Nov. 3, 1959 C. C. COHN 2,911,346

APPARATUS FOR ELECTROLYTIC TREATMENT OF SLIDE FASTENERS

Filed July 29, 1952 2 Sheets-Sheet 1

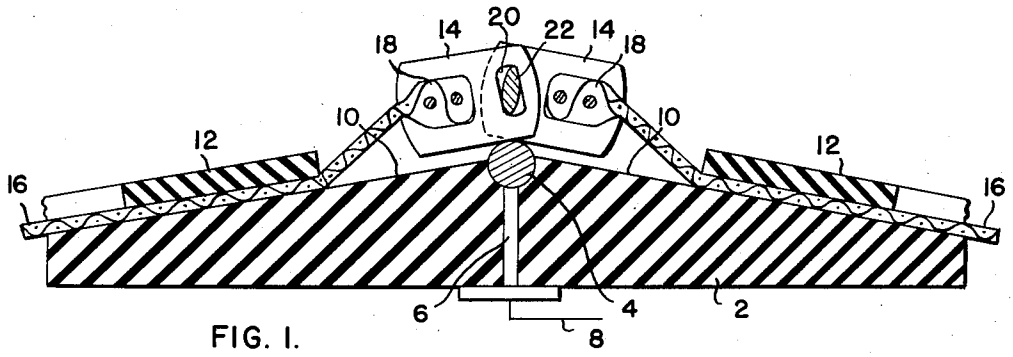


FIG. 1.

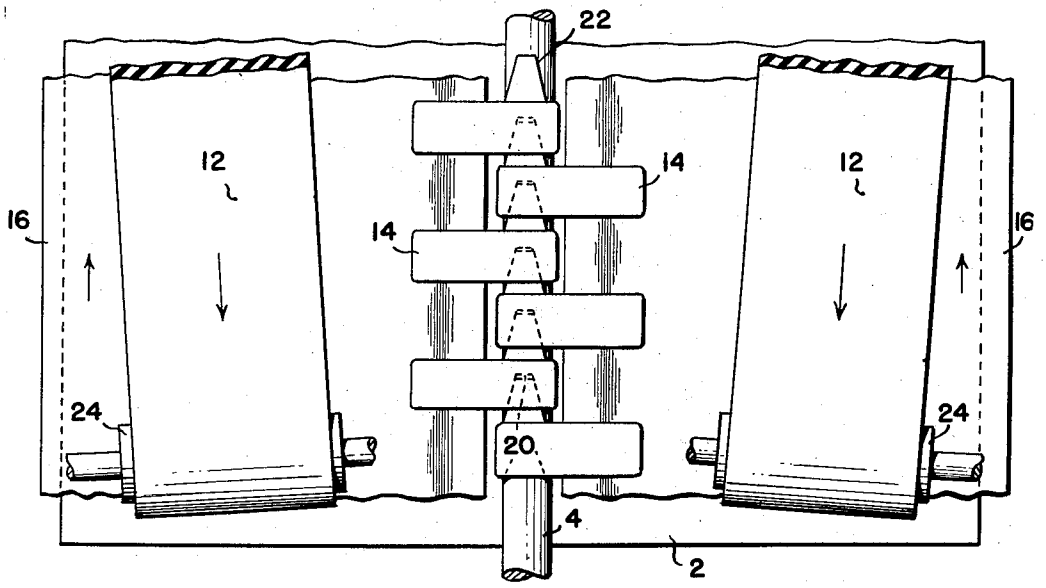


FIG. 2.

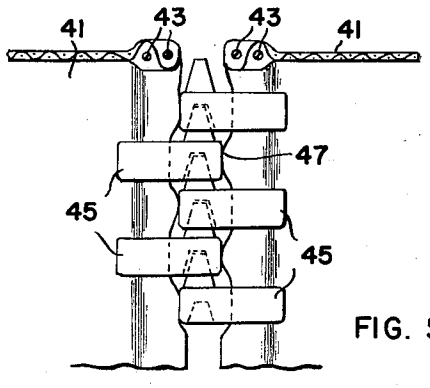


FIG. 5.

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APPARATUS FOR ELECTROLYTIC TREATMENT OF SLIDE FASTENERS

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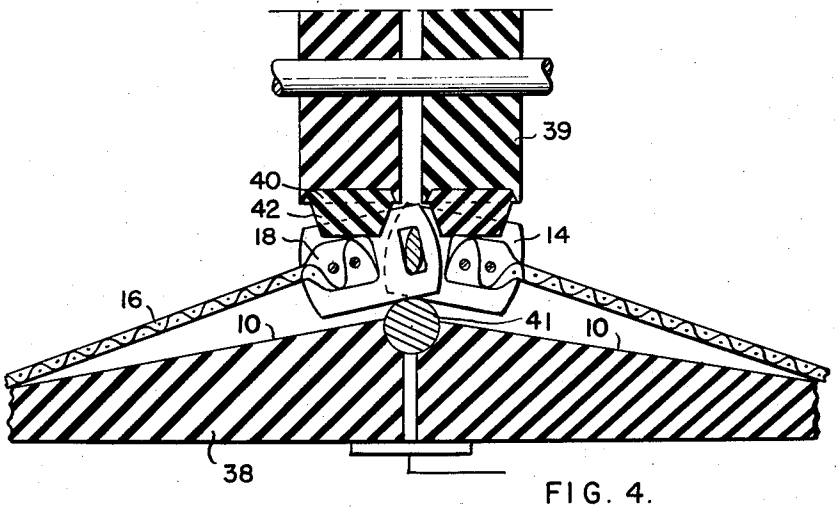


FIG. 4.

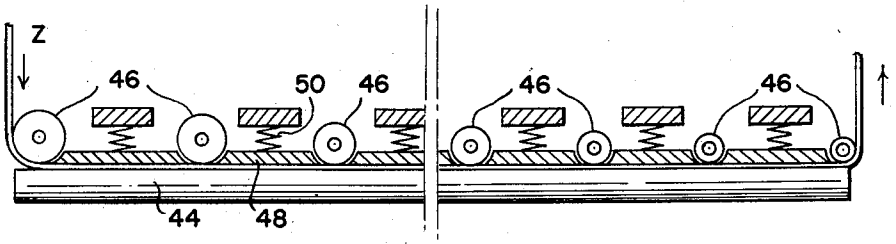


FIG. 6.

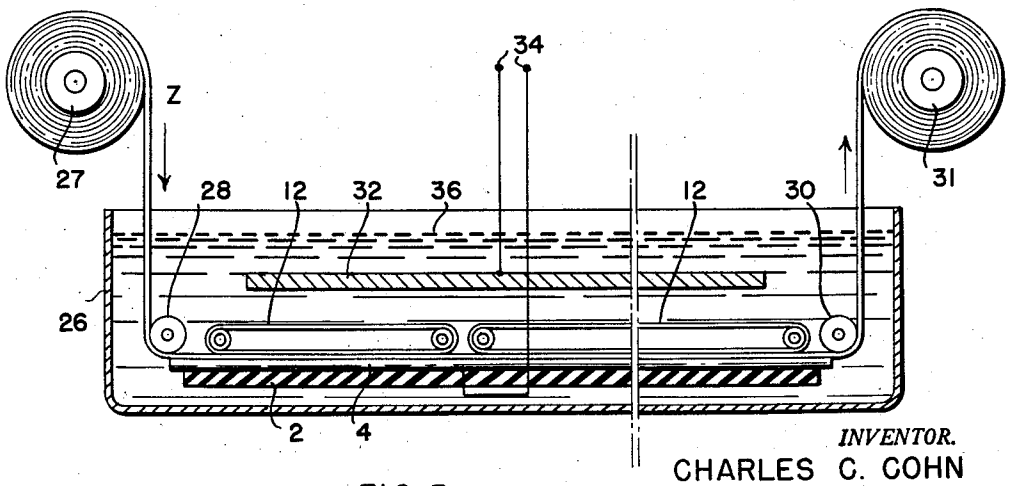


FIG. 3.

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APPARATUS FOR ELECTROLYTIC TREATMENT OF SLIDE FASTENERS

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Application July 29, 1952, Serial No. 301,510

3 Claims. (Cl. 204—206)

This invention relates to methods and apparatus for the electrolytic treatment of elements of slide fasteners, the treatment referred to including electroplating, anodizing of aluminum elements, or the like. The invention has particular reference to the electrolytic treatment of slide fasteners in closed form and in long strips, the treatment being of a continuous nature.

From the following description, it will be evident that the invention is applicable to the electrolytic treatment of such fasteners in general, but to simplify the description, stress will be particularly laid on the anodizing of aluminum or aluminum alloy elements, the handling of the elements evidently being applicable to treatment such as electroplating.

For many uses, particularly in clothing, the natural color of the metal from which the slide fastener elements are formed is objectionable and, consequently, it has been generally customary to provide covering flaps for slide fasteners to hide the elements from view. These flaps, however, are not always desirable and in many instances a better appearance of the product would result if the slide fastener elements, though exposed to view, were colored either to match the adjacent fabric or to contrast with it to provide ornamentation. Various methods of coloring or attempting to color elements have been used. For example, the exposed portions of slide fastener elements have been painted. When a garment having painted slide fasteners is sold the appearance may be quite attractive; but in use the paint very readily becomes dislodged and the irregular exposure of bare metal detracts greatly from the appearance of the garment. It has been recognized that a quite superior colored surface from the standpoint of resistance to wear could be produced if slide fastener elements were made of aluminum or its alloys and the exposed surfaces were oxide coated and then dyed. In particular, if this oxide coating was formed by anodizing the colored oxide coating, being extremely hard, would be quite resistant to wear.

While the desirability of providing colored aluminum slide fasteners of the type just mentioned has been recognized, serious difficulties are involved in securing these results in an inexpensive and commercially feasible fashion. Desirably, commercial production should involve the handling of continuous strips of closed slide fasteners, i.e. slide fasteners comprising the interengaged elements secured to fabric tapes. The process should furthermore be completely consistent with the use of standard slide fastener-forming machines and should involve no material change in the form of the slide fastener elements.

In the case of a closed slide fastener, it might appear that all of the slide fastener elements are in series contact and that, consequently, it would be possible to secure electrical connection with all of the elements by connection with an electrical current source at one end of the strip. In fact, however, this is not the case at least to the extent of providing sufficiently good electrical contact to insure the proper carrying of current with substantially negligible resistance through any considerable length of the strips. In particular, anodizing of aluminum slide fastener elements requires relatively heavy currents and the resistance, due to poor contacts, would cause a very rapid falling off of voltage along the slide fastener. In accordance with my Patent No. 2,572,838, dated October 30, 1951, there is provided a method for the electrolytic treatment of slide fasteners involving the securing of good electrical contacts between the elements of a closed slide fastener by imparting a sinuous form thereto which insures tight electrical engagement at the projections and sockets of the slide fastener elements. The method disclosed in said patent is, however, adaptable only to the anodizing or other electrolytic treatment of finite lengths of slide fasteners inasmuch as the sinuous configuration can be achieved satisfactorily only through racking.

Various other methods for the anodizing or other electrolytic treatment of slide fasteners have been proposed but these generally involve special slide fastener constructions or the use of special apparatus for forming or handling the slide fastener elements. In my Patent No. 2,596,888, dated May 13, 1952, there is disclosed a method involving the preliminary treatment of a shaped wire from which the slide fastener elements are formed. It is, however, from the standpoint of simplicity of production, desirable to effect the electrolytic treatment on a finished closed slide fastener and, in particular, this is desirable when the slide fastener elements and the carrying tape are to be given the same color. This is possible in the case of anodized aluminum slide fastener elements, when the completed closed slide fastener may be subjected to dyeing which will color not only the anodized coatings of the elements but the carrying tapes as well.

The general object of the present invention, therefore, is to provide a method and apparatus for the electrolytic treatment of closed slide fasteners which, in the case of anodizing of aluminum slide fastener elements may be followed by dyeing. In accordance with the invention, and without detriment to the slide fasteners, good electrical contacts between the slide fastener elements are secured resulting in the possibility of handling closed slide fasteners continuously in substantially the same fashion as one might handle a wire in electrolytic treatment thereof.

The foregoing and other objects of the invention will become apparent from the following description read in conjunction with the accompanying drawing, in which:

Figure 1 is a diagrammatic sectional view showing one fashion of advancing a slide fastener through an electrolytic tank;

Figure 2 is a fragmentary plan view of the same;

Figure 3 is a sectional diagram showing the assembly within an electrolytic tank;

Figure 4 is a section similar to Figure 1 but showing a modified type of slide fastener feeding means;

Figure 5 is a diagrammatic fragmentary view of a portion of a slide fastener of modified construction for carrying out the invention; and

Figure 6 is a sectional diagram showing still another modification provided in accordance with the invention.

Referring first to Figures 1, 2 and 3, there is shown

therein a conductive rod 4 which provides a current lead to the slide fastener elements of a closed slide fastener which are progressed thereon. This rod 4 is contained within a slot in an insulating support 2, the upper end of the rod 4 projecting from the slot. In the case of anodizing, the rod 4 will be of aluminum or a suitable aluminum alloy. Electrical contacts are provided to the rod 4 through connections 6 inserted in the member 2, these conductors 6 being joined to the current lead indicated at 8. Desirably, there are a number of these leads particularly in cases of anodizing when heavy currents are supplied. By distributing the leads along the rod 4 potential drop is minimized and the anodizing action is maintained more uniform.

The support 2 is provided with surfaces 10 sloping downwardly and outwardly from the rod 4. Cooperating with these surfaces are belts 12 of rubberized material which clamp against the surfaces 10 the tapes 16 of a slide fastener Z. These tapes carry in usual fashion the slide fastener elements 14 which are clamped on beads 18 woven into the edges of the tape in usual fashion. The slide fastener elements, as usual, are provided with sockets 20 and projections 22 which interengage when the slide fastener is closed.

Both the sockets and projections are of generally pyramidal form, somewhat elongated in the vertical direction as viewed in Figure 1. Since the sockets and projections are formed by punching, it will be found that in general both are not of well defined shape but are merely generally pyramidal with rounded edges and corners. Nevertheless, due to the elongation which has been mentioned, when the slide fastener is closed it will be found that the elements 14 cannot be rotated relatively to each other through any large angle and this is explainable by the elongation of the projections and sockets which cause them to relatively jam as indicated in Figure 1. It is this feature which is in part utilized to promote good electrical contact between adjacent slide fastener elements. The carrying tapes 16 are generally substantially inelastic so that despite the pyramidal forms mentioned above the projections cannot disengage from the sockets by relative movement in a direction lengthwise of the slide fastener.

Preferably, the belts 12 which serve to move the tapes along the support 2, and are suitably driven for this purpose, are so arranged as to diverge in the direction of advance of the slide fastener in contact therewith. By reason of this divergence, which may be slight and is exaggerated in Figure 2, the tapes are pulled apart and this pulling is relieved by slippage of the tapes transversely to the belts. A tension is thus applied tending forcibly to pull the projections 22 outwardly of the sockets in which they are received in a direction transverse to the length of the slide fastener.

For the electrolytic treatment the elements described are immersed in an electrolyte 36 in a tank 26, the slide fastener strip Z being introduced into the tank from a supply reel 27 about a pulley 28 and withdrawn therefrom about a pulley 30 to be taken up by a receiving reel 31, which reel may, in practice, actually follow a rinsing bath. An electrode 32 of suitable metal for the electrolytic process involved is immersed in the electrolyte and is connected to one of the supply terminals 34 the other of which is connected to the rod 4. If electrolytic plating is being carried out, direct current will be used in the usual fashion; but in the case of anodizing, either direct or alternating current may be used and in the case of the latter the electrode 32 may be replaced by another slide fastener and feeding and contacting assembly, the two slide fasteners then becoming alternately anodic during successive half cycles. The broken lines in Figure 3 indicate that the tank and assembly therein may be of any required length, there being multiple pairs of belts such as 12 to maintain the holding, separating and feeding action along the entire length of active treatment of the slide fastener. As will be obvious the rate of advance of the slide fastener and the length of the tank are so chosen that each slide fastener element is subjected to the process involved for the desired length of time. In the case of anodizing there is desirably used a rapid process, preferably using sulfuric acid as the electrolyte, which minimizes the time required for the treatment of each element and, consequently, increases the rate at which the slide fastener may move and decreases the necessary length of the tank. It will, of course, be understood that a plurality of slide fasteners will generally be run in parallel through the same tank. The proper maintenance of electrical contact between the slide fastener elements is achieved in the arrangement described due to two independent conditions which, however, are desirably used together to insure the best possible contact and minimum contact resistance. The two conditions, however, may be used independently.

First, due to the fact that the slide fastener elements secured to the two tapes are relatively angularly displaced as indicated in Figure 1, so that each is in line contact with the upper surface of the rod 4, there is produced a jamming of the projections 22 in the sockets 20 due to their elongation. This jamming, with prevention of lengthwise separation by the inelasticity of the tapes, provides a highly effective maintenance of good electrical conductivity continuously through a considerable number of the slide fastener elements. This continuity of the conductive condition is necessary because the slide fastener elements are by no means perfectly formed and vary in thickness in a vertical direction as viewed in Figure 1. If it were not for the contact between the elements it would be very likely that many of them would not engage the rod 4, being held away from the rod by those of greater thickness. When, however, an angular displacement is produced providing the jamming above described, it is not necessary that each element should engage the conducting rod 4 since there will be adequate current conduction to all of the elements, to some by direct contact with the rod 4 and to others by virtue of the contacts between the elements. Accordingly, uniformity of surface current conditions is attained together with proper electrolytic action.

If the electrolytic action is one of anodizing, the rod 4 will also tend to anodize and would normally have an insulating or high resistance anodic coating built up thereon. However, by maintaining line contact the slide fastener elements scrape the rod and remove any minute coating which may be momentarily formed on the upper contacting surface of the rod. Good electrical continuity therefore, is maintained.

The second condition is achieved by virtue of the lateral pulling apart of the tapes by the diverging belts 12. This action brings the projections 22 tightly against the outside walls of the sockets 20 in which they are received providing an additional contact under substantial force. It has been found that the two conditions which have been described may be used independently, each providing good continuity of conduction between the slide fastener elements. By their combination, as in the arrangement above described, excellent conductivity is assured.

It will be evident that only the upper and side surfaces of the elements as viewed in Figure 1 will be fully subjected to the electrolytic (plating or anodizing) action, but this is unobjectionable since, in general, only one side of a closed slide fastener is visible during use.

It should be noted that the upper surfaces of the zipper elements are freely exposed to the electrolyte and are unobstructed by anything which would inhibit the free escape of gases. This is an essential condition to prevent polarization and interruption of current flow by formation of gas films or pockets.

The same general conditions as exhibited in Figures 1 and 2 may be secured in accordance with Figure 4 in which the rod 41 corresponds to rod 4 and the support 38 corresponds to support 2. In this case, however, in-

stead of utilizing divergent belts there is provided on each side of the slide fastener a pair of pulleys **39** about which are trained belts **40** of rubberized material having teeth **42** arranged to engage and compress the beads **18** of the slide fastener. While, as illustrated in Figure 4, the downwardly applied force on each bead tends also to flex the slide fastener elements about the longitudinal center line of the slide fastener and provides a component of force downwardly and outwardly, it has been found that even if the slide fastener is flat and compressive forces are applied to the beads between the slide fastener elements in directions perpendicular to the flat slide fastener, the slide fastener elements are pulled apart due to compression of the beads which tend then to expand outwardly engaging and pushing the slide fastener elements outwardly. As will be evident the teeth **42** which are indexed to fit between the alternate slide fastener elements serve to provide a feed for the slide fastener, the belts **40** being driven through the pulleys at a suitable rate.

The last mentioned type of action tending to provide good electrical contact between the elements may be achieved by slight modification of slide fastener construction in accordance with Figure 5. Therein the tapes **41**, inelastic in the direction of their length, have their beads formed by the incorporation of heavy elastic rubber strands **43** rather than the usual relatively inelastic heavy cotton strands. Except for this substitution the tapes are of conventional structure and carry the slide fastener elements **45**. When the elements are clamped in position, the rubber strands **43** are compressed and bulge outwardly between the elements providing abutting regions **47** which engage and press outwardly the elements on the other tape. Thus each projection is forced to engage the outer wall of its receiving socket as exaggeratedly indicated in Figure 5. Since the tapes are longitudinally inelastic, the pressure cannot be relieved by relative longitudinal separations of the elements and tight electrical contact is secured. The slide fastener thus provided is progressed through an electrolytic tank in closed condition in contact with a rod or a conducting plate in the same fashion as previously described, there being, however, no necessity for promoting additional contacts by flexing of the slide fastener or pulling apart of its tapes.

Figure 6 shows still another alternative which may be utilized in accordance with the invention. In this modification the rod **44** is similar to the rod **40** and performs a similar function. The slide fastener is progressed along the rod by means of a series of rollers **46** which may be provided with friction surfaces of rubber or rubberized material. As indicated in the figure these rollers are progressively smaller in the direction of feed, and if they are driven at the same angular speed, for example, by a chain trained over equal size sprockets on their shafts, the slide fastener elements will be compressed together in the direction of feed and thus good contact between them is established. Between the rollers the slide fastener may be maintained in contact with the rod **44** by pressers **48** acted upon by springs **50**. These pressers desirably act only on the tapes so as not to mask the zipper elements from the electrolytic action.

The particular treatment involved depends entirely upon the results desired and need not be detailed, reference being made to the discussions of suitable baths, dye procedures and sealing procedures set forth in my patents mentioned above, any of which are herein applicable. As therein pointed out, when anodizing of aluminum slide fastener elements is being effected followed by dyeing, the cotton tapes may be simultaneously dyed, or, alternatively, the cotton tapes may be pre-dyed or subsequently dyed in contrasting colors or with different types of dyes even in substantially the same colors as the slide fastener elements.

Desirably in a continuous anodizing process such as any herein described there is used a type of bath which will effect anodizing in a minimum of time, utilizing high current densities, so that the progress of the tapes may be speeded up consistently with having each element subject to the anodizing action for a sufficient period to secure the desired thickness and type of coating. Sulfuric acid electrolytes are suitable for such anodizing utilizing direct or alternating current, in which case both electrodes **4** and **32**, for example, may be of aluminum. Alternatively, if alternating current anodizing is effected, there may be two sets of slide fasteners in the bath, both moving along and in contact with electrode members such as **4**, the two electrodes being connected to the terminals of the alternating current supply. Numerous anodizing procedures of known types may be used and consequently need not be specifically described.

It will be evident that electroplating may be effected in the same general fashion using, of course, direct current. In the case of electroplating with a metal, the conductivity of the plated surface will not be reduced by the plating operation and it is, therefore, possible to invert the tape in a second path through the bath with its originally plated surface in contact with an electrode to secure plating of the other side of the slide fastener. As pointed out above, however, this is not generally of importance since the slide fastener will be finally used with a particular face exposed.

Reference is made to my United States Letters Patent No. 2,790,756, filed of even date herewith for further methods in accordance with the invention.

What is claimed is:

1. Apparatus for the electrolytic treatment of a closed slide fastener having metallic interengaging slide fastener elements secured to fabric tapes comprising a tank adapted for containing an electrolytic bath, an elongated metallic conductor stationarily mounted within said tank, said conductor being adapted for serving as a rail over which successive completely submerged lengths of said closed slide fastener may be moved with said interengaging slide fastener elements in sliding electrical line contact with said conductor and with all areas thereof exposed to electrolytic treatment except at the lines of said electric contact, and means for frictionally engaging the opposed tape sections of the slide fastener lengths successively overlying said conductor, means for driving said tape engaging means, said engaging means being capable of being actuated by said driving means for guiding and progressively pushing said slide fastener along and pressing the same against said conductor with said interengaging slide fastener elements in sliding electrical contact with said conductor and exposed to treatment as aforesaid.

2. Apparatus for the electrolytic treatment of a closed slide fastener having metallic interengaging slide fastener elements secured to fabric tapes comprising a tank adapted for containing an electrolytic bath, an elongated metallic conductor stationarily mounted within said tank, said conductor being adapted for serving as a rail over which successive completely submerged lengths of said closed slide fastener may be moved with said interengaging slide fastener elements in sliding electrical line contact with said conductor and with all areas thereof exposed to electrolytic treatment except at the lines of said electric contact, and means for frictionally engaging the opposed tape sections of the slide fastener lengths successively overlying said conductor, means for driving said tape engaging means, said engaging means being capable of being actuated by said driving means for guiding and progressively pushing said slide fastener along and pressing the same against said conductor with said interengaging slide fastener elements in sliding electrical contact with said conductor and exposed to treatment as aforesaid, and for simultaneously urging said opposed tape sections to part thereby to urge said interengaging slide fastener elements into good electrical contact with one another.

3. Apparatus as defined in claim 1 wherein the slide fastener guiding and pushing means includes endless belt means acting to turn the slide fastener elements respectively on opposite sides of said conductor downwardly over the latter to position the same at an angle relative to one another.

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