Sept. 23, 1941. E. S. CORNELL ET AL 2,256,734

CONTACT FINGER FOR SWITCHES

Filed May 12, 1938 2 Sheets-Sheet 1

Fig. 1.

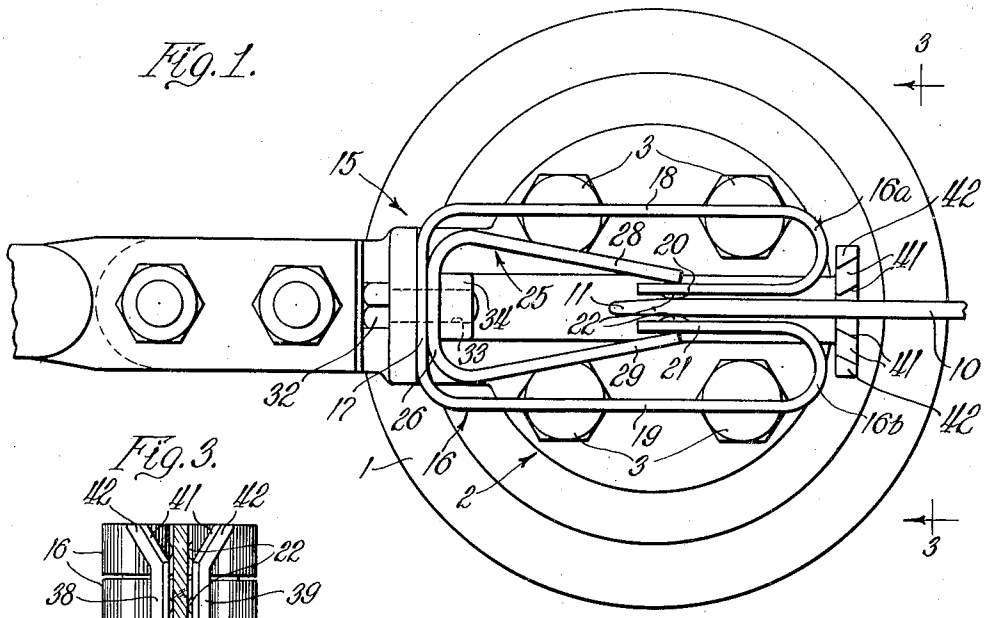


Fig. 3.

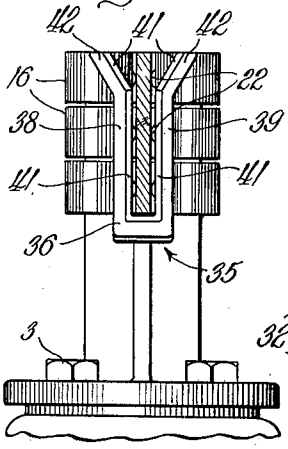


Fig. 2.

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Fig. 5.

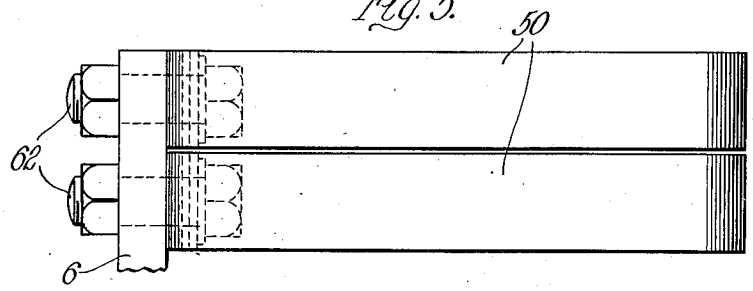


Fig. 4.

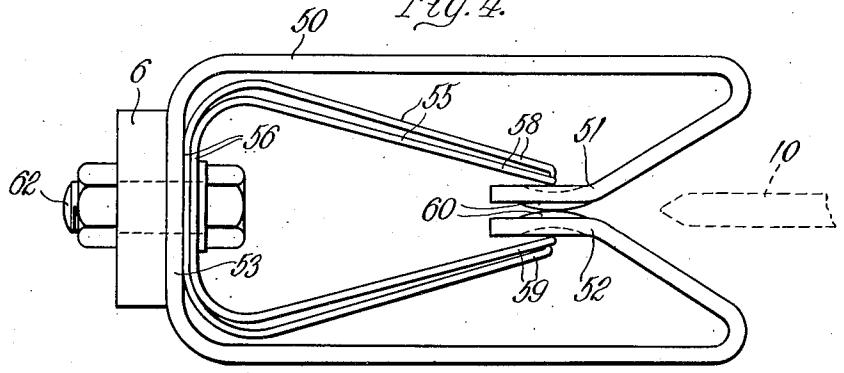


Fig. 6.

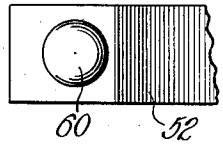


Fig. 8.

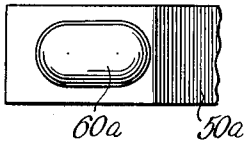


Fig. 10.

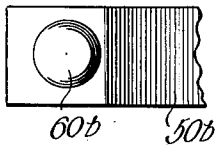


Fig. 7.

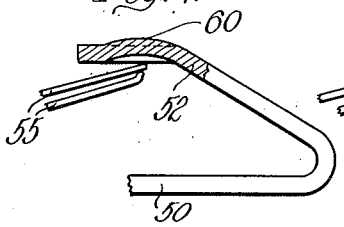


Fig. 9.

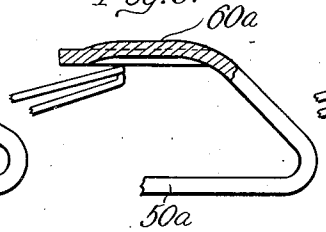
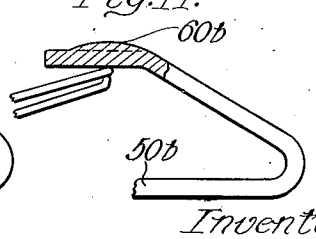


Fig. 11.



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Patented Sept. 23, 1941 2,256,734

UNITED STATES PATENT OFFICE

2,256,734

CONTACT FINGER FOR SWITCHES

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Application May 12, 1938, Serial No. 207,494

6 Claims. (Cl. 200—166)

This invention relates generally to electrical switches, and more particularly to switches adapted to carry heavy currents.

The object and general nature of this invention is the provision of a contact structure for use in switches and the like in which the surfaces in contact are in the nature of a line or point, or a series of them.

A further feature of this invention is the provision of a contact structure, utilizing the high pressure contact principle, which is built up of the number of units or sections that are required to provide sufficient contact for the desired ampere rating.

Another feature of this invention is the provision of a contact structure in which the desired current carrying capacity is provided without the use of mechanical movements, adjusting screws or the like which usually cause such excessive pressures that some form of auxiliary blade motion is required to release the pressure before the switch blade can be opened.

It is a still further object of this invention to provide a contact structure having prestressed point or line contact elements of sufficient number and with sufficient pressure to carry the required current but with low frictional resistance, thereby reducing the force required to open and close the switch blade.

A further feature of this invention is the provision of a switch contact structure in which point or line contact under pressure not only provides ample contact surface for carrying current, but also provides a switch which is kept clean by the action of the contacting points or lines in removing or scraping away the oxides and other material that tend to prevent intimate engagement. Also, in a switch of this construction, due to small contact area, there is less opportunity for the blade and contacts to freeze under ice or sleet conditions.

A further virtue of the present contact structure is its ability to provide good contact which is substantially uniform even though there is lack of accurate alignment of the blade and the contact structure.

A further feature of this invention is the provision of a switch having two pre-stressed point or line contact elements held either together or in blade receiving position under a predetermined force.

These and other objects and advantages of the present invention will be apparent to those skilled in the art after a consideration of the following detailed description, taken in conjunction with the accompanying drawings.

In the drawings:

Figure 1 is a plan view of the contact structure of a switch embodying the principles of the present invention;

Figure 2 is a side view of the construction shown in Figure 1;

Figure 3 is a view taken along the line 3—3 of Figure 1;

Figure 4 is a plan view of a modified form of the present invention;

Figure 5 is a side view of the form of the invention shown in Figure 4; and

Figures 6 to 11, inclusive, are fragmentary views showing different forms of raised switch blade engaging portions on the inturned ends of the U-shaped conductor.

High pressure contacts for power switches are known. According to the theory of high pressure contacts for power switches, a limited area of actual engagement is put under high unit pressure. It has been found that such structures are capable of carrying large currents without undue heating. The present invention provides a high pressure switch contact structure for use in power switches, and is designed to secure two desirable effects. First, means is provided for insuring a very high unit pressure over a limited area, and, second, the structure of the present contact is such that this high pressure will be secured even if the parts are not accurately aligned. One of the great difficulties in switch structure is to secure accurate and permanent alignment of the blade and contact jaws. The present structure is able to provide the necessary high unit pressure, and to do so without requiring accurate alignment of the jaw and blade. Inaccuracy of alignment does not substantially alter either the unit pressure secured or the area of engagement.

According to our invention, the contact jaws of each contact unit are provided with opposed protuberances which present approximately point or short line contact with an interposed blade. By making these protuberances convex in two dimensions at right angles to each other, the desirable feature of high unit pressure and substantially uniform area of engagement is attained, even though the blade swings in a plane which does not coincide with the median plane of the contact jaws. We term this form of contact projection or protuberance which is convex in any cross section, as double convex. That is to say, the protuberance displays convexity in two dimensions at right angles to each other. Hence, we designate the same in the following claims as double convex to include not only the spherical convex form, but such variations therefrom which permit this feature of securing good and substantially uniform contact even in the absence of accurate alignment of the blade and jaws.

We are aware that power switches have been proposed wherein a convex ridge extends transversely across the jaws, but lack of alignment of the blade immediately destroys the intended area

of engagement of such switches, and we do not claim such as coming within our invention.

Referring now more particularly to Figures 1, 2, and 3, the reference numeral 1 indicates the upper end of one of the insulator stacks which carry the switch. A supporting bracket 2 is bolted, as at 3, to the insulator 1 and includes a conductor receiving lug 5 and an upstanding portion 6. The blade of the switch is indicated at 10, and may be of any usual construction, and, as illustrated, comprises a bar of copper or similar material having its end rounded, as at 11, and is adapted to be swung or forced into a closed circuit position with respect to a stationary contact structure.

The contact structure receiving the switch blade 10 is indicated in its entirety by the reference numeral 15, and includes a plurality of generally U-shaped conductors 16, formed of copper or the like. As best shown in Figure 1, each of the conductors 16 includes an intermediate or base section 17, side portions 18 and 19, and end sections 20 and 21 which are turned inwardly or rearwardly alongside the portions 18 and 19. The ends 20 and 21 extend toward the base portion 17 a substantial distance, and are formed with raised sections 22 in the form of lugs or projections which are adapted to be forced into high pressure engagement with the blade 10 when the latter is moved into the stationary contact structure 15.

The means for forcing the inturned ends of the conductors 16 against the blade 10 comprises a generally U-shaped spring 25 disposed in nested relation within the associated conductor 16, there being as many springs 25 as there are conductors 16. Each spring includes a base or intermediate section 26 which is disposed adjacent the portion 17 of the associated conductor, and each spring also has ends 28 and 29 which act against the outer surfaces of the inturned conductor ends 20 and 21 at points directly in line with the projections 22.

The several conductors and springs are fastened to the bracket 2 by means of bolts 32 which extend through the upstanding portion 6 of the bracket 2 and through openings in the intermediate portions 17 and 26 of the conductors and springs, and into tapped openings 33 which are formed in the attaching portion 34 of a member 35, the outer end 36 of which is formed to serve as a guide to facilitate movement of the blade 10 into the stationary contact structure. The member 35 includes a connecting section 37 which extends from the attaching portion 34 to the lower part of the guide 36, and the latter is formed with upstanding sections 38 and 39 which are flared forwardly, as at 41, and upwardly and outwardly, as at 42. Thus, whether the blade 10 moves directly inwardly or inwardly from an upward direction, the guide 36 aids the blade 10 in moving into the desired position. As many conductors 16 and springs 25 may be provided as desired, depending upon the desired current carrying capacity of the unit. This is an important feature of this invention in that it makes it possible to bulid up any desired size of unit.

In operation, when the blade 10 is forced into closed circuit position between the contact sections 20 and 21, the springs 28 and 29 force the projections 22 into high pressure engagement with the switch blade. By virtue of the relatively small area of engagement at these points and relatively large pressure exerted by the springs 25, the portions 22 wipe or scrape all oxide and other material from the blade 10 so that there is actual metal-to-metal contact under relatively high pressure, thereby providing ample contact surface for carrying the current. Since the area of actual contact at the points 22 is relatively small, there is materially less frictional resistance to the movement of the blade 10 than in conventional switches in which the contact elements have relatively large areas of contact with the switch blade. Where such relatively large areas of contact are present, even with high pressure, there is not the scraping or cleaning action that is secured in the present construction.

When the switch blade 10 is disengaged from the contact structure, the portions 20 and 21 are moved into engagement with one another by the spring arms 28 and 29, so that when the switch blade is open, there is less tendency for corrosion and accumulation of dirt.

Figures 4 and 5 show a modified form of the present invention in which the guide 35 of Figures 1 and 2 has been omitted. Referring now to Figures 4 and 5, the contact structure comprises one or more flexible conductors 50, each of which is generally U-shaped and has ends 51 and 52 turned backwardly or inwardly toward the intermediate or base portion 53 of the conductor. A pair of springs 55, formed of steel or the like and also U-shaped, have their base sections 56 disposed against the portion 53 of the conductor 50 and have ends 58 and 59 which bear against the ends 51 and 52 of the conductor.

The ends 51 and 52 are formed with protuberances 60, and the springs 55 are made so that they act against the ends 51 and 52 to hold the projections 60 against each other with a predetermined force. It will be noted from Figure 4 that the bent portions of the conductor 50 adjacent the ends 51 and 52 are formed in the general shape of a V so as to serve as a guide for a switch blade 10 which is adapted to be forced by the switch mechanism (not shown) longitudinally into the contact structure. The inward movement of the switch blade 10 acts against the projections 60 to secure a wiping high pressure engagement between the contact structure and the blade 10. As many units may be employed as desired, and each pair of springs 55 and the associated conductor 50 are secured to the bracket 6 by suitable bolt means 62. The number of units employed will depend upon the current carrying capacity that it is desired the contact structure shall have.

The pressure increasing projections or lugs 22 of Figure 1, and 60 of Figure 4, are shown in these figures as protuberances formed by pressing a suitable tool against the conductor ends so as to force some of the material of the conductor outwardly to form the protuberances. Figures 6 and 7 show the details of the construction as utilized in Figure 4. It will be noted that the spring ends 55 act against the conductor 50 in exact alignment with the protuberances 60.

In Figures 1, 4, 6, and 7, the protuberances are shown as being generally spherical, thereby providing more or less point contact between the contact structure and the associated switch blade. If it is desired to have more extended contact, the construction shown in Figures 8 and 9 may be employed in which the conductor 50*a* has an elongated protuberance 60*a* formed therein in any suitable manner. Another way of forming generally spherical protuberances is indicated in Figures 10 and 11 in which the conductor 50*b* is shown as having upset portions 60*b*. The ad-

vantage of this construction is that there is more material at the protuberances than in the previously described structures.

It is to be observed that the protuberances 22, 22 in Figure 1 or 60, 60 swing angularly when they are separated by thrusting the blade 10 between them. This is the case because the bottom of the U-shaped body 16 of Figure 1, or 50 of Figure 4, and of the spring 25 or 55 is in each case rigidly clamped to the support. Hence these protuberances swing angularly away from and toward each other as they are moved by the entrance or exit of the switch blade between them. This angular motion would be intolerable if surface contact as of two flat surfaces against each other were desired. Because these protuberances are convex, the slight degree of angular motion which would destroy flat surface contact is unobjectionable in this construction, as the change in angular position merely presents a different point of contact without substantially altering the nature of the contact. Because of the greater length of metal involved in the recurved form of the contact 16, the change in spring loading due to shift in position is less pronounced. The action is smooth and easy.

So far as we are aware, the use of point or line engagement in switch contacts of this type is new, and therefore, while we have shown and described above the preferred means in which the principles of the present invention have been embodied, it is to be understood that our invention is not to be limited to the particular details shown and described, but that, in fact, widely different means may be employed in the practice of the broader aspects of our invention.

What we claim, therefore, and desire to secure by Letters Patent is:

1. A switch member comprising a supporting member, a pair of approximately parallel conducting plates adapted to receive a switch blade between them, said plates being mounted upon said support for limited motion toward and away from each other, said plates having on their facing surfaces double convex protuberances registering with each other, converging spring arms bearing at their outer ends upon the backs of said plates and holding said protuberances in contact with each other with an initial predetermined pressure.

2. The combination of claim 1 characterized by said plates comprising outwardly diverging portions for guiding the switch blade between said protuberances, and said protuberances comprising convex surfaces of small radius to produce unit pressures of high intensity.

3. The combination of claim 1 characterized by the plates constituting integral parts of the legs of a generally U-shaped bar of conducting metal, the protuberance having approximately spherical surfaces, and the converging spring arms forming two sides of a continuous flat bar bent into triangular form, the two arms converging at substantially a common apex and engaging the said plates substantially at the backs of said protuberances.

4. An electric switch member comprising, in combination, conducting support means, a generally U-shaped contact member formed of flat strip conducting material and mounted on said support means and having its ends turned inwardly for receiving a switch blade therebetween, opposing portions of said inturned ends having double convex protuberances which project toward each other to provide substantially point contact engagement with opposite sides of said switch blade, and a generally U-shaped spring member nested within said U-shaped contact member with its ends bearing against said inturned ends substantially in alignment with the contact areas of said protuberances and biasing the same into high pressure contact engagement with said switch blade, said spring member being prestressed to cause mutual engagement of said contact areas under pressure when said switch blade is withdrawn from engagement therewith.

5. An electric switch member comprising, in combination, conducting support means, a generally U-shaped contact member formed of flat strip conducting material and mounted on said support means and having its ends turned inwardly for receiving a switch blade therebetween, said inturned ends having outwardly flaring portions for guiding said switch blade into switch closed position, opposing portions of said inturned ends bearing double convex protuberances which project toward each other to provide substantially point contact engagement with opposite sides of said switch blade, and a generally U-shaped spring member of flat spring stock nested within said U-shaped contact member with convergent sides terminating in ends bearing against said inturned ends substantially in alignment with the contact areas of said deformed portions and biasing the same into high pressure contact engagement with said switch blade.

6. An electric switch contact comprising in combination conducting support means provided with a substantially flat clamping face, a contact element of flat bar stock comprising a flat base portion, integral arm portions substantially normal to said base portion, free end portions disposed in substantially parallel relation to each other and to said arm portions with the free ends extending toward the base portion, integral guide portions intermediate the end portions and the arm portions for guiding a blade between the free end portions, said free end portions having double convex protuberances adapted to engage each other when the blade is withdrawn from between them, and a prestressing spring of approximately triangular shape disposed inside said contact element and having a base portion overlying and bearing against the flat base portion of the contact element, and a pair of convergent spring arms the ends of which bear against the backs of the end portions of the contact element substantially in registry with the protuberances, said spring holding said protuberances in contact under a predetermined initial pressure, whereby forcing of a blade between the protuberances causes separation of the spring arms and a substantial increase in the tension of said spring arms, and means for clamping the bases of the spring and the contact element together upon said clamping faces.

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