Feb. 11, 1930. G. F. HARRINGTON 1,746,650

SHUNTED SPRING

Filed June 7, 1926 2 Sheets-Sheet 1

Fig. 1

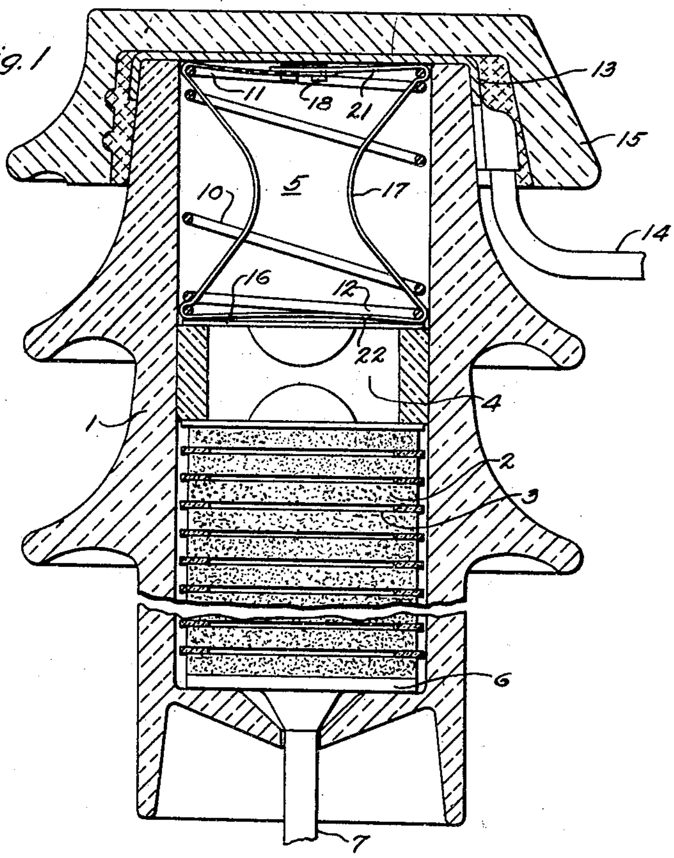

Fig. 2

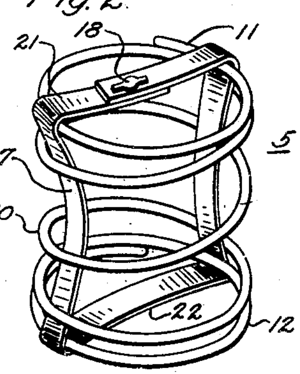

Fig. 3

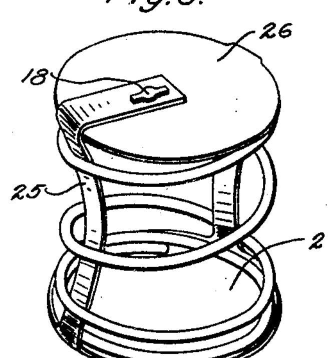

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Fig. 4.

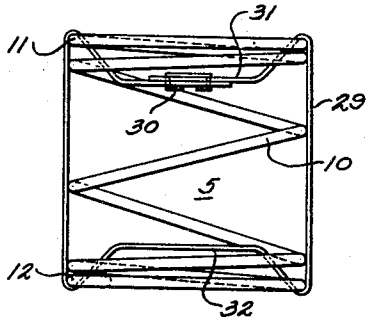


Fig. 5.

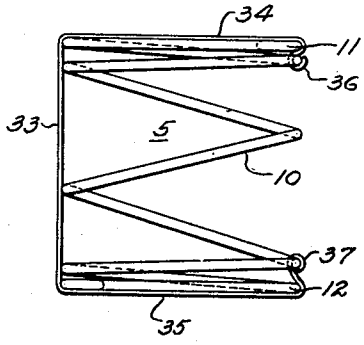


Fig. 6.

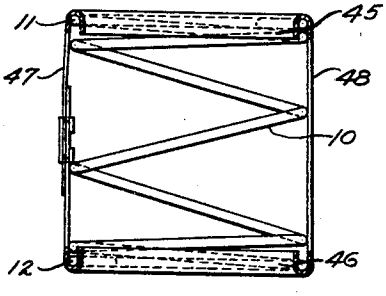
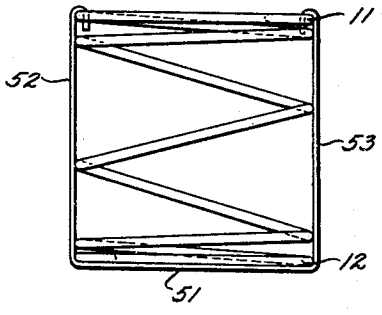


Fig. 7.



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UNITED STATES PATENT OFFICE

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SHUNTED SPRING

Application filed June 7, 1926. Serial No. 114,051.

My invention relates to shunted springs and it has as its object to provide an improved shunt for compression springs which radically reduces the time and cost of their manufacture.

In many classes of electrical apparatus, more particularly in lightning arresters, electrical conducting members are loosely assembled in a column and held in contact with each other by means of a compression spring which is also used to make contact with the end member of the column against which the spring bears. The springs which are usually employed for that purpose are made of a helically wound steel wire, and in order to secure a good conducting connection between the members bearing on both ends of the spring, a conducting shunt must be provided which permits a ready flow of current between the two conducting members without in any way interfering with the free play of the spring when it is compressed or released.

According to my invention, a very simple but efficient shunt for such springs is obtained by surrounding the helical spring with a flat strap of soft, highly-conducting sheet metal, such as copper, the strap extending over the end surfaces of the helix to constitute the conducting end surfaces of the spring, and having an intermediate pliable portion constituting the connection between the two contacting portions at the ends of the spring.

The foregoing and other objects of my invention will be best understood by reference to the accompanying drawings, wherein

Figure 1 is a sectional view of a lightning arrester embodying my invention,

Fig. 2 is a perspective view of a shunted compression spring used in the lightning arrester shown in Fig. 1,

Fig. 3 is a view similar to Fig. 2 showing a modification of my invention, and

Figs. 4 to 7 are elevational views of further modifications of my invention.

Referring to Fig. 1, a lightning arrester is shown comprising a tubular porcelain casing 1 having mounted therein a plurality of superposed resistor discs 2, spaced from each other to provide small flat discharge gaps 3 and a series insulating gap device 4. The details of the lightning arrester, as shown in the drawings, are fully described in Patent No. 1,509,497, to Joseph Slepian.

In order to hold the members of the column in contact with each other and to prevent the same from being moved or shaken in transportation, as well as in order to secure conducting connections to the end members of the column, a compression spring 5 is provided, at one end of the column, which holds the superposed members in contact with each other and presses the same towards a bottom terminal plate 6 to which is connected a bottom terminal lead 7.

The compression spring 5 is made of steel wire, or other suitable elastic material, which is wound into a helix 10, the end turns 11 and 12 of the helix being so formed as to constitute parallel surfaces. The upper end turn 11 of the spring presses against a metallic cap or terminal member 13 enclosing the upper end of the tubular porcelain casing 1 and connected to an upper terminal lead 14. A porcelain cap 15 is secured on the top of the metal cap 13 to protect the interior of the arrester from the weather.

To provide a good conducting connection between the upper terminal lead 14 and the series insulating gap 4, which constitutes the upper end of the discharge column of the lighting arrester, the spring 5 must have a good conducting shunt connecting the conducting cap member 13 at the top of the arrester with the upper terminal plate member 16 of the series gap 4.

In the lightning arresters manufactured for the past several years the conducting shunt was a rather expensive item and consisted of two discs of good conducting material, such as copper or brass, having a diameter approximately equal to, or somewhat larger than, the diameter of the helix 10, the two discs being held together and conductively connected with each other by a flexible stranded wire threaded through the center of the helix and through central holes in the two discs and soldered thereto. The purpose of such shunt was to provide a good conducting connection between the terminal mem-

bers at the top and bottom of the spring, without interfering with the movement and resilient action thereof.

The operations of preparing the perforated discs, threading the stranded wire through the center of the helix and the perforations in the discs and soldering the stranded wire to the discs, made the cost of the compression spring more expensive than was warranted by the rather simple function that was assigned to it, and it has been deemed highly desirable that such undesirable expense be eliminated without affecting the performance of the arrester.

After numerous designs and trials of various constructions, I have found that by using a flat pliable strap of soft highly-conducting sheet metal, I am able to make the conducting contact members at the ends of the spring and the shunt connection between the same of a single piece of metal, dispensing with the several operations involved in the old type of spring shunt, and making the cost of a complete shunt for the spring less than the cost of a single disc of the prior-art shunt.

The construction of the new shunt is clearly shown in Figs. 1 and 2. A flat strap 17 of soft sheet copper is spanned over the surface of the bottom turn 12 of the spring, the two sides of the strap being then bent into the interior of the helix 10 and led along the spring to the upper turn 11 and being then bent outwardly around the upper turn 11. The free ends of the strap are then loosely connected together into a closed loop by means of a staple 18 or other suitable fastener. The flat strap portions 21 and 22, extending over the top and bottom end turns 11 and 12 of the spring, constitute the terminal contact members of the shunt while the side portions of the loop, which are threaded between the wires of the helix, constitute the shunt proper, being equivalent to the stranded wire utilized in the hereinbefore mentioned shunts of the prior art. The spring is preferably held slightly compressed by the strap member 17 shown in Figs. 1 and 2.

The preparation of the new shunt is very simple, a standard paper stapling machine being sufficient to fasten the two ends of the strap. The material which I preferably use for the strap consists of thin sheet copper approximately 5 mils thick. Straps of approximately ½″ width are used in connection with springs of 2″ diameter. Since the side portions of the loop are threaded through the interior of the spring, the strap is well supported by the spring and does not fall off the same while being handled in the manufacture of the arrester. The idea of utilizing a continuous strap of soft sheet material for making both end-contact members of the shunt and the intermediate conducting connection between the same may be embodied in many other forms, some of which are shown in Figs. 3 to 6 inclusive.

In the modification of my invention shown in Fig. 3, the shunt is similar to that shown in Figs. 1 and 2, the only difference being that the conducting strap 25 is punched or cut with enlarged circular portions 26, 27 to provide larger contact surfaces at the upper and lower ends of the compression spring.

In the embodiment shown in Fig. 4, a strap 29, of sufficent length to reach around the spring helix 10 in its extended or uncompressed state, is prepared with its ends stapled together at 30 to provide a loop. The loop, as finished, is slid over the spring and the two end members 31 and 32 which extend over the end turns 11 and 12 of the spring, are pressed inwardly somewhat. The depressed portions so provided are sufficient, in many cases, to hold the strap in place during the assembling operations, until the spring 10, with its shunting loop 29, is placed in its final position in the arrester.

In the modification of my invention shown in Fig. 5, a pliable strap 33 of conducting material of U-shape is slid over the spring 10, the two side legs 34 and 35 of the U-shaped strap extending, respectively, over the surfaces of the end turns 11 and 12 of the spring, and having their ends 36 and 37 wound around the wires of the end turns, or adjacent turns, to hold the strap in place.

In the modification of my invention shown in Fig. 6, a thin copper sheet is formed into two annular cups 45 and 46, embracing the end turns 11 and 12 of the spring helix, the two cups being held together by strap portions 47 and 48 which are punched integral with the portions forming the cups. The shunt just described is assembled either by first forming the two cups 45 and 46 and then slightly compressing the spring and sliding the cups into place, or by first making the portions of the sheet which form the two cups in the shape of straight annular washers and bending the sides of the washers around the end turns after the loop is placed over the spring.

Still another form of my invention is shown in Fig. 7, wherein a conducting strap 51 of U-shape is placed with its bight or middle portion over one end turn 12 of the helix, the two legs 52 and 53 of the strap extending over the sides of the spring and being bent inwardly around the upper turn 11.

It will be noted, in connection with each of the embodiments of my invention, that the shunt passes over the end turns of the spring. The result of this simple construction is that when the spring element is inserted in place in the assembled arrester, the pressure of the spring serves to press the shunt member against the terminal plates 13 and 16 of Fig. 1, whereby good electrical contact is secured

without resorting to soldering, bolting or other special connecting means.

The foregoing very simple constructions radically reduce the cost of production of the shunts and make possible large economies in an article that is being used in very large quantities in electrical apparatus of the class described hereinbefore, and in many other applications.

I claim as my invention:

1. In combination with a helical compression spring, a circuit comprising electrically conducting terminal members, and a continuous strap of pliable conducting material constituting electrical contact surfaces interposed between said terminal members and the ends of the spring, said strap being supported by the spring, and the contact surfaces of said strap being held against said members by said spring.

2. In combination with a helical compression spring of relatively poor conducting material, a circuit including electrically conducting terminal members, and a conducting shunt for said spring comprising contact members of conducting material extending over the ends of the spring, and an integral pliable strap of the same material extending between said contact members and holding the same together, said shunt including means for preventing accidental slippage from the spring, said contact members being held against said terminal members by said spring.

3. A shunted compression spring comprising a helix of resilient wire and a strap of pliable conducting material extending between the end surfaces of the helix and constituting contact surfaces thereon, said strap being threaded through the turns of the helix.

4. A shunted compression spring comprising a helix of resilient wire, a closed loop of flat pliable conducting sheet material surrounding the helix and constituting contact surfaces at the ends thereof, said loop being threaded between the turns of the helix.

5. A shunted compression contact spring comprising a helix of elastic material and having substantially parallel end turns, a continuous flat sheet-metal strap of conducting material extending the length of the spring and along the outer surfaces of the end turns to constitute the contact surfaces thereof.

6. A shunted compression contact spring comprising a helix of elastic material and having substantially parallel end turns, a continuous flat sheet-metal strap of conducting material extending the length of the spring and disposed over the outer surfaces of the end turns to constitute the contact surfaces thereof, said strap being threaded between the turns of the helix.

7. The combination with a helical compression spring of resilient wire having substantially parallel end turns, of an electrical shunt therefor comprising a closed loop of pliable conducting sheet material having two contact portions extending over the surfaces of the end turns and having, also, intermediate portions extending lengthwise the spring.

8. The combination with a helical compression spring of resilient wire having substantially parallel end turns, of an electrical shunt therefor comprising a closed loop of pliable conducting sheet material having two contact portions extending over the surfaces of the end turns and having, also, intermediate portions extending lengthwise of the spring, said intermediate portions being threaded between the turns of the helix.

9. In combination with a helical compression spring of relatively poor conducting material, a circuit including electrically conducting terminal members, and a conducting shunt for said spring comprising contact members of conducting material extending over the ends of the spring, and an integral pliable strap of the same material extending between said contact members and holding the same together, said contact members being held against said terminal members by said spring.

10. A shunted compression spring comprising a helix of resilient wire, a closed loop of flat pliable conducting sheet material extending along opposite sides and over the ends thereof and constituting contact surfaces at the ends thereof, the portions of said loop across the ends of said spring being overlapped and joined together.

In testimony whereof, I have hereunto subscribed my name this 2nd day of June, 1926.

GEORGE F. HARRINGTON.