APPARATUS FOR ELECTROTREATING METAL SLIDE FASTENERS

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AGENT
My invention relates to a method of, and to equipment for, electrotreating metal slide fastener elements. More particularly, the invention pertains to electrotreating slide fastener elements which are spacedly attached along an edge of a tape or band of metal for cooperation with mating slide fastener elements, such tape when provided with a series of slide fastener elements being generally referred to as a slide fastener stringer.

Great difficulties are encountered in electrotreating scoops or slide fastener elements when mounted on a carrier of an electrically non-conducting material, such as a cotton tape. The primary object of this invention is to generally improve the method of, and the means for, electrolytically plating or otherwise electrolytically coating of scoops or slide fastener elements mounted on a non-conducting tape.

In surface treating scoops by electrolytic means, it has been the practice to treat loose or unattached scoops and to secure already treated scoops to tapes. Such treatment is only applicable to a method of manufacturing slide fasteners wherein scoops prior to their attachment are individually finished and may individually be subjected to various treatments. However, since methods of manufacturing slide fasteners in this way are relatively slow and are being more and more abandoned, the electrolytic treatment of unattached scoops is also being relinquished. It is also customary to weave into, or otherwise intimately unite with, a slide fastener tape a metal conductor to provide electrical contact along all of the scoops attached to that tape. But the incorporation of metal conductors in a tape usually impairs the flexibility of the stringer and thus involves a disadvantage. It has also been suggested to electroplate scoops or slide fastener elements by means of special equipment. In one of the suggested apparatus a slide fastener stringer is passed around metallic rollers arranged for individual rotation about their axis. This apparatus is complicated. It is an object of this invention to provide a simple and economic means for electrically charging the scoops of at least one slide fastener stringer at a time while it passes through the electrolytic bath.

Recently a suggestion has been made to use an external conductor in strip form for providing electrical contact between the engaged scoops of a slide fastener. Yet this suggestion involves the disadvantage that the conductor suggested will readily be crushed and ruined and cannot be used in continuous processes. One of the main objects of my invention centers about the provision of an external conductor which will temporarily interlocked with at least one stringer but which, from a practical point of view, is not perishable and can be used in continuous processes without the need, incident to the aforesaid prior suggestion, of restoring the used and ruined strip to a new use or of discarding the strip.

Another object of my invention is to provide conductors adapted to individually engage each slide fastener element of a series of such elements when attached in uniformly spaced relation to a tape of non-conducting material. The conductor according to my present invention is flexible and capable of being fixed when united with a slide fastener stringer, and it is used in endless form.

A further object of my invention is to provide an apparatus which connects at least one stringer, before it enters the electrolytic bath, with a suitable conductor and which disconnects both after leaving this bath.

Still another object is to provide means for regenerating those parts of the equipment necessarily plated during the passage through an electrolytizing bath.

To the accomplishment of the foregoing and other more particular objects which will hereinafter appear, my invention consists in the method steps and apparatus elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings, in which:

Fig. 1 is a fragmentary, partially sectioned plan view illustrating the operation of one form of the pull-up fixture according to the invention, the pull-up fixture being used to lock two slide fastener stringers into a coil spring or to unlock such assembly;

Fig. 2 is an end elevation of the view of Fig. 1;

Fig. 3 is an enlarged fragmentary view toward the beaded edge of one of the two stringers shown in Fig. 1, and illustrating the engagement of the coil spring with the scoops of that stringer;

Fig. 4 is a diagrammatic plan view illustrating one form of a plated apparatus;

Fig. 5 is a side elevation of the same with parts removed;

Fig. 6 is explanatory of the operation of the apparatus of Figs. 4 and 5;

Fig. 7 is a fragmentary, isometric view showing diagrammatically an electrotreatment apparatus;

Fig. 8 is explanatory of the operation of the apparatus of Fig. 7;

Fig. 9 is a cross section through the conductor used in the apparatus of Fig. 7;
Fig. 10 is a fragmentary, partially sectioned view illustrating, in plan, the pulling up of a stringer with the conductor of Fig. 9 by means of another form of a pull-up fixture.

Referring to the drawing, the apparatus in all forms shown is intened to electrolytically treat working having metallic elements attached in spaced relation upon the edge of a continuous non-conducting carrier. The specific example shown is a slide fastener stringer comprising, in Fig. 1, the two non-conducting textile tapes 26 and metallic fastener elements 28, or in Figs. 7 and 10, the single non-conducting textile tape 12 with metal fastener elements 28 indicated along its edge. In accordance with the present invention, the apparatus comprises not only a tank containing an electrolyte, but also an endless supporting flexible conductor comprising conductor metallic elements formed, dimensioned and spaced for temporary interlocking engagement with each of the work metallic elements, and also a fixture for guiding the conductor and the work into engagement in such a fashion that the metallic elements are interlocked with the work elements. In Fig. 1 a fragment of the endless supporting conductor is shown at 14, and the fixture at 16, while in Fig. 10 the endless supporting conductor is shown at 72, and the fixture at 74.

As is usual in electroplating, the tank is provided with an electrode immersed in the electrolyte, and the polarity of the potential applied to the electrode depends upon the particular metal being treated. In other words, the treatment may be either cathodic or anodic.

If desired, the endless supporting conductor may be de-plated, and for this purpose a de-plating tank 54 is shown in Fig. 4. However, the advisability of de-plating depends upon the economics of the process, considering for example, the value of the metal recovered, and the cost of the endless conductor which, if not de-plated, must eventually be discarded and replaced. That de-plating is optional is shown in Figs. 6 and 8, Fig. 9 schematically showing the process with de-plating, and Fig. 8 schematically showing the process without de-plating.

The endless supporting conductor is illustrated in two forms. In Figs. 1, 2 and 3 the endless supporting conductor is a helical coiled spring 16 which is formed by the fixture 18 with two continuous slide fastener stringers 26. In Figs. 9 and 10 the endless supporting conductor is a slide fastener stringer having not only a tape 82 and fastener elements 84, but also an electrical conductor 88 extending longitudinally thereof in contact with and connecting the metallic elements. As here illustrated, the conductor forms a part of the head of the fastener tape. Fig. 10 shows how a fixture 74, generally resembling a slider, serves to guide the endless supporting conductor 72 and the unplated slide fastener 72 into meshing engagement.

Considering the invention in greater detail, and referring first to Figs. 1 and 2 of the drawing, a pull-up fixture 10 serves to connect two identical slide fastener stringers 12 with a coil spring 14 of the helical type. The fixture fixture consists of a main body 46 and a tube 18. The body 16 comprises an annular portion 20 and two pairs of parallel walls 22, each wall having an internal side flanges 24. The tube 18 is, as shown in Fig. 1, at the wide end of the body 16 and forms a continuation of the annular portion 22. The body 16 defines a channel 29, shown in Fig. 1, functioning to lock the stringers into the coil spring, or to separate the stringers from the coil spring when engaged with each other. The coupling and uncoupling action of the pull-up fixture 10 conforms, as will hereinafter be shown, to the respective direction in which the coil spring and stringers are fed into the pull-up fixture. Each of the stringers 12 comprises a tape 28 having slide fastener elements 26 attached to its headed edge 32. The tapes and heads being of a non-conducting material, there can be no electrical contact between the fastener elements of either stringer. The coil spring 14 is to furnish a continuous contact along the fastener elements of each stringer.

From inspection of Figs. 1 and 3, the function of the fixture 12 will be clear. The stringers 12 and the coil spring 14 are threaded through the fixture in the direction of the arrow X indicated in Fig. 1, that is to say, the coil spring is inserted at the free end of the tube 18 and passed straight through the tube and the annular portion 23 of the fixture body 16, while the stringers are convergently passed through the fixture body. The engagement of the coil spring with the stringers takes place in the straight stem of the channel Ch. In order that this engagement be possible for this engagement, its pitch must be substantially equal to the pitch of the fastener elements, and the diameter of the spring wire substantially equal to the spacing between the fastener elements. The pitch of the fastener elements is the distance from one point on a fastener element to the corresponding point on the adjacent element of the same stringer, or the thickness of an element plus the spacing between two adjacent elements. Any coil or turn of the coil spring 14, as shown in Fig. 3, touches one fastener element at 2 and the adjacent fastener element of the same stringer at U. From Fig. 3, it will also be clear that each fastener element of either stringer is in contact with two adjacent coils of the spring, for instance, the coil 236 with the coils or turns 24C and 24C' (see also Fig. 1); by choosing the correct wire diameter a positive electrical contact between the spring and each of the elements of the two stringers is secured. In Fig. 1, it is shown how spaced portions of the coil spring after the engagement of the spring with the stringers, are nested in their seats S, each seat being formed by two adjacent fastener elements of the same stringer and the respective tape bead. It will be obvious that a tight fit is necessary to provide a reliable electrical contact.

It will be understood that a pull-up fixture of the type of the fixture 10 can be so constructed as to connect a coil spring with one stringer only.

The apparatus shown in Figs. 4 and 5 illustrates the use of the coil spring 14 for electrically charging elements 28 of two slide fastener stringers 12 during the passage through an electroplating bath. A pair of rolls 31, 31' at the entry side of a tank 32 pulls the coil spring and the stringers through a pull-up fixture 10', which is identical with the fixture 10, shown in Figs. 1 to and 2, and functions here to connect the stringers with the coil spring. The coil spring passes in the direction of the arrow Y over a wheel 34, carried on a stand 35, and through the guide tube 18' of the fixture 10', whereas the two stringers 12 are centrifugally fed into the pull-up fixture after being prepared for the now following electroplating step. The connected structure Ss, as
it leaves the rolls 21, 31', is pulled through the tank 32 by another pair of rolls 38, 38' at the exit side of the tank. The rolls 38, 38' are arranged in the same way as are the rolls 21, 31'. The rolls 31 and 38 are power driven, whereas the rolls 31', 38' are idle. The driven rolls 31 and 38 are mounted on shafts 40 and 42 respectively, and these shafts are provided with pulleys 44 and 46, respectively, connected to motors (not shown). The idle rolls 31' and 38' are firmly pressed against the stringer tapes. The rolls 31 and 31', as well as the rolls 40 and 50, are provided with grooves disposed circumferentially around the periphery of each roll and adapted to accommodate the coil spring 14.

The rolls 40 and 50 are suitably journaled underneath the level 51 of the electroplating bath, and the structure 52 passes under them for the desired electrolytic deposition. After leaving the tank the structure 52 passes around the exit guide roll 52, also provided with a groove G, and through the fixture 10'. The fixture 10' is identical with the fixture 10 and is used in the reverse manner for the purposes of passing the stringers as soon as disjoined from the coil spring pass through the rolls 38, 38'. The coil spring moves toward, and passes around, the guide wheel 34' carried on a stand 35', enters a tank 54, thereby passing over the entry roll 56, under the rolls 58, 58 and over the exit roll 59', and finally returns to the wheel 34. The rolls 58, 58 guide the coil spring through the electrolyte in the tank 54. The rolls 56, 58, 58, 56' are likewise provided with grooves G.

In this electroplating process the tank 32 serves the purpose not only of depositing elements 28 of the two stringers 12 but also the coil spring 14 are being plated. The tank 54 is used to discharge into its electrolyte the metal which has been deposited upon the coil spring during its passage through the plating bath of the tank 32.

The positive wire 60 of the plating circuit is connected to the anodes 62 of the plating metal which anodes are suspended in the bath of the tank 32 from insulated bars 64 by hooks 66. Cathodes 68 in the plating tank 54 are electrically charged by being connected by means of the wire 61 to the negative pole of the source of power used. In operation, the current passes from the anodes through the electrolyte to the structure 52 because this structure faces the anodes, and hence, has a negative polarity. The current carries metal from the anodes and deposits it on the slide fastener elements and on the coil spring. As soon as the coil spring faces the cathodes 68 in the plating tank it assumes positive polarity, and the metal deposited on the coil spring is being stripped.

With the arrangement shown, insulated rolls are used. All of the rolls are formed or covered with a suitable insulating material.

The principle of the electroplating apparatus as shown in Figs. 4 and 5 will be best understood from Fig. 6 in which a slide fastener stringer 12 moving in the direct direction shown has a pair of springs connected with the coil spring 14 or any other suitable endless electrical conductor moving in the direction of the arrow Q. It will be understood that two slide fastener stringers can just as well be connected with the coil spring. The assembled stringer passed through the plating tank 32, the conductor supporting the stringer during its passage through the tank. After leaving this tank the assembled structure is separated whereupon the stringer 12 is subjected to the treatment next following in the manufacturing line while the coil spring 14 passes through the plating tank 54. The current is supplied from a suitable source 10 to the anodes 62 disposed in the tank 32, and conducted away from the structure 52 disposed in the tank 54. While the conductor or coil spring 14 moves through the plating tank, the plating metal is deposited both on the conductor and stringer due to the negative polarity assumed by the conductor. As the conductor moves on into the deplating tank where it faces the cathodes, the metal which has been deposited thereon will be stripped.

The process according to the invention is applicable to any known electrolytic surface treatment, such as, anodizing, providing with a corrosion resistant film, electro-color plating, etc.

In a method of anodizing or anodically oxidizing, for instance aluminum scoops, no second electrolytic bath is needed. The circuit in such anodic oxidation of aluminum includes the anode, formed by the parts of the apparatus as shown in the figure disposed by the conductor connecting the scoops, the electrolyte, and a suitable cathode. Neither is a second tank needed in the method of imparting a corrosion resistant film to metals, an example of which method is disclosed in the co-pending application of Hans Bermann and Sigmund Katz, Ser. No. 564,545, filed November 21, 1944, now abandoned. This electrolytic treatment also uses the connected conductor-stringer-structure as an electrode.

The modification shown in Fig. 7 differs in two main respects from that shown in Figs. 4 and 5. In Fig. 7, an apparatus for electroplating having one tank only is shown. A conductor 72 moving in the direction of the arrow W is connected with a stringer 12 by means of a pull-up fixture 74, and the connected conductor and stringer is guided through the electrolytic bath in the tank 76 (shown in phantom) and thence through the pull-up fixture 74' to separate the assembly. The conductor supports the stringer in its passage through the tank 76. One wire of the electroplating circuit is connected to the conductor by means of a spring 38' and another wire is connected to the other wire is connected to an electrode 80 in the tank 76. The principle of the apparatus of Fig. 7 is most clearly illustrated in Fig. 8.

The conductor used in the apparatus of Fig. 7 is more clearly shown in Fig. 9. It is generally designated as 72, and it resembles a slide fastener stringer in that it comprises a tape 82 having metal members 84 spacedly clamped around a beaded edge 86. The head 86 is formed by two cords 88 and 92 disposed on opposite sides of the tape. While the tape 82 and cord 88 are of a non-conducting material, the cord 92 consists of a braided metallic cord and is conducting.

Referring now to Fig. 10, the pull-up fixture 74 of Fig. 7 functions like a slider for slide fasteners to couple the conductor 72 and the slide fastener stringer 12 together or to uncouple same. The members 84 of the conductor 72 in the same spaced relation as are the slide fastener elements 28 to the tape 28, and are provided with interlocking means (projections P and depressions D) adapted to cooperate with the interlocking means of the fastener elements 28. The numbers 84 fit tightly between the fastener elements 28 and secure a substantial electrical contact between the conducting cord 90 and each fastener element.
In a continuous electrotreating process great lengths of slide-fastener stringers must be subjected to the electrolytic bath. It is to be understood that the novel features incorporated in the apparatus shown in Figs. 4 and 5 and Fig. 1, respectively, are applicable to an apparatus wherein any desired length of a stringer will be subjected to the electrotreatment at any one instant. This may be done in any known way, for instance, by passing the stringers in slings through the electrolytic baths. With such an arrangement it will be necessary to provide additional positive driving means distributed along the processing line in order to avoid undue high tension of the stretchable slide fastener tapes at any one point. It will also be understood that in each of the possible processes according to my invention various steps must be carried out prior to and after each electrotreatment operation which steps are generally known and need not be specifically mentioned. In a process like that illustrated in Figs. 4 and 5 there, will also be steps to be carried out between the electrotreatment operations.

The novel and improved apparatus of my present invention, the disclosed method and the advantages in the use and operation thereof will, I believe, be fully apparent to the person skilled in the art from the above disclosed description thereof. It will be further apparent that many changes may be made both in the apparatus and method without departing from the spirit of the invention defined in the following claims.

1. Apparatus for electrolytically treating work having metallic elements attached in spaced relation upon the edge of a continuous electrically non-conducting carrier, said apparatus comprising a tank containing an electrolyte, an endless, supporting, flexible electrical conductor comprising a helical coiled spring, the turns of the spring having substantially the same pitch as the fastener elements, means for temporarily interlocking the spring turns into engagement with each of the fastener elements, means for feeding the spring-engaged and supported work through the tank, and a fixture for separating the spring from the work.

2. Apparatus for electrolytically treating the spaced, electrically unconnected, metallic fastener elements of a continuous slide fastener stringer comprising a tank containing an electrolyte, an endless, supporting, flexible electrical conductor comprising spaced, electrical-conductor-connected metallic elements, the spaced metallic elements having substantially the same pitch as the fastener elements on said continuous stringer, and an endless, supporting, flexible electrical conductor comprising a helical coiled spring, the turns of the spring having substantially the same pitch as the fastener elements, means for temporarily interlocking the spring turns into engagement with each of the fastener elements, means for feeding the spring-engaged and supported work through the tank, and a fixture for separating the spring from the work.

3. Apparatus for electrolytically treating the spaced, electrically unconnected, metallic fastener elements of a continuous slide fastener stringer comprising a tank containing an electrolyte, an endless, supporting, flexible, electrical conductor comprising a helical coiled spring, the turns of the spring having substantially the same pitch as the fastener elements, means for temporarily interlocking the spring turns into engagement with each of the fastener elements, means for feeding the spring-engaged and supported work through the tank, and a fixture for separating the spring from the work.

4. Apparatus for electrolytically treating the spaced, electrically unconnected, metallic fastener elements of a continuous slide fastener stringer comprising a tank containing an electrolyte, an endless, supporting, flexible, electrical conductor comprising a helical coiled spring, the turns of the spring having substantially the same pitch as the fastener elements, means for temporarily interlocking the spring turns into engagement with each of the fastener elements, means for feeding the spring-engaged and supported work through the tank, and a fixture for separating the spring from the work.
potential with respect to the potential of the anode, means for temporarily interlocking into engagement the electrically connected metallic elements with each of the electrically unconnected fastener elements to thereby form the cathode, means for feeding the temporarily interlocked strings through the tank, and means for separating them.

8. Apparatus for anodizing the spaced, electrically unconnected aluminum fastener elements of a continuous slide fastener stringer, comprising a tank containing an electrolyte, a cathode in contact with the electrolyte, an endless, supporting, flexible, electrical conductor comprising spaced, electric conductor connected metallic elements, the spaced metallic elements having substantially the same pitch as the fastener elements and being of a contour to permit temporarily interlocking engagement with each of the metallic fastener elements, means for progressively and temporarily interlocking the conductor connected metallic elements into engagement with each of the electrically unconnected fastener elements, means for separating the endless supporting conductor from the stringer as they leave the tank, a second tank containing an electrolyte, a cathode in contact with the electrolyte of said second tank, and means for feeding the endless, flexible conductor through both tanks and the aforementioned means.

9. Apparatus for anodizing the spaced, electrically unconnected, aluminum fastener elements of a continuous slide fastener stringer, comprising a tank containing an electrolyte, a cathode in contact with the electrolyte, an endless, supporting, flexible, electrical conductor comprising a helical coiled spring, the turns of the spring having substantially the same pitch as the fastener elements, the spring having a positive potential with respect to the potential of the cathode, means for temporarily interlocking the spring turns into engagement with each of the fastener elements to thereby form the anode, means for feeding the temporarily interlocked supported stringer through the tank, and means for separating the endless, flexible conductor from the stringer.

10. Apparatus for electroplating the spaced, electrically unconnected, metallic fastener elements of a pair of continuous slide fastener stringers, the pitch of the fastener elements on both stringers being substantially the same, comprising a tank containing an electrolyte, an anode in contact with the electrolyte, an endless, supporting, flexible, electrical conductor comprising a helical coiled spring, the turns of the spring having substantially the same pitch as the fastener elements on the pair of stringers to permit temporarily interlocking engagement with each of the metallic fastener elements, means for progressively and temporarily interlocking the spring turns into engagement with each of the electrically unconnected fastener elements of both stringers, means for separating the spring from the stringers as they leave the tank, a second tank containing an electrolyte, a cathode in contact with the electrolyte of said second tank, and means for feeding the spring through both tanks and the aforementioned means.

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