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ELECTRICAL SHUNT

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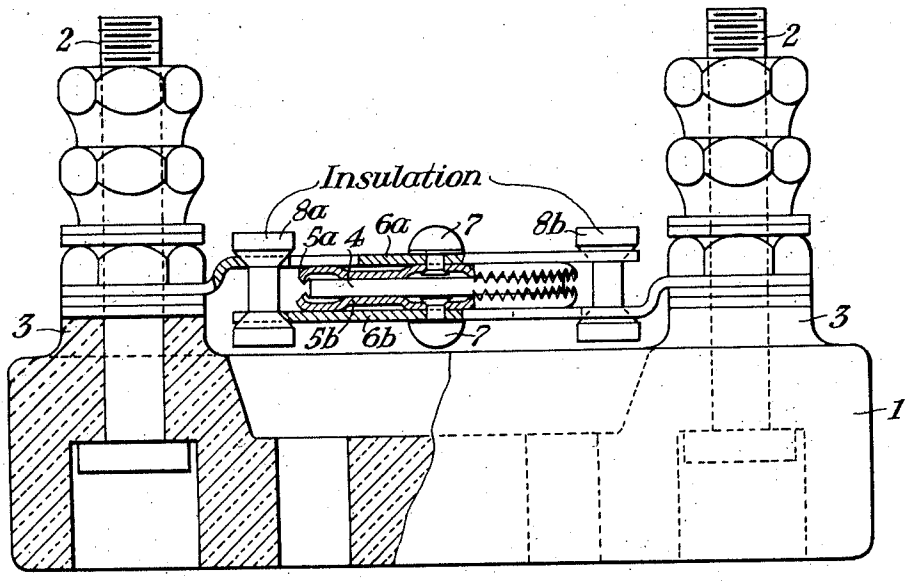


Fig. 1.

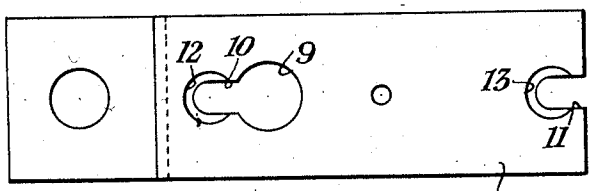


Fig. 2.

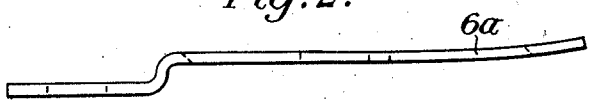


Fig. 2a.



Fig. 3.



Fig. 3a.

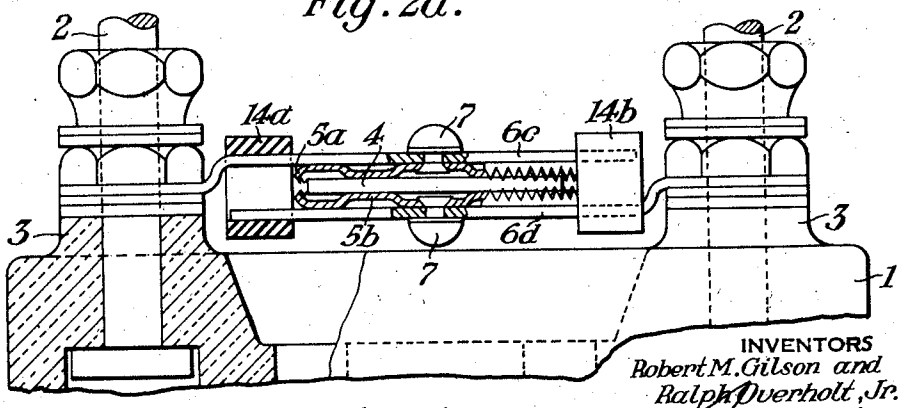


Fig. 4.

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ELECTRICAL SHUNT

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4 Claims. (Cl. 201—63)

Our invention relates to electrical shunts and more particularly to a combination of an electrical shunt and a lightning arrester in which the resistance element is readily removable by hand and provides protection not only against lightning discharges but also against excessive voltages such as may be below the sparking voltage of the arrester.

One object of our invention is to provide a simple, effective and inexpensive mounting for the resistance element of the combined shunt and lightning arrester. Another object of our invention is to provide a mounting assembly such that each part in one portion of the assembly is interchangeable with the corresponding part in another portion of the assembly, and the assembly as a whole permits manual removal and replacement of the resistance element easily without danger of breakage or damage to this element. Other objects, purposes, and features of our invention will be apparent from the description which follows.

We accomplish the foregoing objects by using a resistance element having a negative resistance-voltage characteristic in parallel with a spark gap and by using identical top and bottom clamping members for the resistance element, with identical means at each side of the element for fastening the clamping members together firmly as a unit, the parts being so designed and arranged so as to permit springing by hand into a firmly locked position.

In the accompanying drawing, Fig. 1 is an elevation showing one form of electrical shunt embodying our invention. Figs. 2, 2*a*, 3 and 3*a* show certain details of the shunt shown in Fig. 1. Fig. 4 is an elevation showing a modified form of the apparatus of Fig. 1, also embodying our invention.

Similar reference characters refer to similar parts in each of the several views.

Referring to Fig. 1 of the drawing showing an elevation of the assembled shunt, the insulating base 1 having the raised portions 3 and the terminal posts 2 comprise a terminal block such as the standard terminal block adopted by the American Association of Railroads. The terminal posts of this block with their usual complement of washers and clamping nuts provide the electrical connections as well as the mechanical support for the shunt assembly.

The resistance element of the shunt is preferably in the form of a disc or button 4 and may be composed of any suitable resistance material which has the desired resistance-voltage characteristic from the standpoint of the device to be protected. We have found that for protecting devices such as copper oxide rectifiers, the material commercially known as "thyrite" is well suited because the resistance at normal working voltage is sufficiently high to be unobjectionable and becomes sufficiently low to provide effective protection when the voltage exceeds a safe value. Any other resistance element having the proper negative resistance-voltage characteristics can, of course, be used.

The resistance element 4 is held in place by means of two cup-shaped washers or discs 5*a* and 5*b* which in turn are riveted or fastened to the supporting or clamping members 6*a* and 6*b*. As shown, these discs are riveted to the clamping members by means of the rivets 7. Preferably, the discs 5*a* and 5*b* are each provided with a sawtooth edge for facilitating a discharge between them should the voltage reach extreme values.

The clamping members or spring plates 6*a* and 6*b*, two views of which are shown in Figs. 2 and 2*a*, are made of suitable material such as hard brass or phosphor bronze which has the necessary rigidity and yet is sufficiently flexible to permit the two members to be manually compressed and locked in place by means of the double-headed insulating pins 8*a* and 8*b*, one of which is shown in Figs. 3 and 3*a*. The hole 9 in the top clamping member (as seen in Fig. 2) is sufficiently large to permit the head of the insulating pin 8*a* to be passed therethrough whereas the recesses 10 and 11 are just sufficient to provide clearance for the shank of this pin. The inner surfaces of the heads of each pin are beveled to permit seating in the beveled recesses 12 and 13. The spring plates 6*a* and 6*b* are sprung slightly beyond the flat position (as seen in Fig. 2*a*) in the punching operation so that these plates will exert pressure tending to keep the assembly firmly locked, once the pins are in place. It will be noted that the insulating pins 8*a* and 8*b* are inserted into the recess 10 of the respective spring plate before the cupped washers 5*a* and 5*b* are riveted in place so that the pins are not removable and consequently cannot become lost.

It will also be noted that the washers 5*a* and 5*b* are so shaped as to ride free of the disc 4 at the edges thereof and at the center where clearance for the rivet 7 is required. One reason for this construction is that the disc 4 in commercial form has a metallic contact layer formed on its top and bottom surface but this layer cannot, in practice, be carried to the very edge of the disc. Consequently, it is necessary to avoid

contact near the edge of the disc as such contact might be beyond the metallic layer and cause high resistance by preventing proper contact with the formed surface.

Another reason for shaping the washers 5*a* and 5*b* as shown is that this construction provides a not too great area of contact to resist slight turning of the washer 5*a* when the parts 5*a* and 6*a* are riveted together. It is, of course, desirable that the points of the saw-teeth on the two washers be opposite one another as the voltage at which a discharge will pass between the teeth is determined by their separation or air gap. Uniformity in this air gap can be obtained by rotating one washer slightly until the teeth thereof register with the teeth of the other washer. In order to take care of manufacturing variations and tolerance in the thickness of the discs 4 and other parts, circular shims or spacers (not shown) can be introduced between the disc 4 and either washer, or both, to provide the necessary discharge gap.

It will be further noted that the washers 5*a* and 5*b* establish contact over an appreciable area of the disc 4 and that desirable heat conducting junctions exist between this disc and the washer 5*a*, spring plate 6*a* and the binding post 2. This intimate metallic contact aids in the rapid flow of heat so as to increase its dissipation and so increase the safety, reliability and life of the protective unit.

After the insulating pins are inserted in the spring plates and the washers are riveted in place, the shunt may be assembled. This is done by placing the disc 4 between the two cupped washers as shown in Fig. 1 and compressing the free end of each spring plate until the respective insulating pin which now rests in recess 12 of the upper spring plate 6*a* passes through the slot 11 in the lower spring plate 6*b* and is seated in recess 13. This operation is easily performed by hand before the shunt assembly is mounted on the terminal block 1 and entails no danger of breakage or damage to disc 4 as only a gentle compressive force is applied thereto. The shunt assembly can now be slipped over the binding posts 2 and secured firmly in place on the terminal block. The spring plates are sufficiently thin as to require no increase of length in the binding posts of the standard terminal block so that the assembly requires a minimum of special parts.

Should it be desired to replace the disc 4, this can be done simply by reversing the assembly procedure described above. That is, when the shunt is removed from the terminal block, slight compression of the spring plates enables the free ends of the insulating pins to be pushed out of their respective slots 11 so that the disc 4 becomes free. The new disc is then locked firmly in place, as before.

In the modified form of the invention shown in Fig. 4, the two clamping members 6*c* and 6*d* are held firmly together by means of the rectangular insulating sleeves 14*a* and 14*b*. In assembling, the members 6*c* and 6*d* are pressed together until the insulating sleeves will pass over the free end of the respective clamping member, thus providing an assembly which is mechanically rigid but which permits removal or replacement of the resistance element to be readily made.

The clamping members 6*a* and 6*b*, retaining discs 5*a* and 5*b*, and pins 8*a* and 8*b* of Fig. 1 are duplicate or identical parts. The same is also true of the corresponding parts of Fig. 4, so that there is obtained economy of parts in manufacture.

It will be apparent from the foregoing description that we have provided a simple and effective form of combined electrical shunt and lightning arrester employing a minimum number of parts and permitting removal or replacement of the resistance element to be made simply and easily. The resistance element can be selected such as to provide shunt protection against voltages which may be well below the sparking voltage of the shunt when acting as an arrester so that at high voltages, the apparatus embodying our invention provides two protective paths in parallel, one through the spark gap and another through the resistance element. Since the apparatus is of small size and can be mounted on the usual terminal block, no additional housing space is required by the assembly.

Although we have herein shown and described only two forms of an electrical shunt embodying our invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of our invention.

Having thus described our invention, what we claim is:

1. A mounting for an electrical resistance unit comprising in combination, a pair of spaced spring clamping plates for clamping the unit therebetween and for providing a conducting path with said unit, said clamping plates being provided with a plurality of opposing slots in alignment with each other, one of each slot pair being closed and the slot aligned therewith being open, and a shouldered insulating pin for each said slot pair, said pin engaging one clamping plate at said closed slot and insertable by means of finger pressure into said open slot of the pair against the spring pressure of said clamping plates, whereby the shoulders of said insulating pins trap said spring pressure against said resistance unit to hold said unit firmly in place and render said unit readily removable by hand.

2. A mounting for an electrical resistance unit comprising in combination, a pair of spaced spring clamping plates for clamping the unit therebetween and for providing a conducting path with said unit, said clamping plates being provided with a plurality of opposing slots in alignment with each other, one of each slot pair being closed and the slot aligned therewith being open, a conducting retaining member fastened to each clamping plate for retaining said unit in position against lateral displacement, and a shouldered insulating pin for each said slot pair, the closed slot of each pair having an enlarged portion and a restricted portion, said pin being insertable through said enlarged portion into said restricted portion for locking against removal by said retaining member, the shoulder at one end of said pin engaging one clamping plate at said closed slot, said pin being insertable by means of finger pressure into said open slot of the pair against the spring pressure of said clamping plates, whereby the shoulder at the other end of said pin engages said other clamping plate and traps said spring pressure against said resistance unit to hold said unit firmly in place and render said unit readily removable by hand.

3. A mounting for an electrical resistance unit comprising in combination, a pair of spaced spring clamping plates for clamping the unit therebetween and for providing a conducting path

with said unit, and two insulating locking members one at each side of said unit, said plates having their free ends in alignment with one another, said insulating members having a pair of confronting inner surfaces for engagement with the outer surfaces of said clamping plates, said insulating members being movable by means of finger pressure into locking position, whereby said inner surfaces engage said free ends and trap the spring pressure of said clamping plates against said resistance unit to hold said unit firmly in place and render said unit readily removable by hand.

4. A mounting for an electrical resistance unit comprising in combination, a pair of spaced spring clamping plates for clamping the unit therebetween and for providing a conducting path with said unit, and two insulating sleeves one at each side of said unit, said plates having their free ends in alignment with one another for engagement by the confronting inner surfaces of said insulating sleeves, said sleeves being slidable by means of finger pressure over said free ends against the spring pressure of said clamping plates, whereby said sleeves trap said spring pressure against said resistance unit to hold said unit firmly in place and render said unit readily removable by hand.

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