



(11) **EP 2 131 134 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
22.10.2014 Bulletin 2014/43

(51) Int Cl.:
F28F 9/26 ^(2006.01) **F28F 9/02** ^(2006.01)

(21) Application number: **09161571.6**

(22) Date of filing: **29.05.2009**

(54) **A method for applying a closing plate to an end of a tubular element**

Verfahren zum Anbringen einer Verschlusskappe an ein Ende eines röhrenförmigen Elements

Procédé d'application d'une plaque de fermeture sur l'extrémité d'un élément tubulaire

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL
PT RO SE SI SK TR**
Designated Extension States:
AL BA RS

(30) Priority: **06.06.2008 IT BO20080357**

(43) Date of publication of application:
09.12.2009 Bulletin 2009/50

(73) Proprietor: **Lolli, Valter**
40033 Casalecchio di Reno (Bologna) (IT)

(72) Inventor: **Lolli, Valter**
40033 Casalecchio di Reno (Bologna) (IT)

(74) Representative: **Dall'Olio, Giancarlo et al**
Invention S.r.l.
Via delle Armi 1
40137 Bologna (IT)

(56) References cited:
WO-A1-2005/102579 DE-A1- 3 936 251
GB-A- 553 626 JP-A- 2003 083 698
US-A- 5 224 358 US-B1- 6 349 562
US-B1- 6 453 697

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to an original method for applying a metal plate to an end of a tubular element, also made of metal, with the aim of closing a head thereof.

[0002] The need to perform the above operation is frequent and, in accordance with specific needs, the method used is the one which seems most appropriate to the particular case; for example, it may be necessary to guarantee a liquid or a gas seal coupling, or it may not.

[0003] In the field of thermal sanitary plants for bathrooms and the like, the use of heating radiators is known, which are constituted by a pair of manifolds, arranged vertically, mutually parallel and interconnected by a plurality of conduits, arranged perpendicular at different heights.

[0004] The upper and lower ends of the vertical manifolds are closed by relative plates having profiles which correspond to the section of the manifolds themselves, which are preferably semi-oval.

[0005] The plates can be solid or can afford, in a central zone thereof, a threaded collar for connection of the radiator to the water line of the heating plant.

[0006] In the above-cited case, it is obvious that the joint between the plate and the end of the manifold must be one that ensures liquid seal.

[0007] A first known method comprises welding the plate to the tubular element, with the drawbacks which this leads to in terms of time and costs for the use of specialised personnel, needed not only for the welding, but also for the following lapping and seal control operations.

[0008] A further known method includes realising, in the edge of the plate: a small step destined to define a rest for the tubular element and for centring, with respect to the tubular element, the plate itself, thanks to its partial insertion in the mouth of the tubular element.

[0009] Between the contact zones of the plate and the end of the tubular element, before mounting a special heat-welding paste is manually applied, which paste, following a suitable heat treatment, makes the fixing unremovable as well as guaranteeing a seal against leaks.

[0010] The result of the operation, in particular in relation to the seal, depends on a correct spreading of the paste over the whole contact perimeter.

[0011] In order to obviate the limits of the above solution, the applicant filed a PCT/EP application, PCT/EP2007061948, relating to a "Plate couplable to an opening edge provided in a tubular element, and a method for constraining the plate to the edge."

[0012] The above application relates to a plate internally provided with a first annular channel in which a ring of low-fusion point brazing material is blocked; further annular channels are arrayed spoke-fashion from the first annular channel and extend towards the edge.

[0013] After mounting the plate on the tubular element there is a stage of heating which fuses the ring, the ma-

terial of which, by capillarity, runs along the channels and reaches all the contact zones between the plate and the tubular element; the following cooling enables solidification of the molten metal, guaranteeing joint stability and seal.

[0014] The presence of a ring of fusible material, the same for all plates, guarantees absolute constancy and repeatability of the result, independently of the position assumed in the heating kiln.

[0015] In all the known solutions described above, the junction line between the plate and the tubular element is on the flanks thereof; if the fixing is done by welding, the aesthetic result is not appealing even after lapping, while with the heat-welding paste or the ring of fusible material the situation is improved, although the line is still visible as it is highlighted by the subsequent enamelling.

[0016] The need to realise a step in the plate means that the plate must have a total thickness which is sufficient to leave, at the edge thereof, an adequate residual thickness; in practice, these plates have a thickness of in the region of 3.5 mm. DE3936251 which represents the preamble of claim 1 discloses a refrigerant receiver for use in motor vehicle air conditioner, which has a tubular body, in which an annular seating is afforded at one of its open ends, the seating being defined by an upper and a lower projection made by means of electromagnetic forming.

[0017] DE3936251 also discloses a bottom closure with an obliquely inclined perimeter which gives the closure a truncoconical conformation, with the peripheral edge of the bottom closure being clamped between the lower and the upper projection.

[0018] The aim of the present invention is to provide a method for applying a closing plate to the end of a tubular element, which enables obtaining a mechanically stable joint without the use of any extra material, and which at the same time guarantees an aesthetically improved result with respect to what can be obtained with traditional methods.

[0019] A further aim of the invention relates to the providing of a valid method even where a sealed coupling is to be achieved, by predisposing special operating and/or enactment stages which are similar to those in the prior art.

[0020] A still further aim of the process consists in being defined by simple and rapid actuation stages, which can be realised with constant results, using equipment having contained costs and independently of the ability of the personnel doing the operations.

[0021] A further aim of the invention is to provide a method which can be used both with solid plates and with plates having a threaded central sleeve.

[0022] The characteristics of the method of the invention will better emerge from the following description, in accordance with what is set out in the claims and with the aid of the accompanying figures of the tables of drawings, in which:

figure 1 is an exploded perspective view of a portion of a tubular element and two different plates to be alternatively coupled thereto;

figure 2 is a front view of the same pieces of figure 1, which highlights constructional aspects of the plates and a stage of the method relating to the tubular element;

figures 3 and 4 illustrate, in large-scale, corresponding axial sections of the tubular element, following realisation of successive operating stages of the method;

figure 5 illustrates, in a similar view to preceding figures 3 and 4, the following stage of insertion of the plate into the tubular element;

figure 6 illustrates, in a similar view to figure 5, the following stage of mechanical blocking of the plate to the element.

[0023] With reference to the figures of the drawings, 1 denotes a metal tubular element, for example a metal tubular element 1 which is of the type used in a thermal radiator for installation in a bathroom, and is applicable to one of the two vertical manifolds, to which reference was made in the preamble hereto.

[0024] The ends of the tubular element 1 are destined to be sealedly closed by metal plates which can be solid, as in a first embodiment denoted by 2, or, in a second embodiment denoted by 20, can afford a sleeve 21 in a central zone thereof, which sleeve 21 is internally threaded for connecting the radiator to the water line of the heating plant (figure 1).

[0025] The method of the present invention concerns stages which involve both the preparation of the end of the tubular element 1 and the realisation of the plate 2, 20 and stages which relate to mutual assembly thereof.

[0026] The preparation of the end of the tubular element consists in realising, in the mouth 10 thereof, an annular seating 12 having a predetermined depth P shaped to define a perimeter rest step 13 in a relative bottom situated internally of the tubular element 1.

[0027] According to the invention, the annular seating 12 is obtained by means of successive operations of cold plastic deformation, in particular:

calibrating (denoted by C in figure 2) an inside of the tubular element 1, starting from the mouth 10 and going down to a predetermined depth L (see figure 2 again);

moulding the annular seating 12, having the same shape as the calibrated internal section of the tubular element 1 and having uniformly larger dimensions than the calibrated internal section, such that the moulding action causes material to be pressed to-

wards the inside in order to form the above-mentioned perimeter rest step 13 (figure 3).

[0028] An annular lip 11 is thus defined externally on the annular seating 12, which lip 11 is slimmer than the border of the tubular element 1 (see also figure 3).

[0029] In a preferred embodiment of the method, a stage of rounding the edge 110 of the annular lip (figure 4) is included in the preparation of the tubular element 1.

[0030] The realisation of the plate 2, 20 involves shaping it (in plan view) such as to obtain a profile which is complementary to the profile of the annular seating 12 (figure 1), with a cutting action such that the perimeter surfaces 22 which result have an oblique inclination, thus determining a truncoconical conformation of the plate 2, 20 (figure 2), the thickness S of which must be equal to the depth P of the annular seating 12, at least over a certain width of the relative perimeter edge 23.

[0031] The plate 2, 20 is preferably fashioned from a flat metal sheet having a constant thickness S, which is equal to the thickness S of the depth P of the seating 12.

[0032] In order to obtain the plate 20 in which the threaded sleeve 21 is afforded, the stage of realisation includes drawing, perforating and tapping operations, apart from the operations described above.

[0033] Sealing means 30 are associated to the plates 2, 20 of the embodiment, which sealing means 30 are destined to guarantee liquid seal of the coupling between the plates 2, 20 and the tubular element 1; the sealing means 30, not illustrated in detail, are advantageously of the type described in the patent application mentioned herein above, and comprise a ring 31 of low-fusion point brazing material, schematically denoted by broken lines in figure 2.

[0034] The ring 31 is fixed by friction force to an annular channel 32 (visible in the plate 20 in figure 2) connected to other channels developing spoke-fashion towards the edge (not illustrated).

[0035] The stages of the method for application of the plate 2, 20 to the tubular element 1 comprise:

inserting the plate 2, 20 in the annular seating 12, such that the perimeter cut surfaces 22 exhibit respective converging inclinations in a vertex located externally on the tubular element 1 (figure 5);

fashioning the annular lip 11 in order to superpose it on the perimeter cut surfaces 22 and obtaining, in this way, a mechanical blocking of the plate 2, 20 to the tubular element 1 (figure 6).

[0036] On conclusion of this last operation, as already mentioned, the plate 2, 20 is unremovably fixed to the tubular element 1 and, should the coupling not require further seal characteristics, the application might be considered complete.

[0037] In the specific case, however, that a seal is required, the method comprises a supplementary stage,

using the sealing means 30.

[0038] With reference to the described example, this stage consists in heating the tubular element-plate assembly to a temperature above the fusion temperature of the ring 31, for a predetermined time, followed by a cooling of the assembly in order to obtain a new solidification of the metal of the ring 31, distributed in the contact zones between the plate 2, 20 and the tubular element 1.

[0039] The sealed coupling between the plate 2, 20 and the tubular element 1 can obviously be realised, alternatively to what has been described, by a bead of heat-welding paste, mentioned in the preamble, distribution, in preparation, between the contact zones.

[0040] From the above the positive characteristics of the described method clearly emerge, which characteristics enable the aims indicated in the preamble to be fully attained.

[0041] Firstly, the plate is unremovably fixed merely by mechanical action, entirely contrary to all the known solutions, thanks to the snug fit created by the profiling of the annular lip of the tubular element.

[0042] Further, the conformation of the seating, and consequently the plate, locates the joint line between the two parts in the head of the tubular element, thus in a much less visible zone than on the flank; this leads to obvious benefits from the overall aesthetic point of view.

[0043] Further, the joint line lies on a plane, so that any lapping or sanding operations which might be desired to further reduce the visibility of the line are evidently very simple and effective.

[0044] The described method enables easily obtaining couplings with or without seal, according to needs.

[0045] With the method of the invention, the need to realise the step in the edge of the plate is eliminated and, consequently, the plate can be slimmer; by way of example, metal sheeting of 2 mm thickness can be used instead of the 3.5 mm thickness required for prior-art plates.

[0046] Considering that the above-mentioned plates, in the cited technical sector, are produced in very high numbers, it can be understood how the ensuing savings are of not inconsiderable entity.

[0047] All of the stages of the method are simple and rapid to actuate, with an absolute repeatability in terms of results, by equipment having contained costs, without the need to use specialised personnel.

[0048] The proposed method is advantageous, in general, for all cases in which the application of a metal plate for closing the head of a metal tube is required; in the particular technical sector of the described example, the fact that all the coupling stages of the plate are the same both when the plate is solid and when it is provided with a threaded central sleeve is much appreciated.

[0049] However the above description is intended to be of non-limiting nature, and any modifications to detail in the actuation of the described stages are considered to fall within the ambit of protection thereof, as set out in the following claims.

Claims

1. A method for applying a closing plate (2, 20) to an end of a tubular element (1), comprising:

realising an annular seating (12) in a mouth (10) of the tubular element (1), which annular seating (12) has a predetermined depth (P) and is shaped such as to define a rest perimeter (13) in a bottom thereof situated internally of the tubular element (1);

realising the plate (2, 20), with a plan profile which is complementary to a profile of the annular seating (12), perimeter cut surfaces (22) of the profile being obliquely inclined in order to obtain a truncoconical conformation of the plate (2, 20) and with a thickness (S) of the plate being substantially equal to the depth (P) of the annular seating (12), at least concerning a predetermined width of a perimeter edge (23) thereof; inverting the plate (2, 20) in the annular seating (12), such that the perimeter cut surfaces (22) of the profile exhibit respective inclinations converging to a point located externally of the tubular element (1);

fashioning an annular lip (11) of the tubular element (1) located externally on the seating (12), in order to superpose the annular lip (11) onto the perimeter cut surfaces (22), thus obtaining a mechanical blocking of the plate (2, 20) to the tubular element (1);

characterized in that the stage of realising the annular seating (12) consists in successive plastic cold-deformation operations of the tubular element (1), and **in that** the plastic cold-deformation operations comprise:

calibrating an inside of the tubular element (1), starting from the mouth (10) and reaching a predetermined depth (L);

moulding the annular seating (12) having the same shape as the calibrated interval section of the tubular element (1) and having uniformly larger dimensions than the calibrated internal section of the tubular element (1), such that the moulding action causes some material to be intercepted and pressed towards an inside of the tubular element (1) in order to form the above-mentioned perimeter rest step (13).

2. The method of claim 1, **characterised in that** sealing means (30) are associated to the plate (2, 20), and **in that** subsequent to the stage of fashioning, the sealing means (30) are activated in order to realise a sealed coupling between the plate (2, 20) and the tubular element (1).

3. The method of claim 1 **characterised in that** it comprises, in the stage of realising the annular seating (12), a rounding of the edge (110) of the annular lip (11).
4. The method of claim 1, **characterised in that** operations for affording an internally-threaded sleeve (21) in a central zone of the plate (2, 20) are comprised during the stage of realising the plate (2, 20).
5. The method of claim 4, **characterised in that** the operations for defining the threaded sleeve (21) comprise operations of drawing, perforating and tapping.

Patentansprüche

1. Verfahren zum Anbringen einer Verschlussplatte (2, 20) an ein Ende eines röhrenförmigen Elements (1), umfassend:

Bilden eines ringförmigen Sitzes (12) in einem Mund (10) des röhrenförmigen Elements (1), wobei der ringförmige Sitz (12) eine im Voraus festgelegte Tiefe (P) aufweist und derart geformt ist, dass er einen Ruheumfang (13) in einem Boden desselben definiert, der innerhalb des röhrenförmigen Elements (1) angeordnet ist; Bilden der Platte (2, 20) mit einem planen Profil, das zu einem Profil des ringförmigen Sitzes (12) komplementär ist, wobei am Umfang geschnittene Flächen (22) des Profils schräg geneigt sind, um eine trunkokonische Bildung der Platte (2, 20) zu erlangen, wobei eine Dicke (S) der Platte im Wesentlichen gleich der Tiefe (P) des ringförmigen Sitzes (12) ist, wenigstens in Bezug auf eine im Voraus festgelegte Breite einer Umfangskante (23) desselben; Einführen der Platte (2, 20) in den ringförmigen Sitz (12), derart, dass die am Umfang geschnittenen Flächen (22) des Profils jeweilige Neigungen aufweisen, die an einem Punkt konvergieren, der außerhalb des röhrenförmigen Elements (1) angeordnet ist; Herstellen einer ringförmigen Lippe (11) des röhrenförmigen Elements (1), die außerhalb des Sitzes (12) angeordnet ist, damit die ringförmige Lippe (11) die am Umfang geschnittenen Flächen (22) überlagert, wodurch eine mechanische Blockierung der Platte (2, 20) am röhrenförmigen Element (1) erreicht wird; **dadurch gekennzeichnet, dass** die Stufe des Bildens des ringförmigen Sitzes (12) aus aufeinander folgenden Kunststoffaltverformungsvorgängen des röhrenförmigen Elements (1) besteht und dass die Kunststoffaltverformungsvorgänge Folgendes umfassen:

5

10

15

20

25

30

35

40

45

50

55

Kalibrieren eines Inneren des röhrenförmigen Elements (1) beginnend am Mund (10) und Erreichen einer im Voraus festgelegten Tiefe (L); Formen des ringförmigen Sitzes (12) in derselben Form wie der kalibrierte Innenbereich des röhrenförmigen Elements (1) und mit im Wesentlichen größeren Abmessungen als der kalibrierte Innenbereich des röhrenförmigen Elements (1), derart, dass der Formungsvorgang bewirkt, dass ein Teil des Materials aufgefangen und zu einem Inneren des röhrenförmigen Elements (1) gedrückt wird, um die Umfangsruhestufe (13) zu bilden.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Platte (2, 20) Dichtungsmittel (30) zugeordnet werden und dass nach der Stufe des Herstellens die Dichtungsmittel (30) aktiviert werden, um eine abgedichtete Koppelung zwischen der Platte (2, 20) und dem röhrenförmigen Element (1) zu bilden.
3. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** es auf der Stufe des Bildens des ringförmigen Sitzes (12) ein Abrunden der Kante (110) der ringförmigen Lippe (11) umfasst.
4. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** Vorgänge zum Erzielen einer Innengewindehülse (21) in einer mittleren Zone der Platte (2, 20) in die Stufe des Bildens der Platte (2, 20) eingeschlossen sind.
5. Verfahren nach Anspruch 4, **dadurch gekennzeichnet, dass** die Vorgänge zum Definieren der Gewindehülse (21) Vorgänge des Ziehens, Perforierens und Gewindeschneidens umfassen.

Revendications

1. Un procédé d'application d'une plaque de fermeture (2, 20) sur une extrémité d'un élément tubulaire (1), comprenant :

la réalisation d'un logement annulaire (12) dans une embouchure (10) de l'élément tubulaire (1), ledit logement annulaire (12) a une profondeur (P) prédéfinie et est conforme de manière à définir un périmètre d'appui (13) dans un fond respectif situé à l'intérieur de l'élément tubulaire (1) ; la réalisation de la plaque (2, 20) avec un profil plan qui est complémentaire à un profil du logement annulaire (12), des surfaces périmétriques de coupe (22) du profil étant inclinées oblique-

ment de manière à obtenir une conformation tronco-conique de la plaque (2, 20) et avec une épaisseur (S) de la plaque qui est essentiellement égale à la profondeur (P) du logement annulaire (12), au moins pour ce qui est d'une largeur prédéfinie d'un bord périmétrique (23) correspondant ;

l'insertion de la plaque (2, 20) dans le logement annulaire (12), de manière à ce que les surfaces périmétriques de coupe (22) du profil présentent des inclinaisons respectives convergeant en un point situé à l'extérieur de l'élément tubulaire (1) ;

le façonnage d'une lèvre annulaire (11) de l'élément tubulaire (1) située à l'extérieur du logement (12), de manière à superposer ladite lèvre annulaire (11) sur les surfaces périmétriques de coupe (22), obtenant ainsi un blocage mécanique de la plaque (2, 20) à l'élément tubulaire (1) ;
caractérisé en ce que la phase de réalisation du logement annulaire (12) consiste en des opérations successives de déformation plastique à froid de l'élément tubulaire (1), et **en ce que** les opérations de déformation plastique à froid comprennent :

le calibrage de l'intérieur de l'élément tubulaire (1), à partir de l'embouchure (10) et jusqu'à une profondeur (L) prédéfinie ;

le moulage du logement annulaire (12), ayant la même forme que la section intérieure calibrée de l'élément tubulaire (1) et ayant des dimensions uniformément plus grandes que celles de la section intérieure calibrée de l'élément tubulaire (1), de manière à ce que l'action de moulage détermine l'interception et la pression de matériau vers l'intérieur de l'élément tubulaire (1) afin de former le rebord périmétrique d'appui (13) susmentionné.

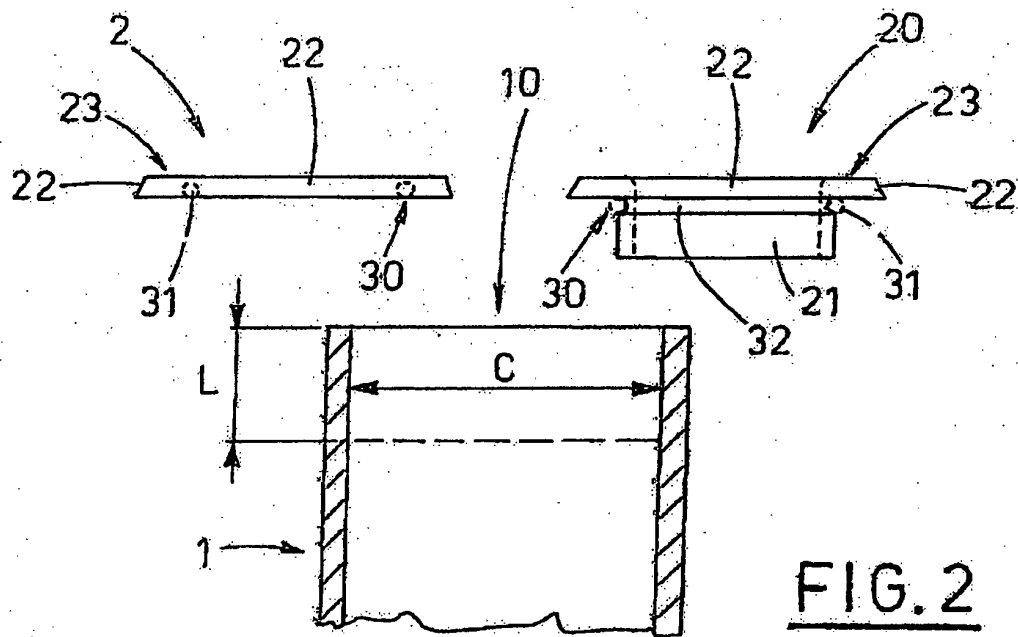
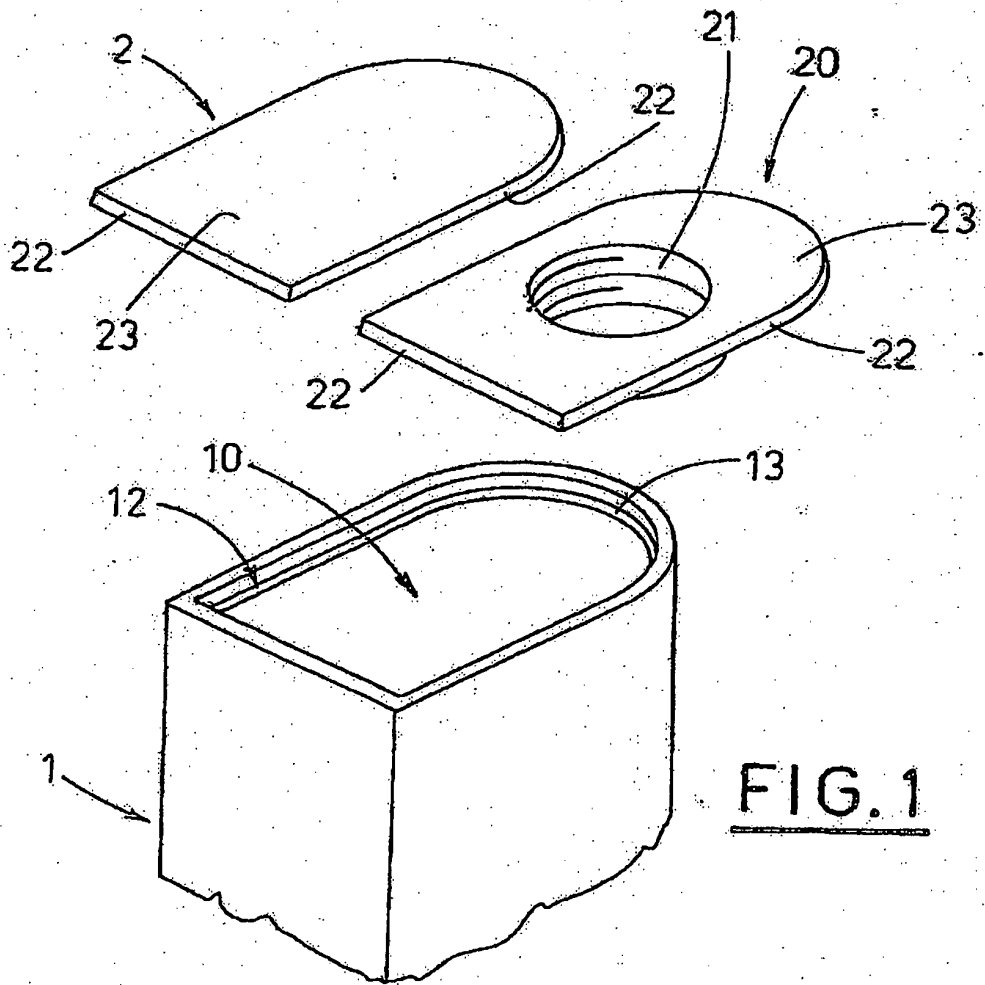
réalisation de cette même plaque (2, 20).

5. Le procédé selon la revendication 4, **caractérisé en ce que** les opérations de définition du manchon fileté (21) comprennent des opérations d'emboutissage, de perçage et de taraudage.

2. Le procédé selon la revendication 1, **caractérisé en ce que** des moyens de scellage (30) sont associés à la plaque (2, 20), et **en ce que**, successivement à la phase de façonnage, les moyens de scellage (30) sont activés de manière à réaliser un accouplement étanche entre la plaque (2, 20) et l'élément tubulaire (1).

3. Le procédé selon la revendication 1, **caractérisé en ce qu'il** prévoit, lors de la phase de réalisation du logement annulaire (12), un arrondissement du bord (110) de la lèvre annulaire (11).

4. Le procédé selon la revendication 1, **caractérisé en ce que** des opérations servant à définir un manchon intérieurement fileté (21) dans une zone centrale de la plaque (2, 20) sont prévues pendant la phase de



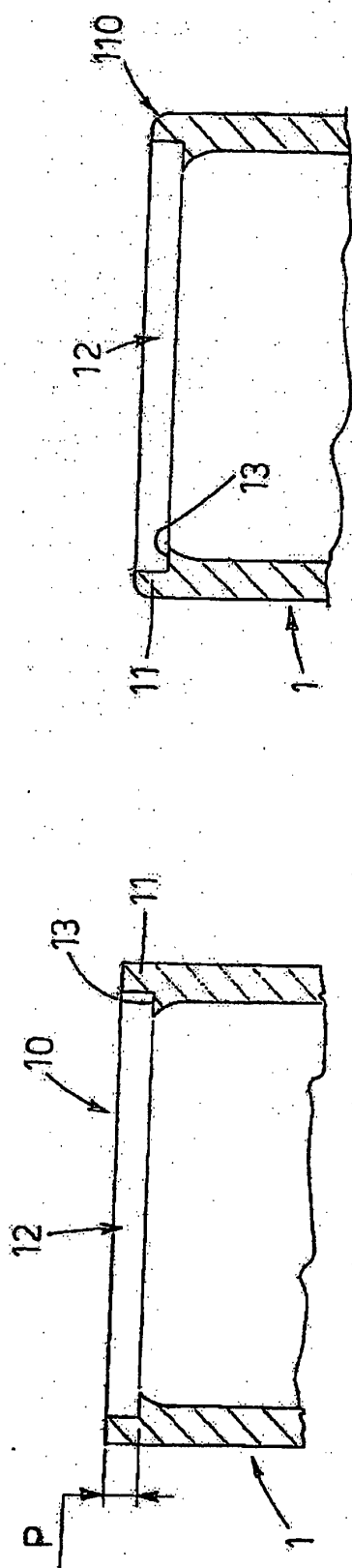


FIG. 3

FIG. 4

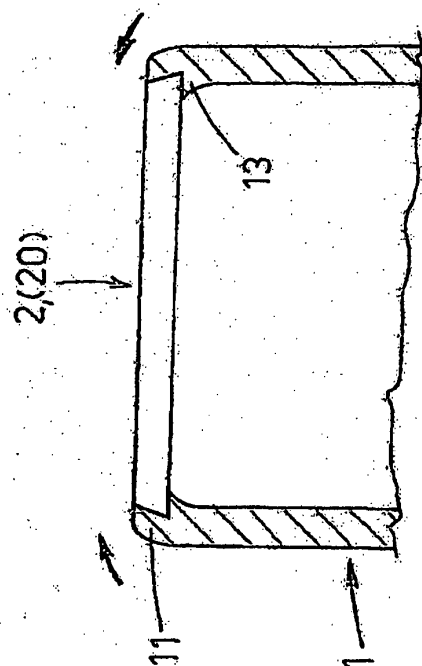


FIG. 6

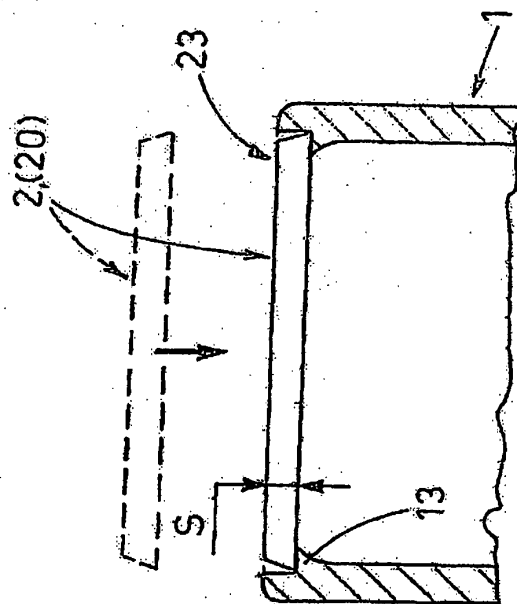


FIG. 5

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2007061948 W [0011]
- DE 3936251 [0016] [0017]