

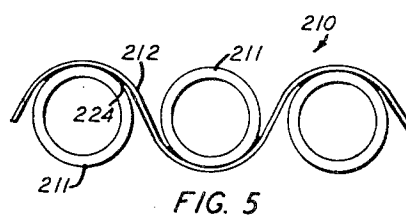
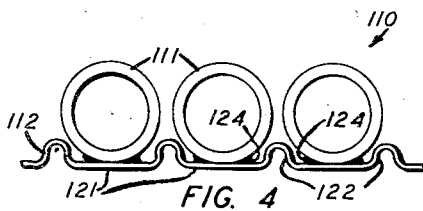
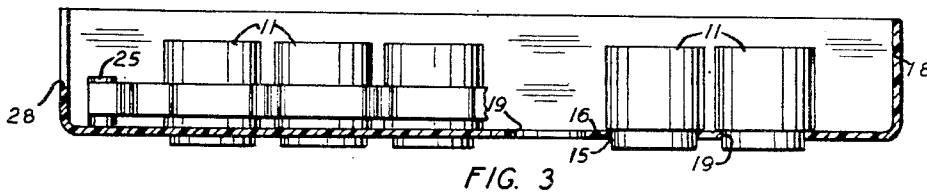
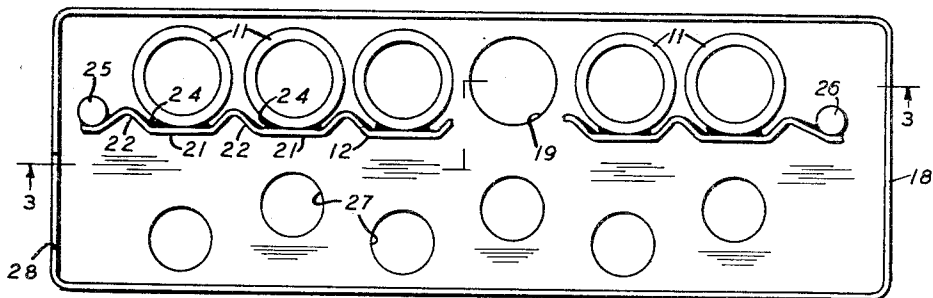
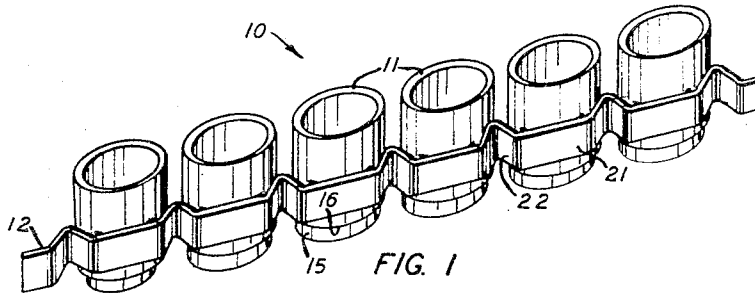
Jan. 29, 1957

F. A. CHRISTOFFEL

2,779,094

METHOD OF ASSEMBLING BUSHINGS IN A SHELL

Filed Aug. 16, 1951



INVENTOR
F. A. CHRISTOFFEL
BY *W. H. Ranz*
ATTORNEY

1

2,779,094

METHOD OF ASSEMBLING BUSHINGS IN A SHELL

Frank A. Christoffel, Baltimore, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application August 16, 1951, Serial No. 242,131

3 Claims. (Cl. 29—445)

This invention relates to a method of assembling bushings, and particularly to a method of assembling bushings in a shell useful in the manufacture of cable terminals.

In the manufacture of certain types of cable terminals, a plurality of terminal elements are positioned within a plastic shell, the terminal elements are connected to the individual conductors of a cable stub and the shell is filled with a suitable resin which surrounds the terminal elements and the portions of the cable stub within the shell. Among the terminal elements used in such terminals are bushings designed to receive lightning protector units, and these bushings are inserted in apertures in one of the walls of the plastic shell.

Since there may be from 20 to 50 of these bushings in one cable terminal, it obviously would be a time-consuming operation to insert them individually in the apertures in the shell wall. It has been suggested that a group of these bushings be placed in alignment, soldered together and inserted as a unit in a row of holes in the shell, but these holes are not always uniformly spaced and sometimes difficulty was encountered in positioning the bushings of such a unit in the holes. Also it is desirable to ground these bushings while making electrical tests on the cable terminals, and the need existed for a simple and effective means to accomplish this end.

An object of the invention is to provide a new and useful method of assembling bushings.

A further object of the invention is to provide a new and useful method of assembling bushings in a shell suitable for use in making cable terminals.

In accordance with certain features of the invention, there is provided a bushing assembly comprising a plurality of bushings and a strap secured to each of the bushings to hold them together. The strap may be corrugated so that it may be flexed laterally, and may be extended and contracted longitudinally.

These and other objects and advantages of the invention will be apparent from the following detailed description of bushing assemblies embodying the invention, when read in conjunction with the annexed drawings, in which:

Fig. 1 is a perspective view of bushing assembly embodying the invention;

Fig. 2 is a top plan view of a partially assembled cable terminal with the bushing assembly shown in Fig. 1 positioned therein, a part of the bushing assembly being broken away to show the construction of the shell more clearly;

Fig. 3 is a longitudinal section taken along line 3—3 of Fig. 2;

Fig. 4 is a fragmentary top plan view of another form of bushing assembly embodying the invention, and

Fig. 5 is a fragmentary, top plan view of still another form of bushing assembly embodying the invention.

2

Referring now to the drawings, and particularly to Figs. 1, 2 and 3, there is shown a bushing assembly, indicated generally by the numeral 10, consisting of a plurality of bushings 11—11 and a flexible strap 12 secured thereto so as to form with the bushings a unitary assembly.

Each of the bushings 11—11 is provided with an extension 13, which is of smaller outer diameter than the remainder of the bushing, and a shoulder 16. These bushings are intended to be positioned in a plastic shell 18 with the extensions 13 extending through openings 19—19 formed in the bottom of the shell 18, and with the shoulders 16—16 resting upon the bottom of the shell. The openings 19—19 are punched in the bottom of the shell 18 and, despite the fact that great care is exercised to keep the spacing between these openings uniform, they occasionally are misaligned laterally or spaced nonuniformly longitudinally of the shell 18.

Obviously, if the strap 12 were rigid, the bushings 11—11 would not be able to accommodate themselves to these irregularities in the spacing of the openings 19—19, and it would be impossible to insert the assembly properly in the shell 18. In order to permit the assembly to adjust itself to irregularities in the spacing of the openings so that the bushings may be inserted therein easily, the strap 12 is given such a configuration and is of such dimensions as to permit the bushing assembly, of which it forms a part, to be flexed laterally and to be extended or contracted longitudinally by an amount sufficient to conform to irregularities in the spacing of the openings 19—19.

In the embodiment shown in Fig. 1 of the drawings, the strap 12 consists of a thin strip of metal, which has been formed with a plurality of straight sections 21—21 joined by bent, substantially V-shaped sections 22—22. This strip is joined to the bushings 11—11 at the straight sections 21—21 by means of soldered joints 24—24, which provide not only a physical connection but also an electrical connection between the bushings 11—11 and the strap 12. It is obvious from the configuration of the assembly 10, and particularly because of the shape of the strap 12, that the entire assembly is flexible and may be expanded or contracted much in the same manner that an accordion may be opened and closed.

A terminal 25 is secured in the bottom of the shell 18, and projects upwardly parallel to the bushing near the left hand end of the bushing assembly 10. A similar terminal 26 is positioned near the right hand end of the shell 18. After the bushing assembly 10 has been forced into position in the shell 18, the end of the strap 12 adjacent to the terminal 25 is bent around the terminal and soldered thereto, and the other end of the strap is secured in a similar manner to the terminal 26.

The shell 18 with the bushing assembly 10 positioned therein represents one of the initial steps in the manufacture of a cable terminal in which the bushings 11—11 constitute some of the terminal elements. Other terminal elements (not shown) having lightning protector units secured thereto are positioned in openings 27—27 formed in the bottom of the shell 18 with the lightning protector units attached thereto extending into the bushings 11—11. The end of a cable stub (not shown) having the individual conductors therein fanned out is inserted in the shell 18 through a slot 28 formed in one end thereof, and the conductors are soldered to the terminals positioned in the openings 27—27. Subsequently, a suitable molten resin is poured into the shell 18 so as to surround the bushing assembly 10 and the other elements positioned in the shell 18.

Before the resin is poured into the shell to form a completed cable terminal, the terminal elements positioned in the shell and connected to the cable stub are tested to see whether all the connections are effective, and whether the circuits through the cable stub are complete. In making such tests, the terminals 25 and 26 are connected to a suitable ground connection, and thereby the entire group of bushings in the bushing assembly are connected to ground through the strap 12. Even if one of the soldered joints 24—24 is broken, only one bushing will be disconnected from ground, and the other bushings are grounded. In using the final cable terminal, the terminals 25 and 26 also will be connected so as to ground each of the bushings 11—11 through the strap 12. Thus, the strap 12 serves the additional function of providing a grounding connection for each of the bushings 11—11.

Usually the bushings 11—11 and the terminals 25 and 26 are made of brass, because brass may be machined readily into the desired shape and, at the same time, it is a good conductor of electricity. The strap 12 preferably is made of a copper strip which has been dipped in tin in order that it may be soldered readily to the brass bushings 11—11. Obviously, the bushings 11—11 and the strap 10 could be made of other materials, and the strap 10 could be secured to the bushings 11—11 by suitable hermetic processes other than soldering. For example, the strap 12 could be brazed to the bushings 11—11, or could be secured thereto by spot welding, if desired.

In Fig. 4 of the drawings, there is shown a bushing assembly 110 forming an alternative embodiment of the invention. In this embodiment, bushings 111—111, which are identical with the bushings 11—11, are secured together by a strap 112, which is similar to the strap 12 shown in Figs. 1, 2 and 3 of the drawings. In this embodiment of the invention, the strap 112 consists of a plurality of straight sections 121—121, which are joined by bent substantially U-shaped sections 122—122. The strap 112 is fastened to the bushings 111—111 by soldered joints 124—124.

The U-shaped sections 122—122 function in substantially the same manner as do the V-shaped bent sections 12—12. The principal advantage of the U-shaped bent sections over the V-shaped bent sections is that the U-shaped bent sections provide a little more longitudinal flexibility to the assemblies. However, they require a slightly larger amount of material, and occupy somewhat greater space than do the V-shaped bent sections 12—12. Consequently, this assembly might not be suitable for use where the spacing between the openings 19—19 is very small.

A third embodiment of the invention is shown in Fig. 5, in which there is shown a bushing assembly 210, consisting of bushings 211—211 secured together by means of a strap 212. The strap 212 is of sinusoidal shape, and is secured by soldered joints 224—224 to the opposite sides of the successive bushings 211—211. This construction provides a very rugged bushing assembly, which may be flexed laterally and extended or contracted to a considerable degree longitudinally. This type of assembly is most suitable where the spacing between the holes 19—19, into which the bushings 211—211 are to be inserted, is not very small.

It is obvious that bushing assemblies embodying the invention, of which those shown in the drawings are merely illustrative, possess a number of decided advantages. In a bushing assembly of this type, a group of bushings are held together with sufficient rigidity to normally maintain the bushings in alignment so that the entire group may be inserted at one time in the holes in the shell. On the other hand, such assemblies may be flexed laterally sufficiently to permit the bushings to be inserted in holes that are displaced slightly from the longitudinal axis of the assembly. They, likewise, may be extended or con-

tracted enough longitudinally to permit the bushings to be inserted easily in openings that are misaligned longitudinally of the bushing assembly. The connecting strap not only holds the bushings together during the insertion of the assemblies in terminal shells, but also serves as an electrical conductor which connects the bushing to testing and communication circuits. The strap also holds the bushings in place while the resin is being poured into the shell.

In some of the annexed claims, the bushing assemblies are described as being both laterally and longitudinally flexible. This language is intended to embrace both the lateral flexing and the longitudinal extension and contraction of the assemblies.

The straps 12, 112 and 212 are stated in some of the annexed claims to be corrugated. The term "corrugated," as used in those claims, is intended to embrace the configurations of the straps 12, 112 and 212, as well as other similar shapes.

While in the embodiment of the invention described hereinabove the corrugated straps are soldered to the bushings, they may also be connected to the bushings by brazing, spot welding or other suitable methods. Since all these processes involve the application of heat to produce a physical and electrical joint, such processes have been defined in the claims as being hermetic. This term is intended to embrace the processes specifically described and other related processes involving the use of heat to make a suitable joint.

Obviously, various changes and modifications may be made in these bushing assemblies without departing from the essential inventive concept which is common to them all. For example, the bushing assembly shown in Fig. 1 has only six of the bushings 11—11 secured to the strap 12, and this number was shown only to simplify the drawings. In actual practice, terminal straps including from 20 to 50 or more bushings may be joined together physically and electrically by soldering a suitable corrugated strap thereto in the manner described to form bushing assemblies suitable for use in making cable terminals and the like.

What is claimed is:

1. The method of assembling bushings in a shell having a plurality of holes therein substantially uniformly spaced in a substantially straight line, which comprises arranging a plurality of bushings in parallel alignment and spaced apart the normal distance between said holes in the shell, hermetically securing all the bushings to a flexible, corrugated metal strap at intervals along said strap corresponding substantially to the spacing between the holes in the shell to form a flexible assembly with the bushings, and inserting the assembly as a unit into the shell and simultaneously adjusting the relative positions of the bushings as needed to seat them in the holes in the shell.

2. The method of assembling bushings in a shell having a plurality of holes therein substantially uniformly spaced in a substantially straight line and also having a pair of terminals therein near the ends of said line, which comprises arranging a plurality of bushings in parallel alignment and spaced apart the normal distance between said holes in the shell, hermetically securing all the bushings to a flexible, corrugated metal strap at intervals along said strap corresponding to the normal spacing between the holes in the shell but leaving free ends of the strap projecting beyond the aligned bushings, inserting the resulting assembly as a unit into the shell and simultaneously adjusting the positions of the bushings with respect to each other so as to seat the bushings in the holes in the shell, and hermetically securing the free ends of the strap to the terminals in the shell whereby all the bushings may be connected to an electrical circuit.

3. The method of assembling bushings in a shell having a plurality of holes therein substantially uniformly spaced in a substantially straight line, which comprises arranging a plurality of bushings in parallel alignment and spaced

5

apart the normal distance between said holes in the shell, forming a flexible metal strap into a shape such that it has a plurality of substantially straight sections joined by bent sections, hermetically securing the strap to the bushings at the straight sections of the strap to form a flexible assembly therewith, and inserting the assembly as a unit into the shell and simultaneously adjusting the relative positions of the bushings to seat them in the holes in the shell.

5

10

441,130
665,195
1,833,462
1,880,081

164,946
565,746

6

References Cited in the file of this patent

UNITED STATES PATENTS

Brewer ----- Nov. 25, 1890
Eneas ----- Jan. 1, 1901
Hagist ----- Nov. 24, 1931
Frederickson ----- Sept. 27, 1932

FOREIGN PATENTS

Great Britain ----- June 23, 1921
Germany ----- Dec. 6, 1932