March 22, 1932. E. C. RANEY 1,850,771

ELECTRIC SWITCH

Filed Feb. 25, 1929 2 Sheets-Sheet 1

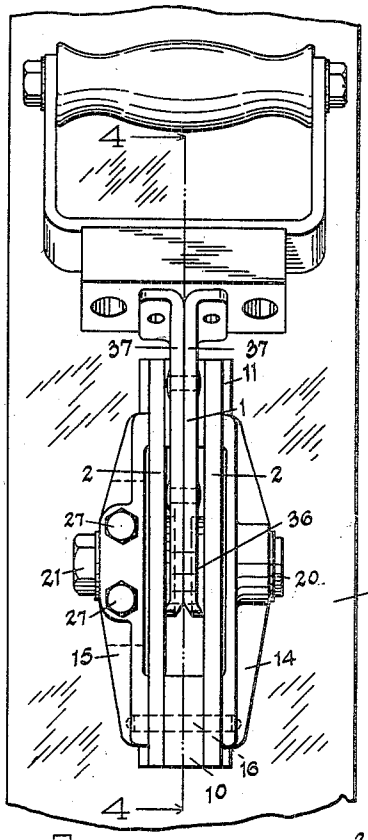


Fig 1

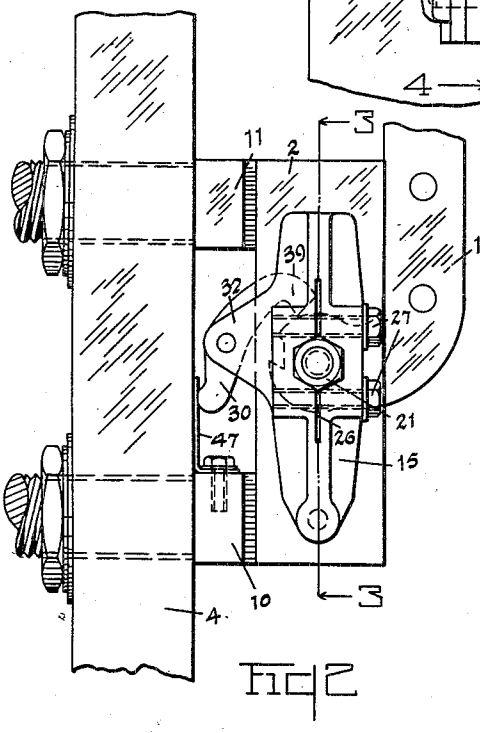


Fig 2

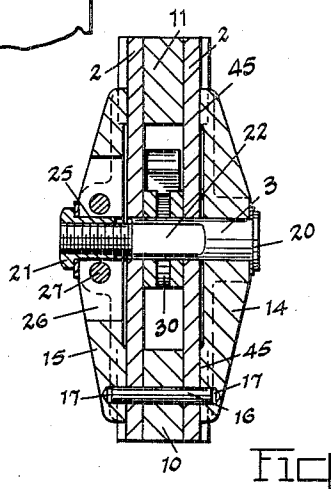


Fig 3

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ELECTRIC SWITCH

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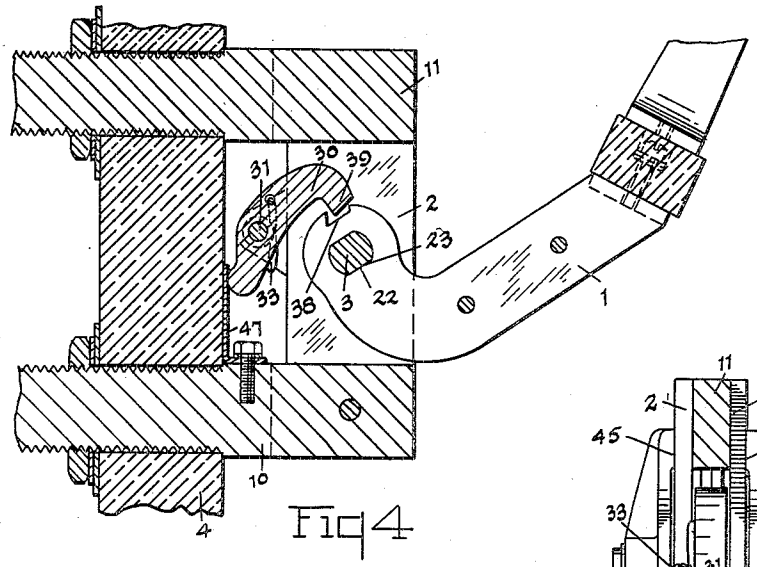


Fig 4

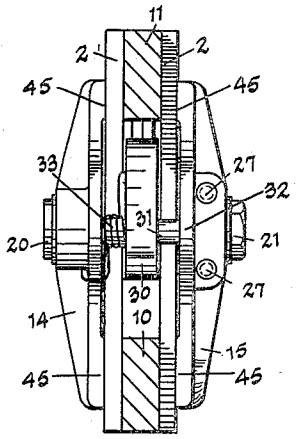


Fig 6

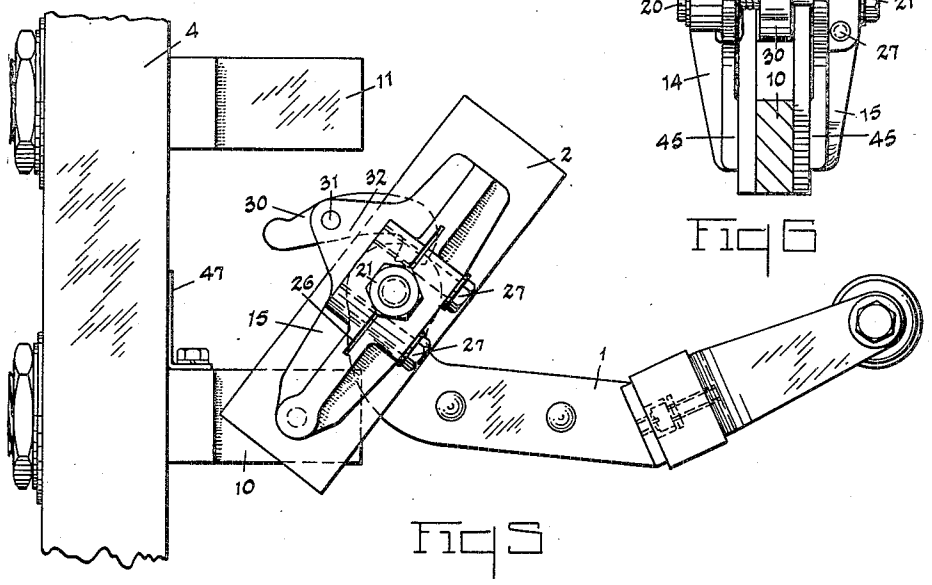


Fig 5

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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH

Application filed February 25, 1929. Serial No. 342,535.

My invention has for its object to provide an efficient electric switch which is so constructed that the movable contact of the switch will be pressed against the fixed contacts with an increased pressure upon the completion of the closing movement of the movable contact, and whereby the pressure will be reduced in advance of an opening movement of the movable contact. Clamping the movable and fixed contacts, one against the other with a heavy pressure, produces a negligible drop of potential at the contacts since it reduces contact resistance to a very small amount and, for the same reason, heating of the contacts is eliminated. Also reducing the pressure in advance of any movement of the movable contact relative to the fixed contact, reduces wear and enables easy operation of the switch.

The invention provides a contact movable relative to a pair of fixed contacts that form the terminals of an electric circuit, and an element for not only operating the movable contact, but also a means for pressing the contacts together. Upon reverse movement of the element, the contact pressure is first released and, upon further movement of the elements, the contacts are separated. The actuating element may operate a suitable wedging or clamping member, such as a cam or a screw, to press the contacts against each other or to release them according to the movement of the actuating element.

The invention may be contained in switches of different forms and, to illustrate a practical application of the invention, I have selected a switch containing the invention as an example of such structures and shall describe it hereinafter. The switch selected for purposes of illustration is shown in the accompanying drawings.

Fig. 1 is a front view of the switch. Fig. 2 is a side view of a part of the switch. Fig. 3 is a view of a section taken on the plane of the line 3—3 indicated in Fig. 2. Fig. 4 is a view of a section taken on the plane of the line 4—4 indicated in Fig. 1. In Fig. 5 the switch is shown in its open position while Figs. 2 and 4 show the switch in its closed position. Fig. 2 illustrates the position of the parts when the conductors of the switch have been clamped one against the other while in Fig. 4 is shown the position of the parts when the pressure is released from the conductors, either upon the completion of the closing movement of the movable contacts or just in advance of the opening movement of the movable contacts. Fig. 6 illustrates a rear view of the movable parts of the switch.

The manually operated switch shown in the drawings is provided with a movable element, or switch arm, 1, that is pivotally supported between a pair of movable contacts 2, by means of a bolt 3. The movable contacts 2 are pivotally supported on the switch plate or board 4, whereby the switch arm 1 may be operated to swing the movable contacts or conductors 2 towards, or away from, the board 4 to close and open the switch and may continue its pivotal movement, relative to the movable contacts to clamp the movable contacts against the fixed contacts of the switch.

In the particular form of construction shown, the movable contacts 2 are supported for pivotal movements on one of the fixed contacts, such as the fixed contact 10, and so that the movable contacts 2 may be swung into contacting relation with the other fixed contact 11. The fixed contacts 10 and 11 are secured to the board 4 and means is provide for connecting the fixed contacts 10 and 11 with an external circuit in a manner well known in the art.

Preferably a pair of clamps 14 and 15 are used for pressing or drawing the movable and fixed contacts against each other. The clamps 14 and 15 are located on the outer faces of the movable contacts 2. The bolt 3 extends through the clamps 14 and 15 and the movable contacts 2 and the clamps are held in position, one relative to the other, by the pin 16 which pivotally supports the movable contacts 2 on the fixed contact 10. Preferably, the inner faces of the clamps 14 and 15 are provided with sockets 17 for receiving the end of the pin 16 that extends through the fixed contact 10 and the movable contacts 2. The pin 16 coacts with the bolt 3 to prevent any angular displacement of the movable con-

tacts and the clamps relative to each other, and maintains these parts in their parallel and coactive relation. The pin 16 has a length and the sockets 17 have a depth sufficient to maintain the parts in this relation and yet to permit the clamps 14 and 15 to clamp the ends of the movable contacts against the fixed contact 10 as well as the fixed contact 11.

The movable contacts are clamped together by the rotation of the bolt 3 which is connected to the switch arm 1. The bolt 3 has a head 20 that engages the outer surface of the clamp 14 and a nut 21 that engages the outer surface of the clamp 15, and, consequently, rotation of the bolt 3 by the operation of the switch arm 1, will draw the clamps 14 and 15 towards each other by reason of the wedging surfaces formed by the thread of a bolt coacting with the similar surfaces of the thread of the nut and consequently, cause the contacts 2 to be tightly pressed against the contacts 10 and 11. The bolt 3, as shown in Fig. 4, is provided with flattened surfaces 22, while the switch arm is provided with an oblong opening 23 that fits the bolt where it is flattened and, consequently, upon a movement of the switch arm, relative to the movable contacts 2, the switch arm will cause the bolt 3 to rotate and draw the clamps 14 and 15 towards each other, the nut 21 being locked in position so as to prevent rotation of the nut with the bolt.

The nut 21 may be secured in position by any suitable means. In the particular form shown, the nut 21 has a cylindrical sleeve 25 that extends into an opening formed in the central part of the clamp 15 which is slotted as at 26 to afford some flexibility as between opposite sides of the clamp 15. A pair of screw bolts 27 extend through parts of the clamp 15, located on opposite sides of the slot 26, one side being tapped to receive the threaded portions of the belts 27 and, when the bolts 27 are screwed down, the sleeve 25, of the nut 21, is clamped tightly between the parts of the clamp 15 and is thus securely held as against rotation when the bolt 3 is rotated by the operation of the switch arm 1. Thus, the nut 21 may be adjustably secured to the bolt and the arm, to vary the clamping pressure produced by the arm 1 operating upon the bolt and nut. The clamping pressure may be increased to such an extent as to bend the clamps. Preferably, the clamps are elastic to produce a maximum pressure per unit of area at the inner edges of the fixed contacts by reason of the flexing of the clamps.

In order that the switch arm may be used for moving the movable contacts 2 towards and away from the closed position, and also to produce the clamping or releasing operations in each swinging movement of the switch arm, means is provided for automatically releasing the movable contacts from the arm when the movable contacts have been placed in the closed position and also for connecting the switch arm to the movable contacts when the movable contacts have been released from their clamped relation to the fixed contacts. Thus, the switch arm is caused to pivotally move about the pin 16 during a part of each swinging movement and about the axis of the bolt 3 in another part of the movement. In order to thus positively swing the movable contacts into and away from the closing position, and yet to enable it to operate the bolt 3 to clamp the contacts together, a latch is provided which connects the switch arm to the movable contacts and releases the switch arm from its positive connection with the movable contacts. The latch for thus interlocking the switch arm 1 with the movable contacts is operated upon movement of the movable contacts to a predetermined point relative to the fixed contacts and also when the movable contacts are moved away from the predetermined point.

In the form of construction shown, a spring pressed dog 30 is connected to the movable contacts and is operated by a fixed part that may be connected to, or form a part of, the board 4 when the movable contacts are located in switch closing position. The dog is, preferably, pivotally supported by the pin 31 on the ears, or lugs, 32, formed on the edges of the clamps 14 and 15 and is spring pressed by the spring 33 to engage the switch arm. The inner end of the switch arm 1 is provided with a notch 38 that is adapted to be engaged by the nose 39 of the dog 30 when the switch arm 1 has moved a short angular distance to rotate the bolt 3 sufficiently to release the pressure between the movable contacts 2 and the fixed contacts 10 and 11. This positively connects the switch arm to the conductors and, upon continued movement of the switch arm, the switch arm will swing the movable contacts, together with the clamps, about the pivot pin 16.

When the switch is open, the parts will be as shown in Fig. 5. In the closing operation, the parts are rotated about the pin 16 and when the lower end of the dog 30 engages the board 4, in the upward swinging movement of the parts, the nose of the dog will be lifted out of the notch 38, and, upon continued movement of the switch arm 1, the bolt 3 will be rotated and the clamps 14 and 15 will be drawn towards each other to clamp the movable contacts against the fixed contacts.

Preferably, the clamps 14 and 15 are so formed that they will engage and clamp only the end portions of the movable contacts. Their inner faces are, preferably, raised, as at 45, at points opposite the portions of the inner surfaces of the movable contacts that

make contact with the sides of the fixed contacts. Inasmuch as the current density will be maximum at the inner corners of the fixed contacts, the raised portions are, preferably, located so as to engage the movable contacts, so as to produce the desired pressure at these points.

Also, if desired, a protective strip 47 is supported at a point where the lower end of the dog 30 would otherwise engage the board. When the dog reaches the point where it is desired to release the connection of the switch arm with the movable contacts, the lower end of the dog 30 engages the strip 47.

It is thus apparent that I have provided a switch which may be readily opened and closed and at the same time one which has a contact pressure many times greater than is possible where no means is provided for increasing the pressure after the contacts are in closed position. As a matter of fact, the contact pressure may easily be made 2000 lbs. or more and yet require a relatively small pressure on the operating means to effect opening or closing. This renders a switch, embodying my invention, especially adaptable for use in adverse atmospheric conditions, or for out-door service.

I claim:

1. In an electric switch, a pair of fixed contact terminals, a movable contact member for connecting the fixed terminals and pivotally mounted on one of the said fixed terminals, a clamping member mounted on said movable contact member, a handle lever for operating said movable contact, a bolt rigidly connected to the said handle lever and located between the ends of the movable contact, a nut connected to the said clamping member, the said bolt being engaged by the threads of the nut, whereby relative movement between the operating handle and the movable contact produces a pressure between the movable contact and both of the said fixed contacts.

2. In a switch, a pair of fixed contacts, a movable contact supported for pivotal movements relative to the fixed contacts, a pair of clamping members, the end portions of the clamping members located on opposite sides of the fixed contacts, a handle lever, a bolt connected to the handle lever and rotatably supported on the said clamping members and located at a point intermediate the fixed contacts when the switch is closed, a nut located on the bolt and adjustably secured to one of the clamping members to produce the desired contact pressure between the ends of the movable contact and the fixed contacts when the handle lever is rotated relative to the movable contact.

3. In a switch, a pair of fixed contacts, a movable contact supported for pivotal movements relative to the fixed contacts, a pair of clamping members, the end portions of the clamping members located on opposite sides of the fixed contacts, a handle lever, a bolt connected to the handle lever and rotatably supported on the said clamping members and located at a point intermediate the fixed contacts when the switch is closed, a nut located on the bolt and adjustably secured to one of the clamping members, the bolt and nut located at a point to produce substantially equal pressures of the ends of the movable contact against the first contacts when the handle lever is rotated relative to the movable contact.

4. In a switch, a pair of fixed contacts and a pair of movable contacts, a pin movable longitudinally in one of the fixed contacts, for pivotally supporting the movable contacts relative to the fixed contacts, the movable contacts adapted to make contact with the lateral faces of the fixed contacts, a pair of clamping members having sockets for receiving the ends of the pins, a bolt and a nut, one end of the bolt connected to one clamping member and the other end located in the other clamping member and engaging the nut, means for adjustably securing the nut relative to the last named clamping member, a handle lever connected to the bolt for operating the bolt and drawing the clamping members towards each other and clamping the ends of the movable contacts against the fixed contacts.

5. In a switch, a pair of fixed contacts, a movable contact supported for pivotal movements relative to the fixed contacts, a handle lever pivotally connected to the movable contact at a point intermediate the fixed contacts when the switch is closed and for swinging the movable contact to the closed position, a clamping member having ends located at the sides of the fixed contacts when the movable contact is in closed position, means for connecting the handle lever to the movable contact to prevent rotation of the handle lever relative to the movable contact, means for releasing the handle lever to permit rotation of the handle lever relative to the movable contact, means operated by the handle lever when it is rotated relative to the movable contact for clamping the movable contact against the fixed contacts.

6. In a switch, a pair of fixed contacts, a movable contact, a pin extending through the movable contacts and one of the fixed contacts, a pair of clamping members having holes for receiving the ends of the pins, a bolt extending through the clamping members and the movable contact and rotatable relative to the clamping members and the movable contact, a handle lever connected to the bolt, a nut threaded onto the bolt, means for adjustably connecting the nut to one of the clamping members, and means for connecting the handle lever to the movable contact to prevent rotation of the handle lever relative to the movable contact, and means for releasing the handle lever for rotating

the bolt relative to the nut for clamping the movable contact against the fixed contacts when they are placed in closed position.

7. In a switch, a pair of fixed contacts, a pair of movable contacts, a pin extending through the movable contacts and one of the fixed contacts, a pair of clamping members having holes for receiving the ends of the pins, a bolt rotatable relative to the clamping members and the movable contact, and having end parts located in the clamping members and the movable contacts, a handle lever connected to the bolt, a nut threaded onto the bolt, means for adjustably connecting the nut to one of the clamping members, a fixed member, a dog pivotally connected to the clamping members, a spring for operating the dog to engage the switch arm for preventing rotation of the bolt relative to the clamping members, the dog having a part engaging the fixed member for releasing the switch arm to permit rotating of the bolt when the contacts are in switch closed position.

8. In a switch, a pair of fixed contacts forming the terminals of a circuit, a pair of movable contacts for connecting the fixed contacts at the opposite ends of the movable contacts, and means located intermediate the fixed contacts and the ends of the movable contacts for drawing, at the said intermediate point, the movable contacts towards the fixed contacts to force the ends of the movable contacts against the fixed contacts.

9. In a switch, a pair of fixed contacts forming the terminals of a circuit, a movable contact for connecting the fixed contacts at opposite ends of the movable contact, a pair of clamping members, the end parts of the clamping members for clamping the ends of the movable contact and the fixed contacts together, means located intermediate the ends of the clamping members and substantially central with respect to the movable contact for drawing, at the said intermediate point, the clamping members towards each other to clamp the ends of the movable contact and the fixed contacts between the clamping members and producing approximately equal pressures at the ends of the movable contact against the fixed contacts.

10. In a switch, a pair of fixed contacts forming the terminals of an electric circuit, a movable contact supported for pivotal movements relative to the fixed contacts and for making contact with the fixed contacts at the opposite ends of the movable contact, a handle lever, a rotatable clamping member connected to the handle lever and to the movable contact and extending transversely with respect to the movable contact at a point intermediate the fixed contacts and the ends of the movable contact, when the switch is closed, for clamping opposite ends of the movable contact against the fixed contacts when the handle lever is rotated relative to the movable contact.

11. In a switch, a pair of fixed contacts forming the terminals of an electric circuit, a movable contact supported for pivotal movements relative to the fixed contacts for making contact with the fixed contacts at opposite ends of the movable contact, a pair of clamping members, a pair of interengaging members extending through the clamping members at a point intermediate the fixed contacts and the ends of the movable contact, the interengaging members having interwedging surfaces for drawing the clamping members towards each other, a handle lever connected to one of the interengaging members for rotating the interengaging member to which the handle is connected relative to the clamping members for forcing the ends of the clamping members towards each other and clamping the ends of the movable contact against the fixed contacts.

12. In a switch, a pair of fixed contacts, a movable contact, means for increasing the contact pressure after the movable contact is in a closed position, said means operating to apply pressure intermediate the fixed contacts and in a direction transverse to the movable contact and to transmit and distribute the pressure approximately equal to both fixed contacts.

13. In a switch, a pair of fixed contacts forming the terminals of a circuit, a movable contact for connecting the fixed contacts, a clamping member for clamping the fixed contacts and the ends of the movable contact, a handle member connected to the clamping member and the movable contact, a means operated by the handle member for pressing against a part of the clamping member located intermediate the fixed contacts to press the ends of the movable contact against the fixed contacts.

14. In a switch, a pair of fixed contacts forming the terminals of a circuit, a movable contact for connecting the fixed contacts, a handle member and means located substantially midway between the fixed contacts, when the switch is closed, and operated by the handle member for producing a pressure exerted transverse the movable contact at the central part of the movable contact for pressing the opposite ends of the movable contact and the fixed contacts against each other.

In witness whereof I have hereunto signed my name to this specification.

ESTEL C. RANEY.