

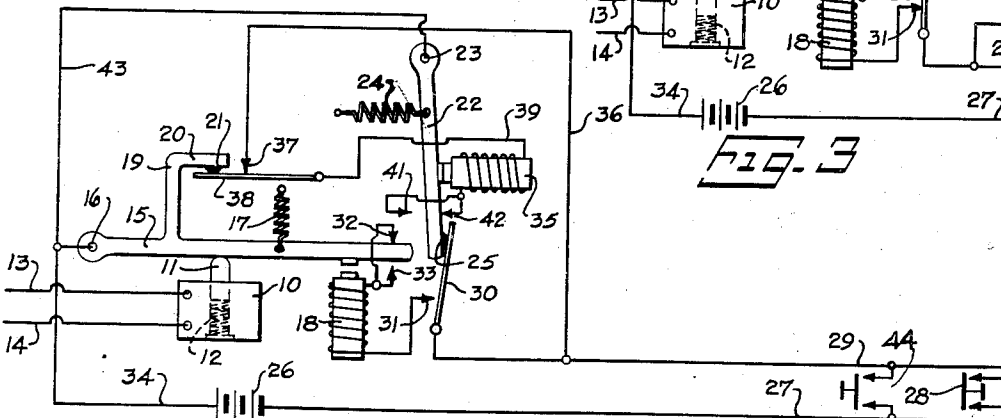
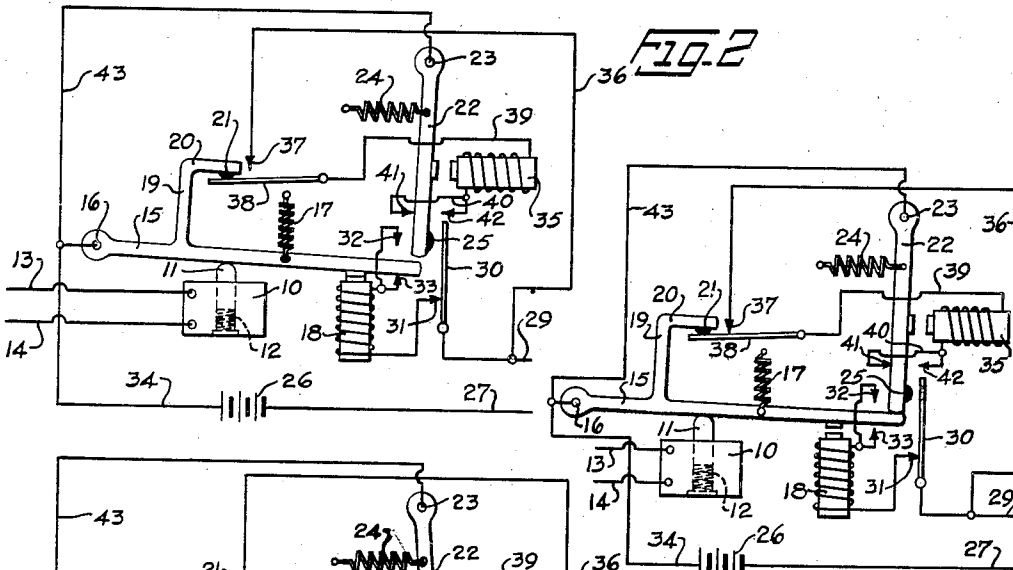
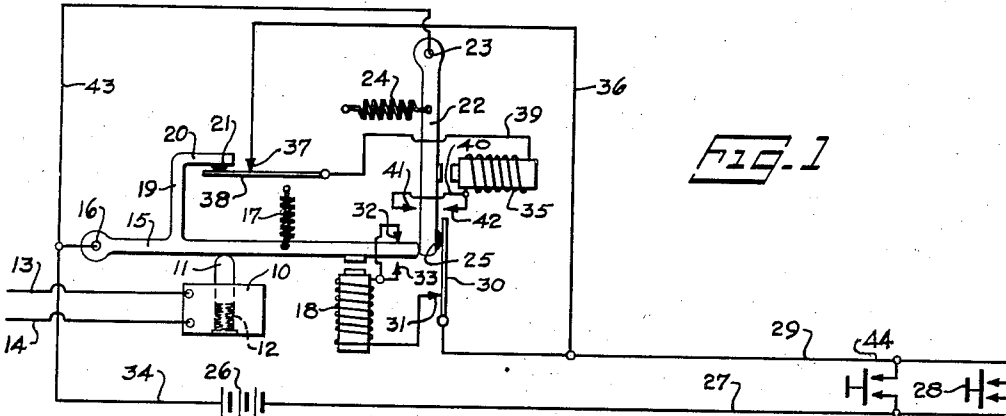
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ELECTROMAGNETIC SWITCHING DEVICE

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ELECTROMAGNETIC SWITCHING DEVICE

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The invention relates in general to electrically powered and manually controlled mechanism for governing the time duration in which remotely located equipment is caused to become active, and the invention specifically relates to a safety insurance device featuring an improved low voltage relay mechanism for controlling at will remotely located high voltage and thus dangerous equipment.

In the installation of electrical equipment it is often desirable to control the same from some point remote from the place where the equipment is located, and in some situations it has been the practice to carry the total high current strength of the equipment for long distances to and through the remotely located control switch. In those cases where the electric equipment to be controlled is powered by alternating current of high voltage and carried through long leads to the control switch, there arises current losses, installation problems and fire hazards especially where the leads must be made heavy to carry such high voltage current and the leads must pass along frail and combustible partitions and the like.

The invention has for a general object the providing of a simple form of low voltage control or relay mechanism for regulating other devices to be controlled thereby and for a more specific object, the providing of a low voltage control mechanism for regulating remotely located high voltage device without the necessity of carrying the high voltage across the long intervening space to the remote control switch.

The invention features a low voltage control system organized to cause a shiftable element of the governed equipment to be moved from a normal inactive position into a set operative position by a first actuation of a pushbutton, or similarly manually controlled circuit closer, to be locked automatically in such operative position by an interlock, and which interlock may be unlocked and thus released by a second actuation of the same pushbutton; and thereafter the control element be returned automatically to its initial position cocked ready to be again actuated.

The invention also contemplates its use in a situation where the controlled device, for instance a light, is to be turned on or off successively by the actuation of any one of a plurality of control switches. In accordance with present practices this is done by the use of three or four way switches which are not only expensive equipment but with their multitude of connecting wires necessitate the use of a rather complicated sys-

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tem of wiring. Accordingly another object of the invention is to provide a simple form of control which can be actuated from any number of switches or pushbuttons to cause successive change in status of the controlled instrumentality and to attain this by utilizing only two wires, or even only one wire in a grounded system.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of mechanism embodying the invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawing:

Fig. 1 is a view in schematic outline showing a preferred embodiment of the invention and with the parts in their normal inoperative, unenergized and unlocked position.

Fig. 2 is a view similar to Fig. 1 with the parts in the position following the first actuation of the control pushbutton and while still held by a powered locking electromagnet.

Fig. 3 is a view similar to the preceding views showing the next succeeding disposition of the parts following the release of the pushbutton and the de-energizing of the locking electromagnet; and

Fig. 4 is a view similar to the preceding figures with the parts in the position with the unlocking electromagnet powered and when the pushbutton has been actuated for the second time.

In the drawings there is disclosed in outline apparatus to be controlled by the control device herein featured and which includes a snap switch 10, the controlling element 11 of which is maintained by a spring 12 normally in an elevated inoperative open-circuit position intercepting the current flow through the main high tension leads 13 and 14. In the device illustrated the switch 10 is designed to close and open the circuit through the leads 13 and 14 and which circuit in the illustrated case is complete within itself and is intended to be of the high voltage alternating current type. The element 11 is formed of insulating material and is moved into its depressed, circuit-closing position by means of a long horizontally extending control element or arm 15, hereinafter sometimes referred to as the locking armature, pivotally mounted on a fulcrum pin 16 at its left end leaving the right end free for a limited vertical movement. The element 15 is actuated by a return spring 17 which

tends to move it into its elevated, inoperative position shown in Fig. 1 when free from the influence of its controlling and locking electromagnet 18 hereinafter described. The control element 15 is provided with an upwardly projecting L-shaped extension 19 including an overhanging arm 20 which is provided on its underside with an insulation button 21. The free end of element or arm 15 coacts with a long pendulum-like arm, rod or latch 22, hereinafter sometimes referred to as the unlocking armature, pivoted on pin 23 and depending vertically therefrom when held in its normal position as shown in Fig. 1.

The armature forming arms 15 and 22 extend substantially at right angles to each other with their free ends in one of two lapping and interlocking relations and with one disposed in the path of movement of the other in their two interlocking positions. In the position shown in Fig. 1 the lower end of armature 22 is biased by its spring 24 to swing clockwise and in abutting relation to the end of the armature 15 and is thus restrained by armature 15 from swinging to the left of its position as shown in this figure.

In the showing in Fig. 2, and assuming the armature 15 is elevated slightly from its position therein shown as hereinafter described, the lower end of the armature 22 having swung to the left of its initial position overlaps the end of the armature 15 so that armature 22 acts as a stop to restrain the elevation of armature 15 into its fully elevated position as shown in Fig. 1. This arrangement of the free ends of the armatures in their selective locking action is sometimes hereinafter referred to as an interlock. The latch forming armature 22 is provided at its lower end and on the outside thereof, that is on the side opposite the armature 15, with an insulation button 25.

The element 15 constitutes the armature of the locking electromagnet 18 which when powered moves the armature downwardly from the position shown in Fig. 1 towards the position shown in Fig. 2 and against the restraint of its return spring 17. The locking electromagnet 18 is included in a low voltage locking circuit energized from a battery 26, or from a transformer or other source of low voltage direct current. Long lead 27 from one side of the battery extends to a remotely located pushbutton 28 shown in open position in Fig. 1 and in closed position in Fig. 4. From the pushbutton a long lead 29 extends to the control device herein featured so that the two leads 27 and 29 form with the pushbutton a two-wire circuit closer of conventional design. Lead 29 extends to an automatic make and break contact including an upstanding spring plate form of contact 30 normally engaging a coacting fixed contact 31. The outer free end of the movable contact 30 normally bears on the insulation button 25 as shown in Figs. 1 and 4. The locking circuit leads from the fixed contact 31, through the electromagnet 18 and leads therefrom to a pair of fixed contacts 32 and 33 disposed in spaced apart relation on opposite sides of the armature 15. The armature 15 is of conducting material and engages contact 32 in its upward limiting position held thereto under the influence of spring 17, and engages contact 33 when in its lowermost limiting position held thereto under the influence of the electromagnet 18 when powered. From the left or pivoted end of the armature 15 return lead 34 completes the locking circuit back to the other side of the battery.

Means are provided which form an unlocking

circuit for shifting the latch armature 22 against the pull of its spring 24 and which circuit includes an unlocking electromagnet 35 disposed opposite the armature 22 adjacent its free end to swing the same in a counterclockwise direction and against the resistance of its return spring 24. The unlocking circuit includes the battery 26, lead 27, pushbutton 28, lead 29 previously described with a branch lead 36 terminating in the relatively fixed element 37 of a second make and break contact, the movable contact element 38 of which is a spring normally contacting with the insulating button 21 formed on the underside of the overhanging arm 20. Movable element 38 is connected by conductor 39 to one end of the unlocking electromagnet 35 and conductor 40 extending from the opposite end of the electromagnet terminates in a pair of spaced apart contact points 41 and 42 disposed on opposite sides of the armature 22 adjacent its free end and both disposed when the parts are in their normal position shown in Fig. 1, in spaced relation from the armature 22 thus normally breaking the unlocking circuit at this point. The armature 22 is of conducting material and from its upper pivoted end the unlocking circuit is completed back through a return lead 43 and lead 34 and hence to the battery 26.

From this construction it is seen that the elements which comprise both the locking and the unlocking circuits are interconnected and arranged in series and interconnected so that when one circuit is in position to become active on the next actuation of the pushbutton the other circuit is set in such position that it will not become active on the next actuation of the pushbutton.

In operation and referring first to the showing in Fig. 1 it will be understood that normally the pushbutton 28 is in its open circuit position, the two electromagnets 18 and 35 are inactive and the control element 15 is held by its spring 17 in position elevated away from the alternating high voltage circuit closing switch element 11. Under these conditions spring 12 is acting on the main switch element 11 to hold the snap switch 10 in its open circuit position. In this position the locking circuit is closed at the contact points 30-31 and at 15-32 and as thus shown in Fig. 1 the control device is ready for the next closing of the remote pushbutton 28.

Closing the circuit for the first time through the depression of the pushbutton 28, the circuit is completed in order from the battery, through the pushbutton and its long leads 27-29, through the make and break contacts 30, 31, the locking electromagnet 18, fixed contact point 32, armature 15 and lead 34 back to the battery. So powering electromagnet 18 causes it to lower its armature 15, breaking contact at 32 but immediately re-establishing it at 33. The inertia effort of the armature 15 responsive to the powering of the locking electromagnet 18 is sufficient to cause it to swing sufficiently far to engage contact 33 and thus re-establish the circuit through the locking electromagnet. This lowering of the armature 15 from the elevated position in Fig. 1 into the lowered position shown in Fig. 2, depresses element 11 against the resistance of its spring 12 thus closing the alternating current circuit closer 10. Incidentally, lowering the armature 15 also tilts the arm 20 downwardly and this breaks contact through the unlocking electromagnet 35 by depressing the spring contact away from the fixed element 37 of the make and break contact as shown in Fig. 2. Freeing the lower end of the

swinging armature 22 from restraint by the control element 15 permits spring 24 to exert a pull on the armature 22 to shift it from the position shown in Fig. 1 into position shown in Fig. 2 closing contact at 41 to thus set the unlocking circuit at this point as shown in Fig. 2, and this position is maintained as long as there is a current flow through the locking electromagnet 18.

Releasing load on the pushbutton 28 intercepts the current flow through the locking electromagnet, deenergizing the same and this permits its spring 17 to elevate the free end of the element 15 from the position shown in Fig. 2 into a position slightly elevated therefrom until it engages and is stopped by the latch armature 22 which is now positioned in the path of return movement of the armature 15 as shown in Fig. 3. This elevation while slight is sufficient to permit the re-establishment of the circuit through the make and break contact at 37 as shown in Figs. 3 and 4 and this position is maintained as long as the pushbutton is in its open circuit intercepting position.

On the second or next succeeding actuation of the pushbutton 28 the circuit is completed from the battery through the lead 27, depressed pushbutton 28, through leads 29 and 36, through the second make and break contacts 37, 38, lead 39, unlocking electromagnet 35, conductor 40, contact 41, armature 22 and leads 43 and 34 back to the battery. The energizing of the unlocking electromagnet 35 acts on the armature 22 to swing it anti-clockwise from the position shown in Fig. 3 into the position shown in Fig. 4. The initial movement swings the upstanding spring contact 30 away from its associated fixed contact 31 and in this way current through the locking electromagnet 18 is intercepted promptly on the second closing of the pushbutton. The removal of armature 22 from its locking position overlapping the armature 15 permits spring 17 to elevate the armature 15 from the depressed position shown in Fig. 3 to the normal elevated position shown in Fig. 4, thus re-establishing the position of the parts as shown in Fig. 1 insofar as the locking mechanism is concerned. The elevation of the armature 15 under action of its return spring 17 lifts the armature away from the controlling element 11 of the snap switch thus permitting its own resetting spring 12 to restore the snap switch to its open circuit condition.

The subsequent breaking of the battery circuit by releasing the pushbutton 28 permits spring 24 to swing armature arm 22 clockwise from the position in Fig. 4 back into the position shown in Fig. 1 thus re-establishing all of the parts in their initial position, cocked and ready to be again actuated on the next closing of the pushbutton as previously described.

By means of a device of this character, it is possible to locate the controlling pushbutton at some point remote from the alternating current mechanism and from the electromagnets and associated mechanism for controlling the same so that the current which passes through the leads to the pushbutton need be of only a small voltage and which thus can be carried by an inexpensive grade of wires and which can be of small size and capable of carrying current of sufficient voltage to actuate the electromagnet without the possibility of creating a fire risk.

While the disclosure has been described as a control for high tension electrical equipment, it is obviously within the scope of the disclosure to utilize the actuating element 15 for the purpose of controlling switches, mechanical locks and in

fact any mechanism which can be governed by a lever or equivalent movable element and capable of being operated by the control device herein featured.

Let it be assumed for example that switch 10 is a lamp switch for turning a remotely located light on and off at will. On a first closing of the pushbutton 28 the light is lit and on the next succeeding closing of the pushbutton the light is extinguished.

The control as thus disclosed has been described in connection with a single pushbutton 28 but it is within the scope of the disclosure to control the circuit by any number of pushbuttons electrically connecting the leads 27 and 29. One such additional press button or equivalent form of circuit closer 44 is shown across the leads 27, 29 and in parallel with the pushbutton 28 but obviously any number of such pushbuttons may be used.

By way of illustration, assume the disclosure is part of a house lighting system, that switch 10 controls one or a bank of lights located somewhere in the house, that circuit closer 28 is say on the first floor and that pushbutton 44 is on the second floor; it is seen that closing either pushbutton turns on the light and that the subsequent closing of either pushbutton puts the light out. Irrespective of the number of pushbuttons in the system there need be only two long main leads 27 and 29 and in this way the usual multitude of wires common with two or three way switch systems are eliminated. It is also obvious that under some circumstances the right side of the battery and portion of the lead 27 at the left end of each pushbutton may be grounded and in this way there is provided a single wire system.

I claim:

1. In a device of the class described, the combination of means forming a high voltage circuit including a controlling circuit closer normally disposed in an open, circuit-interrupting position, of means including a source of low voltage current forming a relatively low voltage circuit for controlling said high voltage circuit closer, said low voltage circuit forming means including a locking electromagnet and an unlocking electromagnet, the armatures of both of said electromagnets being of conductive material, each pivotally mounted at one end and extending substantially at right angle to each other and with their free ends lapping to provide an interlock, the armature of the locking electromagnet being operatively connected to control the high voltage circuit closer, means forming a locking circuit including in series a manually actuated pushbutton, the locking electromagnet and its armature and said source, means forming an unlocking circuit including in series said pushbutton, the unlocking electromagnet and its armature and said source, a pair of springs, one for each armature and acting thereon in opposition to the pull of its associated electromagnet, the locking electromagnet acting when powered to draw its armature into position to close the circuit closer and to permit the spring acting on the unlocking electromagnet armature to dispose the same in the path of the returned movement of the locking electromagnet armature under the action of the spring and thus to provide for the return of the locking electromagnet to its initial position, and said unlocking electromagnet acting when powered to withdraw its armature from its position in the path of return

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movement of the locking armature thereby to permit the spring of the locking electromagnet armature to return it to its initial position and to permit the circuit closer to return to its normal open position.

2. In combination, a main circuit switch, a control circuit, including a relay having an armature for actuating said switch when said relay is energized, a locking relay having an armature for holding said first armature in switch actuating position when said locking relay is de-energized, means under control of said locking relay armature for de-energizing said first relay when said locking relay is energized, means under control of said first relay armature for de-energizing said locking relay when said first relay is energized, and means whereby repeated closing of said control circuit alternately energizes said first relay and said locking relay to alternately close and open said main circuit switch.

3. In combination, a main circuit switch, a control circuit including a relay having an armature for actuating said switch when said relay is energized, a pair of contacts adapted to close the relay circuit in each extreme position of said armature, a locking relay having an armature for holding said first armature in switch actuating position when said locking relay is de-energized, a second pair of contacts adapted to close the circuit of said locking relay armature, means under control of said locking relay armature for de-energizing said first relay when said locking relay is energized, means under control of said first relay armature for de-energizing said locking relay when said first relay is energized, whereby repeated closing of said control circuit alternately energizes said first relay and said locking relay to alternately close and open said main circuit switch.

4. In combination, a main circuit switch, a control circuit including a relay having an armature for actuating said switch when said relay is energized, a locking relay having an armature for holding said first armature in switch actuating

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position when said locking relay is de-energized, a circuit for said first relay including said armature and a pair of contacts adapted to engage said armature in each extreme position thereof to close the first relay circuit, means for yielding holding said armature in one extreme position and to permit holding in the other extreme position by said relay, a circuit for said locking relay including said locking relay armature and a pair of contacts adapted to engage said armature in each extreme position thereof, means for yielding holding said locking relay armature in one extreme position and to permit holding in the other extreme position by said locking relay, means under control of said locking relay armature for de-energizing said first relay when said locking relay is energized, and means under control of said first relay armature for de-energizing said locking relay when said first relay is energized, whereby repeated closing of said control circuit alternately energizes said first relay and said locking relay to alternately close and open said main circuit switch.

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