United States Patent [19]

Hofius, Sr.

[11] 3,884,738

[45] May 20, 1975

[54] **METHOD AND APPARATUS FOR FASTENING SLIDE FASTENERS TO AN ARTICLE**

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[52] **U.S. Cl.** ..... **156/73.1**; 24/205.11 F; 156/66; 156/256; 156/285; 156/513; 156/517; 156/580; 228/1; 264/69

[51] **Int. Cl.** **B32b 31/20**

[58] **Field of Search** ..... 156/73.1, 580, 66, 256, 156/513, 517, 285; 228/1; 264/69; 24/205.11 F

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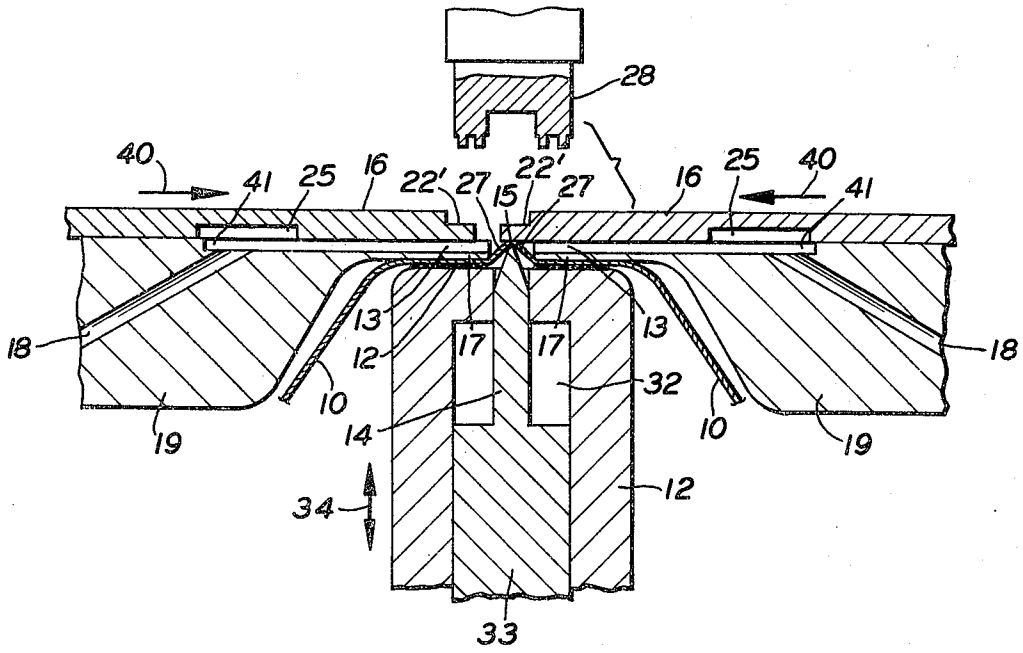
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Primary Examiner—Edward G. Whitby

[57] **ABSTRACT**

A method and apparatus for ultrasonically welding a zipper to another material wherein the material to which the zipper is to be joined is first loaded into a movable anvil and clamped between the anvil and a cutting plate. A die then cuts the material against the cutting plate. After cutting against the plate, the punch overtravels and forces the edges of the material up vertically between the ends of two plates. Then a vacuum applied above the plates draws the edges of the material back over the ends of the plates and holds the edges of the material in place. The zipper is placed into a zipper nest above the edges of the material. An ultrasonic welding system then welds the zipper to the turned back edges of the material.

14 Claims, 18 Drawing Figures



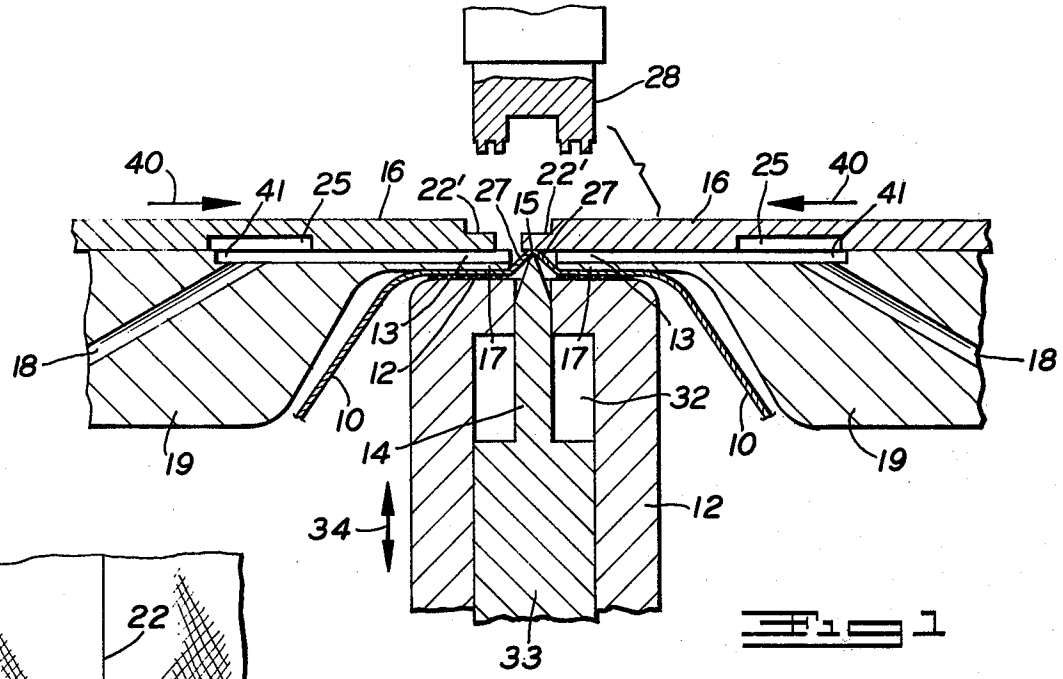


Fig 1

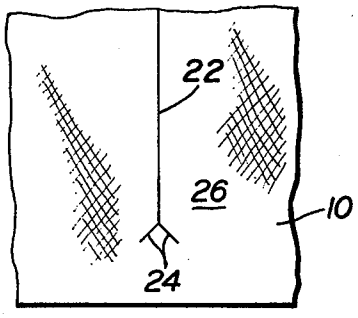


Fig 2

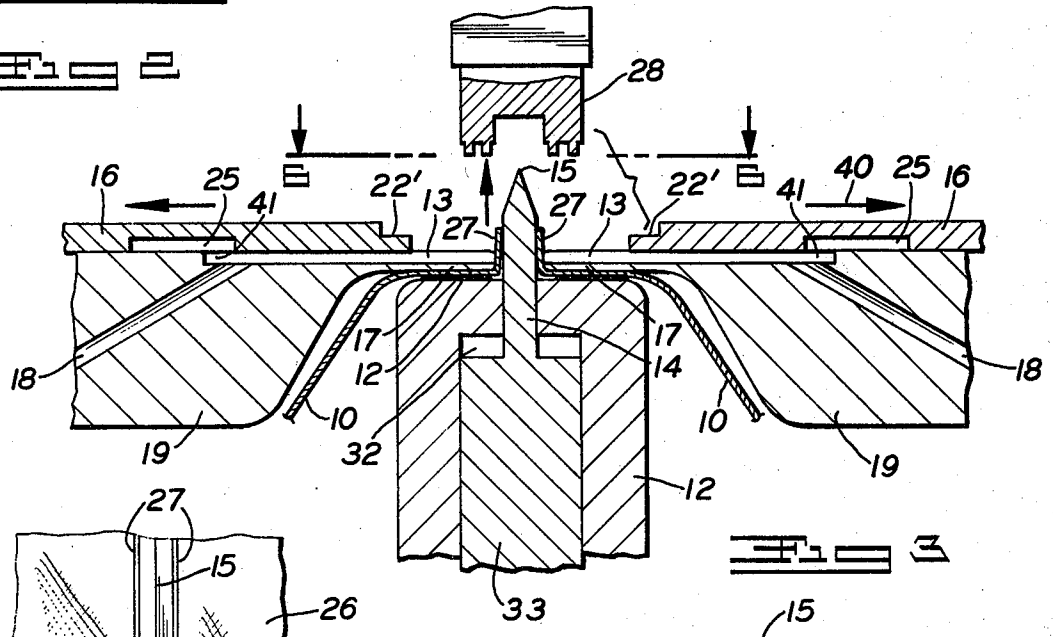


Fig 3

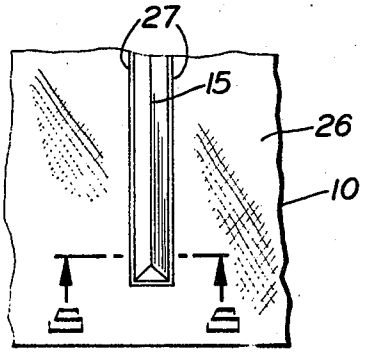


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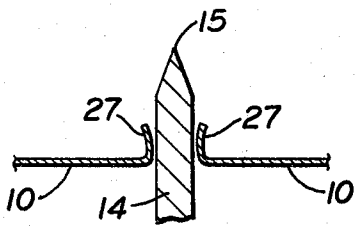


Fig 5

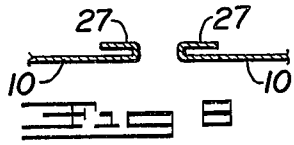


Fig 8

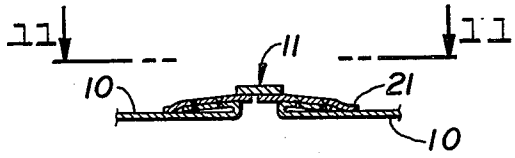


Fig 10

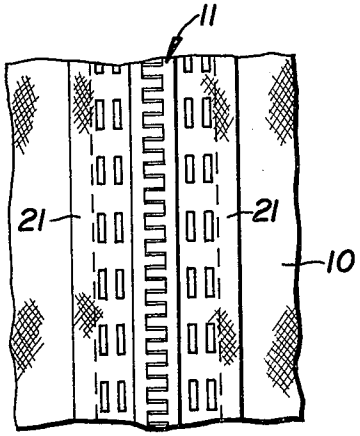


Fig 11

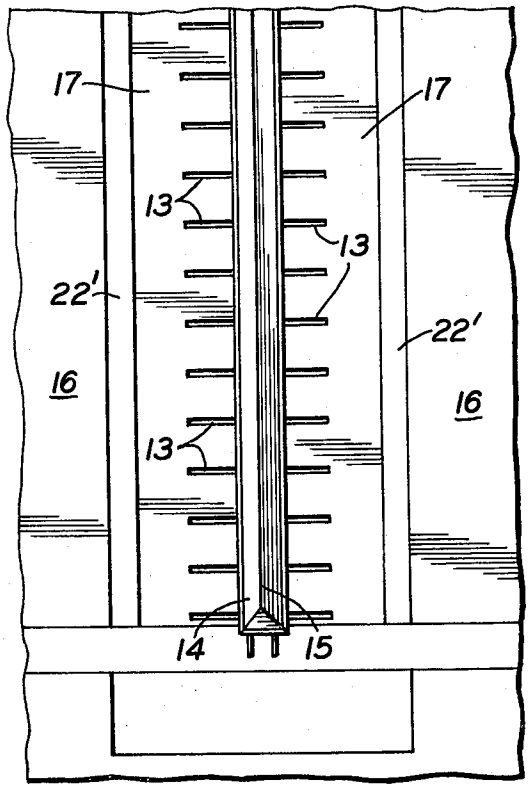


Fig 6

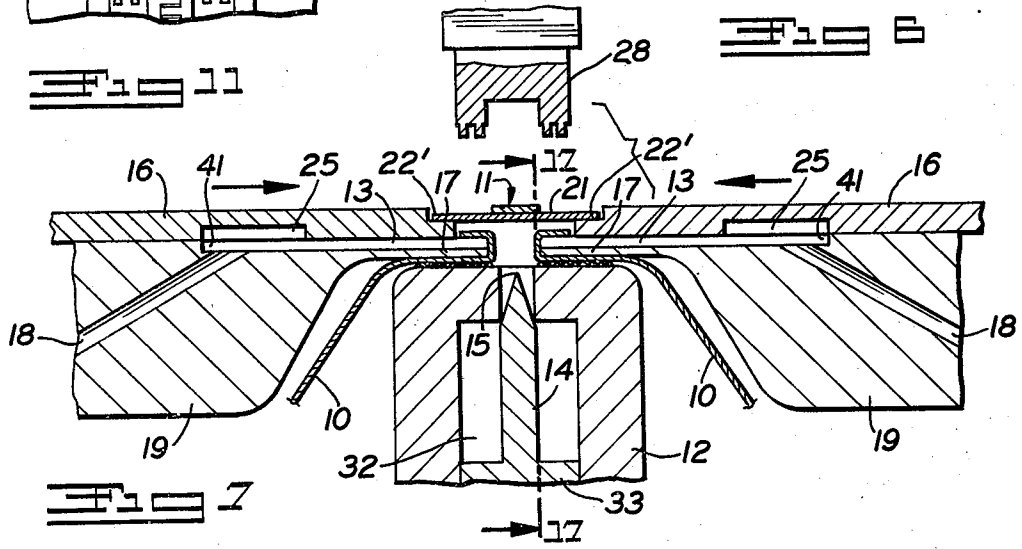


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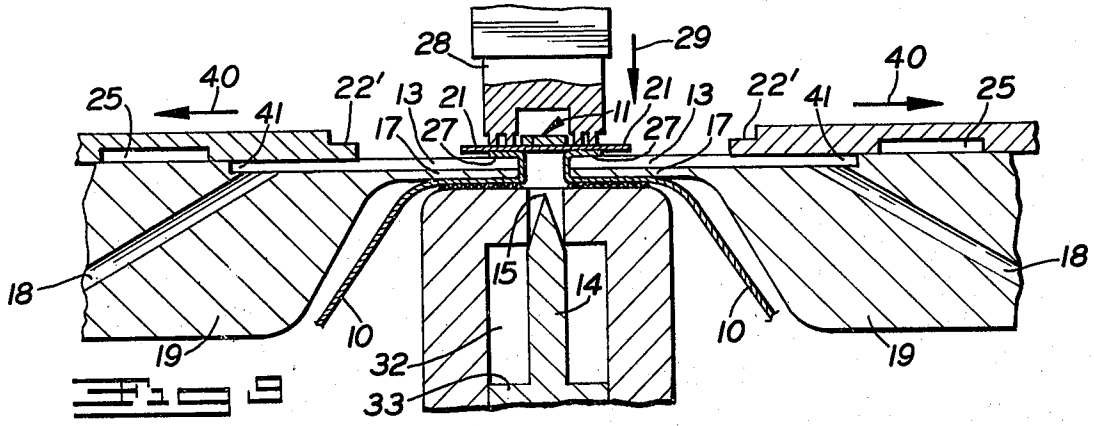


Fig 9

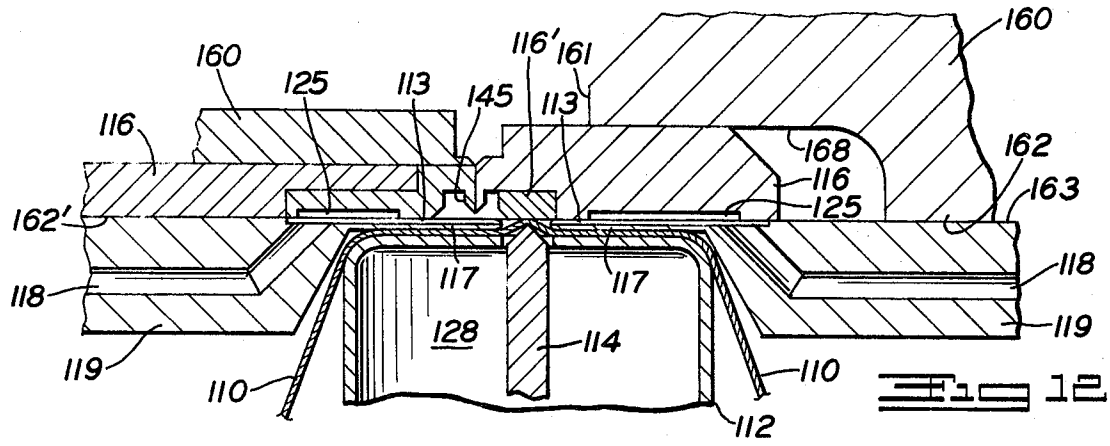


Fig 12

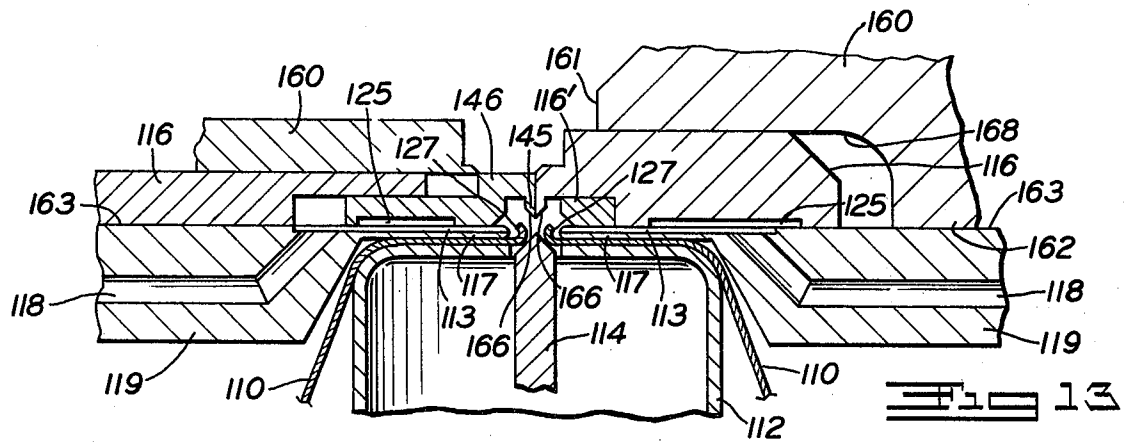


Fig 13

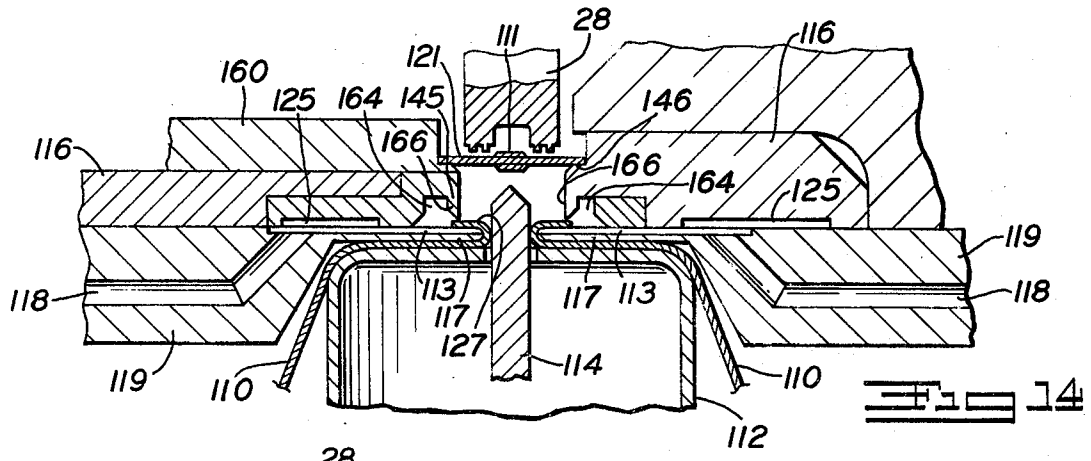


Fig 14

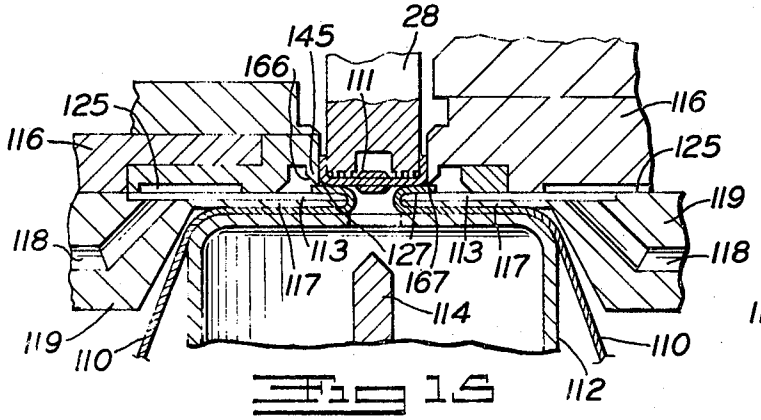


Fig 15

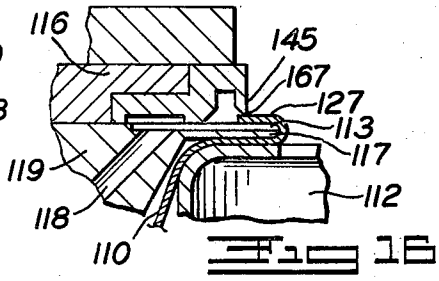


Fig 16

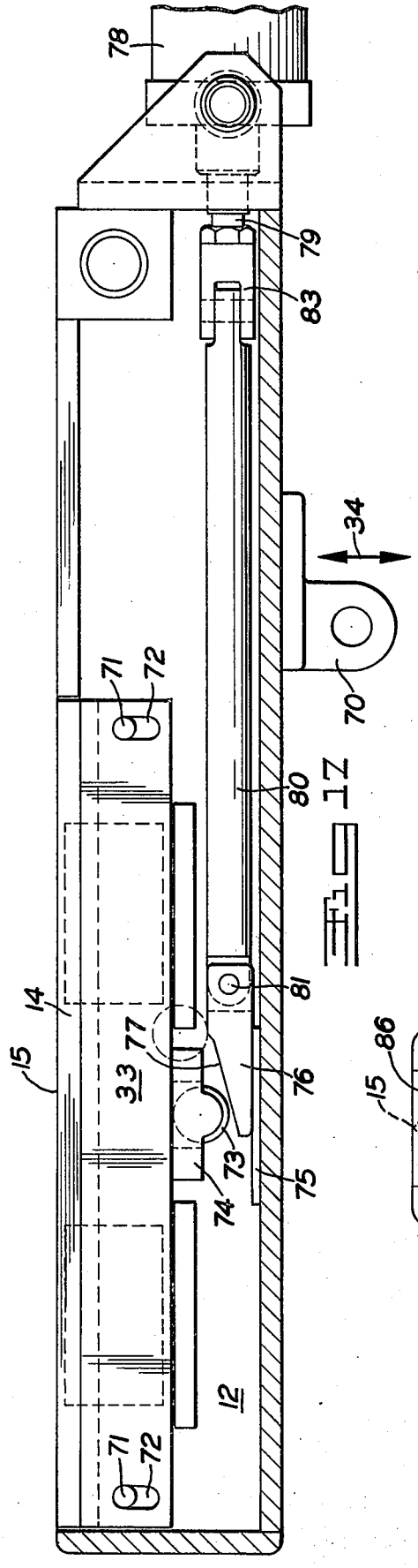

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FIG 17

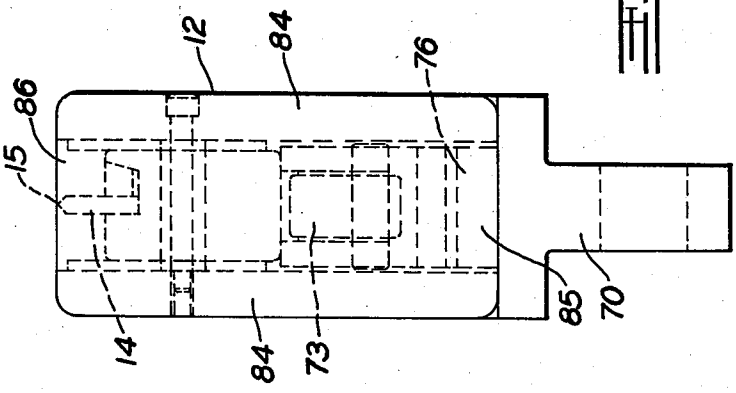

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FIG 18

METHOD AND APPARATUS FOR FASTENING SLIDE FASTENERS TO AN ARTICLE

OBJECTS OF THE INVENTION

It is an object of the invention to provide an improved method and apparatus for attaching a zipper to a garment.

Another object of the invention is to provide a simple and efficient method and apparatus for attaching a zipper to a garment.

With the above and other objects in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawings and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

GENERAL DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial lateral cross sectional view of an apparatus used for carrying out the method according to the invention;

FIG. 2 is a top view of the cloth after it has been slit by the upper edge of the knife as in FIG. 1;

FIG. 3 shows a partial cross sectional view of the machine showing the material after having been cut by the punch and the edges of the material pushed upward by the overtravel of the punch;

FIG. 4 shows a top view of the cloth having its edges up by the overtravel of the punch as in FIG. 3;

FIG. 5 is a cross sectional view of the cloth after the ends are pushed up by the punch as in FIGS. 3 and 4, taken on line 5—5 of FIG. 4;

FIG. 6 shows a partial top view of the fixture;

FIG. 7 shows a partial lateral cross sectional view of the machine with the punch retracted with the ends of the cloth drawn back over the edges of thin support member and the zipper in the zipper nest in the slide plates;

FIG. 8 shows a partial cross sectional view of the material as it would appear removed from the machine in FIG. 7;

FIG. 9 shows a partial longitudinal cross sectional view of the machine with the zipper lowered onto the material and the ultrasonic head moved down into engagement with the zipper material;

FIG. 10 shows a partial top view of the completed zipper welded to the material;

FIG. 11 shows a partial top view of the completed zipper welded to the material as in FIG. 10;

FIG. 12 is a view similar to FIG. 1 showing another embodiment of the invention;

FIG. 13 is a view similar to FIG. 2 showing the embodiment of FIG. 12;

FIG. 14 is a view similar to FIG. 3;

FIG. 15 is a view similar to FIG. 9;

FIG. 16 is a partial view similar to FIG. 15;

FIG. 17 is a side view partly in cross section of the anvil; and

FIG. 18 is an end view of the anvil.

DETAILED DESCRIPTION OF THE DRAWINGS

An example of the machine for carrying out the method disclosed herein is shown in FIGS. 1 through 4. In this example, the machine is made up basically of a

hollow movable anvil 12 with a punch 14 slidably received therein attached to cam follower bar 33. Two vacuum plates 19 terminate in end 17 and two sliding plates 16 slide on top of the ridges defining slots 13 in ends 17 of plates 19. Plates 16 each have transverse grooves 25 in the under side which connect the vacuum channel passages 18 to slots 13 in the vacuum plates 19.

The punch 14 terminates at its upper end in a cutting edge 15 which will be in the shape of the slit 22 in the material 10 and branches 24 connected to the slit 22 which are to be cut for the zipper in the material 10 to which the zipper is to be attached. When the punch has cut the slit 22 and branches 24 in the material, the sliding plates 16 move away from each other to the position shown in FIG. 3 and the punch 14 then moves up between the ends of the plates through the space between the ends 17 of the vacuum plates 19; as the punch overtravels, it carries the cut edges 27 of the material up to the position shown in FIG. 3.

The sliding ends of top plates 16 engage each other at a position offset from edge 15. The inner ends of top plates 16 are thin and form a zipper pocket 22′ in which the zipper can be placed when the plates are brought to the position shown in FIG. 7 prior to lowering the zipper onto the material.

The sliding top plate 16 on the right slides past center so that edge 15 engages plate 16 at a position spaced from its end. Relatively closely spaced slots 13 are formed in the top side of plates 19. The slots 13 extend from the ends 17 of plates 19 adjacent ends to shoulders 41. The grooves 25 in plates 16 connect the vacuum passages 18 in vacuum plates 19 to the slots 13 when the sliding top plates 16 are retracted to a position shown in FIG. 3. Thus when the cutting edge 15 of the punch 14 crush cuts the fabric material 10 against the bottom of the plate 16 and plate 16 moves laterally aside and the punch overtravels to push the edges 27 upward to the position shown in FIG. 3, the vacuum then pulls edges 27 of the material over the top of ends 17 of plates 19. The plates 16 will then move toward each other and over the ends of the tapes 21 and forming the zipper pocket 22′ in plates 16 as shown in FIG. 7. The plates 16 will then be moved away from each other by the force means indicated at 40 and the zipper 11 will drop onto the zipper supported on the end plates 17 as shown in FIG. 9. The ultrasonic head 28 will be lowered into engagement with the tapes of the zipper by a suitable force means indicated by arrow 29. Ultrasonic energy will then be applied to the ultrasonic head 28 which will weld the edges 27 of the material to the zipper tape 21. The ends 27 will actually lie between plates 16 and plate ends 17 in the position shown in FIG. 7 since the material will be only about 0.020 inches thick.

Anvil 12 has an elongated body having spaced sides 84 and a bottom 85 with open top 86. Anvil 12 is fixed to lug 70 and is carried up and down by a force means 34 connected to lug 70 and the anvil may rock around the lug 70. Punch 14 is fixed to follower bar 33 which is guided up and down on pins 71. Pins 71 are fixed to the sides of anvil 12 and extend across it and pins 71 are received in slots 72 in the punch follower bar 33. Follower bar 33 has the bracket 74 fixed to it and bracket 74 carries the follower wheel 73. Plate 75 is fixed to the bottom of the anvil 12 and forms a sliding surface on which cam 76 slides. Cam 76 has a top cam

surface 77 that engages the wheel 73. Cylinder 78 moves the cam 76 forward and backward to raise and lower the follower bar and punch. Cylinder 78 is connected to the anvil 12 and piston rod 79 is attached to the connecting rod 80 by means of pin 83. The connecting rod 80 is likewise connected to the cam 76 by pin 81. The anvil 12 is moved up and down to clamp the material to the plate 16 and the punch is moved up and down by cylinder 78 through the cam 76 and follower wheel 73. Thus the anvil and the punch can rock around the lug 70 and the punch edge 15 will engage the material to be cut over its entire length.

The sequence of operation of the embodiment shown in FIGS. 1–11 is as follows:

Step 1. Sheet material 10 is loaded on anvil 12. Plates 16 are moved together to the position shown in FIG. 1.

Step 2. Anvil 12 moves up and clamps sheet material 10 to the under side of plates 19.

Step 3. Punch 14 moves up and cuts slots 22–24 in material 10 against the lower side of plates 16.

Step 4. Plates 16 move apart from each other and punch 14 overtravels and pushes edges 27 of material up to position shown in FIG. 3.

Step 5. Plates 16 move to position shown in FIG. 7, passing over the edges 27 of the material and slots 25 connect slot 22 with passages 18. Vacuum force from passages 18 through slots 25 and slots 13 pull ends 27 of material 10 back over ends 17 of plates 19 as shown in FIG. 7. Zipper 11 is placed in nest 22'.

Step 6. Plates 16 are moved away from each other and zipper 11 moves down onto top of plates 19. Ultrasonic head 28 descends into engagement with zipper 11 and welds tapes of zipper to edges 27 of cloth.

Step 7. Ultrasonic head 28 moves up away from zipper 11, anvil 12 moves down, plates 19 move outward away from each other and sheet material 10 with zipper 11 attached can be removed.

FIGS. 12 through 16 show another embodiment of the invention similar to the embodiment shown in FIGS. 1–11. Vacuum plates 119 have reduced thickness ends 117 against which material 110 is clamped by anvil 112. Slots 113 in plates 119 are disposed at right angles to transverse slots 125 and connect when the plates 116 are in the position shown in FIG. 13. Hooks 145 on the ends of plates 116 grasp the edges 127 of the material 121 and pull the edges back to the position shown in FIG. 14 prior to the descent of head 140. The hooks 145 thus supplement the vacuum. Punch 114 cuts the cloth against plates 116 as in FIG. 12. With the embodiment of FIGS. 12–16, the edges of the material are more positively folded back by hooks 145.

The operation of the embodiment of FIGS. 12–16 is as follows:

Step 1. Sheet material 110 is loaded on anvil 112 between plates 116 and anvil 112.

Step 2. Anivl 112 moves up and clamps material 110 to plates ends and 117.

Step 3. Punch 114 moves up and cuts slit in sheet material (FIG. 12) against hardened insert 116' in plate 116.

Step 4 Punch 114 overtravels and pushes edges 127 upward. Hooks 145 catch edges 127 and, together with vacuum from passages 118 connected to slots 113 by grooves 125, pull cut edges 127 back (FIGS. 13, 14).

Step 5. Zipper 111 is loaded in nest formed by shoulders 146.

Step 6. Head 140 lowers, bringing zipper 111 down between plates 116, pressing zipper 111 on edges 117 and is ultrasonically welded to the zipper tapes.

Referring to FIGS. 12–16, each sliding plate 116 is slidably supported under a bottom surface 162 on a fixed plate 160. The plates 160 each have an end 161 spaced from the other and a bottom surface 162' which rests on the top surface 163 of plates 119. Surface 168 is spaced above surface 163 and provides a space for sliding plates 116. The hooks 145 on plates 116 are each formed of a slot 164 in the plate 116 and the surfaces 166 are disposed at 45° to the vertical and these surfaces terminate in the edge of the hook which engages the material. The edges 167 of hooks 145 are spaced above the top surface of plate 119 an amount equal to the sum of the thickness of the tape 121 and the material 110. Thus the edges 167 of the hooks 145 hold the edges 127 of the material down during the welding operation, as indicated in FIGS. 14 and 15.

The foregoing specification sets forth the invention in its preferred practical forms but the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of ultrasonically welding a zipper to a sheet of material comprising
   die cutting a slot in said material,
   folding the edges of said material back adjacent said slot,
   placing the tapes of the zipper on top of said folded back edges,
   and ultrasonically welding said zipper to said folded back edges.

2. A method of attaching a zipper to another material by ultrasonic welding comprising
   a. loading the material to which the zipper is to be joined onto a movable clamping anvil,
   b. clamping the material against two spaced vacuum plates,
   c. die cutting a slit in the clamped material against said sliding plates,
   d. moving said sliding plates apart,
   e. pushing the edges of said material adjacent said slit between said vacuum plates by punch overtravel,
   f. applying a vacuum to the cut edges of said material to turn the edges of said material 180° back over on said vacuum plates,
   g. moving the upper slide plate laterally thereby opening up slots in the top side of the plate,
   h. loading a zipper in said machine,
   i. welding the zipper to the edges ultrasonically.

3. An apparatus for ultrasonically welding a zipper to a sheet of material comprising
   two spaced vacuum plates defining a slot,
   laterally extending slots in the top surface of said vacuum plates extending from adjacent the ends thereof,

two sliding plates, one said sliding plate slidable laterally on top of each of said vacuum plates from a position where the ends of said sliding plates are adjacent each other to a position spaced further from each other,

means for connecting said slots in said vacuum plates to a vacuum channel,

a source of vacuum connected to said vacuum channel,

a punch,

an anvil below said vacuum plates adapted to clamp said sheet material to said vacuum plates,

said punch being slidably received in said anvil,

and means connected to said punch to move said punch into engagement with a said sliding plate when said plate is slid over said top of said punch whereby a slit may be cut in said sheet material,

means on said vacuum plates to receive the edges of said cut material with a zipper on top thereof,

and an ultrasonic head above said anvil adapted to move down into engagement with said zipper, clamping said zipper in engagement with said anvil, and means connected to said ultrasonic head for ultrasonically welding said zipper to said material.

4. The apparatus recited in claim **3** wherein said sliding plates are adapted to slide toward each other to bring the ends into engagement with each other at a position spaced laterally from the cutting edge of said punch whereby said punch engages said material at a position spaced from the edge of one said sliding plate.

5. The apparatus recited in claim **4** wherein said punch has a cutting edge generally of a length equal to the length of the zipper to be installed in said material.

6. The apparatus recited in claim **5** wherein said punch has an elongated cutting edge and two branches whereby an end of said slit is cut in the shape of a Y.

7. The apparatus recited in claim **6** wherein said sliding plates each have a hook formed on the end thereof adjacent the other sliding plate, providing a hold down and aid in folding of the edges of said material.

8. The apparatus recited in claim **7** wherein said punch has a wedge-shaped upper end terminating in said cutting edge.

9. The apparatus recited in claim **8** wherein said sliding plate has a hardened insert adjacent said hook engagable by said cutting edge.

10. The apparatus recited in claim **9** wherein said hooks are each defined by slots in each said sliding plate adjacent the end thereof,

the end of said hook is spaced above said vacuum plate by an amount substantially equal to the thickness of said material plus the thickness of the tape on said zipper to be installed on said material.

11. An apparatus for ultrasonically welding a zipper to a sheet of material comprising

a movable top plate,

a vacuum plate terminating at an edge,

a plurality of slots in said vacuum plate extending from said edge to a position spaced from said edge,

said movable top plate supported above said vacuum plate and movable thereover,

a punch,

said punch having an elongated cutting edge adapted to engage said top plate,

means for moving said punch into engagement with said top plate,

said means comprising a single force applied to said punch whereby said punch will rock about said force and engage said plate over the entire length of said punch.

12. The apparatus recited in claim **11** wherein said punch is carried by an anvil,

said anvil extending laterally from said punch on each side thereof,

and means to move said punch relative to said anvil whereby said anvil may be brought into clamping engagement with said material and clamping said material to said vacuum plate,

and said punch may be brought into engagement with said material, cutting said material against said top plate.

13. The apparatus recited in claim **12** wherein means is provided for moving said top plate in a plane parallel to said vacuum plate whereby an edge of said material may be pulled over said vacuum plate.

14. The apparatus recited in claim **13** wherein ultrasonic means is provided for engaging said material above said vacuum plate.

* * * * *