July 6, 1943. E. G. DE VALERA 2,323,459

CIRCUIT CONTROLLING MEANS

Filed Aug. 14, 1940 3 Sheets-Sheet 1

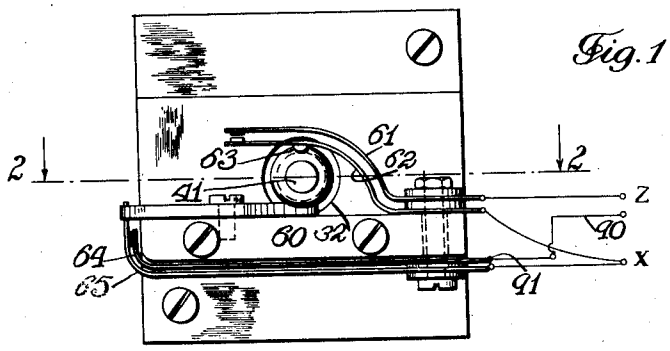


Fig. 1

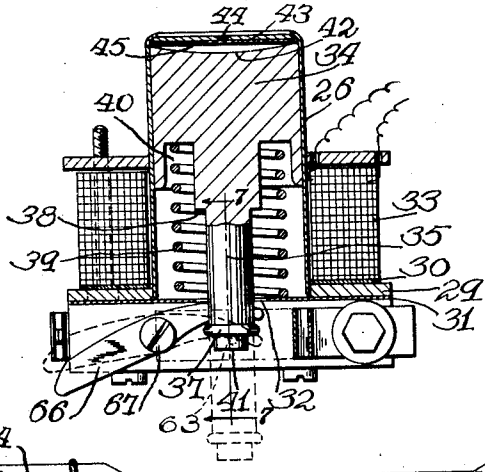


Fig. 2

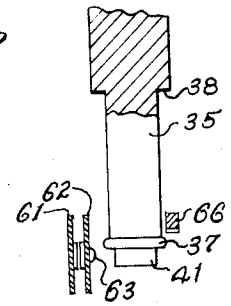


Fig. 7

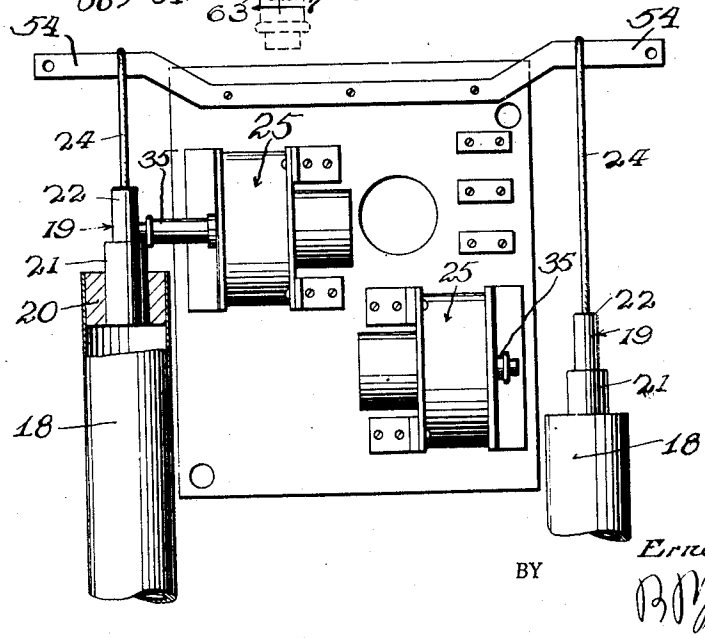


Fig. 5

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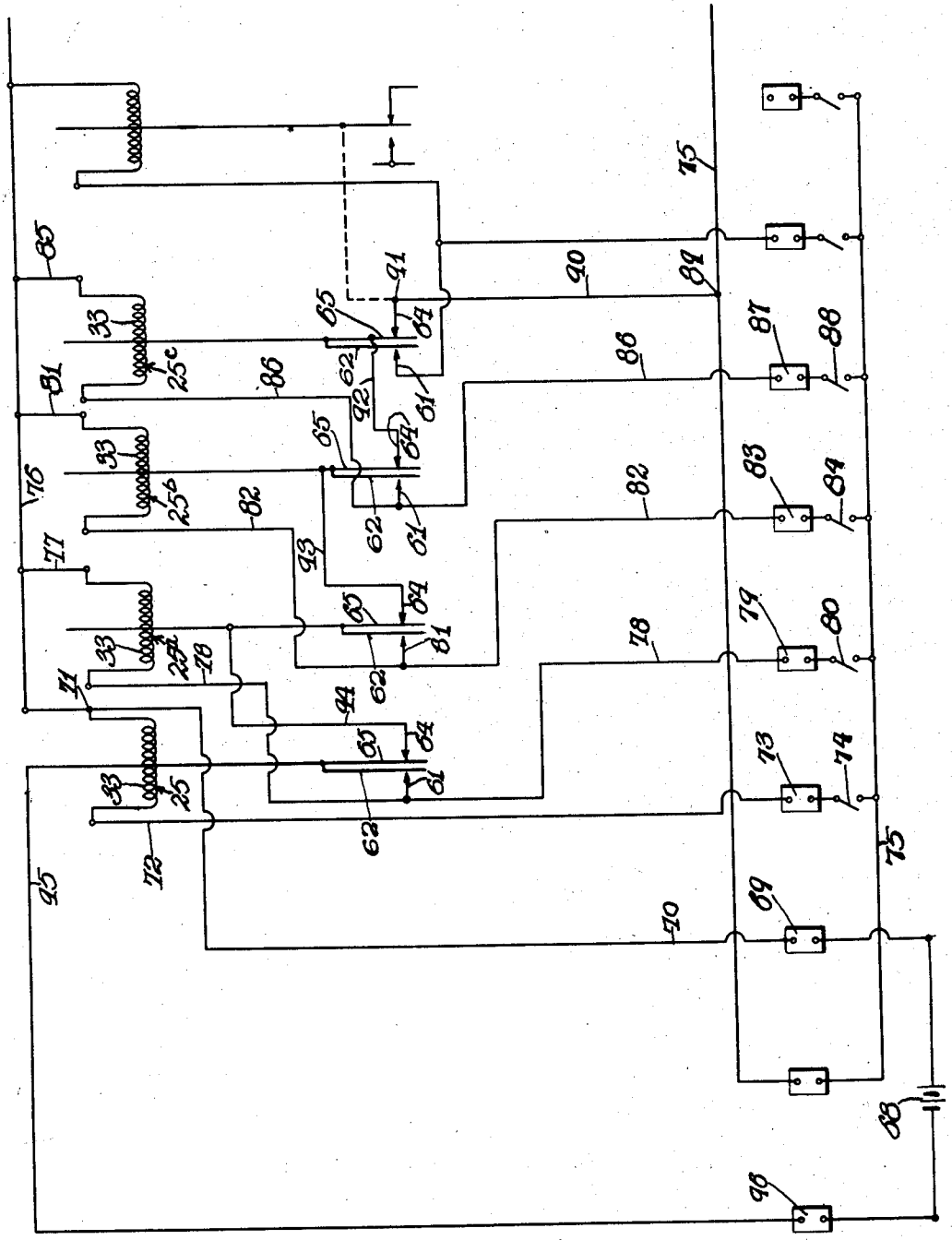


Fig. 6

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CIRCUIT CONTROLLING MEANS

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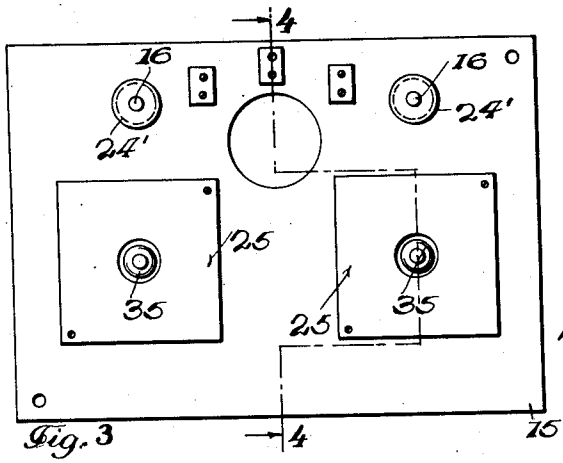


Fig. 3

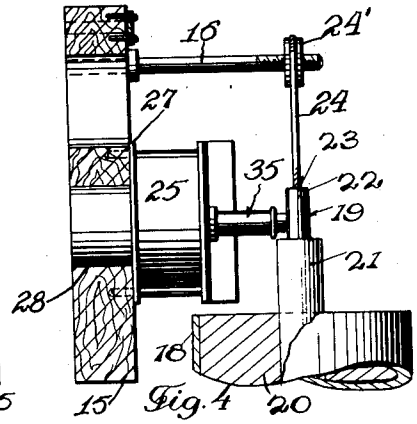


Fig. 4

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Patented July 6, 1943

2,323,459

UNITED STATES PATENT OFFICE

2,323,459

CIRCUIT CONTROLLING MEANS

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Application August 14, 1940, Serial No. 352,608

10 Claims. (Cl. 200—97)

My invention is circuit controlling means, adapted for general use.

An important object of the invention is to provide means of the above-mentioned character which are well adapted for use in connection with signal devices, audible or visual.

A further object of the invention is to provide means for closing a plurality of circuits in succession, upon the closing of a circuit at a given point.

A further object of the invention is to provide means whereby a suitable time interval is provided between the closing of the circuits in succession, so that clearly defined signals may be produced, when the means is used in connection with signalling devices.

A further object of the invention is to provide electrical means to cause a striker to operate a resonant member and to open the circuit of such means at about the time that the striker operates the resonant member.

A further object of the invention is to provide means whereby the striker after operating the resonant member is employed to close another circuit included in the means for operating a resonant member.

A further object of the invention is to provide means to retard the returning movement of the striker from the striking position and to utilize this retarded returning movement for the closing of a circuit for actuating another resonant member whereby a selected interval is obtainable between the signals produced.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a front elevation of one of the combined striker and circuit closing devices,

Figure 2 is a horizonal transverse section taken on line 2—2 of Figure 1,

Figure 3 is a front elevation of a panel showing two of the devices shown in Figures 1 and 2 mounted thereon,

Figure 4 is a side elevation of the devices shown in Figures 1 and 2, associated parts being shown in section taken on substantially line 4—4 of Figure 3,

Figure 5 is a front elevation of a slightly modified form of combined striker and circuit closing device,

Figure 6 is a diagrammatic view of the circuits and associated elements, and

Figure 7 is a vertical section taken on line 7—7 of Figure 2, parts in elevation.

Attention being called first to Figures 1 to 4 inclusive, the numeral 15 designates a support or base. This support is shown as vertically arranged and has rods 16 rigidly mounted thereon. The numeral 18 designates resonant members, preferably producing different sounds. These resonant members are shown as tubular and as substantially cylindrical. At their upper ends, these resonant members have vibration transmitting elements 19, formed of rigid material, such as metal, "Bakelite," or other non-metallic material. The vibration transmitting elements 19 are rigidly mounted within plugs 20, formed of rigid material and these plugs are rigidly mounted within the ends of the tubular resonant members 18. It is thus seen that the vibration transmitting elements 19 are rigidly secured to the resonant members so that when the vibration transmitting elements are struck the vibration will be transmitted to the resonant members. The vibration transmitting elements 19 are preferably cylindrical, are concentric with the resonant members 18 and have considerably smaller diameters than the members 18. The purpose of this is to transmit the blow from the striker to the resonant member near the center of the resonant member or inwardly of the periphery of the resonant member thereby improving the quality of the tone produced by the resonant member. The vibration transmitting element 19 preferably has portions 21 and 22 of different diameters, so that by striking different portions 21 or 22 the resonant member 18 will produce different sounds. As shown in Figure 4, the vibration transmitting elements 19 are also employed to suspend the resonant members 18 and for this purpose the elements 19 preferably have longitudinal openings 23 formed centrally thereof and these openings have flexible elements or cables 24 anchored therein and the cables engage over grooved nuts 24' having screw-threaded engagement with the rods 16.

Disposed inwardly of the resonant members 18 and near the same, Figures 1, 2, 4, and 4a, are combined striking and circuit controlling devices 25. These devices are identical and a detailed description of one will suffice. Each device 25, Figures 1 and 2, comprises a cylinder 26 of non-magnetic material, passing through an opening in a base 27 of insulating material and this base is rigidly mounted upon the support 15 by screws or the like. The rear end of the cylinder 26 extends within an opening 28 formed in the base 15. The forward end of the cylinder 26 is anchored within an opening formed in a plate 29, formed of soft iron, and 30 is insulating material and 31 is a strip extending across the open forward end of the cylinder 26 and having an opening 32. It is thus seen that the cylinder 26 and plates 27 and 29 form a spool for receiving a solenoid winding or coil 33. Mounted to reciprocate within the cylinder 26 is a plunger or

core 34 formed of magnetic material such as soft iron. This cylinder or core fits snugly within the cylinder but is free to slide therein without undue friction but will permit of but a slight escape of air between its periphery and the wall of the cylinder whereby if the rear end of the cylinder is completely closed the air within the cylinder would dampen or retard the movement of the core to a considerable extent. This cylinder or core is a part of a striker and the cylinder or core is equipped with a rod 35 preferably integral therewith and this rod extends through the opening 32 and is equipped near its free end with a flange or rib 37. The rod 35 has an inner shoulder 38, for a purpose to be described. Surrounding the rod 35 is a compressible coil spring 39, one end of which engages the plate 31 and the opposite end of which engages within an annular recess 40, as shown. The purpose of this spring is to return the cylinder or core to the normal starting position, but the spring may be omitted by arranging the parts vertical so that the cylinder or core will gravitate to the starting position. At its forward end the rod 35 has an opening or recess to receive a striking head 41 which may be formed of any suitable material. At its rear end, plunger or core 34 preferably has a spherically curved recess 42. The rear end of the cylinder 26 is covered by a plate 43, having a gas-tight joint at its periphery with the cylinder 26. The plate 43 has an opening 44 for the passage of air. Arranged within the cylinder 26 adjacent to the plate 43 is a disk 45 formed of leather. This leather disk is porous to a certain extent and permits of the slow or retarded passage of air through the same. When the solenoid is deenergized, the spring 39 tends to return the plunger or core 34 to the starting or rear position, and this return movement is retarded by the gradual escape of the air within the cylinder behind the core, such air passing through the porous disk and escaping through the opening 44 in addition to the gradual escape of the air about the periphery of the core. The invention is not restricted to the use of a porous leather disk for this purpose as the disk may be formed of any other suitable material which will have the same or suitable porosity.

As shown in Figures 3 and 4, the rods 35 are arranged at a right angle to the base 15 and are disposed to strike the vibration transmitting elements 19, at the portions 22 thereof. Two of the devices 25 are shown in Figure 3.

In Figure 5, the striking rods 35 of the devices 25 are arranged parallel with the support 15 and suitable means are employed to mount the devices 25 upon the support 15. The vibration transmitting elements 19 and the resonant elements 18 are shown as arranged to be struck by the rods 35 of the devices 25 and these elements 19 are suspended from brackets 54, as shown.

As shown in Figures 1 and 2, a bar of insulating material 60 is rigidly mounted upon the plate 29. The numerals 61 and 62 designate a pair of normally open spring contacts mounted upon the bar 60 and insulated from each other. The contact 62 carries a lug 63 arranged in the path of travel of the flange 37. The numerals 64 and 65 designate a pair of normally closed resilient contacts which are mounted upon the insulating bar 60 and are insulated from each other. The free end of the contact 65 is arranged to be engaged by a finger 66 pivoted between its ends at 67 and the inner end of this finger is arranged between the flange 37 and the shoulder 38.

Attention is now called to Figure 6, wherein a diagram of the circuits is presented. It is to be understood that any suitable number of devices 25 over one is to be employed and I will now describe circuits wherein four of the devices 25 are employed and these devices 25 have been designated 25, 25^a, 25^b, and 25^c for the sake of clearness. In Figure 6, the solenoid windings 33 are shown. In this figure, the numeral 68 designates a source of current, to one terminal 69 of which is connected a wire 70, and this wire is connected at 71 with one end of the first winding 33 of device 25 and the opposite end of the winding 33 is connected with a wire 72, which is connected with a terminal 73 of a single pole switch 74, such as a pushbutton and the opposite terminal of the switch is connected with a wire 75. Connected with the wire 70 at 71 is a wire 76, having connection with a wire 77 connected with one end of the next winding 33 of the device 25^a and this winding 33 is connected with a wire 78 and the wire 78 is connected with the terminal 79 of a single pole switch 80, the opposite terminal of which is connected with the wire 75. Connected with the wire 76 is a wire 81, connected with one end of the next winding 33 of the device 25^b and the opposite end of this winding is connected with a wire 82 and this wire is connected with the terminal 83 of a single pole switch 84 the opposite terminal of which is connected with the wire 75. The wire 85 is connected with the wire 76 and the wire 85 is connected with one end of the next winding 33 of the device 25^c and the opposite end of this winding is connected with a wire 86 and this wire is connected with a terminal 87 of a single pole switch 88 which is connected with the wire 75. Connected with the wire 75 at 89 is a wire 90 which is connected at 91 with the stationary resilient contact 64. The contact 64 normally engages the contact 65 and contact 62 is electrically connected with contact 65. Contact 62 normally disengages contact 61 and is shifted into engagement with contact 61. Contacts 61 in the devices 25, 25^a, and 25^b are connected with wires 78, 82, and 86 respectively. Contact 64 in the device 25^b is connected with a wire 92 which is connected with the contact 65 of the device 25^c. The contact 64 of the device 25^a is connected with wire 93 which is connected with the contact 65 of the device 25^b. Contact 64 of the device 25 is connected with wire 94 which is connected with contact 65 of the device 25^a. Contact 65 in the device 25 is connected with wire 95 which is connected with terminal 96 of the source of current 68.

The operation of the apparatus is as follows:

When it is desired to produce four distinct audible signals the switch or pushbutton 74 is closed. When this is done a circuit is closed to energize the solenoid of the device 25. In this closed circuit current will flow from one pole of the source of current 68, through wire 70, point 71, coil 33 of device 25, wire 72, switch 74, wire 75, wire 90, contact 64, contact 65, wire 92, contact 64, contact 65, wire 93, contact 64, contact 65, wire 94, contact 64, contact 65, and wire 95 back to the opposite pole of the source of current. When the solenoid winding 33 of device 25 is energized the core 34 is thrown forwardly in opposition to the spring 39 and the head 41 will strike the vibration transmitting element 19 and the resonant member 18 will be vibrated to produce the sound. When the striking rod 35 moves forwardly on its striking stroke the

flange 37 engaged the lug or projection 63 and caused contact 62 to momentarily engage contact 61 but this engagement was broken when the flange 37 passed forwardly beyond the lug 63 and before there was sufficient time to energize winding 33 of the device 25a. Therefore, when the core 34 of the device 25 is in the forward position to strike the resonant element, the flange 37 is arranged forwardly of the lug 63 and contacts 61 and 62 are open. At about the time that the core 34 has moved to the forward position to strike the resonant member, the shoulder 38 has moved forwardly and engages the finger 66 and this finger will move contact 65 out of engagement with contact 64, thereby opening the circuit of the winding 33 of the device 25, at contacts 65 and 64. The solenoid winding 33 of the device 25 being now deenergized (the switch 74 being now open and it would make no difference if this switch were again closed during this period), the core 34 in the device 25 is moved in a retarded manner to the rear position by the action of the spring 39 and the air entrapped in the rear end of the cylinder 26 gradually escapes through the porous disk 45. The finger 66 remains in the set position and retains contact 65 out of engagement with contact 64 until the core nears the rear position, at which time flange 37 shifts the finger 66, which releases contact 65 which again engages contact 64. It is thus seen that after the circuit has been closed for energizing the winding 33, device 25, the circuit of this winding is opened at points 64 and 65 and remains open until the core returns to the rear starting position at which time the circuit is again closed at contacts 64 and 65. The flange 37 momentarily caused the contact 62 to engage contact 61 and then traveled forwardly beyond the lug 63. When the core 34 moves rearwardly and nears the rear end of its stroke the flange 37 again engages projection 63 and contact 62 is brought into engagement with contact 61 and contacts 62 and 61 are held in engagement a sufficient length of time for energizing the winding 33 of the device 25a, but flange 37 has shortly before this engaged and shifted lever 66 so that contacts 65 and 64 engage. After this, the continued rearward movement of the core 34 causes the flange 37 to disengage projection 63 and contact 62 again disengages contact 61. It is thus seen that at about the time that contact 65 again engages contact 64, contact 62 engages contact 61, and contact 62 shortly thereafter disengages contact 61. As stated, after the core 34 of device 25 moves to the forward position and returns to a point near the rear position, a circuit is closed for energizing the winding 33 of the device 25a. In this closed circuit current will flow from the source of current 68 through wire 70, point 71, wire 76, wire 77, winding 33 of device 25a, wire 78, contact 61, contact 62, wire 95 back to the source of current 68. The winding of the device 25a is therefore energized and its rod 35 strikes the resonant member to produce the audible signal. When the winding 33 of the device 25 is energized, its core moves forwardly and the circuit is opened at contacts 64 and 65, device 25a, when the rod strikes the resonant member of device 25a, and when the core of device 25a approaches the rear position the circuit is again closed at contacts 64 and 65, device 25a, and also closed at contacts 62 and 61, device 25a, a sufficient length of time to energize the winding 33 of device 25b, after which contact 62 disengages contact 61. When contact 62 engages contact 61, device 25a, to energize winding 33, device 25b, current flows from the source of current 68, through wire 70, wire 76, wire 81, winding 33, device 25b, wire 82, contact 61 and contact 62, device 25a, wire 94, contact 64 and 65, device 25, and through wire 95 back to the source of current. In a similar manner, when winding 33 of device 25b is energized, a circuit will be subsequently closed to energize winding 33, device 25c. It should be noted that when the switch 74 is closed the four devices 25, 25a, 25b, and 25c will be operated to produce in succession four audible signals; that when the switch 80 is closed and the remaining switches open that three audible signals are produced in succession; that when the switch 84 is closed and the remaining switches are open that two audible signals are produced in succession; and that when the switch 88 is closed while the remaining switches are open that only one audible signal is produced. It is thus apparent that a selected number of audible signals may be obtained.

I have shown and described four devices 25, 25a, 25b, and 25c for operating four resonant elements, but any number of such devices may be connected in series. When four devices are used the contacts 61 and 62 of the device 25c would be omitted but these have been illustrated to indicate that other devices may be connected in series.

It is to be understood that the forms of my invention herewith shown and described are to be taken as preferred examples of the same and that various changes in the shape, size, and arrangement of parts may be resorted to, and other uses, and materials employed, without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described my invention, what I claim is:

1. In apparatus of the character described, a solenoid winding, a core moved in one direction by the winding and shiftable in an opposite direction, a dash-pot to retard the movement of the core in the opposite direction, a normally closed circuit closing device opened when the core is moved in the said one direction and remaining open until the core moves in the said opposite direction, and a normally open circuit closing device closed and subsequently opened when the core is moved in the said opposite direction.

2. In apparatus of the character described, a solenoid winding, a core shifted rapidly in one direction by the winding and movable in an opposite direction, means to retard the movement of the core in the opposite direction so that it moves slowly, a normally closed circuit closing device opened by the core when the core approaches the end of its movement caused by the solenoid winding, and a normally open circuit closing device which is momentarily closed and then opened when the core is shifted by the solenoid winding and closed for a longer period and subsequently opened when the core moves in an opposite direction.

3. In apparatus of the character described, a solenoid winding, a core shiftable into the winding and having a rod provided with spaced trip elements, a normally closed circuit closing device, a movable element shifted by one trip element to open the circuit closing device and shifted by the other trip element to cause the closing of the circuit closing device, and a normally open circuit closing device having a part engaged by one trip

element to close and open the same upon the movement of the core in one direction.

4. In apparatus of the character described, a solenoid winding, a core shiftable into the solenoid winding when the winding is energized and having a rod, a normally closed circuit closing device, a movable element arranged near the rod, a trip element carried by the rod and engaging and shifting the movable element to open the normally closed circuit closing device when the core is moved inwardly by the solenoid winding, a second trip element carried by the rod and engaging and shifting the movable element so that it causes the circuit closing device to close when the core moves in an opposite direction, a normally open circuit closing device having an engaging part disposed in the path of travel of the second named trip element of the rod so that the normally open circuit closing device is closed and subsequently opened when the core moves inwardly by the action of the solenoid winding.

5. In apparatus of the character described, a solenoid winding, a core shiftable inwardly by the solenoid winding when it is energized, means to cause the core to move outwardly at a slower speed when the solenoid winding is deenergized, a rod connected with the core, said rod having an inner trip element and an outer trip element spaced from the inner trip element, a normally closed circuit closing device adapted to control the circuit for the solenoid winding, a pivoted lever adapted to be engaged by the inner trip element and shifted thereby to open the normally closed circuit closing device, the pivoted lever remaining in the shifted position until again moved, the pivoted lever being also arranged to be engaged and shifted by the outer trip element whereby the same causes the circuit closing device to close, and a normally open circuit closing device having a part arranged in the path of travel of the outer trip element to be engaged and moved by the outer trip element when the core is moved inwardly and outwardly.

6. In apparatus of the character described, a solenoid winding, a core shiftable inwardly by the solenoid winding when it is energized, means to cause the core to move outwardly at a slower speed when the solenoid winding is deenergized, a rod connected with the core, said rod having an inner trip element and an outer trip element spaced from the inner trip element, a normally closed circuit closing device, a pivoted lever adapted to be engaged by the inner trip element when the core moves inwardly to open the normally closed circuit closing device, the pivoted lever remaining in the shifted position until again moved, the pivoted lever being also arranged to be shifted by the outer trip element when the core moves outwardly for closing the circuit closing device, and a normally open circuit closing device having a part arranged in the path of travel of the outer trip element to be engaged and disengaged thereby upon the beginning of the inward movement of the core and to be engaged and disengaged by said outer trip element when the core moves outwardly and approaches the end of its outward movement, said lever and part being so arranged that the outer trip element engages and shifts the lever prior to its engagement and shifting of said part upon the outward movement of the core.

7. In apparatus of the character described, a solenoid winding, a core shiftable inwardly by the solenoid winding when it is energized, means to cause the core to move outwardly at a slower speed when the solenoid winding is deenergized, a rod connected with the core and having trip elements spaced longitudinally thereof, a circuit closing device, means to operate the circuit closing device and having a part arranged between the trip elements to be alternately engaged thereby, a second circuit closing device, an operating part secured to the second circuit closing device, said operating part being arranged in the path of travel of one of the trip elements to be operated thereby when the rod is shifted in opposite directions.

8. In apparatus of the character described, a solenoid winding, a core shiftable inwardly by the solenoid winding when it is energized, a spring to move the core outwardly, means forming a dash-pot to retard the outward movement of the core, a rod attached to the core and having an inner shoulder and an outer flange, a normally closed circuit closing device, a pivoted lever to operate the circuit closing device and arranged upon one side of the rod between the shoulder and the outer flange to alternately engage therewith, a normally open circuit closing device, and an operating part secured to the normally open circuit closing device and arranged upon the opposite side of the rod and disposed in the path of travel of the outer flange.

9. In apparatus of the character described, a solenoid winding, a core shiftable inwardly by the solenoid winding when it is energized, means to cause the core to move outwardly at a slower speed when the solenoid winding is deenergized, a rod connected with the core, said rod having an inner trip element and an outer trip element spaced from the inner trip element, the outer trip element being relatively narrow, a normally closed circuit closing device, a pivoted lever arranged near the normally closed circuit closing device to engage therewith and open the same, said lever having one end permanently arranged between the inner and outer trip elements to be alternately engaged thereby, a normally open circuit closing device, and a part carried by the normally open circuit closing device and arranged in the path of travel of the outer trip element to be moved thereby, the outer trip element being movable to positions upon opposite sides of said part.

10. In apparatus of the character described, a solenoid winding, a core moved in one direction by the winding and shiftable in an opposite direction, means to retard the movement of the core in the said opposite direction so that it moves slowly, a normally closed circuit closing device, a normally open circuit closing device, and means operated by the core to open the normally closed circuit closing device when the core moves in the said one direction and to momentarily close the said normally open circuit closing device and then permit the normally open circuit closing device to open and said means when the core moves in the said opposite direction serving to again close the normally open circuit closing device and to retain the same closed for a greater length of time than the momentary closing of the same and to again permit the normally open circuit closing device to open and to permit the normally closed circuit closing device to close.

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