

Aug. 9, 1966

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3,265,830

PULL-OUT SWITCH FOR BLADE TYPE FUSES

Filed April 1, 1964

2 Sheets-Sheet 1

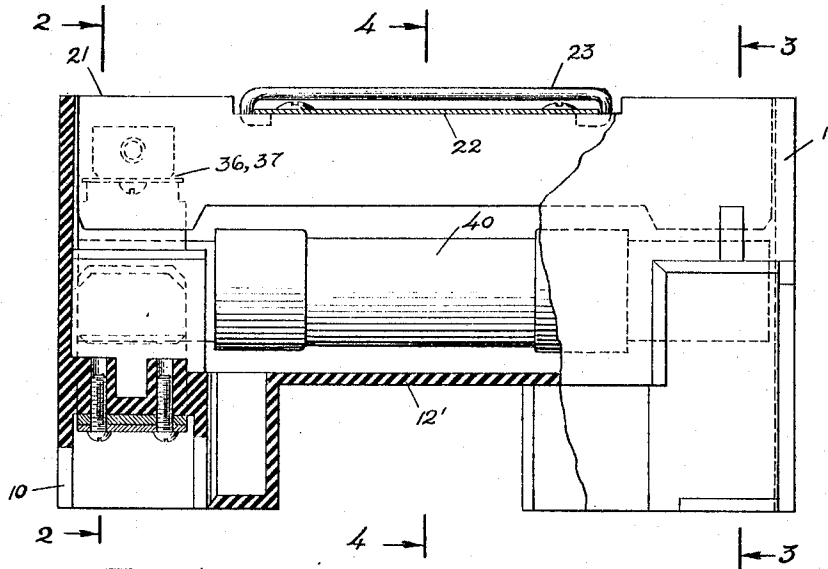


Fig. 1

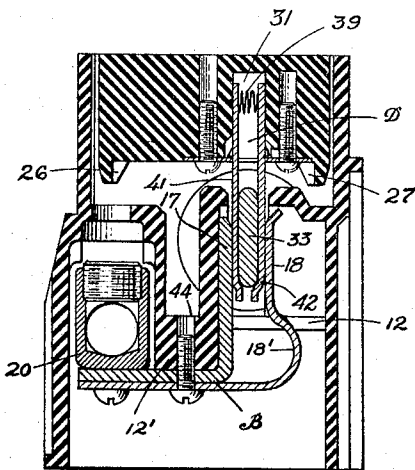


Fig. 3

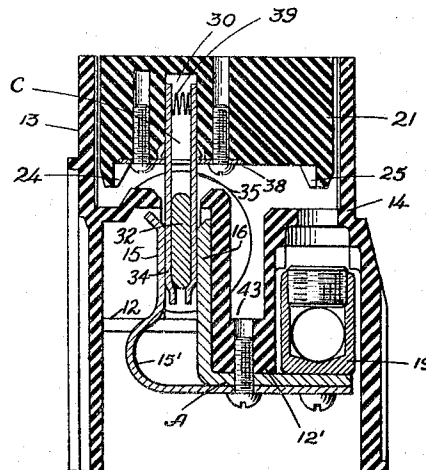


Fig. 2

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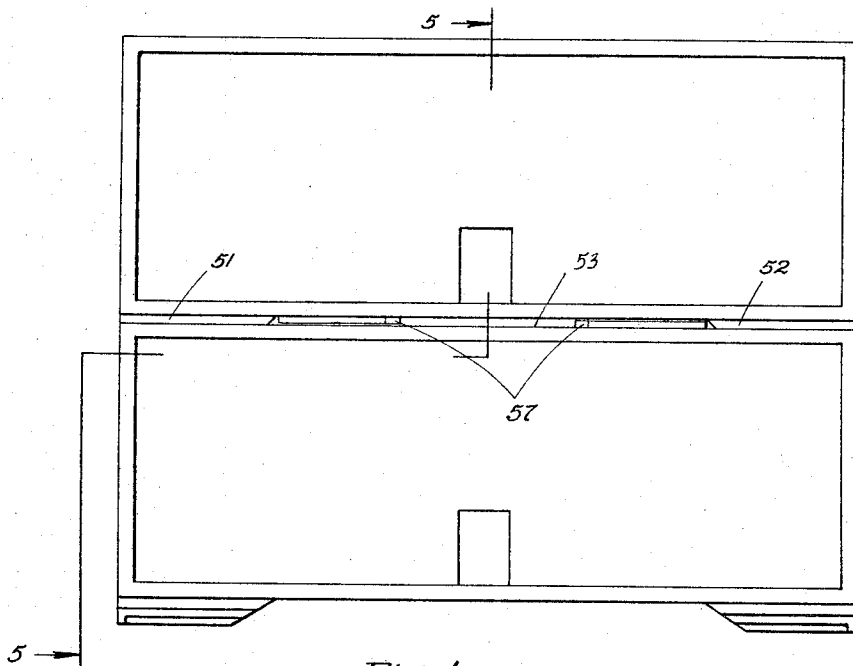


Fig: 4

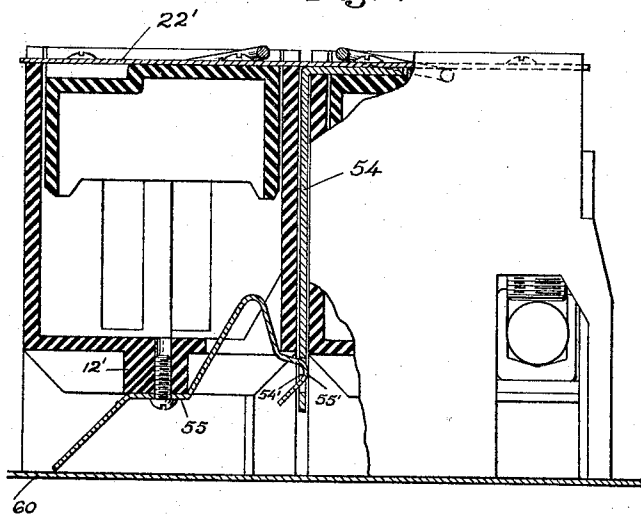


Fig. 5

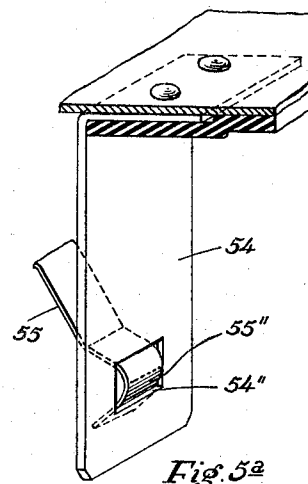


Fig. 5a

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1

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PULL-OUT SWITCH FOR BLADE TYPE FUSES

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Filed Apr. 1, 1964, Ser. No. 356,422

6 Claims. (Cl. 200-114)

This invention relates to the electrical characteristics of a pull-out switch fusible with blade type fuses.

The conventional pull-out switch is composed of essentially two parts. The first is a base or tub including line and load terminals and a switch contact associated with each terminal. The second part is the puller, which is dimensioned for seating in the tub, and which contains the fuse or fuses, and includes fuse blade clips and a switch contact associated with each clip. Upon seating of the puller in the tub, a fused, line-to-load, circuit is completed by the corresponding engagement of tub and puller switch contacts. Unseating the puller causes circuit interruption and permits fuse inspection or replacement.

These devices, which serve the dual function of circuit overload protection and circuit disconnect, have enjoyed widespread exploitation in applications where it is desirable to isolate individual circuits. They suffer, however, from several inherent disadvantages which arise directly from their large current carrying capabilities.

For example, when it is found necessary to interrupt service by unseating the puller, this inevitably (except where there is but a negligible load in the associated circuit) causes a sizable arc to be drawn between the mating tub and puller contacts. A similar effect is found upon contact engagement and is particularly dangerous when the insertion is made hesitantly. This arcing seriously impairs the life of the contacts, and hence the switch, as a consequence of the resultant contact pitting.

Moreover, since the switch serves merely as a current carrying device (at any current value below that for which it is fused) its resistance should be at a minimum to meet the required temperature standards. This necessarily requires a current path, within the pull-out switch, which is both as short as possible and which presents the greatest possible cross-sectional area.

Accordingly, it is the object of this invention to reduce the resistance of the current path in a pull-out switch.

It is a further object of the present invention to decrease the arcing period upon engaging and disengaging the switch contacts.

Briefly, the invention is predicated upon the concept of constructing the fuse clip in such a manner that it may also serve the function of a current breaking contact. In order to reduce arcing, a mechanical obstruction is provided which, upon the insertion or removal of the puller, requires an increased force on the part of the operator immediately prior to the make or break of contacts. Since the effectiveness of the obstruction obtains for only a predetermined time the follow through is accelerated creating a quick make or break as the case may be. It is a feature of the invention to utilize the arc reducing means to eliminate operator hazard by grounding the puller's operating handle.

The above mentioned and other features and objects of this invention, and the manner of attaining them, will become more apparent, and the invention itself will best be understood by reference to the following description of an embodiment of the invention, taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side cutaway view of a mated puller and tub;

FIGS. 2 and 3 are end cross-sectional views taken along lines 2 and 3 respectively of FIG. 1, illustrating the unitary puller clip-contacts of the invention;

2

FIG. 4 is a simplified top view of two adjacent tubs;

FIG. 5 is an end cutaway-cross section emphasizing the spring-blade engagement in accordance with the invention; and

FIG. 5a is a perspective view of the spring and blade shown in FIG. 5.

Referring now to the figures, and in particular to FIGS. 1, 2 and 3, there may be seen fully mated puller and tub for 200 ampere application. The tub, formed of an insulating material such as Bakelite, comprises end walls 10 and 11, side walls 13 and 14 and a platform 12. The platform is of a configuration adapted to provide support and isolation for the electrical elements which it bears, as well as lend structural rigidity to the tub. The portions of the walls extending below the platform serve as footings, and are of sufficient length to raise the electrical components off the surface on which the tub rests.

Mounted upon the insulated projection 12' of the platform are two tube connector assemblies A and B, one end of each of which forms the tub contact jaws 15-16 and 17-18; the other ends of which form platforms for the wire connectors 19 and 20. One blade in each set of contact jaws is biased inwardly, to ensure proper pressure, by an arcuate portion (15', 18') contained within its length, while the other blades 16 and 17 (shown thicker) constitute the primary current path. The two wire connectors, which are disposed electrically on the line and load side, respectively, of the fuse, are shown in a form suitable for conventional wire conductors. Either or both, however, may be modified or in such form as will accept any type conductor (e.g. flat copper fittings for connection to bus bars etc.).

The puller portion of the pull-out switch comprises a rectangular cover 21, of insulating material similar to that of the tub, dimensioned for a slide fit into the tub; the retaining plate 22 acting as a stop. The puller feet 24-27 may also be lengthened to serve this function. Skewing of the puller is prevented by the cover thickness. A handle 23 is pivotally mounted, by means of the affixed retaining plate 22 to the outside of the cover.

Two puller clip-contact assemblies C and D are mounted within corresponding recesses 30 and 31 on the underside of the cover. Since the assemblies are mirror images of each other, only C will be described in detail. In the embodiment shown, the assembly which is fastened to the cover by screws, consists of two metal leaves 34 and 35, retained by their respective necked portions 36 and 37 in the cover affixed plate 38, and biased outwardly at the upper leave portions (and hence inwardly at the lower leave portions) by the spring 39. The inside surfaces of the leaves thus form a fuse clip, for contacting and retaining the fuse blade 32. The lower ends of leaves 34 and 35 are bent inwardly, to prevent the fuse blade from slipping out; to present camming surfaces for the make; and at the same time to protect the leave contact surfaces by offsetting the arc affected edges.

While it is also possible, and perhaps cheaper, to constitute the clip-contact assemblies of less elements, for example, by employing two sections of material having good conductive and resilient properties welded together at one end or by employing an integral body of such material in a U-shape, the depicted arrangement exhibits certain advantages. Among them are the fact that a higher conductivity metal (which does not necessarily have resilient characteristics) such as copper, may be employed for the leaves. Additionally, the arrangement of the drawings will tend to retain its elasticity through continued use. At this point it might be well to note that contrary to conventional apparatus, the thickness of the clip-contacts of the invention are not significantly affected by current carrying considerations, since the current flows parallel rather than transverse, this dimension.

That is, a considerably reduced resistance path is achieved by greatly shortening the current path length and at the same time greatly increasing the path cross-section. As a result the effected resistance is several hundred times less than that obtained with conventional arrangements.

From the foregoing, it may be seen that a fused branch circuit connection is established between line and load conductors (not shown). It consists of the serial combination of the wire connector 19, tub connector assembly A (including the contact jaws 15-16), puller clip-contact assembly (outside and inside surfaces of leaves 34 and 35), fuse blade 32, fuse 40, fuse blade 33, puller clip-contact assembly D (inside and outside surfaces of leaves 41 and 42), tub connector assembly B (including contact jaws 17-18), and wire connector 20. The puller clip-contact assemblies, as well as the tub contact jaws, are offset with respect to the longitudinal axis of the pull-out switch. This permits the switch to be in the "off" condition when so desired by simply reverse seating the puller in the tub and dead-ending the clip-contacts in the platform recesses 43 and 44.

Hesitant insertion or removal of the puller causes excessive arcing and damage to contacts as has been pointed out. Although the effect of such arcing may be partially eliminated by making the secondary or biased tub jaw longer (as shown in FIGS. 2 and 3), so that it and its associated puller contact absorbs most of the arc and resultant pitting on their respective curved surfaces, and even more significant remedy would lay in reducing the arc itself. An arrangement for achieving the latter result will now be explained with reference to FIGURES 4, 5 and 5a.

In FIG. 4 two tubs are shown mounted side by side (for simplicity the details have been omitted). Between the flanged tub portions 51 and 52 an interposed narrow rectangular slot 53 is formed, through the center of which an apertured blade may pass (into the paper in the view shown); the purpose of which will be explained.

In FIG. 5, which is a cutaway view of a pair of fully mated pullers and tubs, the utility of this slot is illustrated. In this embodiment, the dual function handle retaining plate and stop 22' also serves to mount both pullers in corresponding relation to the tubs. On the underside of the puller plate 22', a perpendicular blade 54 is affixed (e.g. by welding or riveting); disposed to enter the passage 53. Blade guiding ribs 57 are added to the outside of the adjacent tub walls to ensure blade centering and alignment of the pullers and tubs for the rectilinear engagement of the respective moving contacts and stationary jaws. A detent spring 55 is mounted on the underside of the tub platform projection 12', and is of such configuration that its end portion 55' juts into the blade passage. Upon initial seating of the pullers in the tubs, and just prior to tub-puller contact engagement, the blade end encounters the spring. It is now incumbent upon the operator to apply more force, thus speeding the "make." As may be seen more clearly in FIG. 5a, as the engagement proceeds, the curved end 55' of the detent spring enters the rectangular blade slot 54'; the end 54'' of the blade slot finally riding down the end of the spring slope 55'' to complete the blade-spring engagement simultaneously with the final puller-tub contact engagement.

During puller-tub disengagement the situation is reversed. Now the end of the blade aperture 54'' must ride up the slope 55'', increasing the force necessary to unseat the pullers immediately prior to contact disengagement. Once the spring has "jumped" the slot, however, the impedance is removed. Again, as in the "make," it is this abrupt removal of an obstruction, which the operator needed an increased force to surmount, which via the follow through effectuates the quick break (or "make" in the former case).

The other end of the spring 55 (on the other side of the projection 12') applies its force downwardly. This

may be employed, as shown, to contact a grounded surface 60 underlying the tub. This grounds the blade, and hence, by virtue of the retaining plate 22', the handles; lessening the shock hazard to the operator.

While in the described embodiment, a pair of pullers and tubs embrace the blade, it will be obvious that since the fuse is asymmetrically located in the puller, the same result may easily be accomplished with a single puller and a single tub or a plurality of each; a dead passage being provided in the appropriate puller and tub for the blade-spring function.

While we have described above the principles of our invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of our invention, as set forth in the objects thereof, and in the accompanying claims.

What is claimed is:

1. In a pull-out switch having a tub portion including line and load terminals and a puller portion adapted to seat in said tub and contain a fuse of the blade type, the improvement therein for reducing the length of the current path comprising: a pair of clip-contact assemblies mounted in said puller for electrically contacting and mechanically retaining the fuse blades, each said assembly comprising a pair of spaced leaves biased inwardly for contacting the outside of the fuse blades on the inside surfaces of said leaves; and a pair of jaw assemblies mounted in said tub and connected to said line and load terminals respectively, said jaw assemblies each comprising a pair of spaced contact blades at least one of which is biased inwardly and disposed to engage a clip contact assembly on the outside leaf surfaces opposite said fuse-contacting inside surface when said puller is seated in said tub.

2. The improvement claimed in claim 1 in which the ends of each pair of said leaves are curved inwardly with respect to each other, and in which the ends of each pair of said contact jaws are curved outwardly with respect to each other, whereby arcs drawn on engagement or disengagement of the contacts will fall substantially in the curved surfaces.

3. The improvement claimed in claim 2 in which each of said clip contact assemblies comprise: a slotted retaining plate mounted on a puller recess, said pair of leaves being substantially rectangular and passing perpendicularly through said plate and adapted to be retained thereby; and means disposed within said puller recess urging said leaves apart, whereby the leave portions on the other side of said plate from said recess are biased inwardly.

4. In a pull-out switch having a tub and puller portion, each including a pair of contact assemblies adapted to engage upon the seating of said puller in said tub, the improvement therein, for facilitating the make and break of contacts, comprising: an elongated blade, having an aperture adjacent one end thereof, mounted at the other end in one of said puller and said tub perpendicular to the tub-puller engagement direction; and a detent spring, mounted in the other of said puller and said tub, disposed to engage the end of said blade adjacent the end of said spring prior to engagement of said tub and puller contacts, for imparting a surmountable force opposing blade travel; said end of said spring having an arcuate portion adapted to partially enter said blade aperture upon final travel of said pullers into said tubs for providing a force aiding the contact engagement and to be overcome upon contact disengagement.

5. The improvement claimed in claim 4 in which said detent spring is mounted in the tub, and in which the end of said switch includes a handle electrically connected to said blade, in which said detent spring opposite the arcuate end extends through the plane of the tub footing; whereby when said tub is mounted on a grounded surface said surface contacts the latter end of said spring,

5

and said spring and hence said puller mounted blade and said handle is grounded.

6. In a pair of pull-out switches having attached puller portions and a tub portion associated with each puller portion, said tub portions having a dead passage therebetween, and each puller and associated tub portion including a pair of contact assemblies adapted to engage upon the seating of said pullers in said tubs, the improvement therein for facilitating the make and break of contacts, comprising: an elongated blade, having an aperture adjacent one end thereof, mounted at the other end between pullers, said blade being disposed to enter said dead passage upon seating of said pullers in said tubs; and a detent spring, mounted in one of said tubs, disposed to engage the end of said blade adjacent the end of said spring prior to engagement of said tub and

6

puller contact, for imparting a surmountable force opposing blade travel; said end of said spring having an arcuate portion adapted to partially enter said blade aperture upon final travel of said pullers into said tubs for providing a force to be overcome upon contact disengagement.

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