Dec. 23, 1941. F. H. ROBY 2,266,804

ELECTRIC TIMING RELAY

Original Filed Jan. 25, 1937 2 Sheets-Sheet 1

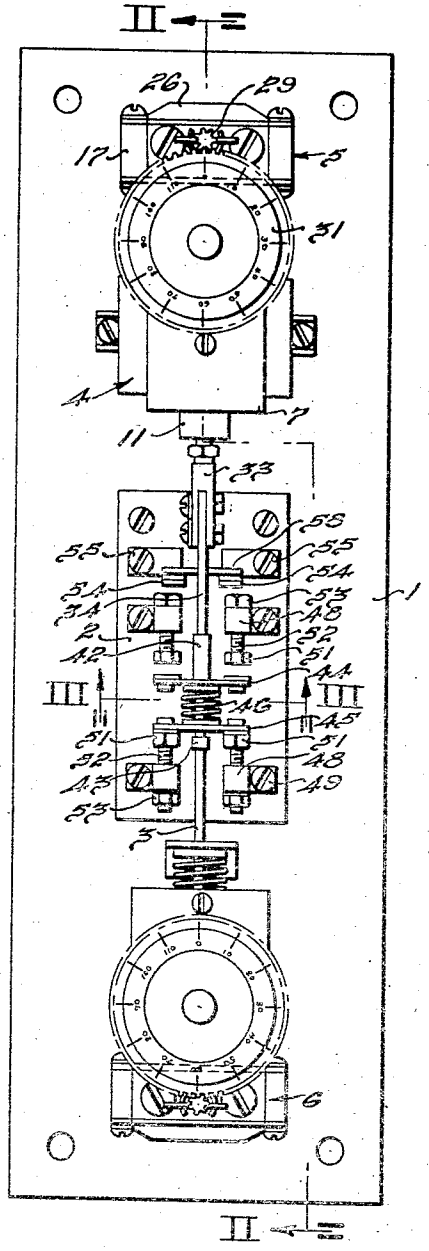

FIG. 1.

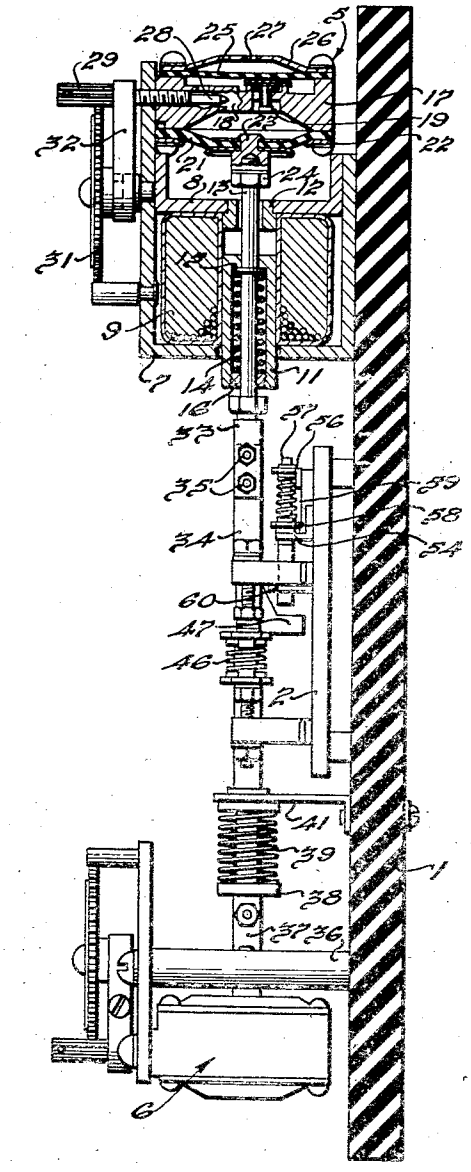

FIG. 2.

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ELECTRIC TIMING RELAY

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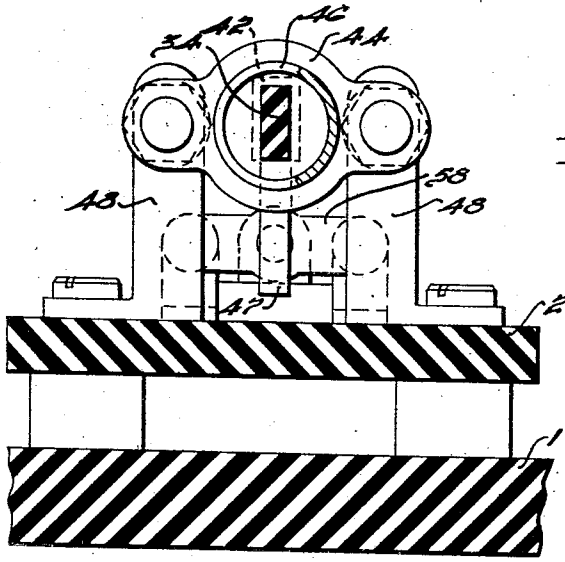

FIG. 3.

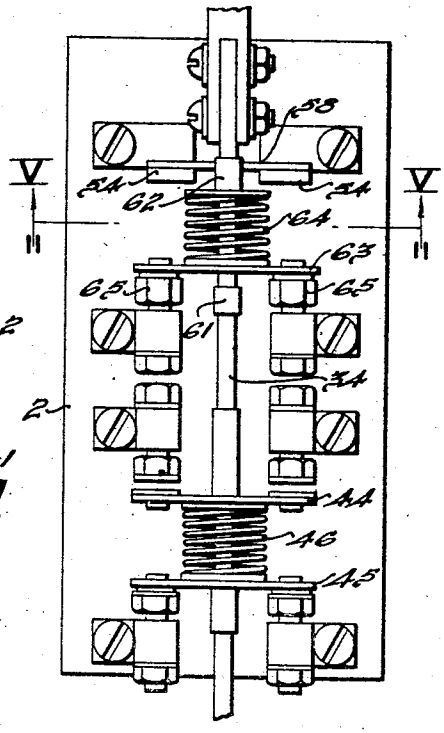

FIG. 4.

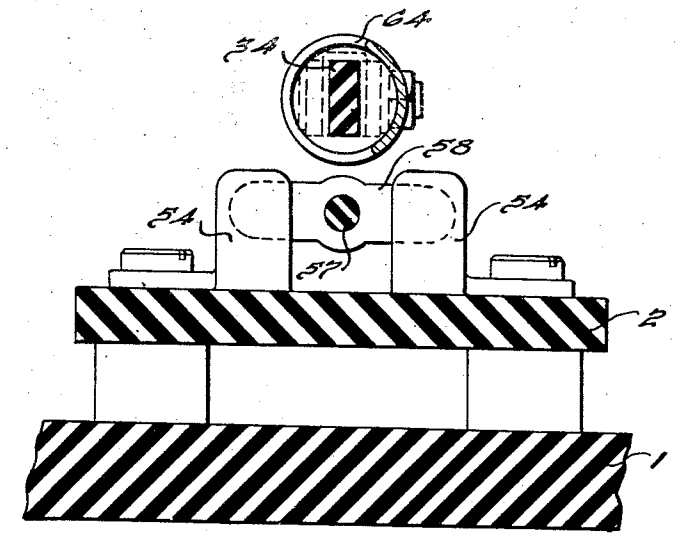

FIG. 5.

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2,266,804

ELECTRIC TIMING RELAY

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Original application January 25, 1937, Serial No. 122,173, now Patent No. 2,124,795, dated July 26, 1938. Divided and this application August 24, 1937, Serial No. 160,637

8 Claims. (Cl. 200—97)

This invention relates to a timing relay or switch including a plurality of contacts adapted to be operated in sequence in a definite timed relation and constitutes a division of application Serial No. 122,173, filed January 25, 1937.

One object of the invention is to provide an improved timing relay having a plurality of normally open and normally closed contacts adapted to be operated in sequence by a movable member in which means is provided for controlling the speed of movement of the member.

Another object of the invention is an electric timing relay having a plurality of normally open and normally closed contacts adapted to be operated in sequence by a reciprocable member in which the speed of movement of the member in its opposite directions is independently controllable.

Another object of the invention is to provide an electric timing relay having successively operable contacts with a pair of separately adjustable timing elements operated to control the time of operation of the contacts in both directions and in which the contacts are independently adjustable to vary their relative operated time in the cycle.

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 elevational view of a timing relay according to the present invention.

Figure 2 is a vertical sectional view on the line II—II of Figure 1.

Figure 3 is a horizontal sectional view on the line III—III of Figure 1.

Figure 4 is a partial elevational view of the stationary and movable contact arrangement of a slightly modified form using additional contacts.

Figure 5 is a horizontal sectional view on the line V—V of Figure 4.

The timing relay according to the present invention is supported upon a back plate or mounting panel 1 and includes generally a stationary contact supporting block 2, a reciprocable rod 3 for operating the movable contacts, an electromagnetic operating means generally indicated at 4, a timing device generally indicated at 5 for timing the downward movement of the rod 3 and a timing device generally indicated at 6 for controlling the upward movement of the rod 3. The electromagnetic operator 4 and timing device 5 are mounted together and comprise a magnetic circuit formed by a pair of U-shaped members 7 and 8 within which is disposed an energizing coil 9 surrounding a solenoid core 11. A button 12 is mounted on the member 8 to cooperate with the core in its attracted position, the complete magnetic path being formed between members 7 and 8, button 12 and core 11. The core 11 is hollow and slidably receives a rod 13 which applies the operating force to the relay. A compression spring 14 is disposed within the core 11 about the rod 13 and presses against a flange 15 rigid with the rod 13 and against a closing nut 16 threaded into the core 11.

Upon the upwardly extending leg of the member 7 is disposed the timing element 5 comprised of a central dividing portion 17 having therein an adjustable bleeding valve 18 and a check valve 19. The dividing portion 17 is of general double cup shape and to its bottom portion a flexible diaphragm 21 is sealably connected as by means of a rigid metallic member 22. A nut 23 is secured to the diaphragm 21 by being riveted through opposite disc washers as shown. The rod 13 is threaded into the nut 23 and is maintained in place by a locking nut 24. A flexible diaphragm 25 is connected to the upper edge of the double cup member 17 by means of a rigid shielding member 26 having a relatively large opening 27 leading to the external air. The valve 18 includes the cylindrical chamber as shown in which is disposed the pin 28 having a small taper relative to the chamber diameter. The pin 28 is threaded into the member 17 for longitudinal adjustment and is provided with gear teeth at its exterior portion 29 meshing with a large indicating gear wheel 31. A split bushing 32 is provided for holding the valve in its adjusted position. This time delay means 5 which has heretofore been described in some detail is more particularly shown and described and claimed in the copending application of Henry A. Wilhelm, Serial No. 110,724, filed November 13, 1936. At its lower end the rod 13 is threaded into a mechanical connector 33 which is slotted at its lower portion to receive a relative rigid insulating rod 34 disposed in the slot and connected therein by the bolts 35.

The time delay device 6 is of identical construction with the time delay device 5 and is supported upon the plate 1 by means of posts 36. The flexible operating diaphragm of this timing device which corresponds to the diaphragm 21 of the timing device 5 is secured to the lower end of the rod 34 by means of a mechanical connector 37 similar to the connector 33. The timing device 6 is identical in construction to the timing device 5 but is disposed in reverse direction so that the check valve therein operates to quickly relieve the fluid within the chamber with which the working diaphragm cooperates when the rod 34 moves in a downward direction and the bleeding valve in the timing device 6 is similar to the bleeding valve 18 in the timing device 5 and operates to time the upward movement of the rod 34. As the timing device 6 is identical in

construction to the timing device 5 which has been described in detail it is thought unnecessary to show or describe this timing device 6 in detail.

Upon the rod 34 adjacent its bottom portion is disposed a washer 38 against which is exerted the force of a compression spring 39 whose opposite end presses against a stationary stop 41 mounted on the back plate 1. Rigid with the rod 34 are a pair of sleeve stops 42 and 43 respectively engageable with a pair of bridging movable contacts 44 and 45. The bridging contacts 44 and 45 are biased to their maximum separated position against the stops 42 and 43 by a compression spring 46 disposed therebetween and about the rod 34. Rigid with the sleeve 42 is a striker 47 engageable with an additional pair of cooperating contacts in the operation of the relay. The contacts cooperating with the bridging contact plates 44 and 45 are identical and are comprised by posts 48 rigidly mounted upon the block 2 and provided with front terminal screws 49. The stationary contacts 51 are provided with threaded supporting stems 52 threaded into the posts 48 for adjustment and maintained in adjusted position by locking nuts 53. Also mounted on the supporting block 2 is an additional set of cooperating stationary and movable contacts embodied by the spaced stationary contacts 54 rigidly secured to the block and provided with front terminal screws 55. A pair of guiding brackets 56 and 60 are rigidly disposed on the block 2 and slidably receive rod 57 upon which is disposed a movable bridging contact plate 58 adapted to cooperate with the stationary contacts 54. A compression spring 59 about the rod 57 and between the contact plate 58 and the bracket 56 biases the contact plate 58 into engaged position. The rod 57 extends downwardly below the stationary contacts 54 into a position to be engaged by the striker 47 on the rod 34 to move the contact plate 58 to its separated position.

The operation of the relay will now be described. Energization of the operating coil 9 will cause upward movement of the core 11 compressing the spring 14 and applying a bias by means of the spring tending to move the rod 13 and the contact operating rod 34 in an upward direction. This upward movement of the rod 34 is timed by means of the timing device indicated at 6 and adjustment of its valve pin will determine the period or speed of movement of the rod. In this movement of the rod the sequence of operation of the cooperating sets of contacts will, of course, be determined by the adjustment or position of the stationary contacts and any desired sequence of operation can be secured by this adjustment. As herein illustrated the contacts have been set to operate in a sequence in accordance with their vertical spacing and here the upward movement of the rod 34 would first engage the sleeve 43 with the bridging contact 45 and move it upwardly to separate it from the spaced stationary contacts 51 with which it cooperates. Continued upward movement of the rod 34 will move the bridging contact 44 into bridging relation with the spaced stationary contacts with which it cooperates and the contact pressure upon the bridging contact 44 will be maintained by the compression spring 46 as it is compressed by movement of the rod 34. Further upward movement of the rod 34 engages the striker 37 with the rod 57 and moves the contact plate 58 upwardly to disengage it from the spaced stationary contacts 54. The rod 34 thus continues to move upwardly until it reaches its extreme position of travel or until the coil 9 is deenergized. Upon deenergization of the coil 9 the core 11 will tend to move downwardly under the action of gravity, thus relieving the force holding the rod 34 in its upward direction. The rod 34 will then start to move downwardly under the action of gravity as assisted by the spring 39 and this movement will be timed by the upper timing device 5 through the bleeding valve 18. As it moves downwardly the contact operation is the reverse of that previously described, the striker 47 first leaving the rod 57 and permitting the bridging contact 58 to bridge the contacts 54, then operating the contact 44 by the engagement of sleeve 42 therewith and lastly engaging the bridging contact 45 with its cooperating stationary contacts.

Adjustment of the valve pin 28 for the timing device 5 will control the speed of movement of the rod 34 in its downward direction. In this downward movement of the rod 34 the check valve in the timing device 6 operates so that this timing device exerts no resistance to the downward movement of the rod. Similarly, in the upward movement of the rod the check valve 19 operates to place the timing control solely on the lower timing device 6. By means of the timing devices 5 and 6 the upward and downward movements of the rod 34 may be independently adjusted to any desired times. The adjustable mounting of the stationary contacts permits their position to be varied so that the time of engagement or disengagement may be separately varied and by this means any desired timing control arrangement may be secured since the cycle timing may be adjusted in both directions and the relative time of operation of the contacts in any cycle or the time spacing between the sets may be independently varied.

The relay according to the present invention is susceptible to a wide variety of uses and may be wired up in any manner to secure timing control of any system arrangement. In the parent application, of which this is a division, a welder control system employing the relay herein described has been specifically described and claimed.

The modification illustrated in Figure 4 is identical with that previously described with the exception of an additional set of contacts. In this modification an additional pair of sleeve stops 61 and 62 are disposed on the rod 34 and an additional bridging contact 63 is provided cooperating with the sleeve 61. A compression spring 64 is disposed about the rod 34 and between the bridging contact plate 63 and the sleeve 62. An additional pair of stationary contacts indicated at 65 and mounted in the identical manner as the contacts 51 previously described are provided to cooperate with the bridging plate 63. This arrangement illustrates how the timing relay according to the present invention may be modified to include any desired number of contacts in any desired contact arrangement. In this arrangement of the relay the upward movement of the rod 34 will first disengage contact plate 45 and then engage contact plate 44, then disengage contact plate 63 and finally disengage bridging contact plate 58, the downward movement of the rod engaging and disengaging these contacts in reverse sequence. The other features of the timing relay including the electromagnetic operator and the opposite timing devices have not been shown in this figure and are identical with those previously disclosed.

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 interpretation within the terms of the following claims.

I claim:

1. A time delay relay comprising a vertically reciprocable member, electromagnetic means for controllably applying an upward biasing force on said member, vertically spaced sets of spaced stationary contacts, bridging contact elements adapted to be separately operated by said member into and out of engagement with their cooperating sets of stationary contacts, an adjustable fluid dash pot controllably delaying the movement of said member in the upward direction, and a separately adjustable fluid dash pot controllably delaying the return movement of said member in the downward direction, at least certain of said stationary contacts being vertically adjustable to vary the spacing between sets and the timing period between successive contact operations.

2. A time delay relay comprising a plurality of sets of normally open and normally closed electrical contacts, means movable in one direction to operate said contacts in sequence to effect movement of the normally open contacts to closed position and the normally closed contacts to open position, electromagnetic means for effecting movement of said first mentioned means in said one direction when energized, time delay means controlling the speed of movement of said first mentioned means in said one direction, means returning said first mentioned means to its initial position when said electromagnetic means is deenergized, said return movement effecting the sequential operation of the sets of contacts to their normal positions, time delay means for controlling the speed of said return movement, said time delay means being independently adjustable so as to effect independent control of the speeds of movement of said first mentioned means in said one direction and in the return direction.

3. A time delay relay comprising a plurality of vertically spaced sets of horizontally spaced stationary contacts, a vertically reciprocable member normally biased to its downward position, a plurality of bridging contact elements carried by said reciprocable member, certain of said contact elements being in engagement with their cooperating stationary contacts and others being out of engagement with their cooperating stationary contacts when the member is in its downward position, remotely controlled means for effecting upward movement of said rod to effect sequential operation of the movable contacts to the reverse position from that occupied when the member is in its downward position, time delay means for controlling the speed of upward movement of said member, said member returning to its downward position when said remote control means is deenergized, and independently adjustable time delay means for controlling the speed of downward movement of the member in which the bridging contacts are sequentially operated into their original cooperating positions.

4. A time delay relay comprising a member rectilinearly movable in opposite directions, electromagnetic means for moving said member in one direction when energized, biasing means for moving said member in the opposite direction when said electromagnetic means is deenergized, a plurality of independent sets of electrical contacts adapted to be sequentially operated by said member in its movement in each direction, and time delay means controlling the speed of movement of said member in each direction and independently adjustable to independently control the speed of movement in each direction.

5. A time delay relay comprising a member movable in opposite directions, means constantly biasing said member for movement in one direction, electromagnetic means for controllably applying a stronger biasing force in the opposite direction when energized, a plurality of independent sets of electrical contacts adapted to be sequentially operated by said member in its movement in each direction, and time delay means for controlling the speed of movement of said member in each direction and adjustable to independently vary the speed of movement in each direction.

6. A time delay relay comprising a plurality of stationary contacts, a plurality of movable contacts adapted to be moved into and out of engagement with said stationary contacts, a movable member for effecting sequential operation of the movable contacts, electromagnetic means for moving said member in one direction when energized, means for effecting the return movement of said member when the electromagnetic means is deenergized, adjustable time delay means providing for delayed movement of said member in said one direction and a second adjustable time delay means providing for delayed movement of said member in the return direction whereby the speed of movement of said member in its opposite directions may be independently varied.

7. A time delay relay comprising a plurality of stationary contacts, a plurality of movable contacts adapted to be moved into and out of engagement with said stationary contacts, a movable member for effecting sequential operation of the movable contacts, electromagnetic means for moving said member in one direction when energized, means for effecting the return movement of said member when the electromagnetic means is deenergized, adjustable time delay means providing for delayed movement of said member in said one direction and a second adjustable time delay means providing for delayed movement of said member in the return direction whereby the speed of movement of said member in its opposite directions may be independently varied, said stationary contacts being adjustably mounted to provide for variation between successive contact operations.

8. A time delay relay comprising a reciprocable rod, a fluid dash pot delay means at each end of said rod, each of said dash pots being effective to controllably delay the speed of movement of said rod in one direction whereby the speed of movement of the rod in opposite directions may be independently controlled, a plurality of movable contact elements mounted on said rod and movable therewith through at least a portion of the movement thereof, a plurality of spaced stationary contacts mounted to be engaged and disengaged by said movable contacts in a predetermined sequence during the movement of said rod, and means for adjustably mounting said stationary contacts to vary the period between successive contact operations.

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