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(54) **A METHOD FOR MAKING A JOINT BETWEEN A GENERALLY FLAT MEMBER, METAL OR NON-METAL, AND AN ELONGATED MEMBER LIKE A WIRE AND AN APPARATUS FOR CARRYING OUT SAID METHOD**

VERFAHREN ZUR HERSTELLUNG EINER VERBINDUNG ZWISCHEN EINEM IM ALLGEMEINEN FLACHEN ELEMENT, METALL ODER NICHT-METALL UND EINEM LÄNGLICHEN ELEMENT WIE EINEM DRAHT SOWIE VORRICHTUNG ZUR DURCHFÜHRUNG DES VERFAHRENS

PROCÉDÉ DE RÉALISATION D'UN RACCORD ENTRE UN ÉLÉMENT GLOBALEMENT PLAT, MÉTALLIQUE OU NON MÉTALLIQUE, ET UN ÉLÉMENT ALLONGÉ TEL QU'UN FIL, ET APPAREIL DE RÉALISATION DUDIT PROCÉDÉ

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(73) Proprietor: **Bollhoff Attexor SA
1024 Ecublens (VD) (CH)**

(72) Inventor: **DUBUGNON, Olivier
CH-1115 Vullierens (CH)**

(74) Representative: **Johansson, Lars E.
Hynell Intellectual Property AB
P.O.Box 138
683 23 Hagfors (SE)**

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Description

Technical field

[0001] The present invention refers to a method for making joints by means of clinching between first and second members, metal or non-metal, whereby said first member, at least in and close to the location where the joint is going to be made, has a generally sheet-formed or flat geometry, and said second member, in the same location, has an elongated form with a length generally much bigger than any measure of its arbitrary section. Such a second member could for instance be a wire, a connection pin of an electrical or electronic component etc.. The section could e.g. be essentially circular which is the case for ordinary electrical conductors or wires or square or have the form of a parallelepiped which is sometimes the case for connection pins of electronic components. In principle it is referred to sections with a maximum width or diameter in the order of 0-10 mm, more specifically in the order of 0.5-3 mm. In the joint area the elongated member has its longitudinal axis essentially parallel to the surface of said first member.

[0002] The invention also refers to an apparatus for carrying out said method.

Background art

[0003] Different tools and methods for making joints of the so called clinch type between two or several sheet-formed members of metal or non-metal are well known in the art. By means of a co-operating punch and matrix the members are joined together by drawing the material in the overlaying sheets interposed between the punch and matrix forming a cavity in the sheets and laterally extending the bottom part of said cavity to lock the members to each other. The independent claim has been delimited vis-à-vis the state of art as disclosed in WO2010139606.

[0004] Mostly this technique is used for purely mechanically joining metal sheets to each other. It should however be clear that under circumstances the joint could also electrically connect two sheet-formed electrically conducting members.

[0005] The clinching technique is thus forming the joint without the use of additional components like screws or rivets or similar. The generally flat members to be joined are deformed by means of the clinching tools to form the joint.

[0006] A similar technical problem consists in joining a first elongated member with a length generally much bigger than any measure of its arbitrary section, e.g. a wire to a second essentially flat member without the use of additional components, only by means of appropriately deforming the members. Solutions to this technical problem find applications e.g. in connecting two electrically conducting members like an electrical wire to a generally flat electrically conducting element.

[0007] The prior art shows solutions to this problem of different types. A first type makes the joint in two steps. In the first step the generally flat member is prepared in a particular predefined way. The pre-configuration could include cutting and bending the member or making holes or slots in the same. In the second step the wire is connected to the flat member in a clinching operation in which mainly the material of the wire by means of the clinching tools is plastically deformed floating into said holes or slots creating the joint. A solution of this type is shown in e.g. the document FR2935550.

[0008] In a second type of solution the wire on the other hand has been provided at its end portion with an integral part which is generally flat so the problem of mechanically and electrically connecting the two members is solved with ordinary clinching between the two generally flat portions. A solution of this type is shown in e.g. the document EP0653586 B1.

[0009] In a third type of solution the flat member comprises at least locally where the joint is going to be made two superposed sheets. An electrical wire is positioned between the superposed sheets and an ordinary clinch joint is fixing the sheet-formed members and the wire together. A solution of this type is shown in e.g. the document FR 2736471.

[0010] In a fourth type of solution the generally flat member is locally cut and deformed so that it could be rolled around the electrical wire or presenting a "tunnel" in which the electrical wire could be inserted. The joint is then created by squeezing the deformed part of the generally flat member around the electrical wire. A solution of this type is shown in e.g. the documents DE102006013347 and EP0634810.

[0011] All the above prior art solutions are complicated because they all imply that either the generally flat member or the wire is prepared in some way to alter its geometry before the joining.

[0012] The prior preparation of one of the members, especially the generally flat member, before the joining procedure can take place clearly limits the choice of the joining area. In certain cases inherent physical restrictions limit the area of the generally flat member where the preparation could be made. In certain cases only the edges of the member will be appropriate for the preparation.

[0013] Once the preparation of the generally flat member has been made the position of the joint is decided.

[0014] These complications have been accepted in the prior art based on the common assumption that an elongated member with small sectional measures, for instance a wire, an ordinary connection pin of an electrical or electronic component etc. could not be fixed directly to a generally flat member by means of clinching.

Brief description of the invention

[0015] One object of the present invention is to provide a method and an apparatus making it possible to fix an

elongated member with small sectional measures, for instance a wire, a connection pin of an electrical or electronic component etc. directly to a generally flat member by means of clinching without previously treating the elongated member or the generally flat member by means of deformation changing its general geometry before the joining procedure is taking place.

[0016] A further object of the present invention is to provide greater almost unlimited choice of joining position on the generally flat member, thus greater flexibility.

[0017] The position of the joint made by the inventive method is in principle only restricted by the limits on the generally flat member where an ordinary clinch joint could be made.

[0018] The invention is not limited to making combined mechanical and electrical joints between electrically conducting members. A pure mechanical application in which the method and apparatus could be used is fixing e.g. a wire grid to a frame, e.g. a metal wire grid to a sheet metal frame by means of clinching. In this case the appropriate joints will be made between a wire in the grid and the metal sheet. In this example either of the two members or both could be pre-treated with an electrically isolating layer which makes the joint pure mechanical.

[0019] In the following and for simplifying the illustration of the inventive idea fixing of a metal wire against a metal plate will be described. However, according to the above this is not limiting the scope of the invention. The wording "wire" or "metal wire" in this context includes a solid wire, e.g. an ordinary solid electrical copper wire or conductor or similar, but also different types of multiple stranded wires, twisted and non-twisted, as well as multiple stranded wires which have been pre-compressed at the free end portion without changing the general geometry.

Description of the drawings

[0020] The invention will be described with reference to the following drawing on which

Fig 1a to 1f illustrate a single stroke method for fixing e.g. a wire against a flat metal sheet,

Fig 2 shows a possible punch and die arrangement for a single stroke method,

Fig 3 shows two different punch forms,

Fig 4 shows alternatives for punch and die forms,

Fig 5 shows a special form of the stripper provided with means for gripping and holding the wire before the fixing,

Fig 6a-c shows the different steps in a two stroke method for fixing the wire,

Fig 7 shows a further variant of the method for fixing the wire,

Fig 8 illustrates an embodiment for gripping and holding a wire according to the inventive method,

Fig 9 illustrates a further embodiment for gripping and holding the wire,

Fig 10 shows two arrangements of cooperating punch and die for creating bridged joints.

Detailed description of the invention

[0021] To simplify the description it is in the following assumed that the two tool parts are working together along a vertical axis with the punch and stripper of the first tool part moving downwards against a die-anvil combination of a static second tool part. It is however clear that said axis can have any orientation in space without changing the principle of the present invention. And it is also clear that the movements of the tool parts could be reversed so that said second tool part will be moved against a static first tool part.

[0022] Figure 1a shows a tool head 3 comprising a punch 1 and a stripper 2. The punch 1 is arranged fixed to the tool head 3 while the stripper 2 is movable coaxially with the tool head 3.

[0023] Fig 1a to 1f illustrate a single stroke method for fixing e.g. a wire against a flat metal sheet. The designation single stroke refers to the fact that the joint between the members is made during one single relative movement between the punch and the die. Single stroke methods for joining sheet formed members to each other are known in the art.

[0024] The stripper 2 is mounted on a cylinder-piston arrangement 4, 5 forming an integral part of the tool head 3. The piston 4 is biased in its lower position by means of a spring 6. This arrangement forms the initial state of the first tool part. As can be seen the piston 1 is somewhat retracted in relation to the stripper 2 so that the end portion of the stripper and the punch form an elongated space for receiving the end portion of the wire 12 to be fixed to the generally flat member 7. In Fig 1a, b the wire, here illustrated as a multiple stranded wire, has been placed between the end portions of the stripper 2. The generally flat metal sheet 7 is resting against the top of the matrix or die 8. The matrix is here only schematically illustrated and comprises in this embodiment an anvil 9 and two or several laterally displaceable die elements 10. The die elements are in this example shown resting against a support surface 11 perpendicular to the vertical axis of the tool part.

[0025] In Fig 1c, d the upper tool part including the punch 1 and the stripper 2 have been moved towards the die 8 to an intermediate position. The stripper 2 is contacting the upper surface of the metal sheet 7 with a comparatively low force, generated by the spring. There-

after the punch 1 will apply the main force on the wire and press the wire 12 into the surface of the metal sheet. The stripper in contact with that surface will block the lateral expansion of the wire material.

[0026] In Fig 1e, f the wire 12 has been pressed through the metal sheet 7 and the wire material has been expanded on the back side of the metal sheet 7' in contact with the anvil. The rounded form of the punch 1 guarantees that the wire is not cut through, cf. Fig 1f and for instance Fig 3.

[0027] Fig 2 shows a possible punch and die arrangement for a single stroke method. An expandable die or matrix of this type is known in the art. The width W of the flat punch is advantageously essentially similar to the diameter of the wire to be fixed. Or it could be slightly bigger. The movable die elements 100 are shown in this case guided on a pin 13 and the counter force is created by means of spring elements 14.

[0028] The cooperating edges of the movable die elements 100 and the punch 1 could be made cutting through the metal sheet 7 or be rounded in order not to cut the metal sheet when creating a leakproof joint with the wire 12.

[0029] Fig 3 shows two different punch forms 101, 102. The upper figure is showing rounded edges designed not to cut the wire during the joint procedure. During the joining procedure the punch will press the wire into the generally flat member and in certain embodiments cut through the flat member along the co-operating edges 103 and 104 on the punch 101 and the movable die elements 100 respectively parallel to the axis of the wire. But the wire should of course not be cut perpendicular to its axis. The lower figure shows a form of the punch 102 which will create two consecutive joining zones along the axis of the wire which will give a bridged joint. This is a form especially advantageous when working in thin metal sheets, cf. Fig 10.

[0030] Fig 4 shows alternatives for the form of the end portion of the punch 1 and the top surface of the anvil 9. These forms could be of advantage when the wire is of the multiple stranded type.

[0031] Fig 5 shows a special form of the stripper 200 provided with means for gripping and holding the wire before the fixing. In the elongated space formed by the end portions of the stripper parts 200 and the tip of the punch 1 for receiving the end portion of the wire 12, upper and lower parallel ridges 15 and 16 respectively are arranged on the inside of the two stripper parts 200. The stripper can expand in order to grip and hold the wire. The two stripper halves 200 are pivoting outwardly against the force from a spring element 17 when the wire is entered into position. When the punch 1 is travelling downwards relative to the stripper parts they will again pivot outwards leaving space for the punch to pass the ridges. This solution allows various sizes of the wires, somewhat smaller or wider than the punch.

[0032] Fig 6 shows the different steps in a double stroke method for fixing the wire. Double stroke methods

for joining metal sheets to each other are also known in the art. In the first step the wire 12 is held between the front ends of the stripper 2 as described in connection to Fig 1. The vertical position of an anvil 900 cooperating with the die is here controlled by a cylinder-piston assembly 18, 19. In Fig 6a and b the anvil 900 is not active which means that it follows the downward movement of the wire 12 and the metal sheet 7 when the punch 1 moves downwards.

[0033] In the next step, Fig 6c, the anvil is activated by means of e.g. hydraulic pressure into the port 20 of the cylinder 18 and lifts the cut out portion of the metal sheet and the partly expanded wire to position them outside the fixed die. In that position the punch 1 makes a second stroke against the wire 12 which will then expand further on the lower side of the metal sheet. The counter force is created by the anvil 900 which is blocked in this step.

[0034] Fig 7 shows a further variant of the method for fixing the wire. Instead of lifting the wire 12 and cut out portion 7" of the metal sheet 7 from the position illustrated in Fig 6b the punch 1 is retracted and a high force is applied between the stripper 2 and the fixed die. This will laterally expand the material of the metal sheet 7 in over the top surface of the wire 12 and create the locking.

[0035] Fig 8 illustrates an embodiment for gripping and holding a wire 12 according to the inventive method. The stripper 2 is here provided with a pair of jaws 21, one on each side of the elongated space for receiving the end portion of the wire 12 to be fixed. The jaws are arranged pivoting and biased against each other by means of two spring elements 22. The free end of each jaw is provided with a recess 23. Thus, when the wire to be fixed is introduced into the space between the stripper and the punch the jaws will grip and hold the wire 12 in the recesses 23. The wire 12 is in this way held in place during the approach of the punch 1. The free ends of the jaws are additionally designed to keep the wire centered until it reaches the sheet surface.

[0036] Fig 9 illustrates a further embodiment for gripping and holding the wire by means of jaws 25, 26. The jaws are as in Fig 8 pivoting around their respective pivot axis and are in this embodiment hold together by means of a toroidal spring 24. As understood this solution is very flexible as it allows to work with different wire diameters. The arrangement also holds the wire well centered during the movement towards the sheet surface. The grip entry 27 is in this case formed slightly expanded away from the punch. This makes the tool especially adapted for pick-and-place-applications in automated procedures.

[0037] Fig 10 shows two arrangements of cooperating punch and die for creating bridged joints. The lower figure shows a side view of a clinched wire of the type twisted multiple stranded wires. A bridge 28 is separating two consecutive squeezed zones 29. This reinforces the crimping and holding effect especially with thin sheets 7.

Claims

1. An apparatus for making joints by means of clinching between first (7) and second (12) members, metal or non-metal, whereby said first member (7), at least in and close to the location where the joint is going to be made, has a generally sheet-formed or flat geometry, and said second member (12), in the same location, has an elongated form with a length axis and a length generally much bigger than any measure of its arbitrary section, by means of a tool provided with a punch (1), a cooperating die and anvil (9) and a stripper (2) surrounding the punch (1), **characterized in that** the end portion of the stripper (2) and the punch (1) form an elongated space and that the dimension of the punch (1) in the direction perpendicular to said length axis is essentially the same as the dimension of the section of said second member (12) in said location.
2. An apparatus according to claim 1, **characterized by** a rounded form of the punch (1) arranged to guarantee that the second member (12) is not cut through.
3. An apparatus according to claim 1 or 2, **characterized by** arranging laterally displaceable movable die elements (10, 100).
4. An apparatus according to claim 3, **characterized by** arranging co-operating edges (103, 104) on the punch (1) and the movable die elements (100), respectively, parallel to the axis of the wire arranged to cut through the first member (7).
5. An apparatus according to any preceding claim, **characterized by** arranging the stripper (2) having two pivoting halves (200) with upper and lower parallel ridges (15, 16) respectively, on the inside of the two stripper halves (200) arranged to grip and hold the second member (12), wherein said pivoting halves (200) are arranged to pivot outwardly against the force from a spring element (17) when a wire is entered into position.
6. A method for making joints by means of clinching between first (7) and second (12) members, metal or non-metal, whereby said first member (7), at least in and close to the location where the joint is going to be made, has a generally sheet-formed or flat geometry, and said second member (12), in the same location, has an elongated form with a length axis and a length generally much bigger than any measure of its arbitrary section, by the use of a tool provided with a punch (1), a cooperating die and anvil (9) and a stripper (2) surrounding the punch (1), **characterized by** using an end portion of the stripper (2) and the punch (1) that forms an elongated space and by using a dimension of the punch (1) in the direction perpendicular to said length axis that is essentially the same as the dimension of the section of said second member (12) in said location.
7. A method according to claim 6, **characterized by** using a rounded form of the punch (1) to guarantee that the second member (12) is not cut through.
8. A method according to claim 6 or 7, **characterized by** pressing the second member (12) through the first member (7).
9. A method according to claim 6, 7 or 8, **characterized by** using laterally displaceable movable die elements (10, 100).
10. A method according to claim 9, **characterized by** using co-operating edges (103, 104) on the punch (1) and the movable die elements (100), respectively, parallel to the axis of the wire to cut through the first member (7).
11. A method according to any preceding method claim, **characterized by** using a stripper (2) having two pivoting halves (200) with upper and lower parallel ridges (15, 16) respectively, on the inside of the two stripper halves (200) to grip and hold the second member (12).
12. A method according to claim 8, **characterized by** a further step wherein the anvil (900) is activated by means of pressure and lifts the cut out portion of the first member (7) and the partly expanded second member (12) to position them outside the fixed die (10) whereby the punch (1) makes a second stroke against the second member (12) which will then expand further on the lower side of the metal sheet.

Patentansprüche

1. Vorrichtung zum Herstellen von Verbindungen mittels Durchsetzfügen zwischen ersten (7) und zweiten (12) Elementen, Metall oder Nichtmetall, wobei

das erste Element (7), wenigstens in und nahe der Stelle, an der die Verbindung hergestellt werden wird, eine im Allgemeinen blattförmige oder flache Geometrie aufweist, und das zweite Element (12) an derselben Stelle eine längliche Form mit einer Längsachse und einer Länge aufweist, die im Allgemeinen viel größer ist als irgendein Maß seines beliebigen Querschnitts,

mittels eines Werkzeugs, das mit einem Stempel (1),

einer zusammenwirkenden Matrize und Amboss (9) und einem den Stempel (1) umgebenden Abstreifer (2) bereitgestellt ist,

gekennzeichnet dadurch, dass der Endabschnitt des Abstreifers (2) und der Stempel (1) einen länglichen Raum bildet und dass die Abmessung des Stempels (1) in der Richtung senkrecht zu der Längsachse im Wesentlichen gleich der Abmessung des Abschnitts des zweiten Elements (12) an der Stelle ist.

2. Vorrichtung nach Anspruch 1, **gekennzeichnet durch** eine abgerundete Form des Stempels (1), der angeordnet ist, sicher zu stellen, dass das zweite Element (12) nicht durchschnitten wird.

3. Vorrichtung nach Anspruch 1 oder 2, **gekennzeichnet durch** Anordnen seitlich verschiebbarer beweglicher Matrizenelemente (10, 100).

4. Vorrichtung nach Anspruch 3, **gekennzeichnet durch** Anordnen zusammenwirkender Kanten (103, 104) an dem Stempel (1) bzw. den beweglichen Matrizenelementen (100) parallel zu der Achse des Drahtes, angeordnet um das erste Element (7) zu durchschneiden.

5. Vorrichtung nach einem vorhergehenden Anspruch, **gekennzeichnet durch** Anordnen des Abstreifers (2), aufweisend zwei schwenkbare Hälften (200) mit oberen bzw. unteren parallelen Wulsten (15, 16) an der Innenseite der zwei Abstreifhälften (200), angeordnet um das zweite Element (12) zu greifen und zu halten, wobei die schwenkbaren Hälften (200) angeordnet sind, nach außen entgegen der Kraft von einem Federelement (17) zu schwenken, wenn ein Draht in Position getreten ist.

6. Verfahren zum Herstellen von Verbindungen mittels Durchsetzfügen zwischen ersten (7) und zweiten (12) Elementen, Metall oder Nichtmetall, wobei

das erste Element (7), wenigstens in und nahe der Stelle, an der die Verbindung hergestellt werden wird, eine im Allgemeinen blattförmige oder flache Geometrie aufweist, und das zweite Element (12) an derselben Stelle eine längliche Form mit einer Längsachse und einer Länge aufweist, die im Allgemeinen viel größer ist als irgendein Maß seines beliebigen Querschnitts,

durch die Verwendung eines Werkzeugs, das mit einem Stempel (1), einer zusammenwirkenden Matrize und Amboss (9) und einem den Stempel (1) umgebenden Abstreifer (2) bereitgestellt ist, **gekennzeichnet durch** Verwenden eines En-

dabschnitts des Abstreifers (2) und des Stempels (1), der einen länglichen Raum bildet, und durch Verwenden einer Abmessung des Stempels (1) in der Richtung senkrecht zu der Längsachse, die im Wesentlichen gleich der Abmessung des Abschnitts des zweiten Elements (12) an der Stelle ist.

7. Verfahren nach Anspruch 6, **gekennzeichnet durch** Verwenden einer abgerundeten Form des Stempels (1), um sicher zu stellen, dass das zweite Element (12) nicht durchschnitten wird.

8. Verfahren nach Anspruch 6 oder 7, **gekennzeichnet durch** Drücken des zweiten Elements (12) durch das erste Element (7).

9. Verfahren nach Anspruch 6, 7 oder 8, **gekennzeichnet durch** Verwenden seitlich verschiebbarer beweglicher Matrizenelemente (10, 100).

10. Verfahren nach Anspruch 9, **gekennzeichnet durch** Verwenden zusammenwirkender Kanten (103, 104) an dem Stempel (1) bzw. den beweglichen Matrizenelementen (100) parallel zu der Achse des Drahtes, um durch das erste Element (7) zu schneiden.

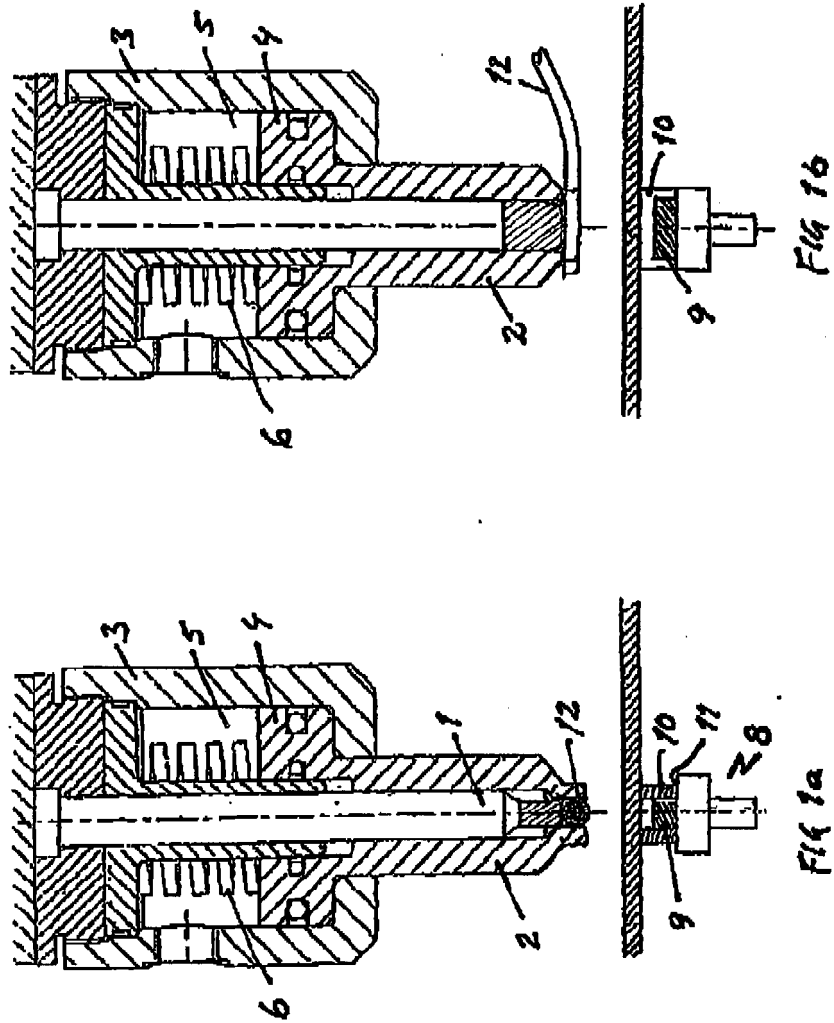
11. Verfahren nach einem vorhergehenden Verfahrensanspruch, **gekennzeichnet durch** Verwenden eines Abstreifers (2), aufweisend zwei schwenkbare Hälften (200) mit oberen bzw. unteren parallelen Wulsten (15, 16), an der Innenseite der zwei Abstreifhälften (200), um das zweite Element (12) zu greifen und zu halten.

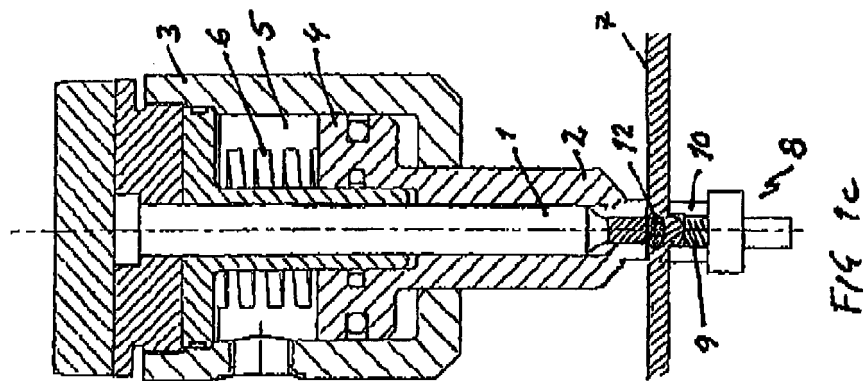
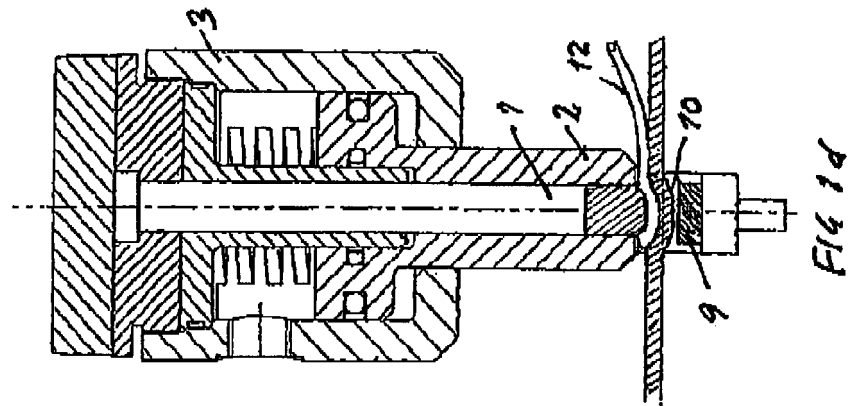
12. Verfahren nach Anspruch 8, **gekennzeichnet durch** einen weiteren Schritt, wobei der Amboss (900) durch Druckmittel aktiviert wird und den ausgeschnittenen Abschnitt des ersten Elements (7) und des teilweise ausgedehnten zweiten Elements (12) hebt, um sie außerhalb der festen Matrize (10) zu positionieren, wodurch der Stempel (1) einen zweiten Hub gegen das zweite Element (12) macht, das dann weiter an der unteren Seite des Metallblatts ausgedehnt wird.

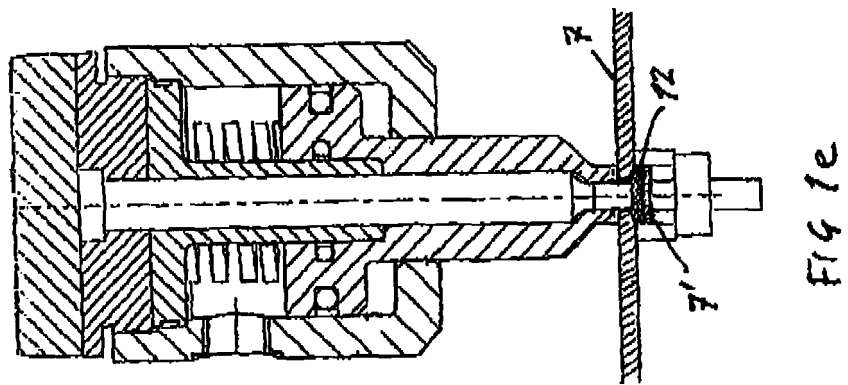
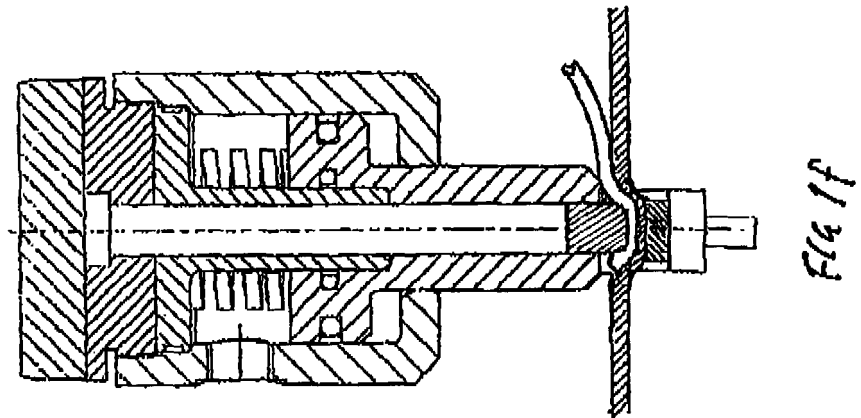
Revendications

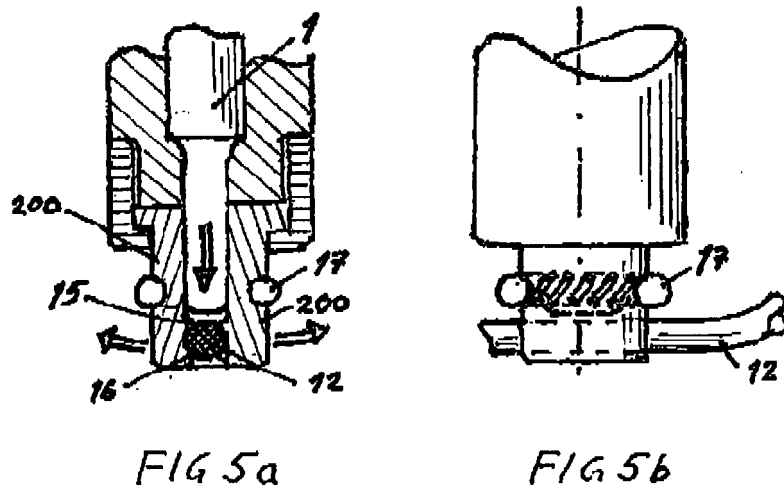
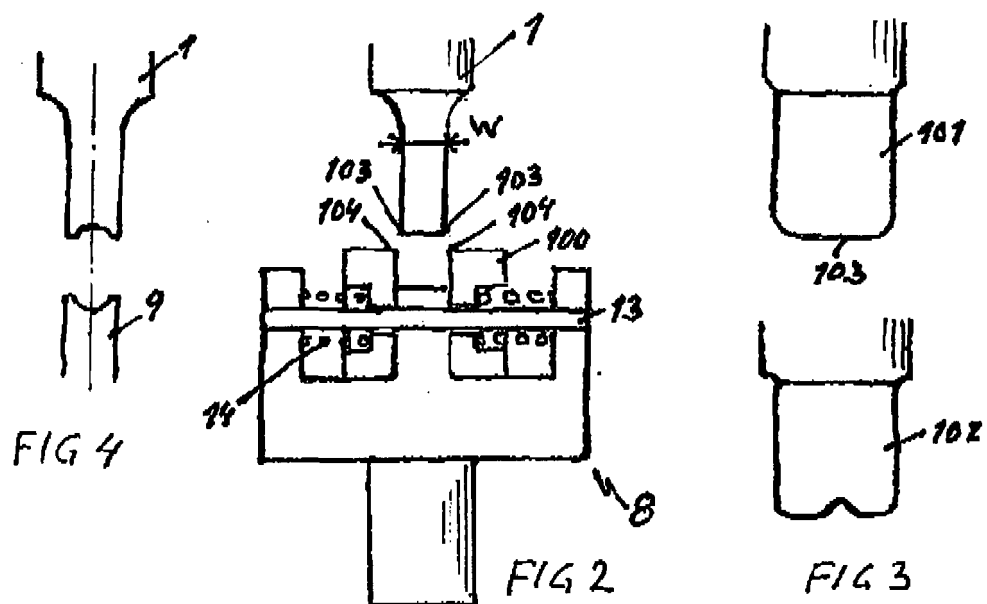
1. Un appareil pour réaliser des jonctions par clinchage entre un premier (7) et un deuxième (12) éléments, métalliques ou non métalliques, ledit premier élément (7), au moins à l'emplacement dans lequel la jonction va être réalisée et à proximité de celui-ci, a une géométrie généralement en forme de feuille ou plate, et ledit deuxième élément (12), au même emplacement, a une forme allongée avec un axe longitudinal et une longueur généralement beaucoup

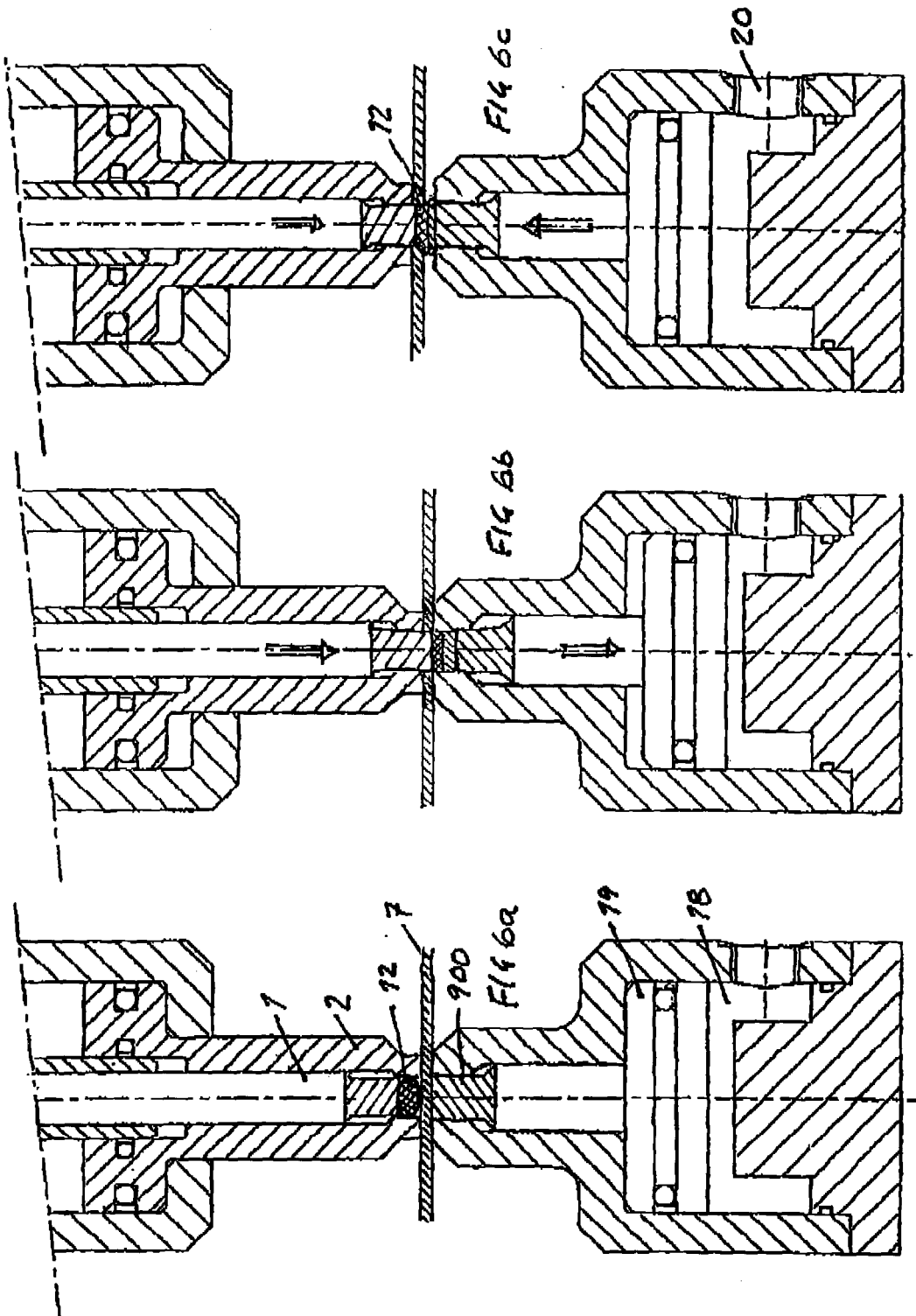
- plus grande que toute mesure de sa section arbitraire, au moyen d'un outil muni d'un poinçon (1), d'une matrice et enclume (9) coopérantes et d'un organe dit stripper (2) entourant le poinçon (1), **caractérisé en ce que** la partie d'extrémité du stripper (2) et du poinçon (1) forment un espace allongé et **en ce que** la dimension du poinçon (1) dans la direction perpendiculaire audit axe longitudinal est essentiellement la même que la dimension de la section dudit deuxième élément (12) audit emplacement.
2. Un appareil selon la revendication 1, **caractérisé par** une forme arrondie du poinçon (1) agencée de manière à garantir que le deuxième élément (12) n'est pas découpé de façon à traversante.
 3. Un appareil selon la revendication 1 ou la revendication 2, **caractérisé par** le fait d'agencer des éléments formant matrice mobiles (10, 100) déplaçables latéralement.
 4. Un appareil selon la revendication 3, **caractérisé par** le fait d'agencer des bords coopérants (103, 104) sur le poinçon (1) et les éléments formant matrice mobiles (100), respectivement, parallèlement à l'axe du fil agencé pour découper le premier élément (7) de façon traversante.
 5. Un appareil selon l'une quelconque des revendications précédentes, **caractérisé par** le fait d'agencer le stripper (2) de façon qu'il ait deux moitiés pivotantes (200) avec des arêtes parallèles (15, 16) supérieures et inférieures respectivement, sur l'intérieur des deux moitiés de stripper (200), agencées pour saisir et maintenir le deuxième élément (12), lesdites moitiés pivotantes (200) étant agencées pour pivoter vers l'extérieur à l'encontre de la force d'un élément formant ressort (17) lorsqu'un fil est mis en position.
 6. Un procédé de fabrication de jonctions par clinchage entre un premier (7) et un deuxième (12) éléments, métalliques ou non métalliques, dans lequel ledit premier élément (7), au moins à l'emplacement dans lequel la jonction va être réalisée et à proximité de celui-ci, a une géométrie généralement en forme de feuille ou plate, et ledit deuxième élément (12), au même emplacement, a une forme allongée avec un axe longitudinal et une longueur généralement beaucoup plus grande que toute mesure de sa section arbitraire, par l'utilisation d'un outil muni d'un poinçon (1), d'une matrice et enclume coopérantes (9) et d'un organe dit stripper (2) entourant le poinçon (1), **caractérisé par** le fait d'utiliser une partie d'extrémité du stripper (2) et du poinçon (1) qui forme un espace allongé et par le fait d'utiliser une dimension du poinçon (1) dans la direction perpendiculaire audit axe longitudinal qui est essentiellement la même que la dimension de la section dudit deuxième élément (12) audit emplacement.
 7. Un procédé selon la revendication 6, **caractérisé par** le fait d'utiliser une forme arrondie du poinçon (1) pour garantir que le deuxième élément (12) n'est pas découpé de façon à traversante.
 8. Un procédé selon la revendication 6 ou la revendication 7, **caractérisé par** le fait de presser le deuxième élément (12) par l'intermédiaire du premier élément (7).
 9. Un procédé selon la revendication 6, 7 ou 8, **caractérisé par** le fait d'utiliser des éléments formant matrice mobiles (10, 100), déplaçables latéralement.
 10. Un procédé selon la revendication 9, **caractérisé par** le fait d'utiliser des bords coopérants (103, 104) sur le poinçon (1) et les éléments formant matrice mobiles (100), respectivement, parallèles à l'axe du fil pour découper le premier élément (7) de façon traversante.
 11. Un procédé selon l'une quelconque des revendications de procédé précédentes, **caractérisé par** le fait d'utiliser un stripper (2) ayant deux moitiés pivotantes (200) avec des arêtes supérieures et inférieures (15, 16) parallèles respectivement, sur l'intérieur des deux moitiés de stripper (200) afin de saisir et de maintenir le deuxième élément (12).
 12. Un procédé selon la revendication 8, **caractérisé par** une étape supplémentaire dans laquelle l'enclume (900) est activée au moyen d'une pression et soulève la partie découpée du premier élément (7) et le deuxième élément partiellement expansé (12) pour les positionner à l'extérieur de la matrice fixe (10), de sorte que le poinçon (1) effectue une deuxième course contre le deuxième élément (12) qui va ensuite s'expanser davantage sur le côté inférieur de la tôle.

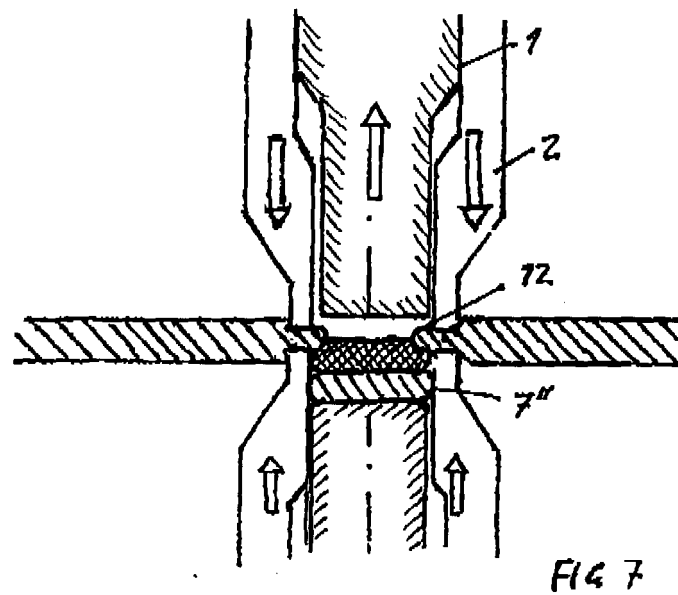
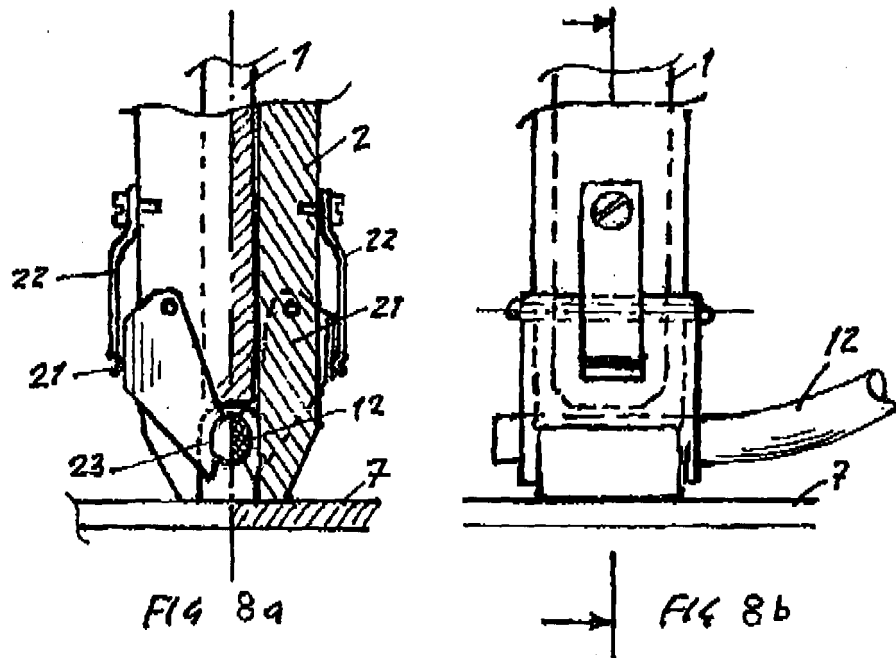












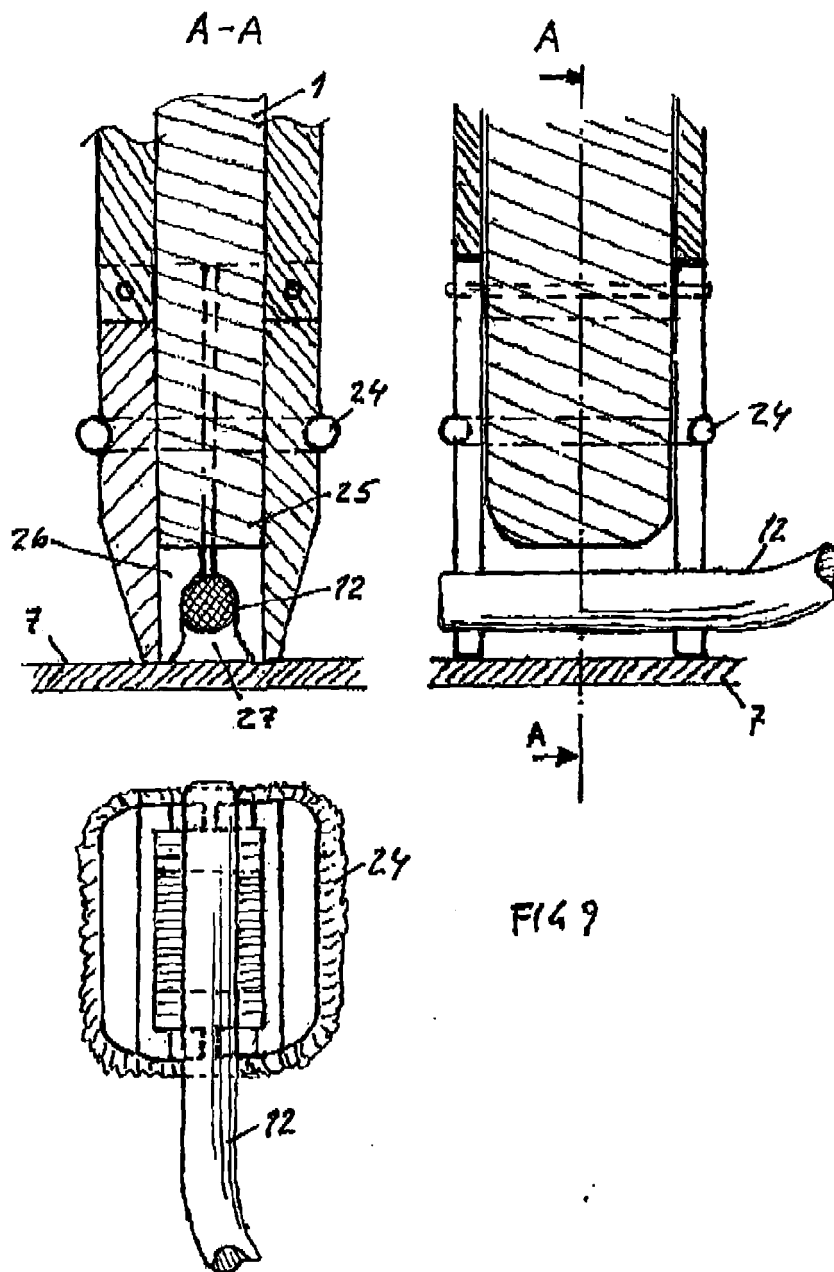
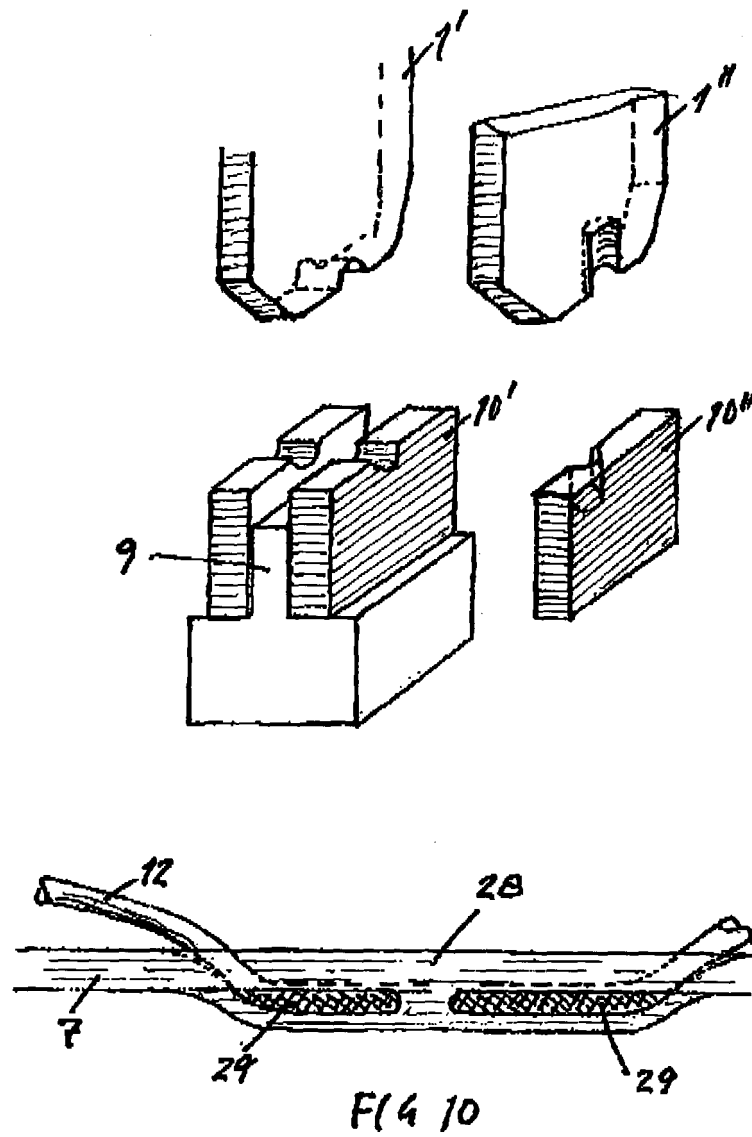


FIG 9



REFERENCES CITED IN THE DESCRIPTION

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