June 6, 1950 W. E. BAKER 2,510,792

RESISTANCE SWITCH

Filed Feb. 4, 1949 3 Sheets-Sheet 1

Fig. 1.

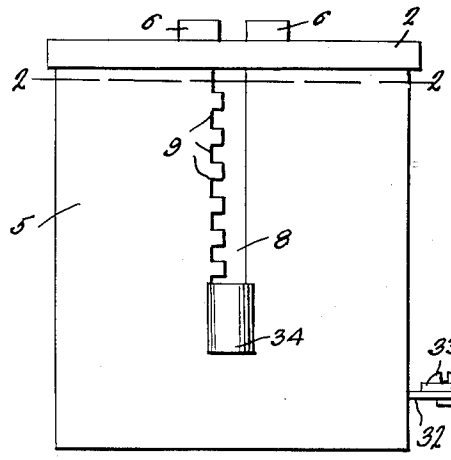


Fig. 4.

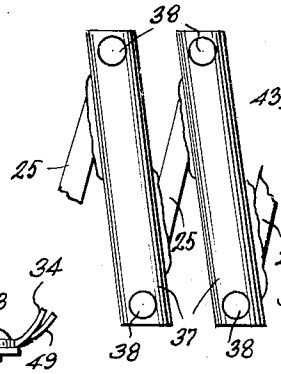


Fig. 5.

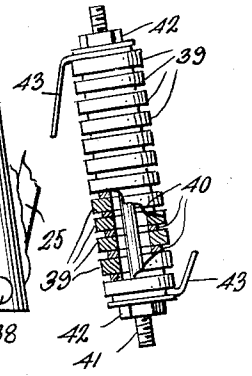


Fig. 2.

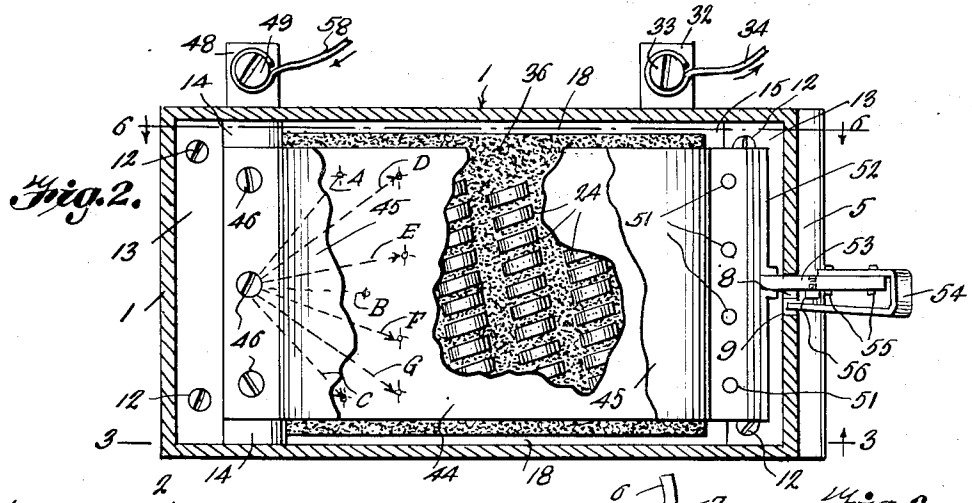
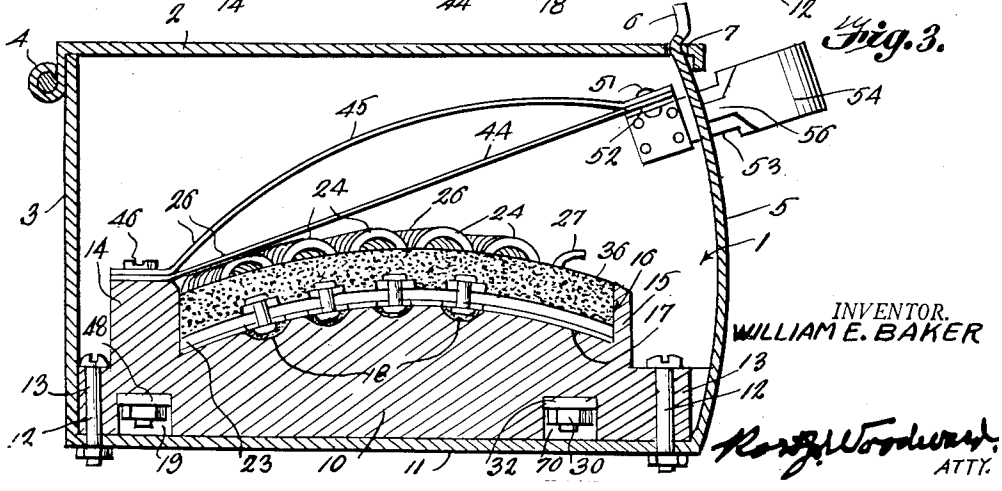


Fig. 3.



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Fig. 6.

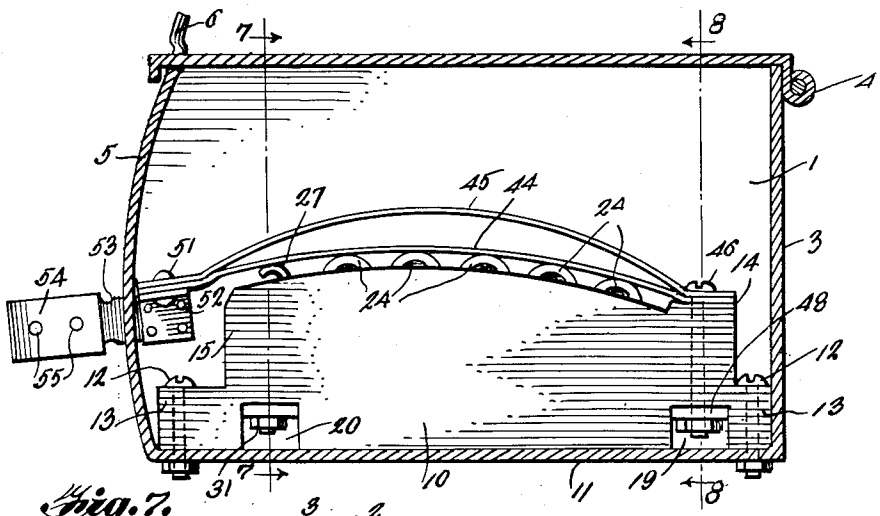


Fig. 7.

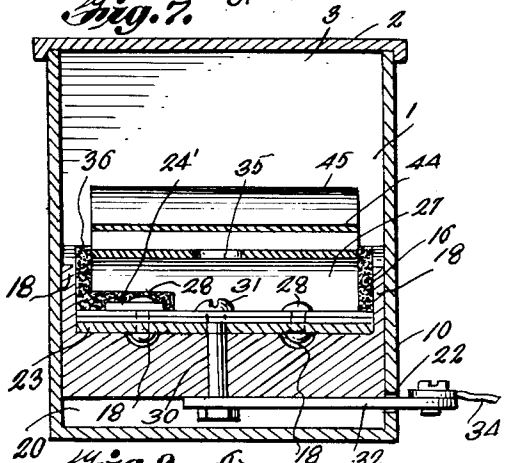


Fig. 9.

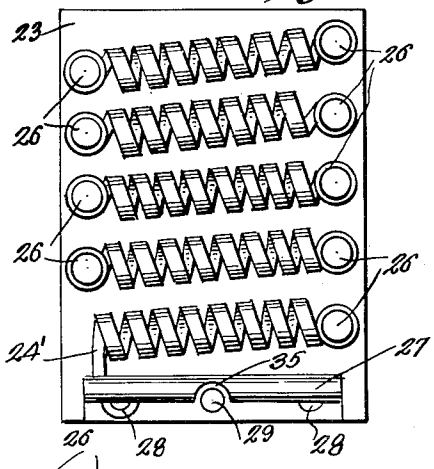
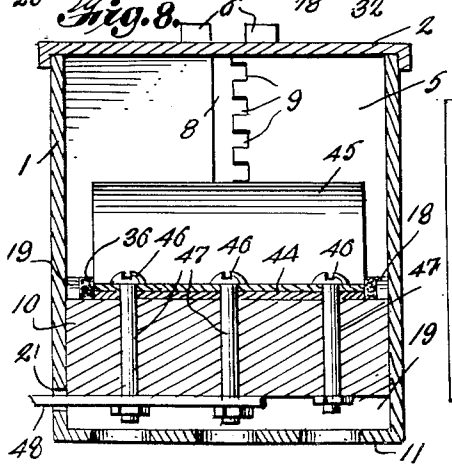


Fig. 8.



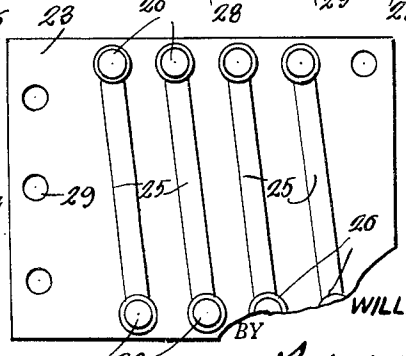


Fig. 10.

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Fig. 11.

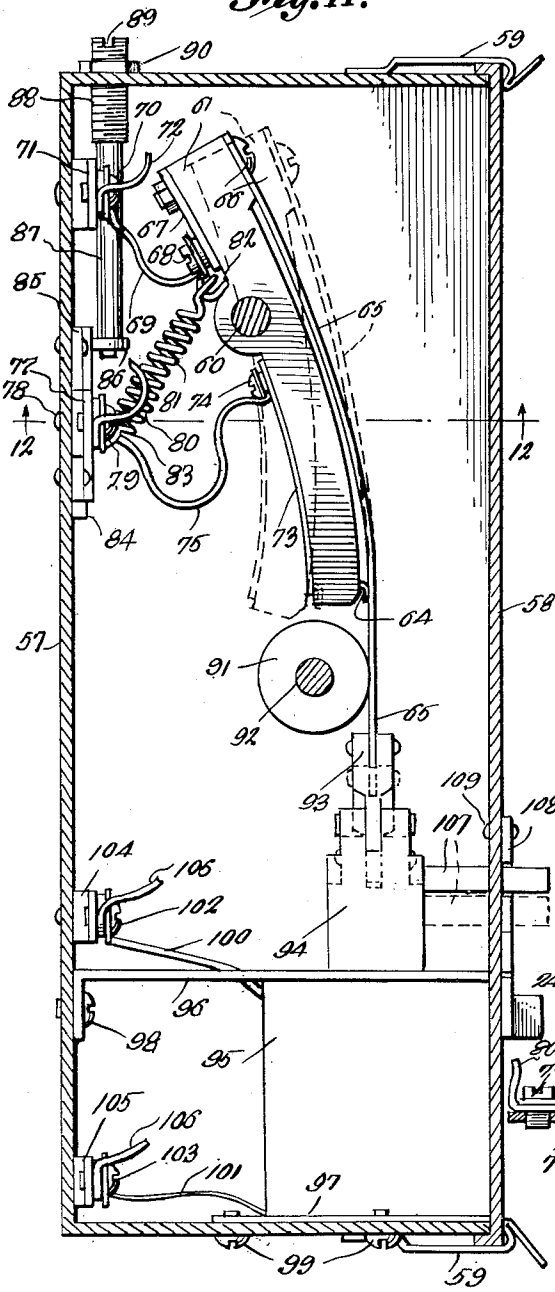


Fig. 13.

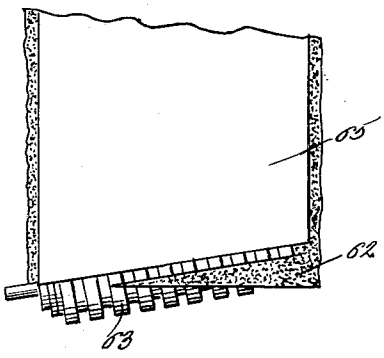
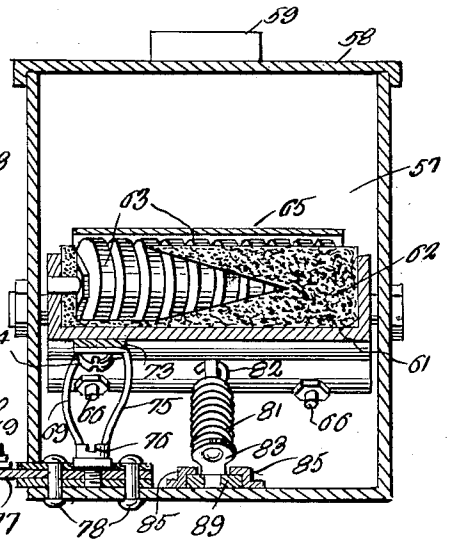


Fig. 12.



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RESISTANCE SWITCH

William E. Baker, Chickasha, Okla., assignor of twenty-six and two-thirds per cent to Wiley True, twenty-six and two-thirds per cent to Roy I. Edwards, ten per cent to Randall H. Sharpe, and ten per cent to W. B. Jones and Edward B. Jordan

Application February 4, 1949, Serial No. 74,582

8 Claims. (Cl. 201—48)

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This invention relates to switches and more particularly to a switch adapted for use in a circuit carrying heavy current of high voltage, it being one object of the invention to provide a switch which includes in its construction a resistance which is gradually brought into engagement with a movable contact as the switch is closed.

Another object of the invention is to provide a switch having a movable contact which is moved into and out of a closed position without opening the door of the box or housing of the switch.

Another object of the invention is to provide the switch with a resistance consisting of a plurality of sections so formed and so arranged in series with each other that a resistance of comparatively long length may be mounted upon a carrier of small dimensions and thus reduce the size of the switch to such an extent that it occupies a small amount of space when installed for use.

Another object of the invention is to provide a switch having a movable contact so constructed and so mounted that it may be moved into and out of a closed position without arcing taking place and thus prevent the switch from being damaged by arcing.

Another object of the invention is to provide the switch with a movable contact which is pivotally mounted for movement towards and away from the stationary contact and so formed that the movable contact may be flexed longitudinally and thus conform to the longitudinal curvature of a body of insulation constituting a support for the resistance forming a portion of the stationary contact.

Another object of the invention is to provide the switch with a resistance consisting of a plurality of sections mounted diagonally of a support or body in parallel spaced relation to each other so that when the movable contact is swung towards the stationary contact the movable contact will progressively move into engagement with the sections of the resistance and have contact with each section before it has been moved into complete engagement with a preceding section.

Another object of the invention is to provide a switch having a movable contact which may be moved towards a closed position manually or by action of a solenoid and thus allow manual or automatic closing of the switch.

Another object of the invention is to provide the movable contact with a handle which may be moved into position to dispose the movable

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contact in complete or partial engagement with the resistance and the handle then secured in the adjusted position.

With these and other objects in view the improved switch consists of a special construction and arrangement of parts disclosed in the accompanying drawings wherein:

Fig. 1 is a view looking at the front end of the switch box.

Fig. 2 is a longitudinal sectional view taken along the line 2—2 of Figure 1 and showing portions of the switch in section and other portions in top plan.

Fig. 3 is a vertical sectional view taken longitudinally of the switch along the line 3—3 of Figure 2.

Fig. 4 is a fragmentary view showing resistance bars connected in series.

Fig. 5 is a view showing a resistance element partially in top plan and partially in section.

Fig. 6 is a view similar to Figure 3 showing the movable contact in a fully closed position.

Fig. 7 is a transverse sectional view taken along the line 7—7 of Figure 6.

Fig. 8 is a transverse sectional view taken along the line 8—8 of Figure 6.

Fig. 9 is a top plan view of the resistance.

Fig. 10 is a bottom plan view of the resistance.

Fig. 11 is a sectional view taken longitudinally through a switch of a modified construction.

Fig. 12 is a transverse sectional view taken along the line 12—12 of Figure 11.

Fig. 13 is a fragmentary view showing portions of the movable contact and the resistance forming a portion of the stationary contact.

This improved switch has a box or housing 1 which may be formed of metal, or other suitable material, and has a cover 2 which is hinged to one end wall 3 of the box as shown at 4 so that the cover may be moved to opened and closed positions. The other end wall 5 of the box carries tongues 6 which pass through an opening 7 formed at the free end of the cover and constitute a resilient latch for releasably holding the cover closed. This end wall 5 is outwardly bowed and formed with a slot 8 which extends longitudinally of the wall and from this slot lead transversely extending recesses or notches 9 which are spaced from each other longitudinally of the slot. Any means desired may be employed for mounting the box upon a support.

Within the box or casing 1 is mounted a block of insulating material 10 which constitutes a base for the switch and is of such dimensions that it fits snugly in the box where it is secured against

the bottom 11 of the box by bolts 12 passed through feet or flanges 13 at ends of the base. A shoulder 14 extends across one end portion of the base and across its other end portion the base is formed with a second shoulder or lip 15 which is of less thickness than the shoulder 14. These shoulders form end walls for a recess 16 having its bottom formed by the longitudinally arcuate upper face 17 of the base, as shown in Figure 3, it being noted that the recess is of less width than the base and is thus formed with side walls 18, as shown in Figures 2 and 7. The upper edges of the side walls conform to the curvature of the bottom 17 of the recess or pocket and this bottom is formed with rows of pits 17' spaced from each other longitudinally of the base. The base is also formed across its under face with grooves 19 and 20 which extend the full width of the base and communicate with openings 21 and 22 formed through the side walls of the box.

A combined stationary contact and resistance is mounted in the pocket 16 and consists of a mounting sheet 23 which is formed of flexible insulating material and carries a plurality of resistance coils 24 connected in series by strips 25 of conductive material. The resistance coils and the connecting strips extend diagonally across the mounting sheet, as shown in Figures 9 and 10, with the resistance coils resting upon the upper face of the sheet and the connecting strips bearing against the under face of the sheet and connected at their ends with ends of the coils by metal rivets 26 which pass through side edge portions of the sheet. A terminal strip 27 is secured across the front end of the mounting strip by rivets 28 and curves upwardly and forwardly from the mounting strip. The adjacent resistance coil has its end portion 24' secured under the head of one of the rivets 28 to establish an electrical connection between the coil and the terminal strip, and midway its length the terminal strip is formed with an opening 29 which registers with an opening 30 formed through the base to receive a bolt 31. This bolt has its lower portion protruding into the groove 20 and through the inner end of a conductor strip 32 which passes through the opening 22 and at its outer end carries a screw 33 for connecting a circuit wire 34 with the strip 32. A notch 35 is formed in the lip of the terminal strip 27 over the opening 29 so that a screw driver may be readily applied to the bolt 30 and the nut for the bolt tightened after the bolt has been passed through the terminal strip 32. After the sheet 23 carrying the resistance coils and the connecting strips has been fitted into the pocket 16 and disposed upon the bottom 17 of the pocket melted insulating material 36 is poured into the pocket about the coils and completely fills the pocket, but portions of the coils protrude from this insulating material as shown in figures 3 and 6. Therefore individual engagement may be made with the convolutions of the coils when the switch is closed and since the coils extend diagonally the resistance will have a long length relative to the length of the pocket and the base.

Instead of forming the resistance from the coils of conductive metal shown in Figure 9 they may be formed as shown in Figure 4 or as shown in Figure 5. In Figure 4 the resistance sections are formed from metal tubes or bars 37 which correspond in length and capacity to the coils. These resistance elements extend diagonally across the upper face of the mounting sheet and are secured at their ends by fasteners 38 which correspond to the rivets 26 and connect ends of

the resistance elements with ends of the connecting strips 25. The resistance element or member shown in Figure 5 consists of a plurality of metal rings or disks 39 spaced from each other by smaller rings of insulation 40 and disposed about a metal rod 41 having threaded ends upon which nuts 42 are screwed to apply binding pressure to the rings and hold them in close fitting engagement with each other and also hold ends of the connecting strips 43 in engagement with the resistance element.

The movable contact is of a compound construction and consists of a wide strip 44 of flexible conductive metal and a companion strip 45 formed of resilient metal. The strip or spring 45 is bowed upwardly longitudinally and has its ends resting flat against end portions of the conducting strip 44, the inner or rear ends of the two strips being formed with registering openings to receive bolts 46 by means of which the movable contact is mounted upon the rib 14 of the base. These bolts pass downwardly through openings 47 formed through the base and protrude into the transversely extending groove 19 and certain ones of the bolts pass through a terminal strip or bar 48 which extends longitudinally in the groove with one end portion passing through the opening 21 of the box and carrying a screw 49 by means of which a second circuit wire 50 is connected with the bar. At the free end of the movable contact the ends of the strips 44 and 45 are secured flat against each other by rivets 51 which secure them to a cross bar 52 serving as a reinforcement for the free end of the movable contact and also as a carrier to which the handle 53 is secured. The handle which is formed of insulation passes outwardly through the slot 8 and carries a latch 54. This latch forms an enlargement or finger hold for the handle by means of which the handle may be readily grasped and the handle moved longitudinally in the slot to open or close the switch. The latch is U-shaped and formed from a strip of resilient metal, and upon referring to Figure 2 it will be seen that the latch has one arm secured flat against the handle by rivets 55 and its other arm spaced from the handle and reduced in width at its free end to form a finger 56 which enters the slot 8 and is engageable in the notches 9 to releasably hold the handle and the movable contact in an adjusted position. When pressure is applied to the latch transversely of the handle its free arm will be forced towards the handle and the finger dislodged from a notch so that the handle may be shifted longitudinally in the slot and the movable contact shifted towards an opened position or a closed position. The spring strip 45 exerts longitudinal strain upon the flexible strip 44 so that it will not have undesired contact with the coils of the stationary contact when in a fully or partially opened position and since the spring strip is yieldable the flexible strip may be gradually flexed or bent into contact with the coils of the stationary contact when the movable contact is swung towards a closed position.

When this switch is in use it is mounted upon a support where it is secured either by means of the bolts 12 or in any other desired manner. The circuit wires 34 and 56 are secured under the heads of the screws 33 and 49 and when the movable contact is in the opened position shown in Figure 3 no current will flow through the switch. When the movable contact is swung downwardly towards its closed position the flexible strip 44 the flexible strip gradually moves

into engagement with the convolutions of the resistance coils, a portion of this progressive movement of the movable contact into engagement with the coils of the stationary contact being indicated by the dotted lines A, B, C, D, E, F, and G in Figure 2. As the strip 44 of the movable contact makes contact with the convolutions of the coils the effective length of the resistance formed by the coils is gradually reduced and action of the resistance will have been gradually reduced to its minimum. It will thus be seen that while the switch will be closed for the entire distance from the end of the coil closest to the attached end of the resistance to the fully closed or depressed position of the movable contact in which its flexible strip bears against the curved cross bar 27, the effective action of the resistance will be reduced or increased by downward or upward movement of the handle in the slot 8. It will also be noted that when the movable contact has been shifted to a desired position of adjustment the finger of the latch 54 may be allowed to enter adjacent notch 9 of the slot 8 and the handle will be firmly held against movement along the slot and the movable contact securely held in its adjusted position.

In Figures 11, 12 and 13 there has been shown a resistance switch of a modified construction. In this embodiment of the invention the box 57 is mounted upright against a wall, instrument panel, or other suitable support by fasteners passed through its rear wall or in any other desired manner. The box is open at its front and this open front of the box is closed by a cover or door 58 which is removably held in its closed position by resilient latches 59. A pivot rod 60 extends transversely through the box or casing 57 and upon this rod is tiltably mounted a body of insulation 61 constituting the base of the switch and corresponding to the base 10. This block or base is formed with a pocket 62 in which a plurality of resistance coils 63 are mounted, the coils being disposed diagonally and connected with each other in series similar to the manner in which the coils previously described are arranged. Details of the coils and the manner in which they are constructed and mounted are omitted as they are duplicates of the coils already described. There has also been provided a contact bar or strip 64 corresponding to the contact strip 27 for engagement by the movable contact strip 65 when the block is in the position shown in full lines in Figure 11. This contact strip 65 is formed of flexible sheet metal having conductive qualities and has one end secured to the base by bolts 66 which pass through the base. One of the bolts has its threaded end portion passing through a conductor strip 67 carrying a screw 68 to which a wire 69 is secured, the other end of the wire being engaged with a screw 70 carried by a terminal bracket 71 and tightened to secure this wire 69 and also secure a circuit wire 72. A conductor 73 extends longitudinally of the base from the terminal strip 64 and at its other end carries a screw 74 to which is applied an end of a wire 75 leading to a screw 76 carried by a conductor strip 77 which is secured in insulated relation to the rear wall of the box by rivets 78. This conductor strip projects outwardly from the box through an opening in a side wall thereof and its outer end portion carried a screw 79 to which a circuit wire 80 is attached. When the switch is closed and its movable contact 65 resting against all of the resistance coils 63 and the terminal strip 64 the resistance is fully active but when the switch is opened the movable contact strip is out of engagement with the coils.

A spring 81 urges the body or base 61 towards the closed position shown in full lines in Figure 11. This spring has one end engaged with a hook 82 carried by the base midway the width thereof and its other end anchored to an arm or clip 83 projecting from a carrier 84 which is slidably mounted between tracks 85 and shiftable longitudinally of the rear wall of the box. An eye 86 projects from the carrier strip near the upper end thereof and in this eye is swiveled the reduced end of a rod 87 which extends longitudinally in the box and has its outer end portion thickened and threaded as shown at 88. This threaded end portion of the rod is engaged through a threaded opening formed in the top wall of the box and its outer end is cut to form a groove 89 for reception of the blade of a screw driver and upon the protruding end portion of the rod is screwed a nut 90 serving as a lock for the rod or screw 87. When the rod is screwed inwardly the mounting 84 is shifted downwardly and the tension of the spring increased until it will urge the base 61 to the tilted position shown in full lines in Figure 11 but allow the base to be tilted to the position indicated by dotted lines when the switch is opened. After the spring has been properly tensioned the nut 90 is tightened and applies binding force to secure the rod or screw against accidental turning.

The movable contact strip 65 is of such length that it extends beyond the lower end of the pivoted base and across a roller 91 which is rotatably mounted in the box upon a rod or pin 92. The lower end of the contact strip is secured in a coupling 93 carried by and projecting from the core 94 of a solenoid 95 which is mounted in the lower portion of the box or casing. The solenoid is carried by supporting brackets 96 and 97 which are secured against the walls of the box by a suitable number of screws 98 and 99 and terminal wires 100 and 101 for the winding of the solenoid are engaged with screws 102 and 103 carried by mountings 104 and 105 attached to the rear wall of the box in insulated relation thereto. The circuit wires 106 are attached to the screws 102 and 103 and when current is allowed to flow through the solenoid winding the core 94 will be retracted and pull applied to the movable contact strip 65 to tilt the base 61 about the rod 60 towards the dotted lined position of Figure 11 and open the switch. A pin 107 projects from a side of the core and through a slot formed longitudinally of the cover 58 with an end portion projecting outwardly from the cover for engagement by a latch 108 which is pivoted to the cover by a rivet 109 for swinging movement into and out of position for engaging the pin and securing the core against accidental longitudinal movement.

Having thus described the invention, what is claimed is:

1. A switch comprising a base of insulation, said base having an upper face formed with ribs extending across its end portions and along its opposite sides and constituting side walls and end walls of a pocket, said pocket having a longitudinally arcuate bottom, the base having its under face formed near its ends with transversely extending grooves, a stationary contact in said pocket consisting of a mounting sheet of insulat-

ing material fitting snugly within the pocket against the arcuate bottom thereof, resistance coils of low conductive wire extending transversely across the upper face of said sheet diagonally thereof and in parallel relation to each other and spaced from each other longitudinally of the sheet and each having convolutions spaced from each other, metal strips extending across the under face of said sheet transversely thereof and spaced from each other longitudinally thereof, metal rivets passing through the sheet and electrically connecting ends of the strips to ends of the coils in series therewith, a terminal strip extending across one end of the upper face of said sheet and connected with one end of the adjacent coil, a mass of insulation filling the pocket above the mounting sheet and filling space about and within the coils and holding the coils in transverse spaced relation in each other, a conductor strip in the groove at one end of the base projecting from one end of the said groove and adapted to have a circuit wire connected with it, a bolt passing through the base and connecting the terminal strip with the conductor strip, a second conductor strip in the groove at the other end of the base projecting from an end of the said groove and adapted to have a circuit wire connected with it, a movable contact strip formed of flexible metal and extending longitudinally of said base and of a length and breadth adapting it to entirely cover and make contact with all of the coils when in a closed position, a bolt passing through the base and one end of the movable contact and through the second conductor strip, the last mentioned bolt holding the movable contact in engagement with the base and allowing tilting movement of the contact strip into and out of position for progressive and successive engagement with the convolutions of the coils and the terminal strip of the stationary contact, and a handle carried by the movable contact for moving the same to adjusted positions.

2. A switch comprising a base adapted to be secured to a carrier, a stationary contact carried by said base and including a mounting sheet of insulation extending longitudinally of the base and bowed outwardly longitudinally, resistance coils of low conductive wire extending across the outer face of said strip transversely thereof and disposed diagonally of the sheet in spaced relation to each other longitudinally of the sheet and each having convolutions spaced from each other, metal connecting strips extending across the inner face of said sheet transversely thereof in spaced relation to each other, rivets passing through the sheet and connecting ends of the coils and the connecting strips in series with each other, insulation filling space between and within the coils and holding the coils in spaced and insulated relation to each other, a movable contact strip of flexible metal secured at one end to the base adjacent one end of the stationary contact and extending longitudinally of the said stationary contact and being of greater width than the coils, the movable contact having a member at its free end for swinging the movable contact into progressive engagement with the convolutions of the coils of the stationary contact, fasteners of conductive material securing the movable contact and the stationary contact to the base, and conductor strips held to the base by said fasteners and projecting therefrom and having their outer end portions adapted to have circuit wires connected with them.

3. A switch comprising a base of insulation, a stationary contact carried by said base and extending longitudinally thereof and consisting of resistance coils of low conductive wire extending transversely of the base diagonally thereof and each having convolutions spaced from each other, conductive members connecting ends of the coils in series, a movable contact of greater width than the coils extending longitudinally of the base and mounted at one end for swinging movement into and out of progressive engagement with all of the convolutions of the coils, conductor strips connected one with the attached end of the movable contact and the other with an end coil at the attached end of the stationary contact, said conductor strips being adapted to have circuit wires connected with them, and means for releasably securing the movable contact in adjusted positions with predetermined portions of its length in conductive engagement with convolutions of the coils.

4. A switch comprising a base of insulation, a stationary contact carried by said base and extending longitudinally thereof and consisting of resistance coils of low conductive wire extending transversely of the base diagonally thereof and members connecting ends of the coils in series, a movable contact extending longitudinally of the base and mounted at one end for swinging movement into and out of progressive engagement with the convolutions of the coils, members for connecting circuit wires with the stationary contact and the attached end of the movable contact, and means for releasably securing the movable contact in an adjusted position.

5. A switch comprising a base of insulation having a surface arcuate longitudinally of the base, a stationary contact mounted upon the arcuate surface of said base and conforming to the longitudinal curvature thereof, said stationary contact consisting of a plurality of resistance coils of low conductive wire extending transversely of the base diagonally thereof and each consisting of convolutions spaced from each other, said coils having their ends connected in series with each other, and a movable contact extending longitudinally of the base over the stationary contact and of dimensions adapting it to completely cover the coils, the movable contact being formed of flexible metal and mounted at one end upon the base for movement into progressive and individual engagement with the convolutions of the coils of the stationary contact, and means for connecting circuit wires with the stationary contact and the movable contact.

6. A switch comprising a base of insulation having a surface arcuate longitudinally of the base, a stationary contact mounted upon the arcuate surface of said base and conforming to the longitudinal curvature thereof, said stationary contact consisting of a plurality of resistance coils of low conductive wire extending transversely of the base diagonally thereof and each having convolutions spaced from each other, said coils having their ends connected in series with each other, and a movable contact extending longitudinally of the base over the stationary contact, said movable contact being mounted at one end upon the base for swinging movement towards and away from the stationary contact, said movable contact consisting of a lower strip of flexible metal of a length and width adapting it to completely cover the coils of the stationary contact and an upper strip of resilient metal

bowed upwardly longitudinally and secured at its ends to ends of the flexible strip and applying longitudinal stress to the flexible strip.

7. A switch comprising a base of insulation having a surface arcuate longitudinally of the base, a stationary contact mounted upon the arcuate surface of said base and conforming to the longitudinal curvature thereof, said stationary contact consisting of a plurality of resistance coils of low conductive wire extending transversely of the base diagonally thereof and each having convolutions spaced from each other, said coils having their ends connected in series with each other, and a movable contact extending longitudinally of the base over the stationary contact and being mounted at one end upon the base for swinging movement towards and away from the stationary contact, said movable contact consisting of a lower strip of flexible sheet metal of a width adapting it to bear against and completely cover the coils of the stationary contact when in a closed position and an upper strip of resilient sheet metal bowed upwardly and having its ends secured to ends of the flexible strip and serving to exert longitudinal stress upon the flexible strip, and a handle extending from the free end of the movable contact midway the width thereof.

8. A resistance switch comprising a base of insulation having its upper face formed with a recess forming a pocket extending longitudinally of the base and having a longitudinally curved convexed bottom, a stationary contact in said pocket having a mounting sheet of insulation resting upon and conforming to the curvature of the bottom of the pocket, wire coils extending transversely of the pocket upon the mounting sheet, metal strips extending across the under face of the said sheet, fasteners passing through

the sheet and ends of the coils and the metal strips and connecting the same in series to form an elongated resistance, insulation filling the pocket above the mounting sheet and holding the coils in spaced relation to each other, a movable contact consisting of upper and lower sheets of sheet metal having inner and outer ends in flat contacting engagement with each other, the inner end portions of the connected sheets being secured against the base and mounting the movable contact for swinging movement into and out of position for progressive engagement of its inner sheet with the coils, the said inner sheet of the movable contact being flexible and the outer sheet thereof being resilient and bowed outwardly between its attached ends, members for connecting circuit wires with the attached end of the movable contact and the opposite end of the stationary contact, and a handle projecting from the free end of the movable contact for moving the said movable contact towards and away from the stationary contact and releasably securing the movable contact in an adjusted position.

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