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(54) **IMPROVED PANEL CLINCHING METHODS**

VERFAHREN ZUR VERBINDUNG VON PLATTEN

PROCEDES AMELIORES D'ASSEMBLAGE DE MINCES FEUILLES DE TOLE

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- **PATENT ABSTRACTS OF JAPAN, M-823, page 131; & JP,A,01 022 427 (TOYO SEIKAN KAISHA LTD) 25 January 1989 (25.01.89)**

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] This invention relates to improved panel clinching methods. The term "clinching" is also known as "press joining" or "integral fastening".

2. Prior Art

[0002] Spot welding is the most commonly used technique for joining vehicle body components in the automotive industries. As the strength of each spot weld cannot be guaranteed, eg. due to the inclusion of rubbish between the components, or poor weld penetration, designers must increase the number of welds to ensure adequate joint strength.

[0003] Spot welding has not yet been developed as an accurate, reliable method for joining galvanised steel or aluminium components.

[0004] With galvanised steel, welding action destroys the galvanising about the weld site, making it liable to corrosion.

[0005] Aluminium has great potential in the automobile field due to its light weight, but the lack of a suitable spot welding method is one reason which has minimised its application.

[0006] One alternative to spot welding is the use of self-piercing rivets, and a method of, and apparatus for, the fastening of metal panels with self-piercing rivets is disclosed in US Patent No 4,615,475 (Fuhrmeister) (= International Publication Number WO 84/04710).

[0007] A further alternative method is metal clinching, where two sheets of metal are deformed into a locking engagement using a punch-and-die combination. Examples of metal clinching methods are disclosed in:

1. DE 4009813 (Fraunhoffer-Ges Ford Ange);
2. DE 1452820 (Philips Patentverwaltung GmbH);
3. DE 3726392 (Kuka Schweissanlage);
4. EP 330061 (Eckold W. & Co GmbH);
5. EP 215449 (Rapp E.);
6. GB 2244946 (Fairacre Limited);
7. GB 2123734 (BTM Corporation);
8. US 391995 (Du Vernay); and
9. US 387599 (Ladouceur et al).

[0008] While these methods enable metal sheets to be jointed together, they have relatively low shear and axial load strengths, and the joints do not have an outer face substantially flush with the surrounding sheet metal (and are so not applicable in exposed areas, eg. within an engine compartment).

SUMMARY OF THE PRESENT INVENTION

[0009] It is an object of the present invention to provide a panel clinching method where the shear strengths of the clinching joint is increased.

[0010] It is a preferred object to provide a method where the axial load strength of the clinched joint is increased.

[0011] It is a further preferred object to provide a method where the outer face of the joint may be substantially flush with the surrounding sheet metal.

[0012] It is a still further preferred object to provide a method where ancillary components may be supported by or from the clinched joint.

[0013] It is a still further preferred object to provide a method where the clinched joint may be "capped" to constrain any stress lines in the metal panels in the region of the joint. Other preferred objects will become apparent from the following description.

[0014] According to a first aspect of the present invention there is provided a panel clinching method, according to claim 1.

[0015] In a single stage method, the rivet or slug may be inserted into the joint as the joint is formed, the rivet or slug co-operating with the punch to deform the panels into the supporting die. In a two-stage process, the rivet or slug co-operates with the metal panels into the die, and a sleeve external to the punch then deforms the rivet or slug within the joint.

[0016] The bore of the rivet or slug may be threaded, serrated or otherwise profiled to engage and support an anchor for, eg. a wiring loom support, a trim cover panel fastener or the like. A plastic insert may be fitted to the rivet or slug to provide a flush outer face.

[0017] Preferably, the panels are pre-clamped to the die before the punch drives the rivet or slug into the panels to form the clinched joint; or before the clinched joint is formed and the rivet or slug is then inserted into the joint.

[0018] According to a second aspect of the present invention there is provided a panel clinching method according to claim 7.

[0019] According to a third aspect of the present invention there is provided a panel clinching method according to claim 10.

[0020] While the invention is particularly suitable for joining sheet metal panels, it is also suitable for polymeric materials (eg. Polyethylene, polyurethane, polypropylene, nylon) where one or more metal panels are substituted by panels of polymeric material. For example, the methods are suitable for joining, eg. An aluminium sheet to a polypropylene sheet, where the polymeric sheet may be locally preheated (eg. By the supporting die) to assist in the "flow" of the polymeric material as the joint is formed. The rings or components may also be formed of polymeric material and be clinched to metal and/or polymeric material sheets.

[0021] The shanks of the rivets or slugs may be pro-

vided with external splines, grooves, teeth or other protrusions or recesses to provide additional grip between the rivets or slugs and the panels in the clinched joint.

[0022] Adhesives can be applied, eg. to the shanks of the rivets or slugs to assist bonding of the rivets or slugs to the panels. Adhesives may also be provided within the bore of the tubular or semi-tubular rivets or slugs to be extruded into the clinched joint, as the rivets or slugs are deformed, to assist the bonding of the rivets or slugs to the panels.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

FIG 1 is a sectional side view of a hollow rivet or tubular slug suitable for clinching two panels of metal together;
FIGS 2 to 5 are sectional side views of the steps in a two-stage process of forming a clinched joint of a first embodiment;
FIG 6 is a sectional side view of the clinched joint of the first embodiment;
FIG 7 is a sectional side view of a modified tubular rivet or slug;
FIGS 8 to 11 are sectional side views of the steps in a single-stage process of forming a clinched joint of a second embodiment;
FIG 12 is a sectional side view of the clinched joint of the second embodiment;
FIG 13 is a sectional side view of a solid rivet or slug;
FIGS 14 and 15 are sectional side views of the steps of forming a clinched joint in a method not in accordance with the invention;
FIG 16 is a sectional side view of the clinched joint according to the method of figure 14 and 15;
FIG 17 is a sectional side view of a semi-tubular rivet or slug;
FIGS 18 to 22 are sectional side views of the steps of forming a clinched joint of the fourth embodiment;
FIG 23 is a sectional side view of the clinched joint of the fourth embodiment;
FIG 24 is a (a) top plan, (b) sectional side, and (c) bottom plan view of a component;
FIG 25 is a sectional side view of a clinched joint using the component of Fig 24 but not in accordance with the invention;
FIG 26 is a similar view of a modified form of the clinched joint of FIG 25 that is in accordance with the invention;
FIG 27 is a (a) top plan, (b) sectional side, and (c) bottom plan view of a second component;
FIG 28 is a sectional side view of a clinched joint of a seventh embodiment not in accordance with the present invention; and
FIG 29 is a sectional side view showing the clinched joint of FIG 28 where the component is supported in a die.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] Referring now to FIGS 1 to 6, the tubular rivet 10 of FIG 1 is driven into the metal panels to form the clinched joint 11 of FIG 6.

[0025] The metal panels 12, 13 to be joined together are supported on the die assembly 14 of a clinching tool (s), the die assembly having expandable and contractable collets 16 associated with a collet holder 17 and anvil 18 arranged to allow the joint 11 to be released when formed.

[0026] The clinching tool 15 has a pre-clamping head 19 which clamps the metal panels 12, 13 to the die assembly and has internal (spring-loaded) balls 19A to locate and centralise the rivet 10. A punch 20 is slidably journalled in a sleeve 21, slidably journalled in the pre-clamping head 19, and the punch 20 and sleeve 21 are connected to respective hydraulic rams (not shown).

[0027] The operation of the clinching tool 15 will now be described.

[0028] After the metal panels 12, 13 are clamped to the die assembly 14 by the pre-clamping head 19, the punch 20 is driven through the rivet 10 into engagement with the upper panel 12; the sleeve 21 engaging the rivet 10. The punch 20 and rivet 10 are advanced to deform the metal panels 12,13 into the die assembly 14 (see FIG 4). The sleeve 21 is then advanced to cause the inner end of the rivet 10 to be outwardly-deformed (see FIGS 5 and 6).

[0029] The anvil 18 can be spring-loaded or forcibly raised as a post-forming operation against the punch 20 to assist in deforming the rivet or slug.

[0030] The insertion and deformation of the rivet assists in locking the metal panels 12, 13 together, with increase in the shear and axial separation strength(s) (ie. in the direction of arrows A and B, respectively).

[0031] The bore 22 of the rivet 10 may be threaded to receive a fastener or plug to support, eg. an electrical wiring loom or a plastic insert to form a flush cover for the clinched joint 11.

[0032] Referring now to FIGS 7 to 12, a modified tubular rivet 110 has a tapered end 123 to its inner bore 122.

[0033] In this one-stage method, the sleeve 21 is eliminated and the punch 120 is slidably journalled in the pre-clamping head 119. The metal sheets 112, 113 are supported by the die assembly 114 and clamped thereto by the clamping head 119. The punch 120 engages the rivet 110 (see FIG 9) and drives the rivet 110 into the metal panels 112, 113 which are deformed into the die assembly 114 (see FIG 10). The punch 120 is further advanced (see FIG 11) to deform the inner end of the rivet 110 to form the clinched joint 111 (see FIG 12).

[0034] To increase the strength of the dinched joints 11, 111, a solid or semi-tubular rivet or slug may be used.

[0035] Referring now to FIGS 13 to 16, a solid slug 210 (FIG 13) has a concave recess 222 at its lower end

and is used to form the clinched joint 211 of FIG 16.

[0036] The metal sheets 212, 213 are clamped to the die assembly 214 by the clamping head 219 (see FIG 14). The punch 220 is advanced to drive the slug 210 (as an extension of the punch 220) into the metal panels 212, 213 to deform the panels into the die assembly 214 to form the clinched joint 211. It will be noted that the head of the slug 210 is flush with the outer face of panel 212 and such a joint is suitable where aesthetic appeal is required, eg. on a visible surface of a vehicle body.

[0037] The semi-tubular slug 310 (see FIG 17) has a tapered end 323 to its bore 322.

[0038] In the two-stage process shown in FIGS 18 to 23, the metal panels 312, 313 are pre-clamped to the die assembly 314 by the clamping head 319 and the punch 320 is advanced (see FIG 19) to form a conventional button-type clinched joint 311A (see FIG 20). The punch 320 is retracted and a semi-tubular slug 310 is placed in the clinching tool.

[0039] The pre-clamping head 319 clamps the panels (see FIG 21) and the punch 320 is advanced to drive the slug 310 into the clinched joint 311A to deform the slug 310 to form the clinched joint 311 (see FIG 23).

[0040] A component 510 (see FIGS 24 to 26), with a tapered recess or bore 522, and a screw-threaded hole 525 (as part of a sub-assembly - not shown) can also be employed as the die for the clinched joint 511 and provide a mount for the sub-assembly secured to the panels 512, 513.

[0041] As shown in FIG 26, a solid slug 210 can be pressed into the clinched joint 511. (The slug 210 may be screw-threaded and have a slot, Philips-head slot or an Allen-head recess to enable the slug 210 to be removed later if required for dis-assembly of the joint 511).

[0042] FIGS 27 to 29 show the attachment of a second component 610, with a bore 622 and a plain spigot (FIG 27) or screw-threaded end spigot 626 (FIG 28), secured to the clinch-joint 611. (The spigot may also be profiled, e.g. engageable in a catch or lock means).

[0043] FIG 29 shows the component 610 supported by a die assembly 614 during the clinching step.

[0044] In the methods shown in FIGS 24 to 26 and 27 to 29, two panels; 512, 513; 612, 613 are shown secured in the components 510, 610. The methods are also applicable to securing a single panel to the components 510, 610.

[0045] In addition, in all of the methods, one or both panels may be a polymeric sheet (e.g. polypropylene), it being preferred that the inner sheet, (e.g. 13, 113) being the polymeric sheet and the die assembly may be heated at the location of the clinched joint to assist "flow" of the polymeric material.

[0046] For improved recycling, it is preferred that the rivets 10, 110; slugs 210, 310; or components 510, 610 be of the same type of material as the panels as this will obviate the need for disassembly of the joints.

[0047] As an indication of the advantage of methods of the present invention, the use of an 8mm solid rivet or slug in conjunction with a clinched joint increase the shear strength of a sheet metal joint by 50% and the strength to both the shear and axial separation directions can be maintained within controlled limits, unlike spot welds. This means the number of clinched joints can be much less than the number of spot welds, and joints can also support sub-assemblies.

Claims

1. A panel clinching method for clinching together at least two panels (12, 13), wherein a tubular rivet or slug is driven or inserted by a punch assembly (20,21) into a clinched joint (11) between the panels (12,13) to deform the panels (12, 13) being joined into a supporting die (14) wherein the rivet or slug co-operates with the punch assembly to deform the panels (12, 13), **characterised in that** the punch assembly comprises a punch (20) and a sleeve (21) external to the punch (20), the punch (20) is driven through the rivet or slug (10) into engagement with the upper panel (12), the punch and rivet are advanced to deform the panel (12, 13), and the sleeve is advanced relative to the punch (20) to deform at least an inner end of a shank of the rivet or slug (10) outwardly within the clinched joint (11) and **in that** the rivet or slug (10) does not penetrate the panels (12, 13).

2. A panel clinching method according to claim 1, wherein the panels to be joined are pre-clamped to the die (14) before the punch assembly (20, 21) drives the rivet or slug (10) into the panels (12, 13) to form the clinched joint (11).

3. A panel clinching method according to any preceding claim, wherein at least one panel is a metal sheet and at least one panel is a polymeric sheet, the polymeric sheet being pre-heated in the zone of the clinched joint to encourage the flow of the polymeric material as the panels are deformed.

4. A panel clinching method according to any preceding claim, wherein an adhesive is applied to the rivet or slug (10) to assist bonding between the panels (12, 13) and the rivet or slug (10).

5. A panel clinching method according to claim 1, wherein an adhesive is applied to a bore of the tubular rivet or slug (10), the adhesive being extruded into the clinched joint (11) when the tubular rivet or slug (10) is deformed to assist bonding between the panels (12, 13) and the rivet or slug (10).

6. A panel clinching method according to any preceding claim, wherein the rivet or slug (10) has a shank with external splines, grooves, teeth or other pro-

trusions or recesses to provide additional grip between the rivet or slug (10) and the panels in the clinched joint (11).

7. A panel clinching method for clinching together at least two panels (312, 313), using a solid or semi-tubular rivet or slug (310), wherein a punch forms a conventional button-type clinched joint (311) in the panels (312, 313) to be joined, the panels being supported by a die (314) and the punch (320) is then retracted; **characterised in that** the rivet or slug (310) is interposed between the punch (320) and the clinched joint (311); and the punch (320) is advanced to drive the rivet or slug (310) into the clinched joint (311) to deform the panels (312, 313) being joined into a supporting die and to deform outwardly at least the inner end of the shank of the rivet or slug in the clinched joint (311), and **in that** the rivet or slug (310) does not penetrate the panels (312,313).

8. A panel clinching method according to claim 7, wherein at least one panel (312, 313) is a metal sheet at least one panel is a polymeric sheet, the polymeric sheet being pre-heated in the zone of the clinched joint to encourage the flow of the polymeric material as the panels are deformed.

9. A panel clinching method according to claim 7 or 8, wherein an adhesive is applied to the rivet or slug (310) to assist bonding between the panels (312, 313) and the rivet or slug (310).

10. A panel clinching method for clinching together at least two panels (112, 113), using a rivet (110) having a bore (122) with a tapered end (123) and including a shank having an inner end, the method comprising the steps of:

providing a punch (120) having a main body with an engaging shoulder and a reduced diameter lower end for fitting within the bore (122) of the rivet (110).
supporting the panels (112, 113) on a supporting die and clamping the panels with a preclamping head (119);
interposing the rivet (110) between the panels (112, 113) and the punch (120); **characterised by**:

advancing the punch (120) until the shoulder of the main body engages the top of the rivet (110);
further advancing the punch (120) downwardly to deform the panels (112, 113) into the die (114) and to form the clinched joint (111); and
thereafter again advancing the punch (120) downwardly to cause at least the inner end of the shank of the rivet (110) to be outwardly deformed, consequently deforming the panels (112, 113) to secure the clinched joint without penetration of the panels by the rivet (110).

11. A panel clinching method according to claim 10, wherein the lower end of the punch having a height less than a height of the rivet (110); and when the shoulder engages the rivet (110) the lower end of the punch (120) is spaced slightly above the panels (112, 113).

Patentansprüche

1. Platten-Vernietungsmethode für das Vernieten von mindestens zwei Platten (12, 13) miteinander, bei der ein röhrenförmiger Niet oder Rohling durch eine Obergesenkeinheit (20, 21) in eine Vernietungsstelle (11) zwischen den Platten (12, 13) getrieben oder eingeführt wird, um die zu verbindenden Platten (12, 13) in einem stützenden Untergesenk (14) zu verformen, wobei der Niet oder Rohling mit der Obergesenkeinheit zusammenwirkt, um die Platten (12, 13) zu verformen, **dadurch gekennzeichnet, daß** die Obergesenkeinheit ein Obergesenk (20) und eine Hülse (21) äußerlich zum Obergesenk (20) aufweist, wobei das Obergesenk (20) durch den Niet oder Rohling (10) in Eingriff mit der oberen Platte (12) getrieben wird, wobei das Obergesenk und der Niet vorwärtsbewegt werden, um die Platten (12, 13) zu verformen, und wobei die Hülse relativ zum Obergesenk (20) vorwärtsbewegt wird, um mindestens ein inneres Ende eines Schaftes des Niets oder Rohlings (10) innerhalb der Vernietungsstelle (11) nach außen zu verformen; und daß der Niet oder Rohling (10) die Platten (12, 13) nicht durchdringt.

2. Platten-Vernietungsmethode nach Anspruch 1, bei der die zu verbindenden Platten im voraus an das Untergesenk (14) gespannt werden, bevor die Obergesenkeinheit (20, 21) den Niet oder Rohling (10) in die Platten (12, 13) treibt, um die Vernietungsstelle (11) zu bilden.

3. Platten-Vernietungsmethode nach einem der vorhergehenden Ansprüche, bei der mindestens eine Platte ein Blech ist und mindestens eine Platte eine polymere Tafel ist, wobei die polymere Tafel im Bereich der Vernietungsstelle im voraus erwärmt wird, um den Fluß des polymeren Materials beim Verformen der Platten zu fördern.

4. Platten-Vernietungsmethode nach einem der vorhergehenden Ansprüche, bei der ein Kleber auf den

Niet oder Rohling (10) aufgetragen wird, um die Verbindung zwischen den Platten (12, 13) und dem Niet oder Rohling (10) zu unterstützen.

5. Platten-Vernietungsmethode nach Anspruch 1, bei der ein Kleber in eine Bohrung des röhrenförmigen Niets oder Rohlings (10) gegeben wird, wobei der Kleber beim Verformen des röhrenförmigen Niets oder Rohlings (10) in die Vernietungsstelle (11) extrudiert wird, um die Verbindung zwischen den Platten (12, 13) und dem Niet oder Rohling (10) zu unterstützen.

6. Platten-Vernietungsmethode nach einem der vorhergehenden Ansprüche, bei der der Niet oder Rohling (10) einen Schaft mit externen Streifen, Rillen, Zähnen oder anderen Vorsprüngen oder Vertiefungen aufweist, um einen zusätzlichen Halt zwischen dem Niet oder Rohling (10) und den Platten in der Vernietungsstelle (11) zu bewirken.

7. Platten-Vernietungsmethode für das Vernieten von mindestens zwei Platten (312, 313) miteinander, wobei ein massiver oder halbröhrenförmiger Niet oder Rohling (310) verwendet wird, bei der ein Obergesenk eine übliche knopfartige Vernietungsstelle (311) in den zu verbindenden Platten (312, 313) bildet, wobei die Platten von einem Untergesenk (314) gestützt werden und das Obergesenk (320) danach zurückgezogen wird, **dadurch gekennzeichnet, daß** der Niet oder Rohling (310) zwischen dem Obergesenk (320) und der Vernietungsstelle (311) angeordnet wird; und daß das Obergesenk (320) vorwärtsbewegt wird, um den Niet oder Rohling (310) in die Vernietungsstelle (311) zu treiben, um die zu verbindenden Platten (312, 313) im stützenden Untergesenk zu verformen, und um mindestens das innere Ende des Schaftes des Niets oder Rohlings in der Vernietungsstelle (311) nach außen zu verformen; und daß der Niet oder Rohling (310) die Platten (312, 313) nicht durchdringt.

8. Platten-Vernietungsmethode nach Anspruch 7, bei der mindestens eine Platte (312, 313) ein Blech ist und mindestens eine Platte eine polymere Tafel ist, wobei die polymere Tafel im Bereich der Vernietungsstelle im voraus erwärmt wird, um den Fluß des polymeren Materials beim Verformen der Platten zu fördern.

9. Platten-Vernietungsmethode nach Anspruch 7 oder 8, bei der ein Kleber auf den Niet oder Rohling (310) aufgetragen wird, um die Verbindung zwischen den Platten (312, 313) und dem Niet oder Rohling (310) zu unterstützen.

10. Platten-Vernietungsmethode für das Vernieten von mindestens zwei Platten (112, 113) miteinander, wobei ein Niet (110) mit einer Bohrung (122) mit einem konischen Ende (123) und einen Schaft mit einem inneren Ende einschließend verwendet wird, wobei die Methode die folgenden Schritte aufweist:

Bereitstellen eines Obergesenks (120) mit einem Hauptkörper mit einem Eingriffsvorsprung und einem unteren Ende mit verringertem Durchmesser, um in die Bohrung (122) des Niets (110) zu passen;
Stützen der Platten (112, 113) auf einem stützenden Untergesenk und Spannen der Platten mit einem Vorspannkopf (119);
Anordnen des Niets (110) zwischen den Platten (112, 113) und dem Obergesenk (120); **gekennzeichnet durch**:

Vorwärtsbewegen des Obergesenks (120), bis der Vorsprung des Hauptkörpers mit dem Oberteil des Niets (110) in Eingriff kommt;
weiteres Vorwärtsbewegen des Obergesenks (120) nach unten, um die Platten (112, 113) im Untergesenk (114) zu verformen, und um die Vernietungsstelle (111) zu bilden; und
danach wiederum Vorwärtsbewegen des Obergesenks (120) nach unten, um zu bewirken, daß mindestens das innere Ende des Schaftes des Niets (110) nach außen verformt wird, wodurch folglich die Platten (112, 113) verformt werden, um die Vernietungsstelle ohne Durchdringen der Platten **durch** den Niet (110) zu sichern.

11. Platten-Vernietungsmethode nach Anspruch 10, bei der das untere Ende des Obergesenks eine Höhe aufweist, die geringer ist als die Höhe des Niets (110), und bei der, wenn der Vorsprung mit dem Niet (110) in Eingriff ist, das untere Ende des Obergesenks (120) etwas über den Platten (112, 113) beabstandet ist.

Revendications

1. Procédé de rabattement d'au moins deux panneaux (12, 13), dans lequel un rivet ou un pion tubulaire est enfoncé ou inséré par un assemblage de poinçon (20, 21) dans un joint rabattu (11) entre les panneaux (12, 13) pour déformer les panneaux (12, 13) reliés dans une matrice de support (14), le rivet ou le pion coopérant avec l'assemblage de poinçon pour déformer les panneaux (12, 13), **caractérisé en ce que** l'assemblage de poinçon comprend un poinçon (20) et un manchon (12) externe au poinçon (20) le poinçon (20) étant enfoncé à travers le

rivet ou le pion (10) et engagé dans le panneau supérieur (12), le poinçon et le rivet étant avancés pour déformer les panneaux (12, 13) et le manchon étant avancé par rapport au poinçon (20) pour déformer au moins une extrémité interne d'une tige du rivet ou du pion (10), vers l'extérieur dans le joint rabattu (11) et **en ce que** le rivet ou le pion (10) ne pénètre pas dans les panneaux (12, 13).

2. Procédé de rabattement de panneaux selon la revendication 1, dans lequel les panneaux à relier sont soumis à un serrage préalable sur la matrice (14) avant que l'assemblage de poinçon (20, 21) n'entraîne le rivet ou le pion (10) dans les panneaux (12, 13) pour former le joint rabattu (11).

3. Procédé de rabattement de panneaux selon l'une quelconque des revendications précédentes, dans lequel au moins un panneau est une feuille métallique, au moins un panneau étant une feuille polymère, la feuille polymère étant préchauffée dans la zone du joint rabattu pour favoriser l'écoulement du matériau polymère lors de la déformation des panneaux.

4. Procédé de rabattement de panneaux selon l'une quelconque des revendications précédentes, dans lequel un adhésif est appliqué sur le rivet ou le pion (10) pour favoriser le collage entre les panneaux (12, 13) et le rivet ou le pion (10).

5. Procédé de rabattement de panneaux selon la revendication 1, dans lequel un adhésif est appliqué sur un alésage du rivet ou du pion tubulaire (10), l'adhésif étant extrudé dans le joint rabattu (11) lorsque le rivet ou le pion tubulaire (10) est déformé pour favoriser le collage entre les panneaux (12, 13) et le rivet ou le pion (10).

6. Procédé de rabattement de panneaux selon l'une quelconque des revendications précédentes, dans lequel le rivet ou le pion (10) comporte une tige avec des cannelures externes, des rainures, des dents ou d'autres saillies ou évidements pour établir une adhérence additionnelle entre le rivet ou le pion (10) et les panneaux dans le joint rabattu (11).

7. Procédé de rabattement d'au moins deux panneaux (312, 313) par l'intermédiaire d'un rivet ou d'un pion solide ou semi-tubulaire (310), dans lequel un poinçon forme un joint rabattu conventionnel du type à bouton (311) dans les panneaux (312, 313) à relier, les panneaux étant supportés par une matrice (314), le poinçon (320) étant ensuite rétracté; **caractérisé en ce que** le rivet ou le pion (310) est agencé entre le poinçon (320) et le joint rabattu (311); le poinçon (320) étant avancé pour enfoncer le rivet ou le pion (310) dans le joint rabattu (311) pour déformer les panneaux (312, 313) à relier dans une matrice de support, et pour déformer vers l'extérieur au moins l'extrémité interne de la tige du rivet ou du pion dans le joint rabattu (311), et **en ce que** le rivet ou le pion (310) ne pénètre pas dans les panneaux (312, 313).

8. Procédé de rabattement de panneaux selon la revendication 7, dans lequel au moins un panneau (312, 313) est une feuille métallique, au moins un panneau étant une feuille polymère, la feuille polymère étant préchauffée dans la zone du joint rabattu pour favoriser l'écoulement du matériau polymère lors de la déformation des panneaux.

9. Procédé de rabattement de panneaux selon les revendications 7 ou 8, dans lequel un adhésif est appliqué sur le rivet ou le pion (310) pour favoriser le collage entre les panneaux (312, 313) et le rivet ou le pion (310).

10. Procédé de rabattement d'au moins deux panneaux (112, 113) par l'intermédiaire d'un rivet (110) comportant un alésage (122) avec une extrémité effilée (123) et englobant une tige comportant une extrémité interne, le procédé comprenant les étapes ci-dessous:

fourniture d'un poinçon (120) comportant un corps principal avec un épaulement d'engagement et une extrémité inférieure à diamètre réduit destinée à être ajustée dans l'alésage (122) du rivet (110);

support des panneaux (112, 113) sur une matrice de support et serrage des panneaux par une tête de pré-serrage (119);

agencement du rivet (110) entre les panneaux (112, 113) et le poinçon (120); **caractérisé par** les étapes ci-dessous:

avance du poinçon (120) jusqu'à ce que l'épaulement du corps principal s'engage dans la partie supérieure du rivet (110);

avance ultérieure du poinçon (120) vers le bas pour déformer les panneaux (112, 113) dans la matrice (114) et pour former le joint rabattu (111); et

nouvelle avance du poinçon (120) vers le bas pour entraîner la déformation vers l'extérieur d'au moins l'extrémité interne de la tige du rivet (110), avant de déformer les panneaux (112, 113) pour fixer le joint rabattu sans pénétration du rivet (110) dans les panneaux.

11. Procédé de rabattement de panneaux selon la revendication 10, dans lequel l'extrémité inférieure du poinçon a une hauteur inférieure à une hauteur du rivet (110); un léger espacement de l'extrémité inférieure du poinçon (120) au-dessus des panneaux (112, 113) se produisant lors de l'engagement de l'épaulement dans le rivet (110).

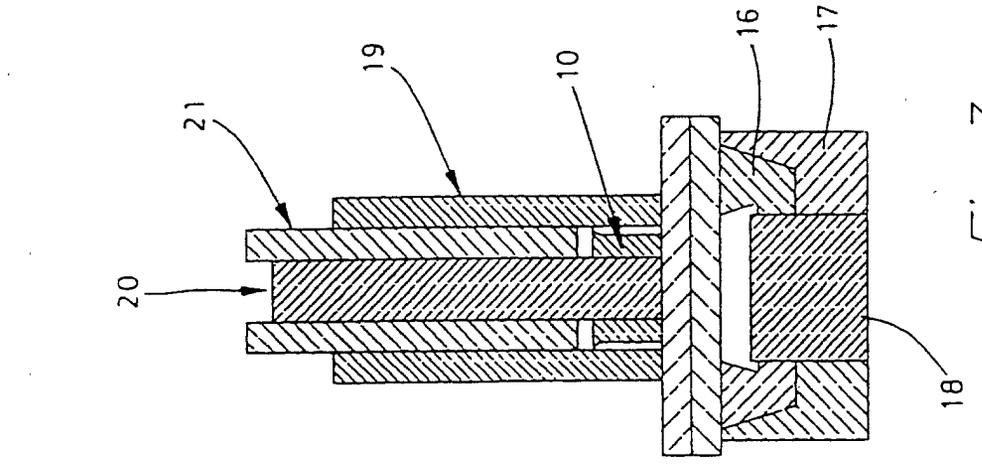


Fig. 3

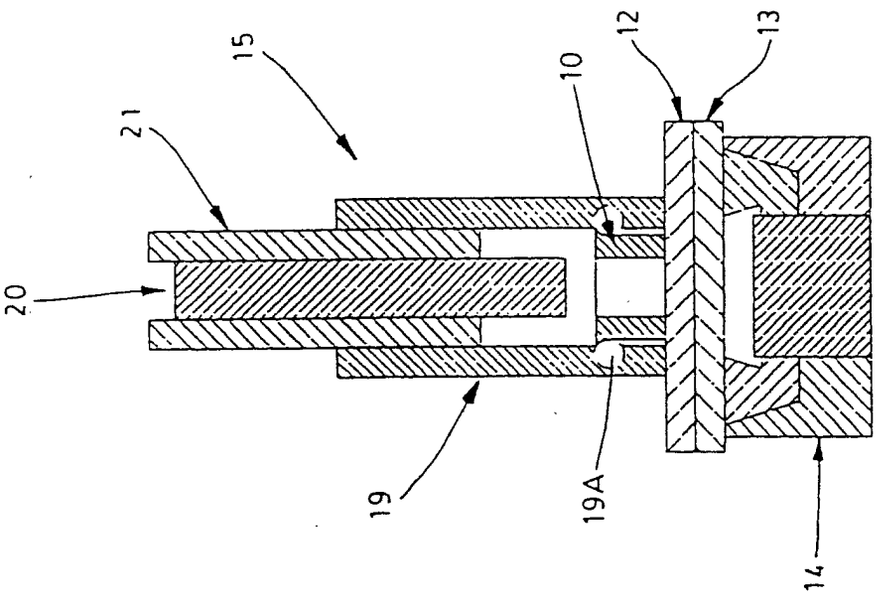


Fig. 2

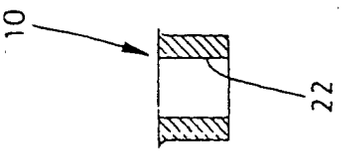


Fig. 1

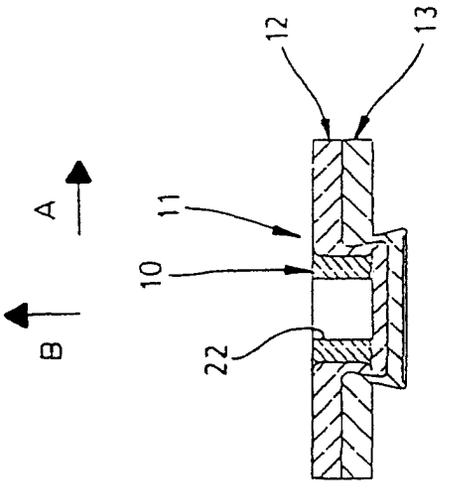


Fig.6

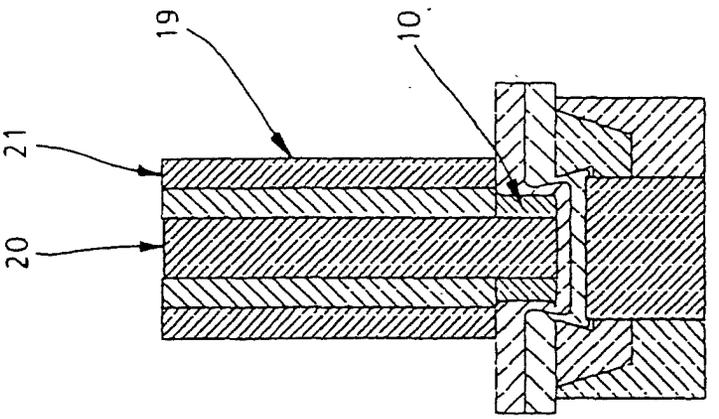


Fig.5

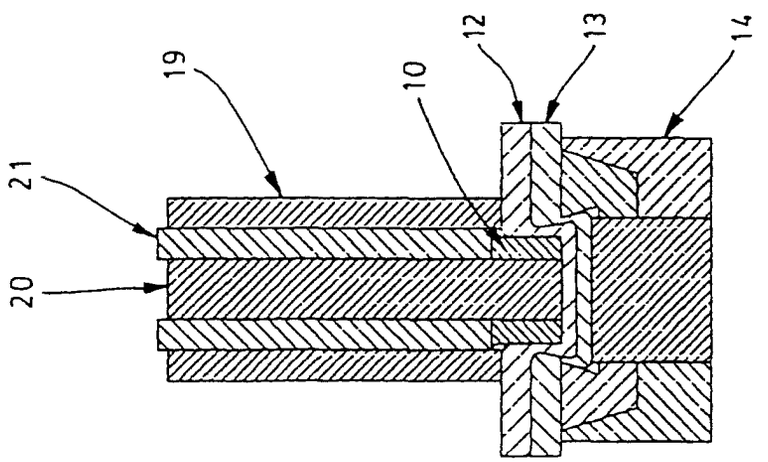


Fig.4

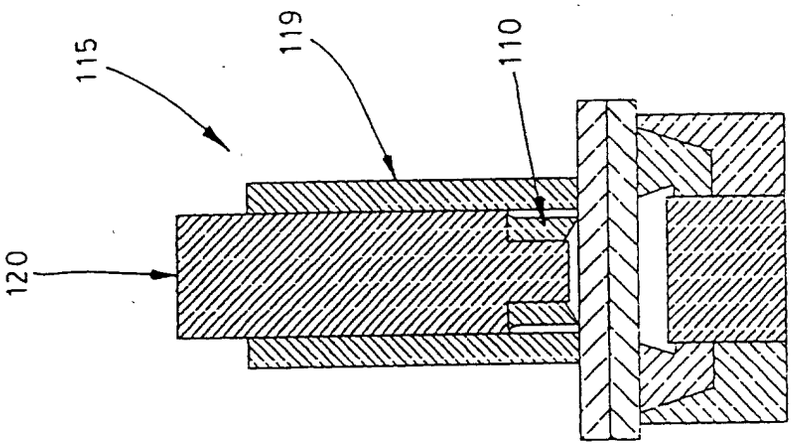


Fig. 9

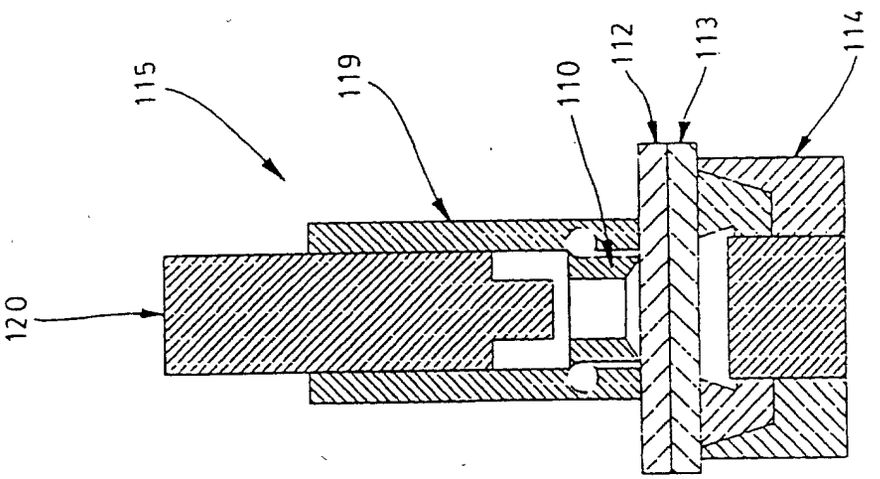


Fig. 8

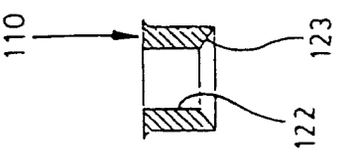


Fig. 7

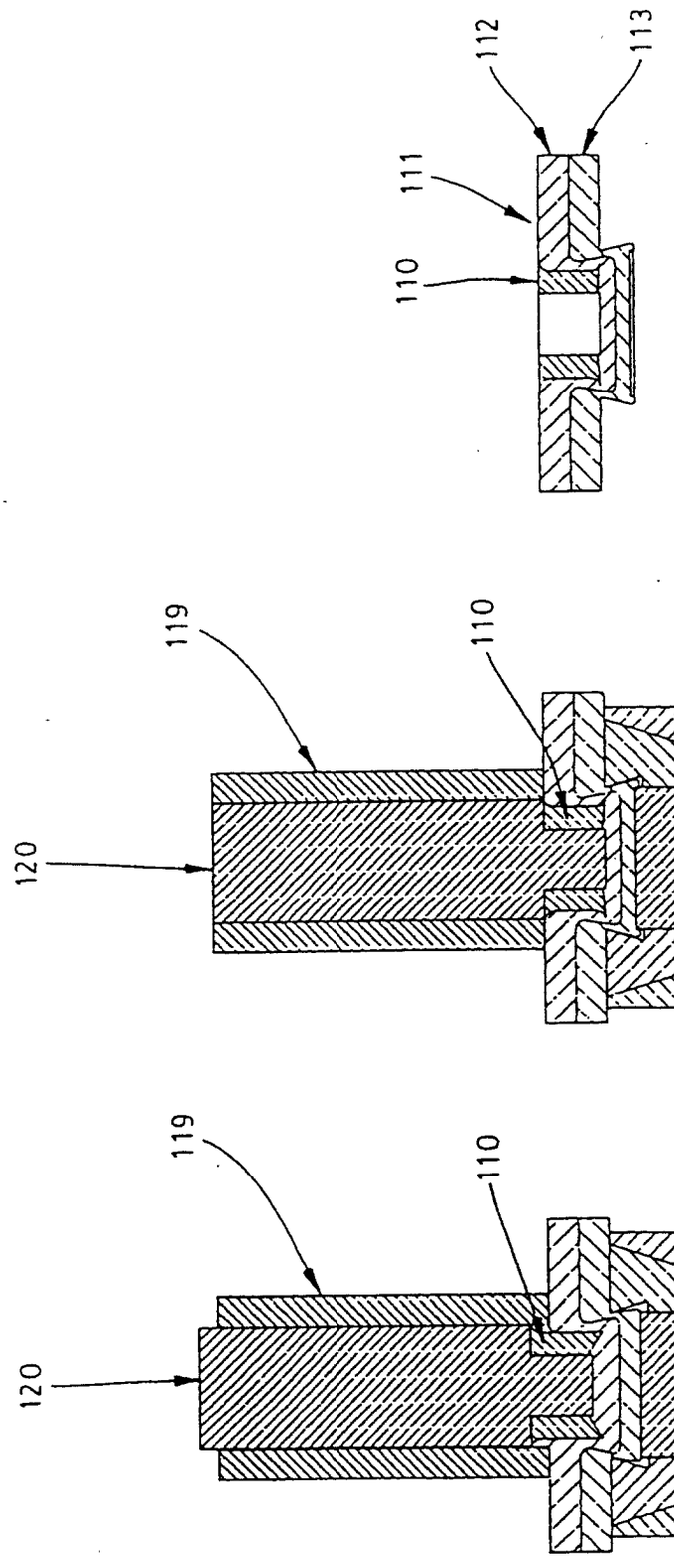


Fig. 12

Fig. 11

Fig. 10

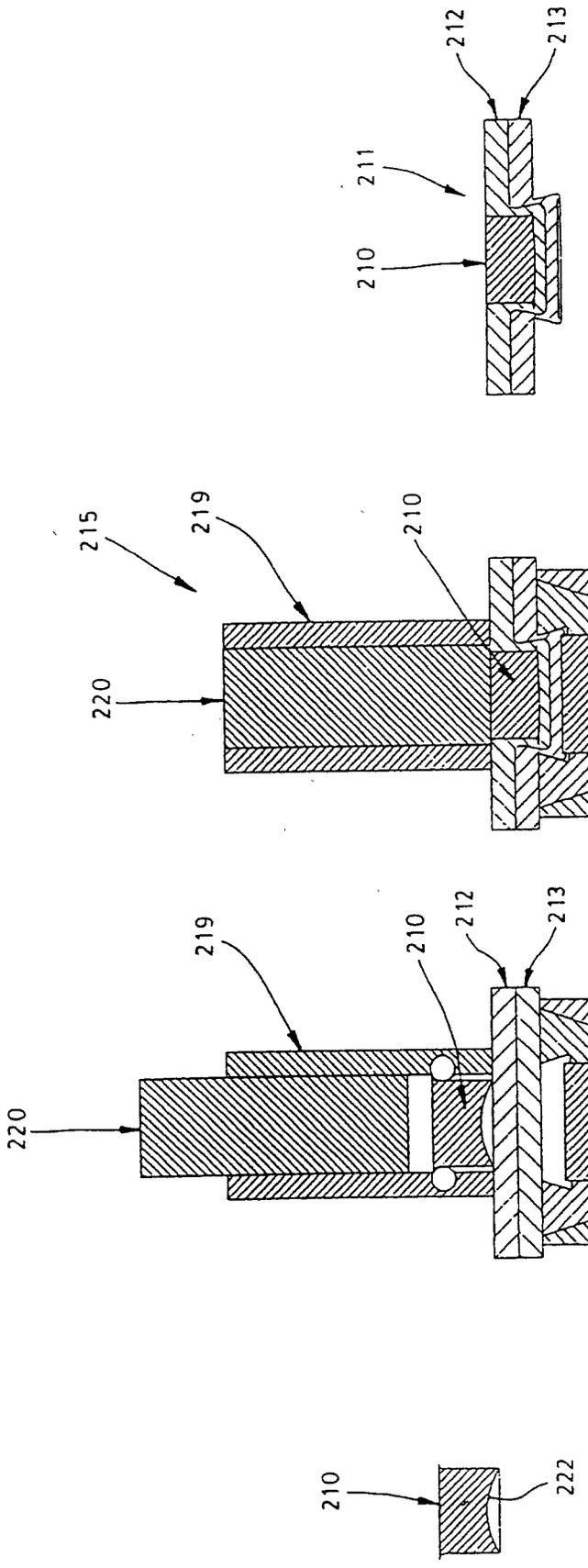


Fig. 13

Fig. 14

Fig. 15

Fig. 16

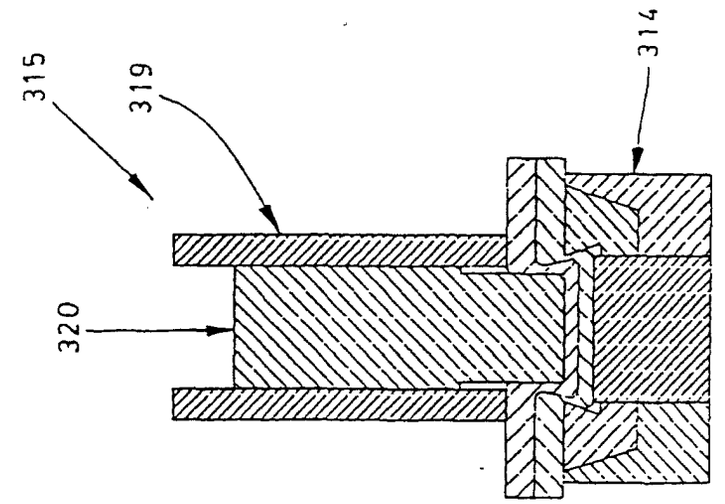


Fig. 19

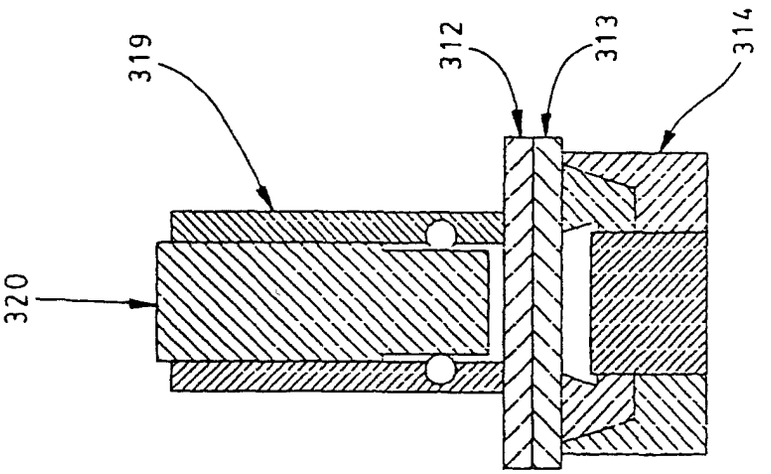


Fig. 18

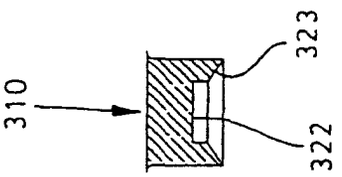
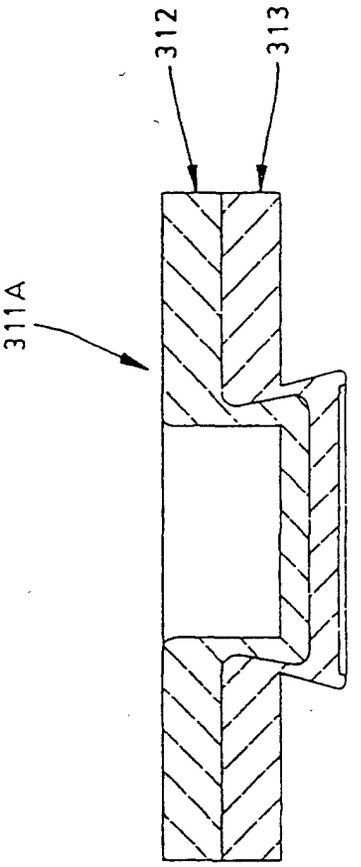


Fig. 17



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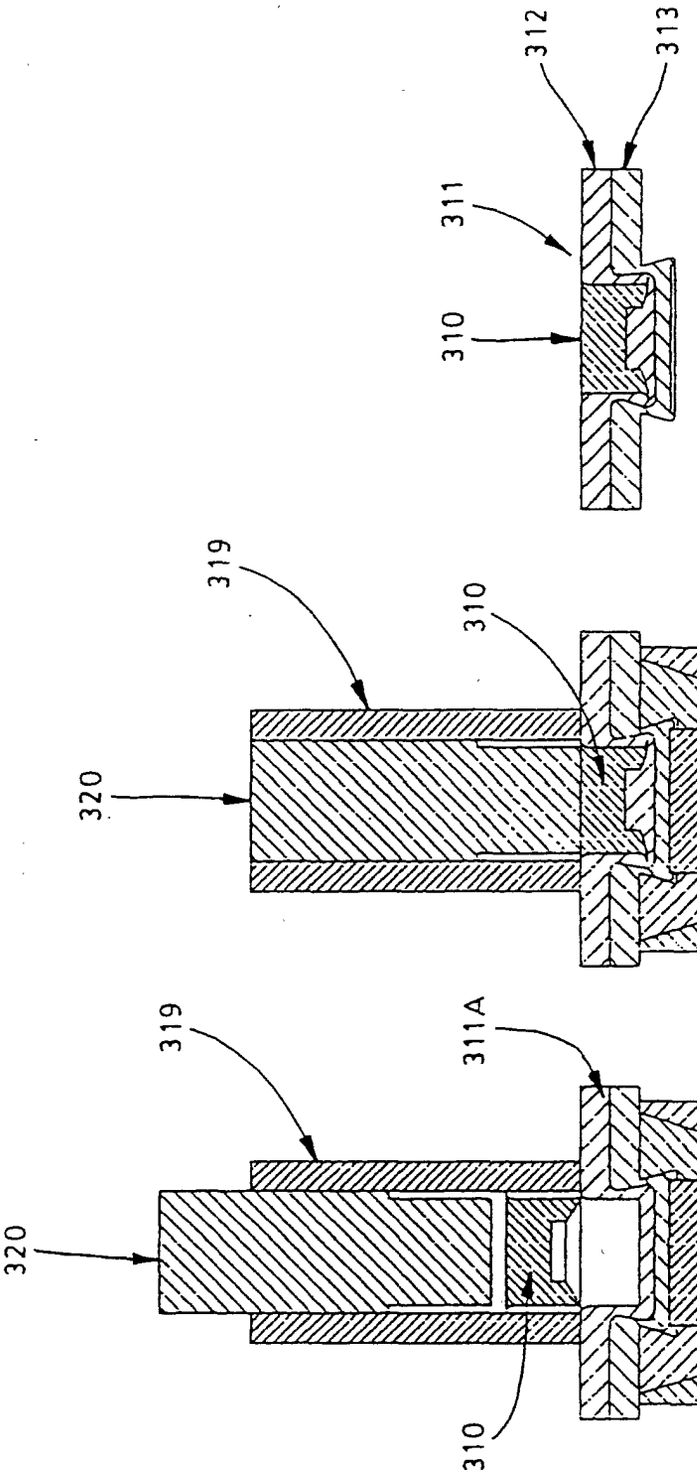

Fig.21

Fig.22

Fig.23

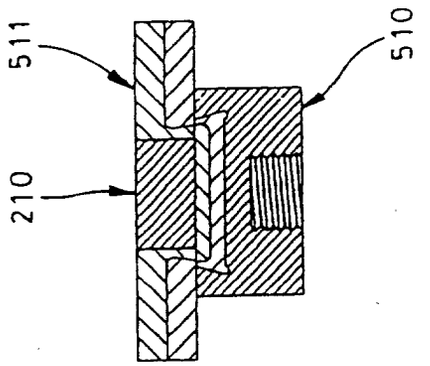

Fig. 26

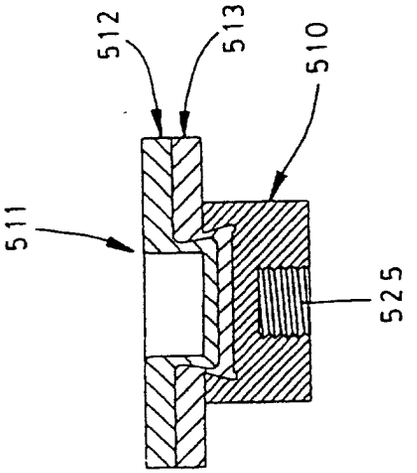

Fig. 25

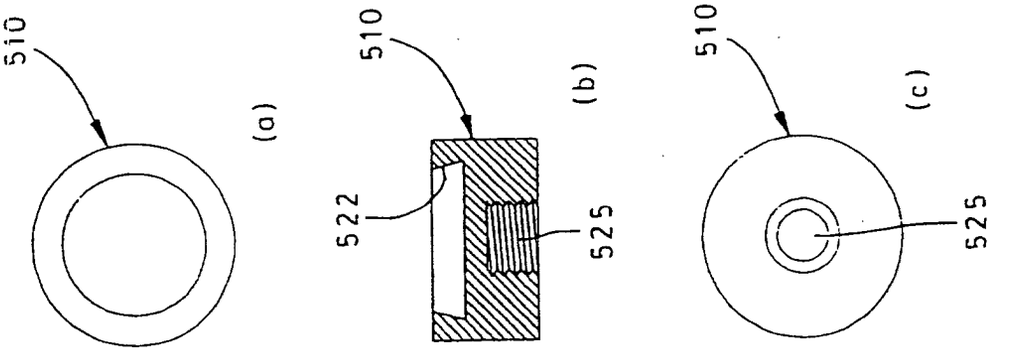

Fig. 24

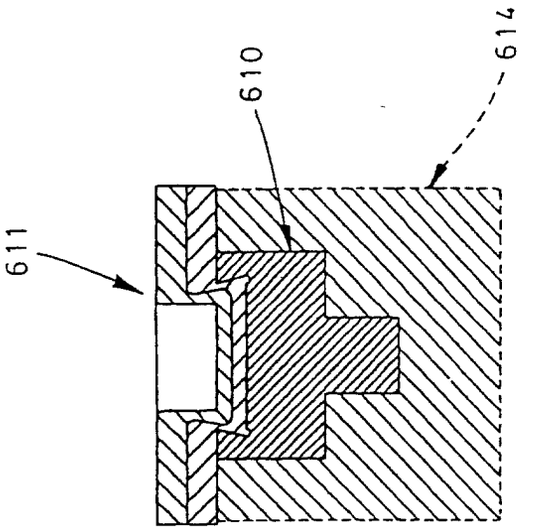

Fig. 29

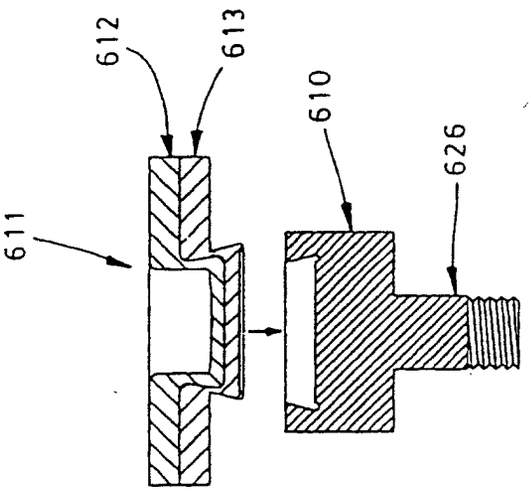

Fig. 28

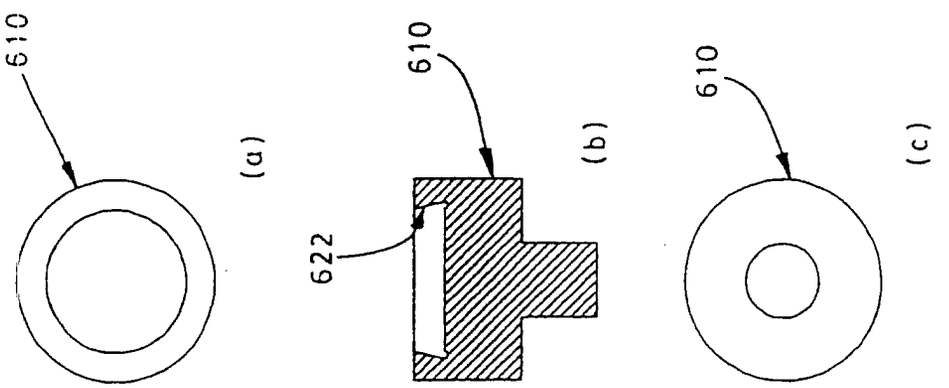

Fig. 27