Oct. 31, 1939. A. H. LAMB 2,178,479

RELAY SYSTEM

Filed Dec. 7, 1936 2 Sheets-Sheet 1

Fig. 1.

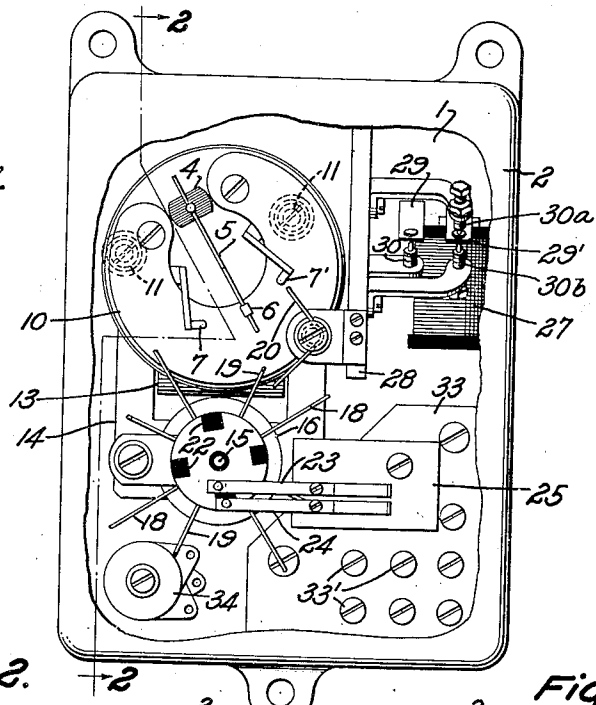


Fig. 2.

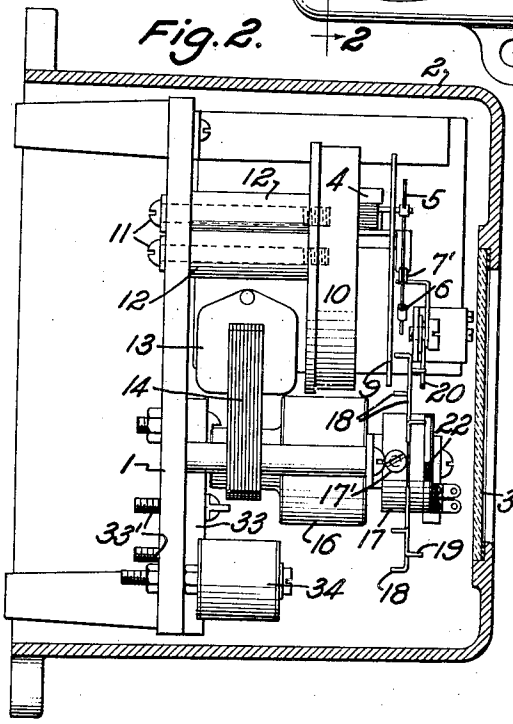
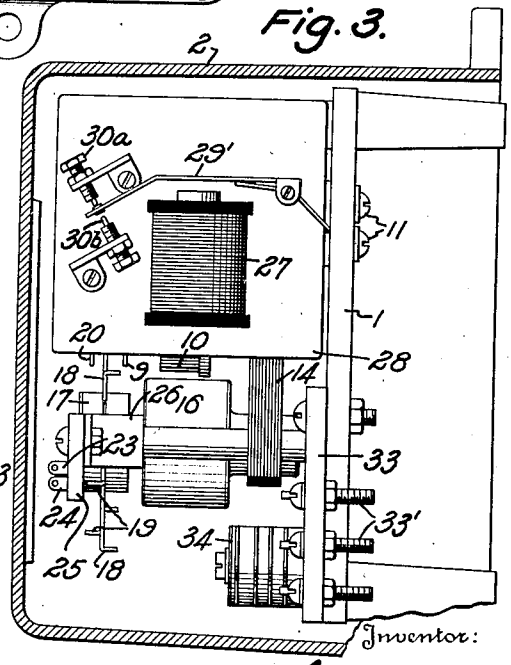


Fig. 3.



Inventor:

Anthony H. Lamb,

By Potter, Pierce & Schaffler,

Attorneys.

Oct. 31, 1939. A. H. LAMB 2,178,479

RELAY SYSTEM

Filed Dec. 7, 1936 2 Sheets-Sheet 2

Fig. 4.

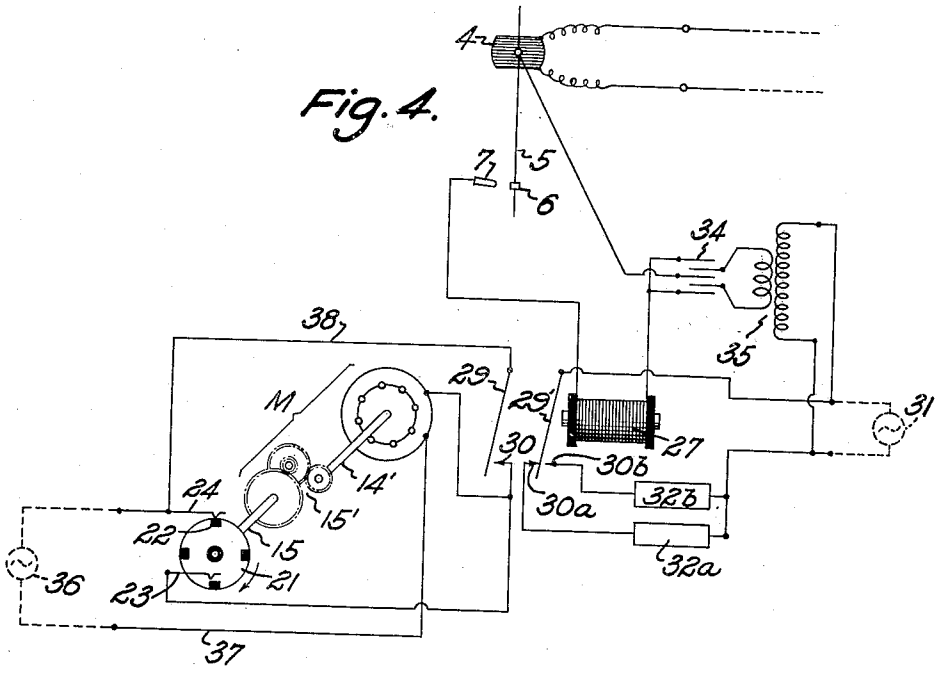


Fig. 6.

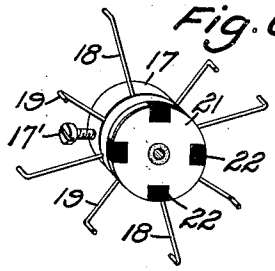


Fig. 5.

Inventor:

Anthony H. Lamb,

By Potter, Pierce & Scheffler,

Attorneys.

Patented Oct. 31, 1939 2,178,479

UNITED STATES PATENT OFFICE

2,178,479

RELAY SYSTEM

Anthony H. Lamb, Elizabeth, N. J., assignor to Weston Electrical Instrument Corporation, Newark, N. J., a corporation of New Jersey

Application December 7, 1936, Serial No. 114,715

13 Claims. (Cl. 175—320)

This invention relates to relay systems and particularly to relay systems of the type which includes a sensitive measuring instrument for regulating the flow of relatively heavy currents in control and/or alarm circuits.

An object of this invention is to provide sensitive relay systems of compact and simple construction that may be used to control relatively heavy current flow for the actuation of an alarm or control mechanism. An object is to provide a relay system of the type including an instrument relay having magnetic contacts and a motor-actuated mechanism for resetting the instrument contacts, the resetting mechanism being of simple design and mounted directly upon the power shaft of a miniature or "clock" motor. More particularly, an object is to provide an exceedingly compact physical construction for a sensitive control system including an instrument relay having magnetic contacts, and a clock type of self-starting synchronous motor for resetting the instrument relay, the relay and motor being partially overlapped upon a supporting base to position the contact arm of the relay within the path of movement of a pusher arm mounted directly upon the power or slow speed shaft of the clock type motor.

These and other objects and advantages of the invention will be apparent from the following specification when taken with the accompanying drawings in which:

Fig. 1 is a front elevation of an embodiment of the invention, the casing which houses the relay or control system being broken away;

Fig. 2 is a vertical section of the same as taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a side elevation of the same, as seen from the opposite side of Fig. 1 and with the casing removed;

Fig. 4 is a wiring diagram of the apparatus shown in Figs. 1 to 3;

Fig. 5 is a wiring diagram of another embodiment of the invention; and

Fig. 6 is a perspective view of a combined switch and pusher arm unit such as shown in Figs. 1 to 3.

In the drawings, the reference numeral 1 identifies a base that may be mounted upon a panel, not shown, to carry the entire control mechanism. A protective housing 2 fits loosely over the supporting base and has a window 3 through which the moving parts of the control unit are visible.

The measuring instrument or relay includes a permanent magnet (not shown), a pivoted coil 4 and a pointer 5 that carries a soft iron rider 6 for cooperation with relatively stationary magnetic contacts 7, 7'. These instrument parts, also the scale plate 9, are mounted on an insulating base 10 that is secured to the supporting base 1 by bolts 11 that, as is customary, may serve as the terminals for the moving coil 4. Spacer sleeves 12 on the terminal bolts 11 provide a clearance space between the supporting base 1 and the instrument relay base 10 for receiving the field coil 13 of a small synchronous motor M of the self-starting type. This motor is of the general type shown in the patent to Warren, No. 1,495,936, granted May 27, 1934, and includes a laminated field 14, a rotor (not shown in Figs. 1 to 3) on a rotor shaft 14' (see Figs. 4 and 5) that is connected to a power shaft 15 by reduction gearing 15' in the gear case 16. It is usually convenient to employ a synchronous motor such as designed for electric clocks, i. e., one having a reduction gear designed to rotate the power shaft 15 one revolution per minute, but other gear ratios may, of course, be used.

The power shaft 15 carries, in single unit, mechanism for separating the magnetic contacts of the instrument relay, operating means for a holding switch to maintain the energization of the motor for a predetermined interval after the separation of the relay contacts and, if desired, a load or alarm circuit switch operator. As illustrated in Figs. 1 to 3 and 6, this unit comprises a block or cylinder 17 of insulating material secured to the shaft 15 by a set screw 17' and carrying one or more "pusher arms" having bent ends for moving the pointer 5 of the instrument relay counterclockwise to separate the magnetic rider 6 from the magnet contact 7. Four pusher arms 18 are illustrated but the number may be varied in accordance with the speed of rotation of the power shaft 15 and the desired control interval. Supplemental radial arms 19 are carried by the block 17 for rocking the bell crank lever 20 which constitutes a pusher arm for separating the pointer 5 and rider 6 from the magnet contact 7'.

The holding switch assembly includes a contact plate 21 at the outer face of the cylinder 17, the plate having four radial notches at which portions 22 of the insulating block 17 are exposed. The spring contacts 23, 24 of the holding switch are carried by an insulating strip 25 that is mounted on the motor strap 26 in which the power shaft 15 is pivotally supported. The contact 23 is in continuous engagement with the central portion of the contact plate 21 and

contact 24 is positioned to engage the insulating sections 22 as the cylinder 17 rotates. The angular arrangement of the pusher arms 18 and the insulating sections 22 is such that the contact strip 24 engages an insulating section 22 to interrupt the motor circuit when a pusher arm 18 is adjacent the magnet contact 7 but spaced from the path of movement of the pointer 5. The circumferential length of the insulating sections is so short that the clockwise rotation of power shaft 15 and cylinder 17 will bring the contact disk 21 beneath contact 24 before the pusher arm 18 separates the relay contacts, thus completing a holding circuit for the motor which, with the illustrated four sets of pusher arms 18 and notches in the disk 21, corresponds to a 15 second control interval for one rotation of shaft 15 in sixty seconds.

The relay contacts may be included in the motor circuit, as indicated in Fig. 5, but the embodiment shown in Figs. 1 to 4 includes an auxiliary relay for completing the motor circuit. This auxiliary relay comprises a solenoid 27 mounted on an insulating plate 28 that is secured to the supporting base 1, and a pair of armature or pivoted contact arms 29, 29'. Contact 29 engages a fixed contact 30 to complete the motor circuit when the solenoid 27 is energized, and contact 29' cooperates with contacts 30*a*, 30*b* to close the alternative circuits from a power source, indicated schematically as an alternating current supply 31, and the alarm or control devices 32*a*, 32*b*, respectively.

A terminal plate 33 of insulating material is preferably secured to the base 1 to carry a plurality of terminals 33' which facilitate the assembly and wiring of the control device. When, as is preferable for high sensitivity and freedom from sparking, the circuit of the relay contacts is traversed by direct current, a small rectifier unit 34 of the copper oxide type is mounted on the base 1, and is supplied with low voltage alternating current through a step-down transformer 35 that is fed from the usual power and light source 31.

The operation of the control unit will be apparent from the wiring diagram, Fig. 4. One terminal of the power source 36 (which may be identical with power source 31 but is shown diagrammatically as a separate unit for clearness) is connected directly to one terminal of motor M by a lead 37, and the other source terminal is connected to the contact 24 of the holding switch and, by lead 38 to the normally open contact 30 of the auxiliary relay. The load or alarm circuit through device 30*a* is normally closed, and, when the control impulse to the relay coil 4 reaches such value that the magnetic rider 6 enters the field of the contact 7, these contacts engage to complete the energizing circuit of the solenoid 27. The armature contacts 29, 29' are drawn into engagement with contacts 30, 30*b*, respectively, thus completing the circuit for the motor and the alarm or control circuit through the device 32*b*. The power shaft 15 of the motor is thereby rotated to bring the contact disk 21 beneath the holding circuit contact 24, and, shortly thereafter, to carry a pusher arm 18 against the pointer 5 to separate the relay contacts. The solenoid circuit is thereby opened, also the original motor circuit at contacts 29, 30, but the motor continues to rotate until the holding circuit is opened by the movement of an insulating section 22 into engagement with the contact 24.

The wiring diagram of Fig. 4 does not show the "high" contact 7' nor the pusher mechanism but the operation is exactly the same when the rider 6 engages the contact 7'. The control impulse to the moving coil 4 may be produced in various ways, as is well known in the art. The moving coil 4 may be connected across a thermocouple in temperature control systems, across a voltage divider in voltage regulating systems, a photocell in light responsive systems, and across other variation producing devices in other control or alarm systems.

As shown in Fig. 5, the auxiliary relay may be omitted when load or alarm circuit contacts are controlled by the unit that is secured to the power shaft 15 of the motor. The cylinder 17' of insulating material carries the pusher arms, not shown, the contact disk 21 and also a series of circumferential contact segments or rings 39, 40, 41 for engagement with contact blades 42 that may be connected to a power supply and to alternatively operative control devices.

It is to be understood that the invention is not restricted to the particular embodiments herein illustrated and described, and that other physical constructions and circuit arrangements fall within the spirit of my invention as set forth in the following claims.

I claim:

1. A relay system including an instrument type relay having contacts operative when engaged to complete an energizing circuit for a motor, a motor included in said circuit and having a rotor shaft geared to a power shaft, switch means including a member actuated by said motor for completing a holding circuit for energizing said motor for a predetermined period independently of the engagement of said relay contacts, and means including a pusher arm actuated by said motor for separating said instrument contacts; said member of the switch means and said pusher arm comprising a unitary assembly mounted upon said power shaft.

2. A relay system of the type including an instrument type relay having magnetic contacts, a miniature motor having a rotor shaft and a power shaft geared to the rotor shaft, means actuated by said motor for separating the relay contacts and an energizing circuit for said motor controlled by said relay contacts, characterized by the fact that said contact-separating means comprises a pusher arm assembly secured to said power shaft, said assembly including switch means for opening the energizing circuit of said motor.

3. A relay or control system comprising an instrument type relay having magnetic contacts, a motor having an energizing circuit adapted to be closed upon an engagement of said relay contacts, said motor having a rotor shaft and a power shaft geared to said rotor shaft, means actuated by said motor for separating said relay contacts; and switch means including a member actuated by said motor for completing an energizing circuit for said motor independently of the engagement of said relay contacts; said contact-separating means and said switch member comprising a unitary assembly mounted directly upon and supported by said power shaft.

4. In a relay system, the combination of a supporting base, a relay having a pair of relatively movable contacts, a motor and means actuated thereby for separating said relay contacts, means for mounting said relay and motor on said supporting base, an energizing circuit for said motor including switch means controlled by said relay

contacts, and a holding circuit for said motor including operating means actuated by said motor, said holding circuit operating means and said contact separating means constituting a unitary assembly.

5. A relay system including a relay having a pair of spaced magnet contacts and a pointer carrying a rider contact of magnetic material, a motor energized by an engagement of the relay contacts, a holding circuit switch actuated by said motor for energizing the same for a predetermined period upon initial energization of said motor by said relay contacts, a rotatable pusher arm actuated by said motor for separating said pointer and its rider contact from one of said magnet contacts, a rocker arm for separating said pointer and its rider contact from the other magnet contact, and an arm rotated by the motor for actuating said rocker arm.

6. In a relay system, a relay for moving a pointer carrying a magnetic rider contact between two stationary magnet contacts, and means for separating said magnetic contact from said magnet contacts; said means including a rotating shaft, a pusher arm on said shaft for separating said rider contact from one magnet contact, a rocker arm having one end for separating the rider contact from the other magnet contact, and an arm on said shaft for actuating the other end of said rocker arm.

7. In a relay system, an instrument relay having a contact arm for engaging a fixed contact, an auxiliary relay having a solenoid included in a circuit controlled by said contacts, said auxiliary relay having contact arms engageable respectively with two sets of switch contacts, a motor for separating said instrument relay contacts, an energizing circuit for said motor including one set of said switch contacts, a holding circuit switch actuated by said motor for energizing the same for a predetermined period upon initial energization of said motor by said set of switch contacts, and a load circuit including the other set of switch contacts.

8. A relay system as claimed in claim 7, wherein said contact arm carries a contact rider of magnetic material and said fixed contact is a magnet.

9. In a relay system, an instrument relay having a contact arm for engaging a fixed contact, a motor having an energizing circuit including said relay contacts, said motor including a rotor shaft geared to a power shaft, means carried by said power shaft for separating said relay contacts, a load circuit switch including an operating member mounted on said power shaft, and a holding circuit for said motor including an actuating member mounted on said power shaft, said actuating members and said contact-separating means comprising a unitary assembly.

10. A relay system as claimed in claim 9, wherein said unitary assembly includes an insulating member secured to said power shaft, and said contact-separating means includes a radial arm supported by said insulating member.

11. In a relay system of the type including a relay having magnetic contacts and a motor for separating said contacts, a pusher arm and switch unit for mounting on a shaft of said motor; said unit comprising a block of insulating material and means for securing the same upon said shaft, a pusher arm mounted on said block, and switch operating means carried by said block.

12. A relay system as claimed in claim 11, wherein said switch operating means comprises a radially notched conductive plate secured to the end of said insulating block.

13. A relay system as claimed in claim 11, in combination with an auxiliary arm mounted on said block for actuating another contact-separating means.

ANTHONY H. LAMB.