Jan. 26, 1943. N. Y. PRIESSMAN ET AL 2,309,081

ELECTRICALLY CONDUCTIVE DEVICE

Filed Oct. 1, 1941

FIG. 1

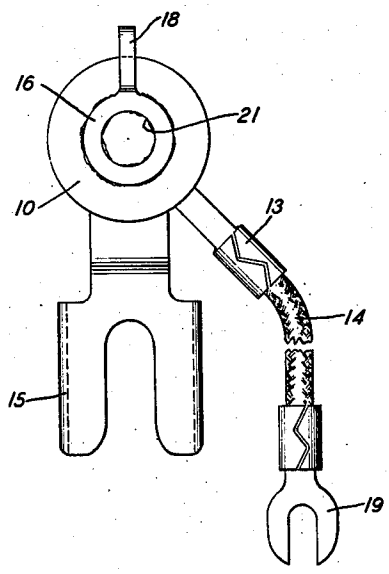
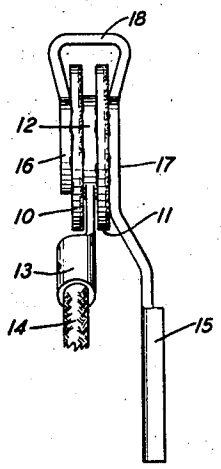


FIG. 2



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ELECTRICALLY CONDUCTIVE DEVICE

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2 Claims. (Cl. 175—366)

This application relates to conductive devices and more particularly to such devices which include dry rectifier discs or similar elements having semiconductive portions.

Conductive devices, comprising assemblies including several dry rectifier discs or similar elements, have heretofore been made by assembling the discs or other elements on bolts and the like or in housings or containers. Such assemblies while useful for many purposes are relatively expensive and, in some cases, too bulky for some applications.

It has been proposed to assemble conductive devices of this character by means of solder. However, this practice is subject to certain limitations because only a low melting point solder can be safely employed. Temperatures sufficiently high to melt ordinary solders are injurious to the semiconductive portion or to the junction between a conductive and a semiconductive portion of the elements used. For example, since it is known that cuprous oxide-copper rectifiers age rapidly at temperatures in the order of 100° C. it is inadvisable to solder such rectifiers at temperatures much higher than this because of the probability of excessive ageing or other damage thereto.

The low melting point of very soft solders which may be safely employed for assembling conductive devices of the type under consideration, are of relatively low strength. For this reason the assembled devices may not be sufficiently rugged to maintain their required electrical characteristics over a reasonable period of time, under the conditions to which such devices may be subjected.

An example of the type of use contemplated is afforded by the so-called "click reducer" employed in telephone sets. These devices which may comprise a small stack of cuprous oxide-copper rectifier discs, are often designed to be housed within the ordinary handset. In view of space limitations, the compact device that can be made by employing a soldered assembly, is desirable. In ordinary use the handset is often subjected to shocks of considerable magnitude due to dropping, violent "hanging up" etc. Under such conditions and others which may be easily visualized, the low melting point solder is likely to fail.

It is an object, therefore, of this invention to employ low melting point solder for the assembly of conductive devices of the type described and at the same time obtain a rugged, self-supporting structure.

A feature of this invention resides in a combined terminal and clamping means which in conjunction with a relatively weak, low melting point solder assures a rugged conductive device of the type described.

Other and further objects and features of this invention will be understood more clearly and fully from the following description of an illustrative embodiment thereof, taken in connection with the appended drawing in which:

Fig. 1 is an elevational view of a conductive assembly embodying the invention; and,

Fig. 2 is a view of the same assembly taken at right angles to that of Fig. 1.

Referring to the drawing 10 and 11 are dry rectifier discs, e. g., cuprous oxide-copper rectifier disc units. The cuprous oxide surfaces of the discs should be provided with a suitable adherent, low resistance, substantially non-rectifying contact. Such a contact may be made by electrolytically or otherwise reducing the surface of the oxide to copper, or by vapor deposition of a metal, such as gold or silver, on said surface. This contact is commonly called a front contact as distinguished from the copper face of the disc which is designated as the back. In the device illustrated, the front contacts each face in the same direction. A terminal member has a disc or ring-like portion 12 between the discs 10 and 11 and a connector portion 13 projecting therefrom. An insulated conductor 14 provided with a terminal 19 may be secured, as by soldering to the connector portion 13.

Another terminal member has a connector portion 15 at one end and at the other a U-shaped portion comprising substantially parallel, contacting elements 16 and 17 and a part 18 connecting 16 and 17 together. The part 18 is sufficiently resilient and elements 16 and 17 are so spaced, that a clamping action is exerted upon the stack comprising discs 10 and 11 and terminal portion 12. The elements 12, 16 and 17 may be provided with a central orifice 21, as indicated for the element 16 in Fig. 1, for a purpose to be described. Low melting point solder is interposed between all mating surfaces of the device.

One method of assembling such a device is as follows: The discs 10 and 11 should be masked or otherwise protected over their edges to avoid deposition of solder thereon. Masking may be accomplished by means of a suitable adhesive tape or a coating of varnish, lacquer or the like. One of the lacquers made from cellulose derivatives would be suitable. The discs may then be placed

in contact with either face of terminal portion 12 and the U-shaped terminal 16—17—18 forced over the assembly to hold the parts together. The assembled parts are dipped into a bath of low melting point solder after suitable preparatory treatment. The solder coats the exposed metal portions of the device and seeps into the spaces therebetween. This seepage is encouraged around the contacting portions of the terminal members 12, 16 and 17 by the orifices 21 therein.

The parts may also be assembled by depositing sufficient amounts of solder on each of the surfaces to be soldered together. The parts may then be assembled as above indicated and dipped in a bath of hot water, alcohol, oil or other suitable material to melt the solder and secure the parts together.

After removal of the device from the soldering bath, the solder solidifies upon cooling and a rugged assembly results. The tendency of the solder to expand during cooling is to some extent resisted by the resilient clamping action of the outer terminal. Thus, the thin layers of solder between the parts are kept relatively dense and the parts are held in intimate contact. Moreover, due to the clamping action, there is less tendency for the solder layers to work loose during expansion. In some cases there is also a tendency for the cooling solder to pull the front contact away from the cuprous oxide surface. This is overcome by the clamping action. A slight expansion of the solder also somewhat increases the gripping action of the outer terminal.

In the finished device the clamping action of the outer terminal added to the adhesive effect of the solder holds the parts together in a relatively strong assembly. The additional effect of the clamping terminal makes the difference between an assembly that might fail mechanically due to the weakness of the solder and one that will stand a considerable strain because of the joint action of the solder and said clamping terminal.

Although a specific illustrative embodiment of the invention has been disclosed, it is to be understood that said invention is not limited thereby but by the scope of the appended claims only.

What is claimed is:

1. A conductive device comprising two cuprous oxide-copper rectifier discs, a terminal member having a flat portion between said discs and in electrical connection with the copper face of one disc and the oxide face of the other, a second terminal having a U-shaped portion embracing said discs, said U-shaped portion comprising two flat substantially parallel elements making contact respectively to the oxide face of said one disc and the copper face of said other disc and a resilient portion interconnecting said flat elements to urge them toward said disc faces, and solder having a melting point below about 100° C. adhering to all mating surfaces of said device, said U-shaped terminal portion exerting a clamping force that in conjunction with the adhesive action of the solder is sufficient to assure a rugged, self-supporting device.

2. A conductive device comprising two dry rectifier discs, a terminal member having a flat, ring-like portion between said discs and a connector portion extending therefrom, another J-shaped, terminal member, the long arm of which comprises a connector portion and the hooked portion of which includes two flat substantially parallel ring-like sections connected together by a resilient U-shaped portion that urges the two flat portions toward each other to clamp the discs and first-named terminal member therebetween, and solder having a melting point below a temperature that would adversely affect the rectifier discs, said solder interposed in thin films between all mating surfaces of said conductive device.

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