J. W. MARK.

ELECTROMECHANICAL SWITCH LOCK AND INDICATOR.

APPLICATION FILED AUG. 4, 1914.

1,199,588.

Patented Sept. 26, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

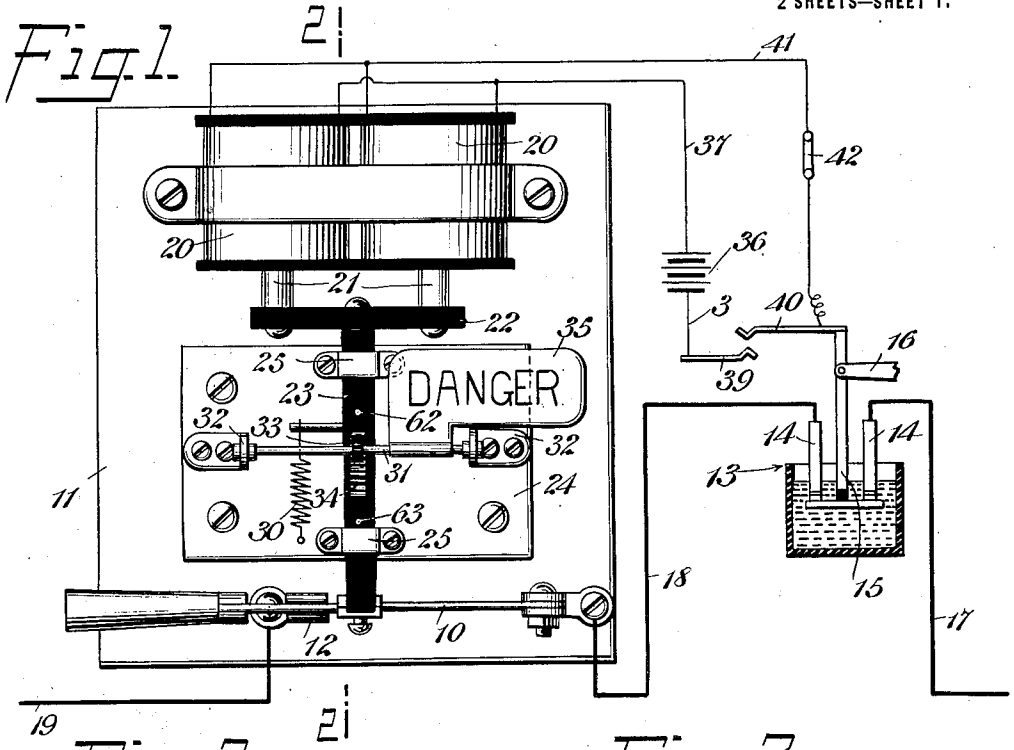


Fig. 2.

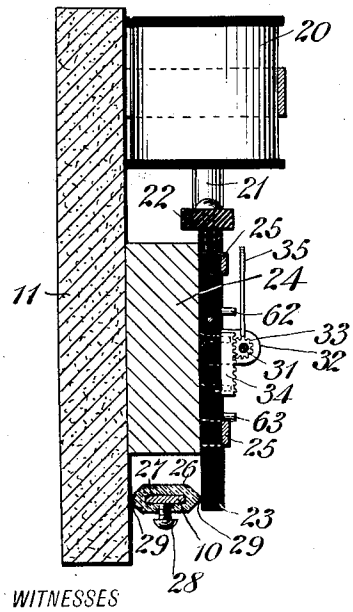
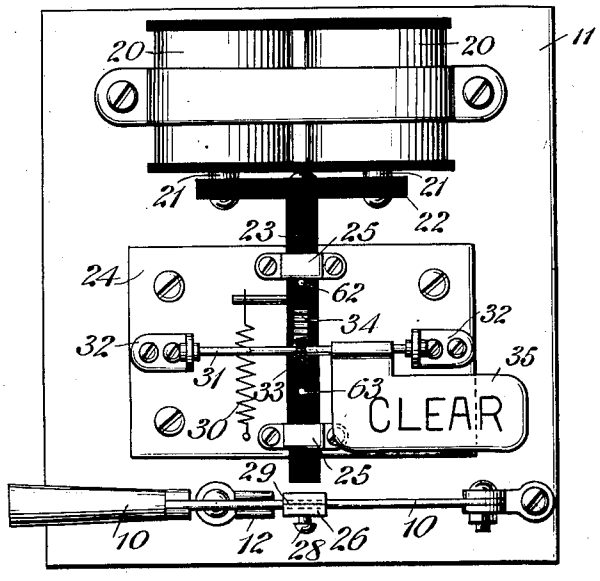


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4

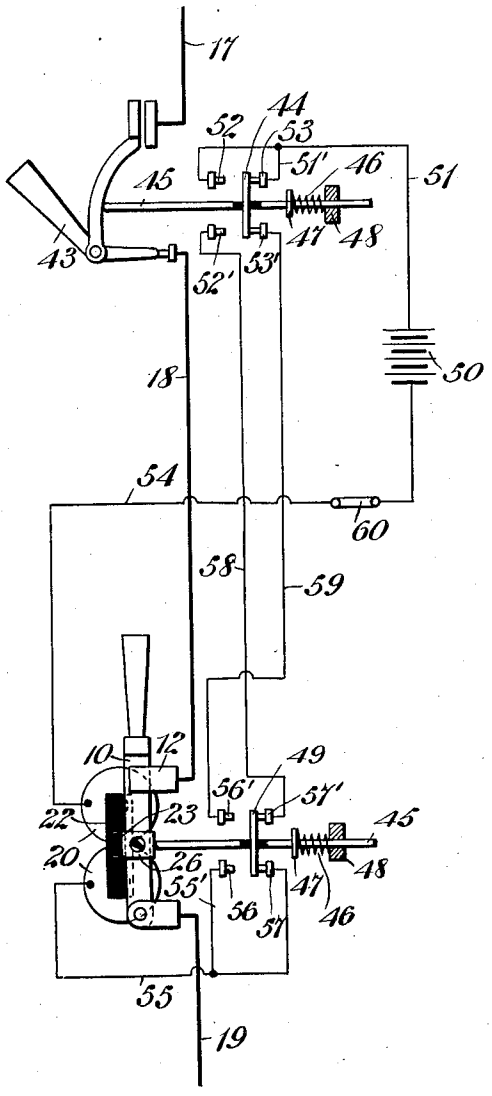
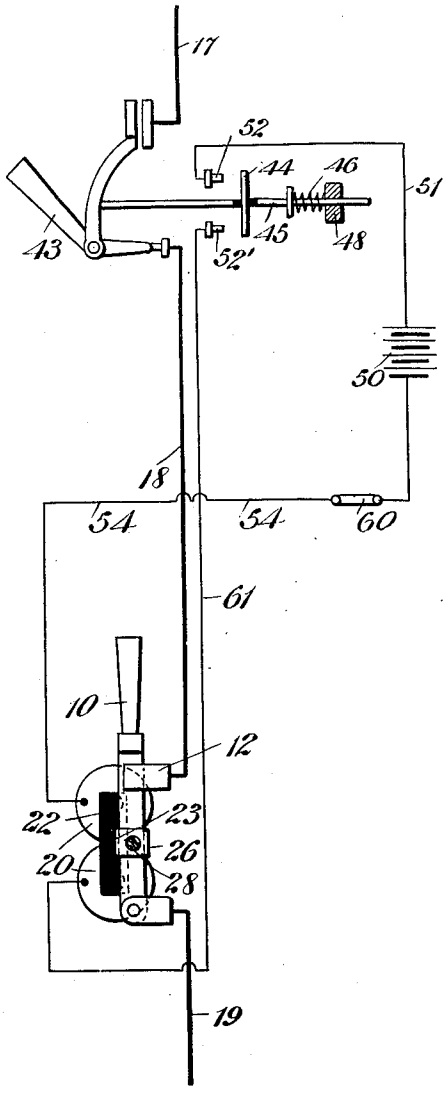


Fig. 5



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ELECTROMECHANICAL SWITCH LOCK AND INDICATOR.

1,199,588. Specification of Letters Patent. Patented Sept. 26, 1916.

Application filed August 4, 1914. Serial No. 854,968.

To all whom it may concern:

Be it known that I, JOHN W. MARK, a citizen of the United States, and a resident of the city of New York, Richmond Hill, borough of Queens, in the county of Queens and State of New York, have invented a new and Improved Electromechanical Switch Lock and Indicator, of which the following is a full, clear, and exact description.

This invention has special reference to an improved and simple electro-mechanical switch lock and indicator for use in power houses or sub-stations and the like, on either high or low potential circuits where the opening of a live circuit at a knife or transfer switch would be dangerous not only to the equipment of the generating or sub-station but also to human life.

The primary object of the invention is therefore comprehended in the provision of a device as described for locking a switch such as a common knife switch used on switchboard panels for controlling either high or low voltage circuits, thus to prevent opening or breaking of the live circuits at a manually, mechanically or electrically operated knife switch and at the same time to give positive indication at the switch as to its being electrically alive or dead and thus safe to operate.

With the above and other objects in view, the invention resides in the peculiar combination and arrangement of parts to be hereinafter more fully described, illustrated and claimed, it being also an object to provide a device which is simple in construction, durable and efficient in operation and not likely to get out of working order.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views, and in which—

Figure 1 is a front elevation of my improved electro-mechanical switch lock and indicator mounted upon a switchboard panel and showing diagrammatically the circuit arrangements for operating the device; Fig. 2 is a vertical sectional view on the line 2—2 of Fig. 1; Fig. 3 is a view similar to Fig. 1 with the locking device shifted to permit operation of the knife switch and with the circuit arrangements omitted; Fig. 4 is a diagrammatic view illustrating the application of the invention to low potential circuits employing a double contact switch and circuit interrupter. Fig. 5 is a view similar to Fig. 4 of a modified application of the invention in which the double contact switch is omitted and the circuit controlling the operation of the lock controlled by a master switch on the operating panels.

In illustrating the application of the invention and method by which it is carried into practice, it is here explained that the device is particularly adapted for locking a switch such as a common knife switch used on switchboards or switchboard panels for controlling high or low voltage or potential circuits, and the purpose of the invention is to lock the switch and prevent it from being closed when the oil switch is closed or cut in, or opened when the oil switch is cut in, and at the same time to indicate by means of a visual signal or sign, the condition of the switch as a warning or caution to the operator. In high potential or voltage circuits, for instance, such as are used for operating an electric railroad, a high tension alternating current is changed to a continuous or alternating current of lower voltage, and in throwing the circuit into operation a knife switch 10 is used. This switch is mounted upon a switchboard panel 11 but this switch is not used to finally close the circuit, as arcing would take place between the switch blade and the connector 12 also carried by the switchboard or switchboard panel, which would result in injury to the working lines or equipment and almost without exception in death or injury to the operator.

To avoid the herein described objections an oil switch 13 constituting one form of circuit-interrupting switch is used, the same usually comprising a pair of fixed contacts 14 and a movable contact 15 which is adapted to bridge the contacts 14 and which is capable of being shifted vertically as by means of a lever 16 connected thereto. This oil switch is connected by a conductor 17 with a suitable source of energy or current supply, not shown, the conductor leading to one of the contacts, while a conductor 18 leads from the other contact to the binding terminal of the switch blade so that when the switch is closed the circuit is traced through the conductor 19 to the working lines or equipment, as will be understood. It will also be obvious that various systems

of distribution may be employed and controlled so that the current will be transferred by the knife switch upon the closing of the circuit breaking or oil switch and that the circuit arrangements shown may be substituted by a single or other phase system of distribution, the principles and methods of operating being the same. With an oil switch of this type the knife switch is first closed and then the oil switch is closed or cut in to close the circuit to prevent the arcing above described, and this oil switch is also used as a circuit interrupter or cut out to similarly avoid the dangers usually present in throwing the circuits into and out of operation.

The electro-mechanical switch lock and indicator member is illustrated as comprising suitable electro-magnets 20 which are mounted upon the switchboard panel which is usually of slate or other insulating material, the magnets in the present instance being positioned above the knife switch and having movable cores 21 which with the magnets produce electrical solenoids. Connected to the cores or movable parts of the magnets or solenoids is an insulated cross head 22 which in turn carries or has fixed thereto an insulated bar 23 which, as shown, is secured to the cross head at its medial point so as to depend therefrom and operate over an insulated base 24 carried by the switchboard panel, the bar being slidably retained in position by bearing straps 25 secured to the block and receiving the bar there-beneath. The bar is adapted to project over the switch blade 10, and in order to prevent the passage of the current into the parts of the mechanism, especially in the case of a current of high potential, an insulated block 26, preferably of porcelain, is slidably fixed to the switch blade, said block having an aperture 27 receiving the switch blade therethrough and being adapted to be held in an adjusted position on the blade by means of a binding or set screw 28 operating through one side thereof to contact with one face of the blade, while the upper and lower edges of the block are tapered to a point, as shown at 29, to reduce the surface of contact of the block with the switchboard panel and of the bar with the block, to a minimum. The bar is normally held in this position when the magnets are deënergized, as by means of a coiled spring 30 anchored to the base 24 and to the bar respectively, while a shaft 31 is rotatably journaled at its ends in bearings 32 fixed to the base at either side of the bar and carries a pinion 33 disposed in mesh with a rack 34 carried by the bar. A sign device or plate 35 is fixed to the shaft so that as the bar is reciprocated the shaft is rotated so that the sign will be elevated when the bar is disposed in the path of the switch under the action of the spring when the magnets have been deënergized. In this position the sign will show the word "Danger" to indicate that the switch is cut in, but when the magnets are energized the bar will be moved out of the path of the switch against the action of the spring to rotate the shaft in the opposite direction so that the sign will be disposed in position to show the word "Clear" to indicate that the circuit is open so that the operator may be duly advised.

To operate the bar and sign device constituting the electro-mechanical switch lock and indicator forming the invention, the magnets are connected in a secondary or auxiliary circuit, in the present instance illustrated as a battery circuit including the batteries 36 forming the source of energy through the conductor 37, the source of energy being connected by a conductor 38 to a stationary contact 39 constituting one contact of a contact switch used to connect the source of energy to the magnets or solenoid for magnetizing or de-magnetizing the latter. The other contact is in the form of a movable contact 40 which is connected to the movable part 15 of the oil switch, such movable contact 40 being positioned at a spaced distance above the stationary contact when the circuit is closed through the oil switch while the auxiliary or battery circuit is traced through a conductor 41 to the magnets. In this manner when the switch 10 is closed and the circuit has been cut in by means of the oil switch, the contacts 39 and 40 will be moved out of engagement to open the battery circuit and deenergize the magnets, whereby the spring will move the locking bar in the path of the switch to prevent it from being opened while the working circuit is closed and to simultaneously show the danger sign. However, should the oil switch be open and the knife switch closed, the battery circuit will be closed by the engagement of the contacts 39 and 40 due to the lowering of the movable member of the oil switch, thus to energize the magnets or solenoid to move or shift the locking bar out of the path of the knife switch against the action of the spring so that the knife switch may be freely operated and the sign will indicate by the word "Clear" that the working circuit is open or dead, or that the switch is safe to operate, as distinguished from the foregoing indication to show that the circuit is closed and the switch electrically alive or dangerous to operate. Furthermore, if the oil switch is closed the battery circuit will be open so that the magnets will be deënergized and the locking bar will be disposed in the path of the knife switch to prevent it from being opened if closed, or to prevent it from being closed if it is open, so that in either event the circuit cannot be cut in or out of serv-

ice by means of the knife switch through accident or mistake.

If desired, the battery circuit may be supplemented by a separate master switch 42 mounted on the operating panel or otherwise for the purpose of controlling the battery circuit and thus the energization and de-energization of the solenoid. Attention is called to the fact that the contact switch controlling the battery or auxiliary circuit is attached to a suitable moving mechanical part of the oil switch, in the present instance the movable contact or member 15, and it will be further observed that the indication is given at the knife switch and is absolutely positive in its operation.

In the adaptation of the device to low potential circuits where the knife switch is included in circuit with a circuit interrupter 43 controlling the working circuit in the usual manner, a movable bridge piece 44 of a double contact switch is operated by and insulated from the movable part of the circuit interrupter, as by means of an insulated plunger 45 which is normally held in engagement with said movable part of the circuit interrupter as by means of a coiled spring 46 mounted on the plunger between a collar 47 and a support 48 which slidably receives the plunger at its end remote from the circuit interrupter. A similar bridge piece 49 is operable by the knife switch in juxtaposition to which the locking device heretofore described is mounted vertically, horizontally or otherwise. In this instance, as before, the bridge piece is operated by and insulated from the movement of the knife switch, and said bridge pieces operate between pairs of contacts connected in opposition so that to energize the magnet or solenoid and release the lock, either the circuit breaker must be out and the switch in or the switch must be out and the circuit interrupter in. For this purpose the battery or auxiliary circuit having the batteries 50 as a source of energy are connected by a conductor 51 to a pair of contacts 52 and 53 on opposite sides of the bridge piece 44. Also disposed to coöperate with the bridge piece are contacts 52′ and 53′ forming with the aforesaid contacts opposed sets adapted to be spanned for closing the circuits or gaps thus produced.

A conductor 54 leads from the battery to the magnet of the locking device and from thence a conductor 55 leads to a pair of contacts 56 and 57 disposed in opposed relation for engagement by the bridge piece of the knife switch, while co-acting contacts 56′ and 57′ forming the sets of contacts of the double contact switch at the knife switch corresponding to the construction employed at the circuit interrupter, are connected in opposition to the contacts 52′ and 53′. In other words, a conductor 58 connects the contacts 52′ and 57′ while a conductor 59 connects the contacts 53′ and 56′, and thus when the circuit interrupter is out and the switch in, the bridge piece 44 will span the contacts 52 and 52′, while the bridge piece 49 will span the contacts 57 and 57′, so that the battery circuit will be completed through these contacts by means of the conductors 51, 54, 55 and 58 to energize the magnet of the locking device and withdraw the locking bar from out of the path of the knife switch so that it may be freely operated or opened. If, however, the circuit interrupter is in and the knife switch out the bridge piece 44 will span the contacts 53 and 53′ while the bridge piece 49 will span the contacts 56 and 56′, and the circuit will then be closed through these contacts and the conductors 51, 54, 55 and 59 by means of the conductors 51′ and 55′ connecting the conductors 51 and 55 to the contacts 53 and 56, respectively, so that the locking bar will again be moved out of the path of the switch and the knife switch can be closed. In this manner when both circuit interrupter and knife switch are closed, the opening of the live circuit at the knife switch is prevented since the bar will be in the path of the knife switch, and when the circuit interrupter is out while the knife switch is open, the closing of the knife switch is prevented until the circuit interrupter is closed, since in this instance it is necessary that the circuit interrupter be in and the knife switch out as in the last described position of the parts. If desired, a master switch 60 may be employed and interposed in the connection between the batteries and the magnet for separately controlling the battery circuit.

In the form of the invention illustrated in Fig. 5 of the drawings, the double contact switch connected in opposition is dispensed with, since the negative switch is opened only when the machinery is shut down and closed before starting. In this instance the contact switch at the knife switch is omitted and a single pair of contacts only, corresponding to the contacts 52 and 52′, are employed and the batteries or source of energy connected to the magnet or solenoid as before, while the contact 52′ is connected directly to the magnet or solenoid by a conductor 61, so that when the circuit interrupter is in the bridge piece 44 will be moved out of the path of the contacts 52 and 52′ and the circuit will then be open so that the spring 30 will act to move the locking bar in the path of the blade of the knife switch to prevent it from being opened or closed, but in the event that the circuit interrupter is out the bridge piece will span the contacts 52 and 52′ to close the circuit and energize the magnet, whereby the locking bar will be moved out of the path of the blade of the knife switch and permit it to be freely oper-

ated. The battery circuit in this instance can be controlled by a master switch on the operating panel as in the last described form of the invention, and it will be seen that a simple device, positive in its operation and durable and reliable in use has been provided which will prove a great boon to the handling or controlling of the electric circuits of electrical systems of distribution. Stop pins 62 and 63 are provided on the locking bar to limit the movements of the latter into and out of the path of the knife switch by engagement with the retaining members of the bar.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. The combination in an electrical circuit, of a knife switch, a bar movable into and out of the path of movement of said switch, mechanical means for moving said bar in one direction, a solenoid for moving said bar in the opposite direction, and means for energizing said solenoid when said circuit is interrupted and for deënergizing said solenoid when said circuit is closed through said switch.

2. The combination in an electrical circuit, of a knife switch, an oil switch having a movable member, a bar movable into and out of the path of movement of said knife switch, mechanical means for moving said bar in one direction, a solenoid for moving said bar in the opposite direction, and means for energizing said solenoid when said circuit is interrupted at said oil switch.

3. The combination in an electrical circuit, of a knife switch, an oil switch having a movable member, a bar movable into and out of the path of movement of said knife switch, mechanical means for moving said bar in one direction, a solenoid for moving said bar in the opposite direction, a supplemental electrical circuit through said solenoid having a stationary contact and a movable contact carried by said movable member of said oil switch, said supplemental circuit being closed when said first named circuit is interrupted at said oil switch and open when said first named circuit is closed through said oil switch to unlock said knife switch or to permit said bar to lock said knife switch.

4. The combination in an electrical circuit, of a knife switch, a bar movable into and out of the path of movement of said switch, mechanical means for moving said bar in one direction, a solenoid for moving said bar in the opposite direction, means for energizing said solenoid when said circuit is interrupted and for deënergizing said solenoid when said circuit is closed through said switch, and a signal device operable by the bar movement to indicate the position of said bar.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN W. MARK.

Witnesses:
J. EDWIN BURCH,
PHILIP D. ROLLHAUS.