

Feb. 16, 1937.

G. O. WILMS ET AL

2,071,149

ELECTRIC SWITCH

Filed July 11, 1935

4 Sheets-Sheet 1

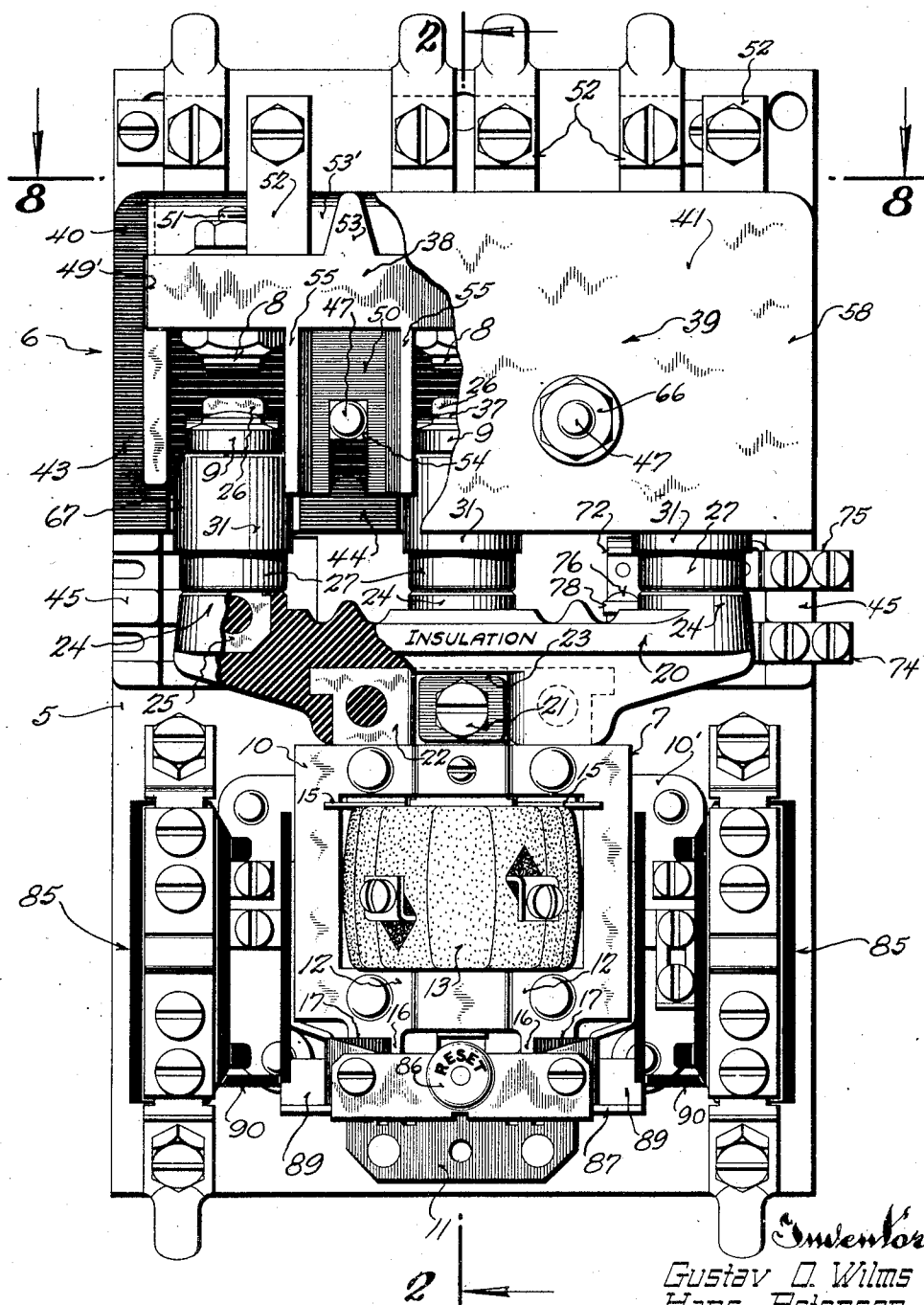


Fig. 1.

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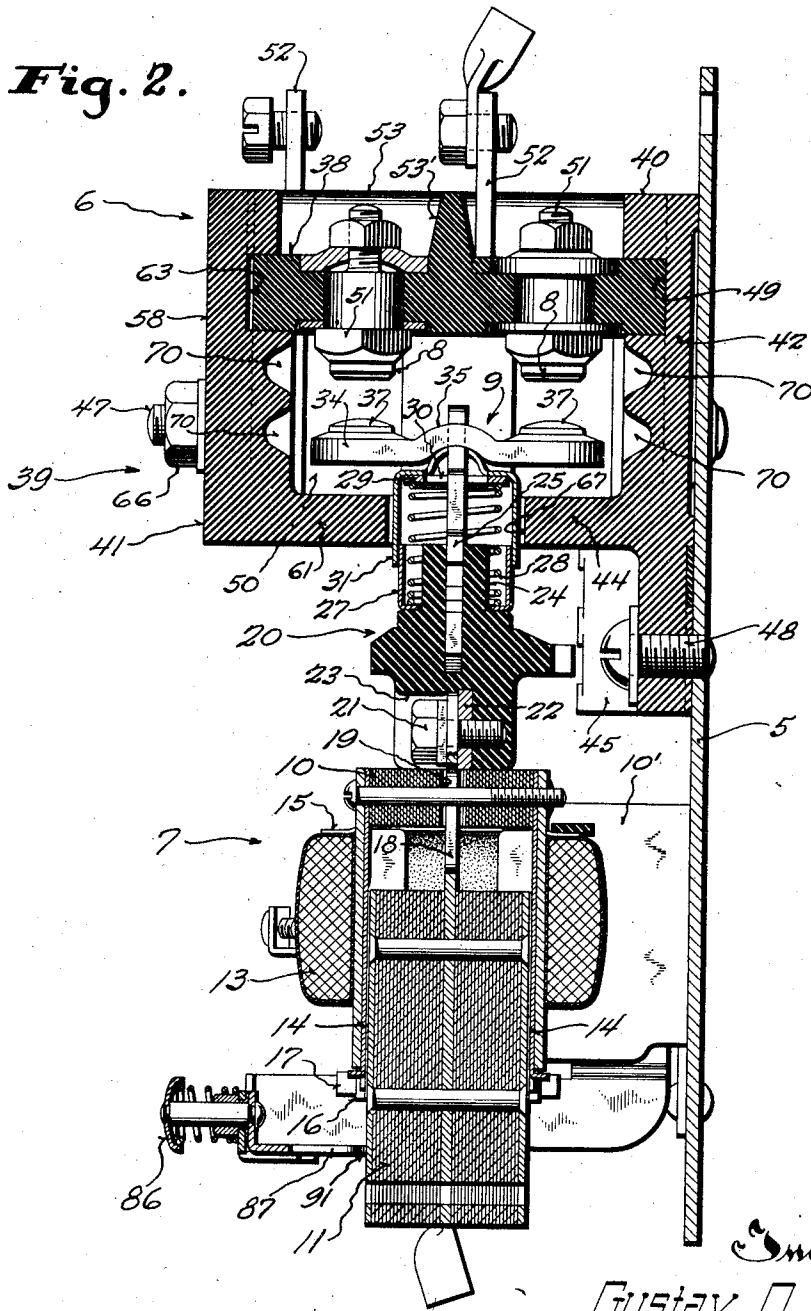
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4 Sheets-Sheet 2

Fig. 2.



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4 Sheets-Sheet 3

Fig. 5.

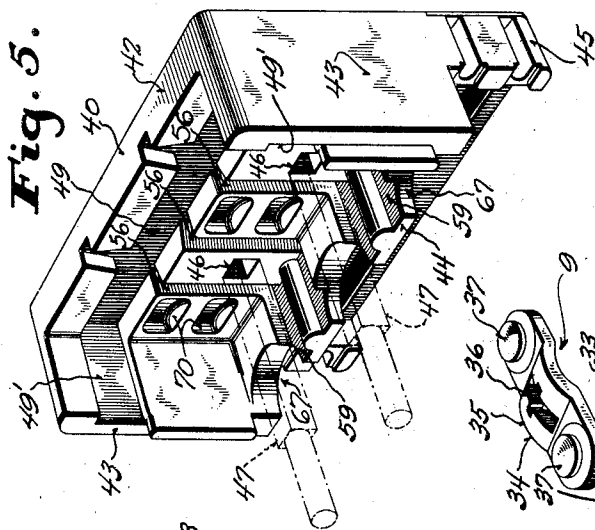


Fig. 4.

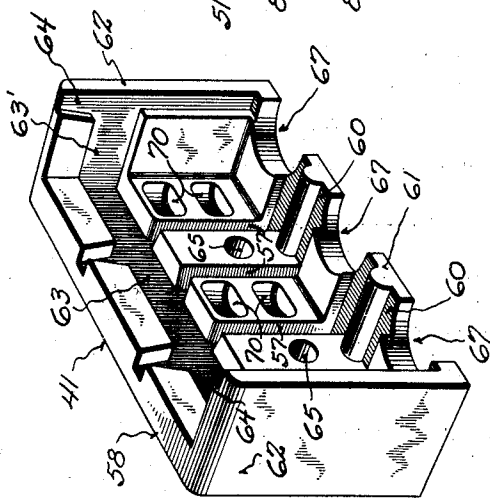
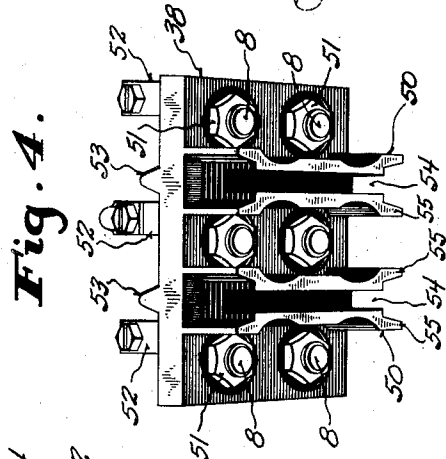


Fig. 3.

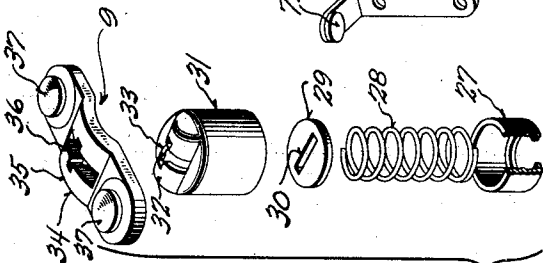


Fig. 11.

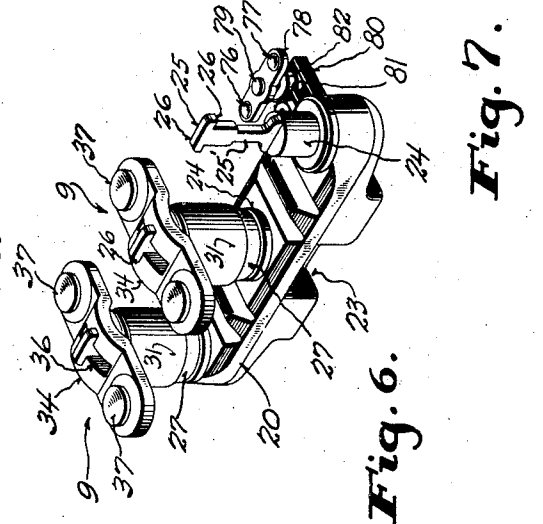


Fig. 6.

Fig. 7.

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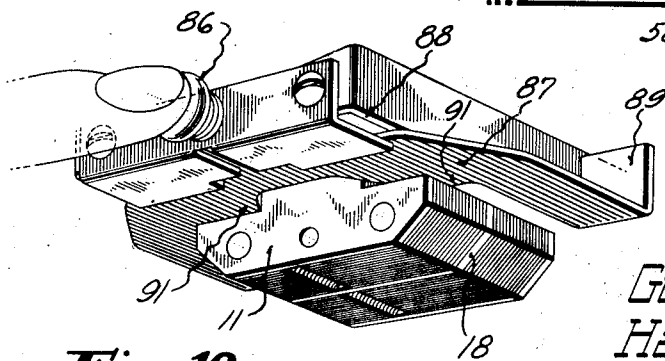
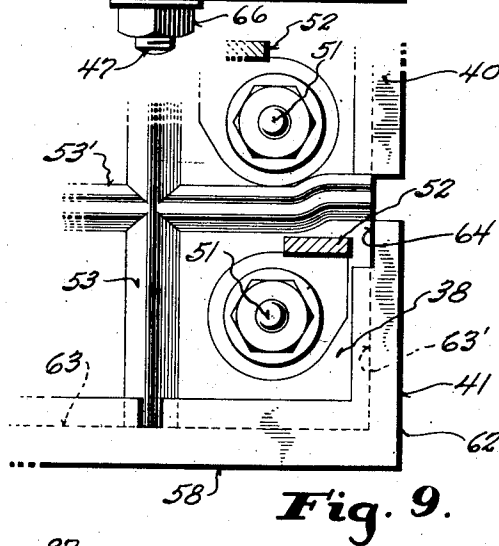
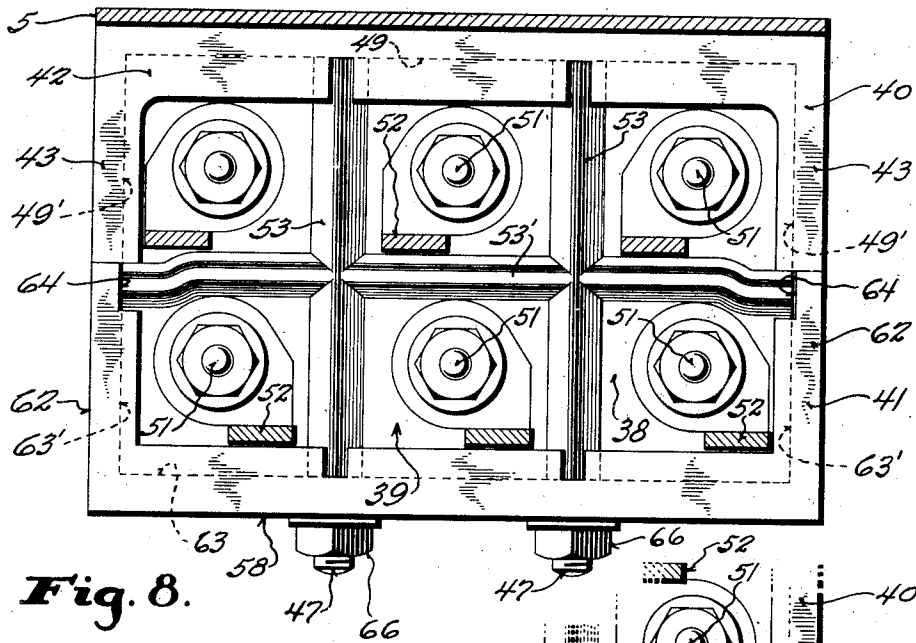
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ELECTRIC SWITCH

Filed July 11, 1935

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,071,149

ELECTRIC SWITCH

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Application July 11, 1935, Serial No. 30,790

31 Claims. (Cl. 200—144)

This invention relates to improvements in electric switches and refers more particularly to electromagnetically actuated control switches of the type shown in Patent No. 1,981,534, issued to Gustav O. Wilms, et al., November 20th, 1934.

As in the patent above noted, the switch of this invention is of the solenoid type wherein the movable contacts have a straight line motion to and from engagement with their respective stationary contacts.

It is a general object of this invention to improve the construction of switches of this character and to increase their arc rupturing capacity through the provision of novel arc enclosing chambers which completely enclose the contacts.

Another object of this invention is to provide an arc enclosing chamber so constructed that while it completely encloses the contacts, they are readily accessible for inspection.

Another object of this invention is to provide an arc enclosing chamber having a readily removable section on which the stationary contacts are mounted.

In this connection, it is a further object of this invention to provide a combined arc enclosing chamber and terminal head so designed that the component parts are all readily removable from the front of the switch.

Another object of this invention is to provide practical means for actuating the movable contacts from without the arc enclosing chambers in such a manner that while the necessary opening through which said means enters the chamber, communicates the chamber interior with the atmosphere and enables substantially a rapid venting of accumulated gases from within the chamber, the completeness of the enclosure is not destroyed to the point of interfering with the effective confinement of the arc within the chamber.

Another object of this invention resides in the provision of an arc enclosing chamber for switches of the character described which is composed of a plurality of component separable parts or sections having interengaging connections incorporating overlapping surfaces so as to more effectually confine the arc.

Another object of this invention is to provide an improved manner of mounting the movable contacts on their carrier.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substan-

tially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a front view of a switch embodying this invention, parts thereof being broken away and in section;

Figure 2 is a longitudinal section view through Figure 1 on the plane of the line 2—2;

Figure 3 is a perspective view of the cover section of the arc enclosing chamber;

Figure 4 is a perspective view of the top wall of the arc enclosing chamber with the stationary contacts mounted thereon;

Figure 5 is a perspective view of the rear section or base of the arc enclosing chamber;

Figure 6 is a perspective view of the movable contactor unit with one of the contact arms and its associated mechanism removed;

Figure 7 is a perspective view of the removed contact arm and its associated mechanism;

Figure 8 is a top view of the switch showing particularly the arc enclosing chamber properly assembled;

Figure 9 is a fragmentary top view of the arc enclosing chamber showing how improper assembly thereof is precluded;

Figure 10 is a perspective view of the lower portion of the solenoid and the overload reset member, showing how closure of the switch by the solenoid is prevented when the reset button is held in; and

Figure 11 is a perspective view showing the contacts of the auxiliary hold-in switch.

Referring now more particularly to the accompanying drawings in which like numerals indicate like parts throughout the several views, the numeral 5 designates a flat sheet metal panel upon which the switch mechanism, indicated generally by the numeral 6, and the electromagnetic actuating means or solenoid 7 are mounted. The switch mechanism comprises a plurality of pairs of stationary contacts 8 adapted to be electrically bridged by movable contact units 9 actuated in a straight line motion by the electromagnetic actuator or solenoid 7.

The electromagnetic actuator or solenoid 7 in its general aspects is substantially like that

shown in the aforementioned patent to Wilms, et al. It incorporates a laminated field piece 10 rigidly mounted on the panel 5 by means of a bracket 10'. The field piece 10 is substantially of inverted U-shape and has an armature 11 slidably received between its legs, the lower ends of which are directed inwardly toward each other to provide ledges 12, the space therebetween, however, being sufficient to accommodate the armature 11.

Within the hollow of the field piece is a coil 13 readily detachably held in place by channel-shaped guideways 14 in which the armature slides. Spring elements 15 confined between the top of the coil and the adjacent portion of the field piece serve to hold the coil down on the ledges 12 and prevent endwise motion of the coil.

The pole pieces of the magnet are provided by downwardly extending projections 16 on the bottom of the ledges 12. Shading coils 17 are mounted on these projections as is customary.

The armature 11 is of inverted T-shape with the stem thereof slidable in the guideways 14 and its head projecting to opposite sides for coaction with the pole pieces 16. Like the field piece 10, the armature is also of laminated construction and a central lamination 18, which is composed of non-magnetic metal, slidably projects through an opening 19 in the top of the field piece. The opening 19 is provided by cutting away some of the central laminations of the field piece.

Attached to a tongue formed by the lamination 18 by means of a screw 21 is a contact carrier 20. This carrier 20 comprises a cross bar of molded insulating material with a metal insert 22 providing a reinforcing rib therefor. The front of the molded cross bar is recessed at its lower portion as at 23 to expose the adjacent central portion of the metal reinforcing rib 22 so that the end of the tongue 18 is engageable directly therewith.

Three upstanding equispaced bosses 24 project from the top of the carrier 20 and have metal posts 25 embedded therein with their upper end portions exposed. The exposed upper end portions of the posts are substantially T-shaped to provide sidewise extending hooks or projections 26 on their upper ends which lie in a plane parallel to the major axis of the carrier bar. Seated on each boss 24 is a spring retaining cup 27 in which the lower end portion of an expansible spring 28 is nested. The spring 28 encircles the post 25 and also the boss 24 and its upper end bears against a washer 29 slotted as at 30 to permit its disposition over the T-shaped post 25.

Telescoped over this entire assembled structure is an outer cup-shaped member 31, the upper closed end of which has a raised bead 32 pressed transversely therein and in which a cross-shaped opening 33 is formed. The cross-shaped opening 33 has a long and short leg with the long leg transverse or at right angles to the axis of the bead 32 and the short leg parallel with the axis of the bead and located in the extreme top portion thereof.

The long leg of the opening is sufficiently large to permit the passage of the T-shaped head of the post 25 therethrough so that by properly disposing the cup member 31 with respect to the post 25, it is possible to engage the same therewith. After engagement to a point at which the opening 33 aligns with the narrow lower portion 25' of the post, the cup member may be turned ninety degrees to align the short leg of its cross-

shaped opening 33 with the post, the short leg receiving the wider portion of the post between the extensions 26 and the narrow part 25'. The cup member is thus held against turning and yieldingly urged against the extensions or arms 26.

This disposes the cup member 31 in a position of rotation at which the axis of its bead 32 is parallel with the major axis of the carrier bar and holds the spring 28 in a state of compression. Mounted on each post 25 outwardly of the cup member 31 is one of the movable contact units 9. These units are all alike and comprise a contact bar 34 which is in the form of a relatively heavy strip of metal, preferably copper, with contacts 37 of a silver-cadmium alloy electro-welded to its end portions. The central portion 35 of the bar is humped up to seat on the bead 32 of the cup member 31 and a cross-shaped opening 36 similar to the opening 33 permits the application of the bar to the post 25. Upon being properly assembled, the bar is confined between the bead 32 and the extensions 26 of the post 25.

The manner of mounting the contact bar permits the same to rock about a transverse axis to enable its contacts 37 to properly engage the stationary contacts 8, but rocking of the bar 34 about a longitudinal axis is prevented so as to preclude the possibility of overheating at the contacts as a result of a rocking motion on the part of the contact bar. As shown, the movable contacts 37 are round topped while the stationary contacts 8 are flat, this combination of shapes having been found to provide the best results.

The stationary contacts 8 are fixed to the top wall 38 of an arc enclosing or arc suppressing chamber, indicated generally by the numeral 39. This chamber differs from arc hoods of the past in that it is totally enclosed and provides a complete enclosure for the contacts. It consists of three separable interengaging sections, a base or rear section 40, the top wall 38, and a cover or front section 41.

The base or rear section 40 comprises a rear wall 42, side walls 43, and a bottom wall 44, the rear wall 42 projecting down beneath the bottom wall 44 and having forwardly extending flanges 45 at its opposite side edge portions which form substantially continuations of the side walls 43.

The rear wall 42 has two spaced square openings 46 to snugly receive mounting posts 47 riveted or otherwise fixed to the metal panel 5. The base section is held on the posts 47 in flat engagement with the panel by a screw 48 passed through the downwardly projecting part of the rear wall and threaded into the panel 5.

The rear and side walls 42 and 43, respectively, of the base section have connecting grooves 49 and 49', respectively, formed in their inner faces to snugly receive the adjacent edge portions of the upper section of the arc enclosing chamber comprising the top wall 38. The top wall 38 is thus slidably engageable with the base or rear section from the front of the switch.

This top wall 38 has two downwardly projecting webs 50 which provide partition walls to divide the interior of the arc enclosing or arc suppressing chamber into three separated compartments. Obviously, each pair of stationary contacts 8 is disposed in one of the compartments thus formed and likewise, the cooperating movable contacts move in these separated compartments for coaction with the stationary contacts.

The stationary contacts, like the movable con-

tacts, are formed of a silver cadmium alloy and are electro-welded onto the heads of copper bolts 51, the stems of which project through and above the top wall to also mount terminals 52. The top wall 38 thus not only provides one wall of the arc hood, but also serves as a terminal head to which the stationary contacts and their terminals are secured, and it is to be noted that the terminals for the contacts are offset with respect to each other so that all of them are readily accessible from the front of the switch to facilitate the attachment of conductor wires thereto.

The upper surface of the top wall 38 is provided with upstanding ribs 53 which divide the top thereof into shallow compartments so as to isolate the respective terminals from each other. The central or longitudinal rib 53' has its ends offset as shown in Figures 8 and 9 and has its extremities overlying the adjacent edges of the side walls 43. When the top wall is properly assembled with the base or rear section of the arc enclosing chamber, the engagement between the ends of the ribs 53' and the front edges of the side walls 43 permits the top wall to move all the way back, but if the top wall is engaged in the grooves 49' in reversed position, i. e., with its front edge rearward, the engagement of the extremities of the rib 53' with the front edges of the side walls 43 will preclude complete and proper engagement of the top wall with the base or rear section, and as will be hereinafter described, will preclude the application of the cover or front section, thus clearly indicating that the top wall has been improperly applied.

The webs 50, which serve as the partitions between the respective contact compartments, are longitudinally channeled as at 54 to snugly receive and embrace the mounting posts 47. In so embracing the posts, the webs or partition walls afford adequate insulation for the posts and preclude the possibility of arcing between the contacts and the grounded posts. Both ends of the webs 50 are also channeled to form spaced flanges 55 which engage in complementary grooves 56 in the rear wall of the rear or base section and similar grooves or recesses 57 in the front wall 58 of the cover or front section 41; and the lower edges of the two webs or partitions 50 have sliding engagement with grooves 59 in the bottom wall 44 of the rear or base section and grooves 60 in the bottom wall 61 of the cover or front section.

Consequently, the partition walls which divide the arc enclosing chamber into separated compartments have a tongue and groove interengagement with both the rear or base section and the front or cover section so as to provide an effective seal between the respective compartments. This interengaging tongue and groove joint between the engaging portions of the different sections provides overlapping surfaces sufficient to form a tortuous leakage path long enough to cool an arc or hot gases escaping from one compartment into the other so that the possibility of arcing between the different poles of the switch is reduced to a minimum.

As already noted, the front or cover section 41 is similar in many respects to the rear or base section. It provides the front wall 58 of the arc enclosing chamber and its bottom wall 61 coacts with the bottom wall 44 of the rear or base section to complete the bottom for the arc enclosing chamber. The side walls 62 of the cover

section coact with the side walls 43 of the base section to complete the side walls of the arc enclosing chamber and like the rear or base section, the inner faces of the front and side walls have continuous and connecting grooves 63 and 63' to slidably receive the adjacent edge portions of the top wall 38. To accommodate the extremities of the longitudinal rib 53' on the top wall, the side walls 62 have recesses 64 above and communicating with the grooves 63', these recesses being of a size to just receive the extremities of the longitudinal rib 53' when the top wall is properly assembled but to prevent complete application of the cover when the top wall is improperly mounted.

There is also an interengaging overlapping joint between the abutting edges of the side walls of the front and rear sections, as shown.

Holes 65 in the front wall 58 receive the threaded outer ends of the posts 47 so that by means of nuts 66 threaded on the posts, the three sections comprising the arc enclosing chamber are held assembled. Obviously, it is only necessary to remove the nuts 66 to permit withdrawal of the cover section when it is desired to expose the contacts for inspection and if a new set of stationary contacts is necessary, the entire top wall may be replaced so that the substitution of contacts is an extremely simple matter.

The bottom wall of the arc enclosing chamber, which is formed jointly by the bottom walls 44 and 61 of the base and cover sections, respectively, has three holes 67 formed half in the base section and half in the cover section, as illustrated. These holes lead to the separated arc suppressing compartments and are of a size to slidably receive the cup members 31 with just sufficient clearance for free sliding action. In other words, the cup members 31 substantially close the holes 67 so that while the movable contacts are actuatable from without the arc suppressing chamber, the completeness of the enclosure afforded thereby is not destroyed to the point of interfering with the confinement of the arc, but it is to be observed that the clearance between the cup members and the walls of the holes is sufficient to facilitate or enable rapid venting of accumulated gases from within the chamber.

At this point it may be noted that the cup members 31 in conjunction with the cup members 27 provide a complete enclosure for the springs which protects the springs from the arc and also guards against the possibility of having their coils catch on the edges of the holes 67. Besides these functions, the spring enclosures afforded by the telescoped cups 27 and 31 serve to close the holes 67 as noted and coact with the heads of the posts to prevent rocking of the contact bars on their longitudinal axes.

In operation, when the electromagnet is energized, the armature is drawn up in a straight line to impart a straight line motion to the contact carrier which lifts all of the movable contacts simultaneously from their switch open positions to which they move by gravity into switch closing positions with each contact arm electrically bridging its respective pair of stationary contacts. The distance of travel is such that all of the individual springs 28 are placed in a further state of compression to thus insure adequate contact pressure.

Upon deenergization of the electromagnet, the movable contact unit drops to an open position thus simultaneously disengaging all of the mov-

able contacts from their respective stationary contacts and breaking each line at two places.

The arc which tends to form upon opening of the switch is suppressed and quickly and effectually extinguished. While it is not positively known just what produces the exceptional arc extinction obtained with this switch, tests indicate that it must be the combined effect of a number of structural features. Possibly the most important element in the chain of causation is the close confinement of the arcs by the enclosure of the contacts within an insulating chamber of restricted volume resulting inter alia in the development of high pressure within the chamber. This, together with the fact that the arcs are positively and forcibly projected in opposite directions away from each other and against opposite walls of the chamber by reason of the relative positions of the stationary contacts and bridging bar and the conductors leading to the contacts, plus the deionizing effect which the silver cadmium alloy of the contacts has upon the closely confined arcs, and the fact that the clearance between the spring enclosures and the holes 67 through which the spring assemblies enter the chamber compartments facilitates the escape or enables venting of the accumulated gases from the interior of the chamber without delay after extinction of the arc so that the chamber is cleared of any deleterious and objectionable gases to make it ready for a closely following cycle, possibly explains how this desirable arc quenching or suppressing effect is obtained.

Stated briefly, it is thought to be the close confinement of the arc to produce a suppressing pressure, cooling of the arc by contact with closely adjacent wall surfaces, the deionizing effect of the metal of which the contacts are composed and the rapid venting of the accumulated gases after extinction of the arc which brings the desired results.

The cooling effect mentioned is augmented by shallow cavities 70 in the walls which the arcs impinge.

A hold-in switch to maintain the solenoid energized is provided by means of two spaced stationary 72 and 73 mounted on terminal members 74 and 75, respectively, fixed to the downward projection of the rear wall and one of the flanges 45 projecting therefrom on the base section of the arc hood. Cooperating with these stationary contacts 72 and 73 are auxiliary movable contacts 76 and 77, respectively, both carried by a contact bar 78 which serves to electrically bridge the contacts 72 and 73 when the movable contact structure is in its circuit closing position. The contact bar 78 is slidably mounted on a post 79 fixed to an insulated arm 80 secured to a web 81 formed as an integral part of the molded contact carrier 20, and an expansive spring 82 coiled about the post 79 provides contact pressure for the hold-in switch.

As will be readily apparent from the drawings, the stationary contacts 72 and 73 may be mounted at either side of the switch and likewise, the cooperating movable contacts may be mounted at either end of the carrier bar 20.

Overload relays, indicated generally by the numeral 85, are mounted one at each side of the electromagnet assembly. The detail of these units forms no part of this invention and is therefore not shown or described. For a description of their specific construction, reference may be had to Patent No. 1,992,595, issued to Gustav O. Wilms February 26, 1935.

These overload relays are of the resisto-therm type and when tripped may be reset by depressing a button 86 which is accessible from the outside of the cabinet in which the switch is mounted.

The resetting mechanism includes, besides the button 86, a sliding structure 87 slidable in a stationary guideway 88. The inner spaced ends 89 of the sliding structure are engageable with the reset arms 90 of the relays so that upon depression of the button, the resetting of the relays is effected.

Heretofore, in switches of this type, it was possible to defeat the overload protection by holding in the reset button, but with the present invention this is impossible because of the fact that as long as the reset button is held down closure of the contactor unit to switch closing position is prevented. To this end, the sliding structure 87 has two wings 91 which move into the path of the pole pieces of the armature upon depression of the reset button, as shown in Figure 10. Consequently, as long as the button is held down, lifting of the armature by the solenoid to close the switch is prevented. Hence, it is impossible with this construction to defeat the protective feature of the overload relays.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art, that this invention provides a substantial improvement in the construction and design of plunger type electric switches and that by reason of the novel arc enclosing chamber, flash-over between the poles of the switch is effectually prevented and as a consequence, instantaneous rupturing of the arc is practically insured and the interrupting capacity of the switch is materially increased.

It will also be apparent that the inherent design of the switch of this invention makes the same self-insulating so that it may be mounted on any non-insulating support. This very highly desirable feature is the direct result of the particular construction of the arc suppressing chamber in that all live parts of the switch are either carried directly by or enclosed within this chamber which being formed of a food insulating material provides all the insulation for the switch and thus entirely obviates the need for slate or other insulating panels.

The means whereby closure of the switch is prevented during the resetting of the overload protective relay and the novel structural relationship of the switch parts and their mounting as defined herein, form the subject matter of divisional applications, Serial Nos. 119,554 and 119,555, respectively, both filed January 8th, 1937.

What we claim as our invention is:

1. In an electric switch, a plurality of sets of stationary and movable contacts, an enclosure comprising three separable fitting sections, integral webs on one of the sections to form partitions dividing the interior of the enclosure into separated compartments each of which contains a set of stationary and movable contacts, and interfitting connections between the edges of said webs and the adjacent walls of the other sections so that the juncture between the partition walls and the adjacent walls of the other sections have overlapping surfaces.

2. In an electric switch, a closed chamber having an entrance opening leading thereto, complementary stationary and movable contacts within the chamber, and means for actuating the movable contact from the exterior of the chamber including a part movable through said opening,

said part comprising a contact spring yieldingly urging the movable contact towards the stationary contact and a spring enclosure telescoped over the contact spring and freely slidable through the opening so as to substantially close the opening without interfering with the action of the spring.

3. In an electric switch, a pair of spaced stationary contacts, a contact bar for electrically bridging the same, a cup member having a transverse bead pressed into its end wall, and means for maintaining the contact bar and cup member assembled so that the bead provides a fulcrum upon which said contact bar may rock, said last named means including a spring seated in said cup member.

4. In an electric switch, spaced contacts, a contact member for electrically bridging the same, a T-shaped post having an interengaging separable connection with the contact member limiting outward endwise motion of said member on the post and permitting inward endwise motion thereof, a spring for yieldingly urging the contact member outwardly on the post, and a cup member telescoped over the post and the spring with its end wall interposed between the spring and the contact member, the meeting portions of said members being shaped to provide a fulcrum about which the contact member may rock.

5. In an electric switch, a pair of spaced contacts, a contact bar for electrically bridging the same, a mounting post for the contact bar, a detachable connection between the contact bar and the mounting post preventing disassembly of said parts in the normal position of the contact bar, a compression spring mounted on said post for yieldingly urging the contact bar outwardly on the post and thereby providing contact pressure for the contacts, and a complete enclosure for the spring comprising telescoped cup members, the ends of the spring bearing against the end walls of the cup members so that said cup members are yieldingly held apart by the spring and the end wall of the cup member adjacent the contact bar being interposed between the spring and the contact bar.

6. In an electric switch, a pair of spaced movable contacts, a contact bar carrying the contacts and electrically bridging the same, and an actuator for the contacts including a movable member of insulating material, a mounting post projecting from said member of insulating material, a detachable connection between the mounting post and the contact bar preventing disassembly of the parts as long as the bar is in its normal position and enabling detachment of the contact bar from the post upon revolving the bar about the axis of the post to a predetermined position, an expansile spring encircling the post and adapted to yieldingly urge the contact bar outwardly on the post, and an enclosure for the spring comprising two telescoped cup members, one cup member having its end wall disposed between the insulating member from which the post projects and the adjacent end of the spring and the other cup member having its end wall interposed between the contact bar and the adjacent end of the spring.

7. In an electric switch, a pair of spaced stationary contacts, a contact bar for electrically bridging the same, a mounting post on which the contact bar is slidably mounted, a spring to yieldingly urge the contact bar in one direction on the post, and means interposed between the contact bar and the spring shaped so as to allow rocking movement of the contact bar about the trans-

verse axis and to restrain rocking movement of the bar on its longitudinal axis.

8. In an electric switch, a pair of spaced stationary contacts, a contact member for electrically bridging the same, a post on which the contact member is slidably mounted, a spring encircling the post and yieldingly urging the contact member in one direction, and a cup member fitted over the spring with its end wall interposed between the contact member and the adjacent end of the spring and the meeting portions of said members being shaped so as to permit rocking movement of the contact member about a transverse axis but to restrain rocking movement of the contact member on a longitudinal axis.

9. In an electric switch, spaced contacts, a contact bar for electrically bridging the same, a mounting post for the contact bar having a connection with the contact bar permitting limited sliding of the contact bar on the post, a cup member telescoped over the post and resting on a shoulder at the base thereof, a second cup member positioned over the post and having a telescoped engagement with the first named cup member, the end wall of the second named cup member being formed with a transverse bead having a sliding but non-rotatable connection with the post which holds said bead transverse to the contact bar so that the bead forms a fulcrum on which the contact bar may rock, and a spring encircling the post and having its ends bearing against the end walls of the cup members to yieldingly urge the same apart and provide contact pressure for the contact.

10. In an electric switch, the combination of a chamber having a hole in its bottom wall, stationary contacts within the chamber, a contact bar for electrically bridging the stationary contacts, a carrier for the movable contact bar outside the chamber, a mounting post on said carrier and projecting through said hole to have a connection with the contact bar inside the chamber, a spring coiled about the post and pressing against the contact bar to yieldingly urge the same toward the stationary contacts, and telescoped cup members encircling the spring to completely enclose the same with the ends of the spring bearing against the end walls of the cup members, and one of the cup members having a free sliding relationship to the walls of the hole so as to substantially close the same.

11. In an electric switch, two spaced stationary contacts, a contact bar for electrically bridging the same, a mounting post on which the contact bar is slidably mounted, a spring encircling the post and pressing against the bar to yieldingly urge the same outwardly on the post, and common means to enclose the spring without effectively interfering with the action of the spring and to hold the contact bar against rocking on its longitudinal axis.

12. In an electric switch including cooperating stationary and movable contacts, a chamber enclosing the contacts and having an opening into the interior thereof, a stationary contact secured to one wall of said chamber, a member movable through said opening and having a retention head at the extremity thereof, a movable contact carried slidably upon said member, a spring surrounding said member and urging said movable contact against the retention head of said member, and a sleeve surrounding said spring and movable with said member and conformed to the shape of said opening so that said sleeve may slide

therethrough while substantially closing the same.

13. In an electric switch, spaced stationary contacts, a contact bar for electrically bridging the same, a post on which the bar is slidably mounted but constrained in its outward movement thereon, a spring encircling the post and bearing against the bar to yieldingly urge the same outwardly on the post, and a cup-like enclosure for the spring fitted over the spring with its end wall interposed between the bar and the adjacent end of the spring and so fitted to the spring and the bar as to enable rocking movement of the bar about a transverse axis while restraining rocking movement of the bar on a longitudinal axis.

14. In an electric switch, spaced stationary contacts, a movable contact adapted to bridge the stationary contacts, an actuator for the movable contact comprising a carrier of insulating material, means for moving the carrier toward and from the stationary contacts, an upstanding post rigidly mounted on the carrier and having a retention head on its upper extremity, the movable contact being slidably mounted on said post and constrained against outward movement thereon by said retention head, a coil spring encircling the post and bearing against the carrier and the movable contact so as to yieldingly urge the movable contact outwardly on the post, and a cylinder-like enclosure for the spring, said enclosure having at least one end wall slidably receiving the post and confined between the adjacent end of the spring and the part against which it bears so as to be held in place by the spring.

15. In an electric switch for industrial control service, a contact enclosing chamber composed of three separate sections, one of said sections providing a solid top wall and the other two sections conjointly providing rear, front, bottom and side walls for the enclosure, an interfitted connection between the first named section and at least one of said other two sections embodying overlapping surfaces so that the first named section is supported therefrom when the other of said two sections is removed to afford access to the interior of the enclosure and at the same time said first named section is readily detachable from its supporting section, a stationary contact on the undersurface of the top wall, an exposed outside terminal above the top wall and electrically connected with the stationary contact, the bottom having an opening opposite the stationary contact, a movable contact engageable with the stationary contact, and a carrier and actuator assembly mounting the movable contact and having a part slidable through said opening in the bottom wall to effect engagement and disengagement of the contacts from outside the chamber.

16. In an electric switch for industrial control service having cooperating stationary and movable contacts, a carrier assembly mounting the movable contact and operable to carry the same into and out of engagement with the stationary contact, an enclosure for the contacts comprising three separate sections, one of said sections being a top section and forming a solid top wall for the enclosure and mounting the stationary contacts, the other two sections being complementary front and rear sections and conjointly forming rear, front, bottom and side walls and having the juncture therebetween formed in the bottom and side walls, means for mounting the enclosure on a fixed support with its rear section rigid with the support, an interfitted readily

separable connection between the top section and the rear section so that the top section is readily detachably supported by the rear section to enable the front section to be removed without disturbing said top and rear sections, and securing means for holding said complementary sections together.

17. In an electric switch for industrial control service having cooperating stationary and movable contacts, a carrier mounting the movable contact and operable to carry the same into and out of engagement with the stationary contact, an enclosure for the contacts comprising three fitting sections, one being a rear section, one a front section, and the other a top section, means on the rear section for mounting the same on a supporting member, a connection between the top section and the rear section whereby the top section restricted to a sliding motion in assembly is readily detachably supported from the rear section and detachable therefrom with a forward sliding motion, and means for removably holding the front section in fitting relationship with the rear section and with part thereof obstructing forward sliding motion of the top section so that by securement of the front section in fitting relationship to the rear section, all of said sections are held assembled and upon removal of the front section complete disassembly of the sections is permitted.

18. In an electric switch having cooperating stationary and movable contacts, a supporting member, a housing of insulating material for enclosing the contacts and mounting the stationary contacts on the supporting member, said housing comprising three fitting sections, one being a rear section, one a front section, and the other a top section, the top section having the stationary contacts mounted thereon, a connection between the top section and the rear section restricted to a sliding motion in assembly whereby the top section is readily detachably supported from the rear section and detachable therefrom with a forward sliding motion, and means rigidly fixed against lateral motion with respect to the supporting member for removably holding the front section in fitting relationship to the rear section with a part of the front section obstructing forward sliding motion of the top section and for holding the assembled sections fixed against shifting on the supporting member.

19. In an electric switch including cooperating stationary and movable contacts, a chamber enclosing the contacts and having an opening into the interior thereof, a stationary contact secured to one wall of said chamber, a carrier, a movable contact carried by said carrier, resilient means between said carrier and said movable contact, and a shield surrounding said resilient means and movable in said opening for substantially closing the same.

20. In an electric switch including a plurality of sets of cooperating stationary and movable contacts, a plurality of chambers enclosing said sets of contacts and having openings into the interior thereof, a set of stationary contacts secured to one wall of each of said chambers, a carrier, a plurality of movable contact sets carried by said carrier, resilient means between said carrier and each of said movable contact sets, and shields surrounding said resilient means and movable in said openings for substantially closing the same.

21. In an electric switch for industrial control service, two spaced stationary contacts, a bar

movable with substantially a translating motion toward and from the contacts to electrically bridge the same, conductors leading to the contacts from a direction opposite to the approach of the bar, an arc-enclosing chamber enclosing said contacts and bar, said chamber having but a single opening leading thereto, a carrier assembly for moving the bar to and from the contacts and having a part movable through said opening and substantially closing the same, the internal dimensions of the enclosure being such that its walls lie closely adjacent to the contacts and bar, and the clearance between said part which moves through the opening and the walls of the opening being sufficient to facilitate the escape of accumulated gases from within the chamber but close enough to confine the arc within the chamber.

22. In an electric switch for industrial control service, two spaced stationary contacts, a bar movable with substantially a translating motion toward and from the contacts to electrically bridge the same, conductors leading to the contacts from a direction opposite to the approach of the bar, an arc-enclosing chamber enclosing said contacts and bar, said chamber having but a single opening leading thereto, a carrier assembly for moving the bar to and from the contacts and having a part movable through said opening and substantially closing the same, said relative positions of the bar, contacts, and conductors being such as to cause arcs drawn between the contacts and bar to move outwardly away from each other in a definite direction towards opposite walls of the chamber, and the internal dimensions of the enclosure being such that its walls lie closely adjacent to the contacts and bar whereby the outwardly projected arcs impinge said opposite walls to produce a quenching effect upon the arcs, and the clearance between said part which moves through the opening and the walls of the opening being sufficient to facilitate the escape of accumulated gases from within the chamber but close enough to confine the arc within the chamber.

23. In an electric switch for industrial control service, an arc enclosing chamber having a top wall and having but a single opening leading into the chamber, two spaced stationary contacts mounted from the under surface of the top wall, terminals disposed above the top wall and electrically connected with said contacts, the portions of the terminal connections adjacent to the contacts approaching the same in a downwardly direction, a bar movable upwardly with a translating motion toward the contacts to electrically bridge the same, a carrier assembly for moving the bar to and from the contacts and having a part movable through said opening and substantially closing the same, said enclosure being of such internal dimensions that its walls lie closely adjacent to the contacts and bar, and the clearance between said part which moves through the opening and the walls of the opening being sufficient to facilitate the escape of accumulated gases from within the chamber but close enough to confine the arc within the chamber.

24. In an electric switch for industrial control service, an arc enclosing chamber having a top wall and having but a single opening leading into the chamber, two spaced stationary contacts mounted from the under surface of the top wall, terminals disposed above the top wall and electrically connected with said contacts, the por-

tions of the terminal connections adjacent to the contacts approaching the same in a downwardly direction, a bar movable upwardly with a translating motion toward the contacts to electrically bridge the same, a carrier assembly for moving the bar to and from the contacts and having a part movable through said opening and substantially closing the same, said relative positions of the bar, contacts and conductors being such as to cause arcs drawn between the contacts and bar to move outwardly away from each other in a definite direction towards opposite walls of the chamber, and the internal dimensions of the enclosure being such that its walls lie closely adjacent to the contacts and bar, whereby the outwardly projected arcs impinge said opposite walls to produce a quenching effect upon the arcs, and the clearance between said part which moves through the opening and the walls of the opening being sufficient to facilitate the escape of accumulated gases from within the chamber but close enough to confine the arc within the chamber.

25. In an electric switch for industrial control service, an arc suppressing chamber of restricted volume and closed on all sides except for, an entrance opening in its bottom, a stationary contact mounted inside the chamber, a movable contact cooperable therewith, and a carrier assembly mounting the movable contact and operable to move the same with a translating motion toward and from the stationary contact, said actuator having, a carrier part and another part providing a resilient and the sole mounting of the movable contact from the carrier part and supporting the movable contact in such a manner as to allow the same to adjust itself to the stationary contact, one of said parts being movable in the entrance opening and conformed thereto so as to substantially close the same whereby opening of the switch under load is accompanied by a compression of gases within the chamber to effect arc suppression.

26. In an electric switch for industrial control service, two spaced stationary contacts, a movable bar for electrically bridging the same, an arc enclosing chamber enclosing said contacts and bar, said chamber having but a single opening leading thereto, a carrier assembly for moving the bar to and from the stationary contacts with a translating motion, said carrier assembly having a carrier part and another part providing a resilient, and the sole, mounting of the movable contact from the carrier part and supporting the movable contact in such a manner as to allow the same to adjust itself to the stationary contacts, one of said parts being movable in the entrance opening and conformed thereto so as to substantially close the same, the internal dimensions of the enclosure being such that it has a restricted volume with its walls lying closely adjacent to the contacts and bar, and the clearance between said part which moves through the opening and the walls of the opening being sufficient to facilitate the escape of accumulated gases from within the chamber but close enough to confine the arc within the chamber.

27. An electric switch for industrial control service, comprising complementary stationary and movable contacts, carrier means mounting the movable contact and operable to move the same with a translating motion into and out of engagement with the stationary contact, a box-like housing providing a chamber enclosing the

contacts, said housing comprising front and rear sections, which together provide the front, rear, bottom and side walls of the housing, and a top section so fitted to at least the rear section that when properly assembled therewith said top and rear sections are held against all relative motion except an assembling and disassembling motion substantially parallel with the plane of the top wall, and means for readily detachably holding the sections against separation.

28. In an electric switch for industrial control service, a chamber closed on all sides except for an entrance opening leading thereto, a stationary contact mounted inside the chamber from one wall thereof, a movable contact cooperable therewith, and a carrier assembly mounting the movable contact and having a part extending through the entrance opening to carry the movable contact with a translating motion to and from engagement with the stationary contact, said chamber being of sectional construction, means on one of the sections for attaching the same to a support, another of said sections having as part thereof the wall upon which the stationary contact is mounted, and a readily separable connection between said sections so that said last named section is readily separable from said first named section without disturbing said first named section.

29. In an electric switch, a pair of spaced stationary contacts, a movable contact member to electrically bridge the stationary contacts, a carrier for the movable contact member, and means for mounting the contact member from the carrier including a coiled spring, a two-part enclosure for said spring, each part having an open end, one of said parts having its closed end bearing against the carrier and receiving the thrust of the spring, the other of said parts having its open end receiving the opposite end of the spring and biased by the spring against the contact member, said two parts being positioned with re-

spect to each other by mutually engaging surfaces, and means to limit outward travel of the contact member from the carrier.

30. In an electric switch, a chamber closed on all sides except for an entrance opening, two spaced stationary contacts inside the chamber, a movable contact member to electrically bridge the stationary contacts, a carrier for the movable contact member disposed exteriorly of the chamber, and means for mounting the movable contact member from the carrier, said means entering the chamber through the entrance opening and substantially closing the same and including a coil spring, a two-part enclosure for the spring, each part having an open end, one of said parts having its closed end bearing against the carrier and receiving the thrust of the spring, and the other of said parts having its open end receiving the opposite end of the spring and biased by the spring against the contact member, said two parts being positioned with respect to each other by mutually engaging surfaces, and means to limit movement of the contact member away from the carrier.

31. In an electric switch for industrial control service, a stationary contact, a movable contact engageable therewith, an arc enclosing chamber enclosing said contacts and having but a single opening leading into the chamber, a carrier assembly having a part movable through said opening to substantially close the same, the internal dimensions of the enclosure and the clearance between said part which moves through the opening and the opening walls being such that an arc drawn between the contacts is closely confined, and the meeting faces of the contacts being composed substantially of a silver cadmium alloy so as to have a deionizing effect on the arc.

GUSTAV O. WILMS.
HANS PETERSEN.

CERTIFICATE OF CORRECTION.

Patent No. 2,071,149.

February 16, 1937.

GUSTAV O. WILMS, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 39, claim 10, strike out the word "movable"; page 6, second column, lines 19 and 20, claim 17, strike out the words "restricted to a sliding motion in assembly" and insert the same after "section" second occurrence, line 18, same claim; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of March, A. D. 1937.

(Seal)

Henry Van Arsdale
Acting Commissioner of Patents.

Disclaimer

2,071,149.—*Gustav O. Wilms*, Milwaukee, and *Hans Petersen*, Wauwatosa, Wis.
ELECTRIC SWITCH. Patent dated Feb. 16, 1937. Disclaimer filed Dec. 13,
1948, by the assignee, *Allen-Bradley Company*.

Hereby enters this disclaimer to claim 2 and claims 19 to 26, inclusive, in said
specification.

[*Official Gazette January 11, 1949.*]

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