April 30, 1957 C. C. COHN 2,790,756

METHOD AND APPARATUS FOR ELECTROLYTIC TREATMENT OF SLIDE FASTENERS

Filed July 29, 1952 2 Sheets-Sheet 1

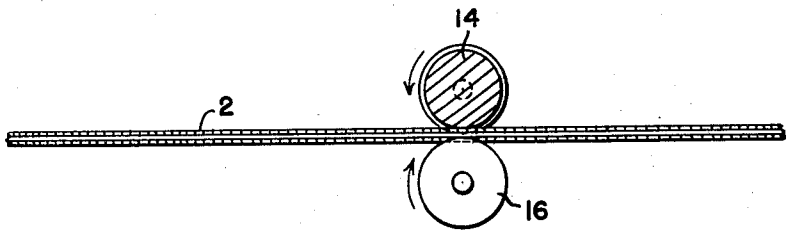


FIG. 1.

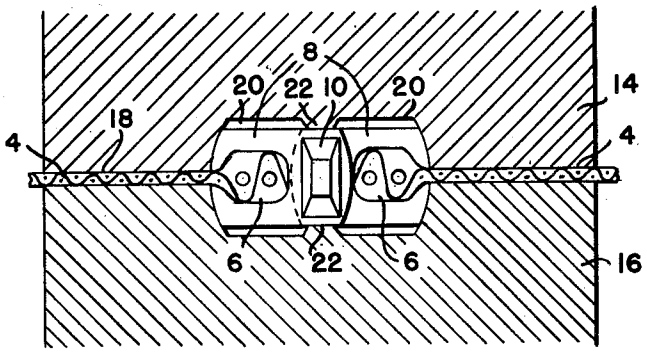


FIG. 2.

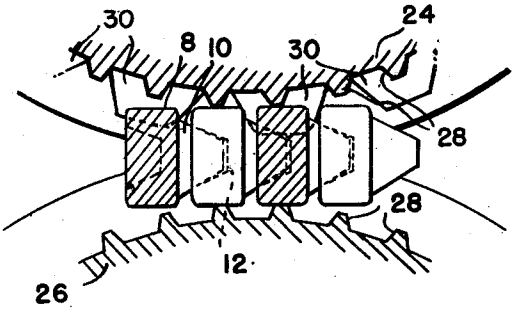


FIG. 3.

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METHOD AND APPARATUS FOR ELECTROLYTIC TREATMENT OF SLIDE FASTENERS

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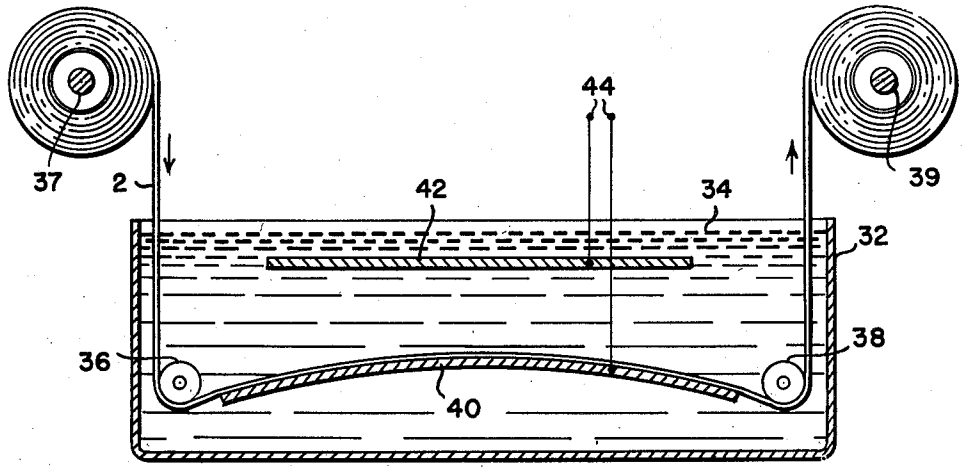


FIG. 4.

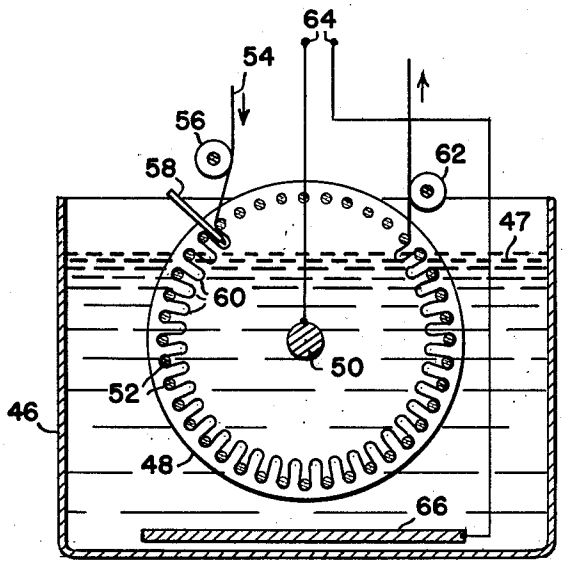


FIG. 5.

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METHOD AND APPARATUS FOR ELECTROLYTIC TREATMENT OF SLIDE FASTENERS

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Application July 29, 1952, Serial No. 301,509

2 Claims. (Cl. 204—23)

This invention relates to methods and apparatus for the electrolytic treatment of elements of slide fasteners of the zipper type, 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 zipper elements are formed is objectionable, and, consequently, it has been generally customary to provide covering flaps for zippers 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 zipper 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 zipper elements have been painted. When a garment having painted zippers 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 zipper 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 zippers 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 zippers, i. e. zippers comprising the interengaged elements secured to fabric tapes. The process should furthermore be completely consistent with the use of standard zipper-forming machines and should involve no material change in the form of the zipper elements.

In the case of a closed zipper, it might appear that all of the zipper 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 zipper elements requires relatively heavy currents and the resistance, due to poor contacts, would cause a very rapid falling off of voltage along the zipper. In accordance with my Patent No. 2,572,838, dated October 30, 1951, there is provided a method for the electrolytic treatment of zippers involving the securing of good electrical contacts between the elements of a closed zipper by imparting a sinuous form thereto which insures tight electrical engagement at the projections and sockets of the zipper elements. The method disclosed in said patent is, however, adaptable only to the anodizing or other electrolytic treatment of finite lengths of zippers inasmuch as the sinuous configuration can be achieved satisfactorily only through racking.

Various other methods for the anodizing or other electrolytic treatment of zippers have been proposed but these generally involve special zipper constructions or the use of special apparatus for forming or handling the zipper 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 zipper elements are formed. It is, however, from the standpoint of simplicity of production, desirable to effect the electrolytic treatment on a finished closed zipper and, in particular, this is desirable when the zipper elements and the carrying tape are to be given the same color. This is possible in the case of anodized aluminum zipper elements, when the completed closed zipper 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 zippers which, in the case of anodizing of aluminum zipper elements may be followed by dyeing. In accordance with the invention, and without detriment to the zippers, good electrical contacts between the zipper elements are secured resulting in the possibility of handling closed zippers continuously in substantially the same fashion as one might handle a wire in electrolytic treatment thereof. This general object of the invention and more detailed objects thereof will become apparent from the following description read in conjunction with the accompanying drawing, in which:

Figure 1 is a diagrammatic sectional view showing the preliminary treatment of a closed zipper to effect good electrical contact between the elements thereof;

Figure 2 is a transverse sectional view showing the same matter as Figure 1;

Figure 3 is an enlarged sectional view showing an alternative arrangement and procedure for securing good electrical contact between the elements of a closed zipper;

Figure 4 is a sectional diagram showing a type of electrolytic procedure which may be carried out as a continuous process; and

Figure 5 is a sectional diagram showing an alternative type of electrolytic procedure carried out as a continuous process.

The nature of the invention may be briefly described by stating that it involves a slight distortion of the interengaging portions of the elements of a closed zipper to provide tight electrical contact. As will appear hereafter, this probably takes advantage of the resistance of the relatively inelastic supporting tapes to extension in the direction of their lengths. The zipper elements contain projections which are roughly pyramidal in form, these being received in corresponding pyramidal openings in the adjacent elements. By applying pressure to the walls of the elements at the sockets, the sockets are reduced in transverse dimension and probably by a wedging action there is thus caused a movement between pairs of elements tending to move them away from each other. If all of the elements are thus treated, the aggregate tend-

ency to increase the effective length of the assembly of zipper elements at their regions of interengagement is resisted by the inelastic carrying tape and, consequently, the elements are held tightly together under a sort of spring action which is found to be sufficient to provide good electrical contact and low resistance through a long length of a closed zipper so treated. It then follows that by making electrical contacts at only spaced points good electrical connections are provided throughout considerable lengths of a continuous length of zipper so that electrolytic treatment may be satisfactorily effected.

Referring first particularly to Figures 1 and 2, there is indicated generally by the numeral **2** a closed zipper which may be of conventional type as generally produced and sold. Such a zipper comprises a pair of substantially inelastic tapes **4** which are beaded at their edges **6** along which there are clamped the zipper elements **8**. Each of these elements comprises a projection **10** and a socket **12** (shown in Figure 3). The projections and sockets are simultaneously formed in the zipper elements by a punching procedure and it will be found on microscopic examination of zipper elements that while these projections and sockets are not well defined as to shape they are both of tapered pyramidal form with their edges and corners generally somewhat rounded and irregular. In any event, however, the projection is essentially tapered and this is also true of the socket.

As manufactured, even though the elements on the two tapes are interlocked, it is found that the electrical contacts between them are quite irregular so that electrical continuity seldom extends along the zipper for more than the space occupied by a few elements.

It might be thought, on casual consideration, that nevertheless if the zipper was drawn along a conducting electrode in flat form there would be produced sufficiently good continuous electrical contact between the elements and the electrode to provide the necessary connections for anodizing or other electrolytic treatment. This, however, is not the case, and the reason is evident upon microscopic inspection of a typical zipper. The zipper elements are not of uniform dimensions, and obviously, therefore, those which extend to a maximum extent from the tapes will prevent engagement of intermediate elements with the electrode. It is accordingly essential that current should be conducted between adjacent elements throughout considerable lengths of the zippers.

It has been proposed that tapes carrying zipper elements might be pressed against a conducting metallic tape by a felt strip saturated with an electrolyte and thus, by individual pressure on each element contact thereof with the metallic tape might be assured. This method, however, is unsatisfactory because the felt strip prevents free escape of gas and accumulation of gas interrupts flow of current. It is essential that freedom of gas removal be afforded and this is the case in my procedure.

In accordance with the present invention, referring particularly to Figure 2, the zipper is passed between a pair of rollers **14** and **16** which are of similar type providing cylindrical portions **18** arranged to clamp and feed the tapes of the zipper strip, one or both of the rollers being driven at suitable speed. The rollers are grooved as indicated at **20** so as to clear the outer surfaces of the zipper elements, but desirably so as to engage the ends of the elements which grip the tape to maintain the assembly of elements passing between the central portions of the rollers. The rollers are provided with outwardly projecting ribs **22** arranged to engage and compress the zipper elements exteriorly of the sockets **12**. The clearances between the ribs **22** are less than the original thickness of the zipper elements so that the walls outside the sockets **12** are pressed inwardly. As a result, and due to the tapered forms of the sockets and projections, a wedging action occurs tending to move the adjacent elements apart in the longitudinal direction of the strip. This tendency to move apart is resisted by the inelastic tapes and the result is that the projections are held in the sockets in a yielding fashion but sufficiently tightly to maintain good electrical contact. Some swaging action may also occur tending to extend the walls of the sockets towards the roots of the projections.

While the zipper elements are thus slightly distorted from their original shapes, the amount of distortion necessary to secure good electrical contact between adjacent elements is not detrimental to the proper eventual operation of the zipper for opening and closing under the action of the usual slide. This is apparently due to the fact that the distortion is transverse to the faces of the tapes whereas the opening and closing motions are in directions in the plane of the tapes. Of course, excessive distortion should be avoided, the ribs **22** being spaced to secure only that distortion which is necessary to provide electrical continuity either when the tape is straight or, as will appear hereafter, when the tape is given a suitable radius of curvature.

Instead of providing continuous swaging or compressing ribs such as at **22** in Figure 2, the compressing or swaging action may be localized as indicated in Figure 3 by providing about the circumferential position corresponding to the rib **22** small teeth **28** which are adapted to engage the zipper elements only adjacent to the walls at the open ends of the sockets **12**. The distortion is thus localized without compression of the other portions of the zipper elements. In order to provide for proper positioning of the teeth **28** with respect to the zipper elements, one or both of the rollers **24** and **26** may be provided with teeth **30** engageable between the zipper elements attached to one of the tapes. In other words, the teeth **30** engage between alternate zipper elements of the series and serve to maintain definite circumferential relationships between the zipper and the rollers. The rollers, of course, may be geared together so that teeth on only one and on only one side of the zipper will suffice.

The electrolytic treatment of the zipper provided in accordance with the foregoing is illustrated in Figure 4. A suitable tank **32** contains an electrolyte **34**. The zipper **2** enters the tank guided about a roller **36** therein and leaves the tank guided about a roller **38**. The zipper may pass from a supply reel **37** and be wound up upon a receiving reel **39**. The receiving reel will be driven at a suitable rate of speed to provide sufficient time in the bath for the electrolytic action to take place on each zipper element. Before passing to the receiving reel the zipper may, if desired, pass through a rinsing bath to remove the electrolyte. Between the rollers **36** and **38** there is a curved electrode plate **40** over which the tape passes with scraping contact. A second electrode is indicated at **42**, and connections are made to terminals **44** which may be supplied with alternating or direct current in accordance with the electrolytic treatment involved. In passing over the electrode plate **40**, some of the zipper elements will have actual rubbing contact therewith and will serve to receive the current which will then be distributed to the elements which may not make contact with the plate through the conductive path afforded between the elements as above described. A rubbing or scraping contact with the plate **40** is maintained which is particularly important in the case of anodizing to prevent the formation of a non-conductive oxide coating on the plate **40** which will be of aluminum or aluminum alloy. Under the conditions indicated, the electrolytic treatment will, of course, occur completely only on one face of the zipper with less complete treatment on the other. However, generally, this is all that is required, there being completely treated the surface of the zipper which will be in view in its final use. It is therefore, generally immaterial that one side of the zipper will be untreated or substantially so. It will, of course, be evi-

dent that in practice there will be a number of zipper strips running side by side through the electrolytic tank for simultaneous treatment.

It will be noted that the face of the zipper undergoing electrolytic treatment is free of obstruction to gas removal so that bubbles may form and escape, avoiding polarization or interruption of current flow.

Figure 5 shows an alternative electrolytic process which may be carried out in accordance with the invention. A tank **46** contains an electrolyte **47** in which is immersed a rotor **48** mounted on a rotating shaft **50**, the rotor carrying at its periphery axially extending rods **52** giving rise to a squirrel cage formation, the entire rotor being metallic. A closed zipper **54**, the elements of which are compressed or distorted as described above, or which are formed originally, to insure proper conductivity between them when the zipper is distorted to proper radii of curvature, is fed past a guide roller **56** and a reciprocating plunger **58** timed with respect to movement of the rotor to project bights between pairs of rods **52** as indicated at **60**. These bights are frictionally held between the rods and are carried about by the rotor through the bath, being finally stripped from the rotor at the postion of guide roller **62**. The rotor **50** is connected to one of a pair of current input terminals **64**, the other of which is connected to an electrode **66** in the case of direct or pulsating current anodizing or electroplating, or, desirably to a second rotor assembly in the case of alternating current anodizing.

In the operation of this process, certain elements of the zipper make actual metallic contact with the rods **52** while current is conducted to the intermediate elements by the serial contacts thereof. If large loops or bights **60** are formed, the zippers treated will usually require preliminary distortion as described above to insure good inter-element conduction; but if small loops are provided between closely spaced bars **52** such preliminary treatment may be unnecessary. Specially formed zippers having good inter-element conduction need not be preliminarily treated. It will be evident that with conduction provided as just indicated proper electrolytic treatment will result.

In the case of anodizing, when oxide coatings will be formed on the rods **52**, which will be of aluminum or aluminum alloy, cleaning of the oxide coatings from the rods will be effected when the bights are formed by plunger **58**, the incoming portions of the zipper scraping the rods are thereby cleaning the same.

Obviously, when the rotor is of suitable axial extent many zippers may be fed thereto and carried thereby in parallel.

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 zipper 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 zipper 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 **40** and **42** may be of aluminum. Alternatively, if alternating current anodizing is effected, there may be

two sets of zippers in the bath, both moving along and in contact with electrode members such as **40**, 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 zipper. As pointed out above, however, this is not generally of importance since the zipper will be finally used with a particular face exposed.

Reference has been made above to the fact that the compression or distortion of the zipper elements may be carried out to such extent that good conductivity between adjacent zipper elements might not exist when the zipper is straight but only when it has a radius of curvature imparted thereto. It will be evident that if the lesser distortion of this type is provided, it is desirable that in the bath the zipper should have imparted to it a suitable radius of curvature, and this may be imparted as indicated by the curvature of the plate **40** or by feeding the zipper about a cylindrical surface which will impart a still smaller but suitable radius of curvature thereto to insure good conductivity between the elements. In general, it may be stated that, with sufficient compression or distortion (though actually slight) the zipper may be made continuously conductive even when straight; with less compression or distortion curvature less than some maximum will be required for continuous conductivity, the maximum depending upon the amount of compression or distortion and, of course, the initial spacing and form of the zipper elements. The compression or distortion required for a particular zipper to cause it to become continuously conductive under a particular radius of curvature may be readily ascertained by trial.

It will also be evident that the zipper as originally manufactured may have its elements suitably formed and tightly assembled, i. e. more closely arranged along the tapes than usual, so that continuity of conductivity will occur when the closed zipper is either straight or conformed to a suitable curvature by contact with a conductive surface over which it moves in the electrolyte.

The broad aspects of the disclosure herein are claimed in my application Serial Number 301,510, filed of even date herewith.

What is claimed is:

1. A method for the electrolytic treatment of a slide fastener of the zipper type having metallic interengaging elements comprising subjecting the elements of the closed zipper to compression to distort the shape of individual elements to reduce clearances between adjacent interengaging elements thereof and then progressing the closed zipper through an electrolytic bath while causing it to conform to a curvature such that electrical continuity is enforced between the interengaging elements thereof and while at least some elements thereof are in conductive contact with a member carrying current for the treatment.

2. A method for the electrolytic treatment of a slide fastener of the zipper type having metallic interengaging elements comprising subjecting the elements of the closed zipper to compression to distort the shape of individual elements to reduce clearances between adjacent interengaging elements thereof and then progressing the closed zipper through an electrolytic bath while curvature is imparted thereto by scraping contact of at least some of the elements thereof over a curved member carrying current for treatment such that electrical continuity is enforced between interengaging elements thereof and

while at least some elements thereof are in conductive contact with said member.

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