determined by said time delay means, and means mounted at the front face of said frame for adjusting and indicating said time interval.

7. In an automatic timing relay having switching contacts, magnet coil controlled means for actuating said contacts and time delay means for delaying movement of said actuating means in at least one direction and including a bellows chamber, valve means for adjustably restricting passage of fluid in at least one direction in response to change in volume of said chamber and including a relatively long passage having a relatively long pin therein, openings at opposite ends of said passage leading to said chamber and to an outside fluid source, said passage and pin having a relatively small relative taper, and means for adjusting the position of said pin within the passage to vary the area of the fluid flow opening.

8. In an automatic timing relay having switching contacts, magnet coil controlled means for actuating said contacts and time delay means for delaying movement of said actuating means in at least one direction and including a bellows chamber, valve means for adjustably restricting passage of fluid in at least one direction in response to change in volume of said chamber and

including a relatively long passage having openings at its opposite ends leading to said chamber and to an outside fluid source, a pin disposed in said passage and adjustable longitudinally thereof, said pin having a small taper whereby adjustment thereof will vary the fluid flow opening and the timing period of the relay.

9. In an automatic timing relay having switching contacts, magnet coil controlled means for actuating said contacts and time delay means for delaying movement of said actuating means in at least one direction, a valve pin for varying said time delay means and having a threaded portion providing for longitudinal movement upon turning thereof, the exterior portion of said pin being provided with teeth in the form of a pinion gear, and a relatively large idle gear wheel meshing with said pinion and provided with indicia for indicating the adjustment of said time delay means.

10. In an automatic timing relay having switching contacts, magnet coil controlled means for actuating said contacts and time delay means for delaying movement of said actuating means in at least one direction, a valve pin for varying said time delay means and having a threaded portion providing for longitudinal movement upon turning thereof, the exterior portion of said pin being provided with teeth in the form of a pinion gear, and a relatively large idle gear wheel meshing with said pinion and provided with indicia for indicating the adjustment of said time delay means, and a spring pressed, split, double bushing engaging said pinion and the hub of said wheel for maintaining the valve pin in its adjusted positions.

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