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(54) **METHOD FOR THE PRODUCTION OF A PRESTRESSED PLATE-SHAPED BUILDING COMPONENT**

VERFAHREN ZUR HERSTELLUNG EINES VORGESPANNTEN PLATTENFÖRMIGEN BAUTEIL
PROCEDE DE FABRICATION D'UN COMPOSANT DE CONSTRUCTION DE TYPE PANNEAU
PRECONTRAINTE

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Description

[0001] The present invention relates to a method for the production of a prestressed plate-shaped building component.

[0002] More particularly, the invention relates to a method for the production of such a building component of the kind comprising a plurality of elongate laminations of wood, placed in side-by-side relationship and held in contact under pressure with each other in an elastically compressed state by a plurality of mutually spaced transverse tension bars of metal, which extend each through one row of through holes in the laminations and which, at their ends, are provided with anchoring means, projecting in lateral directions therefrom and bearing under pressure against cooperating bearing surfaces of the two outer laminations, provided at the outer sides of said laminations.

[0003] Building components of said kind are utilized especially as structural floor components in buildings and bridges. However, they may be utilized also for other purposes. For instance, they may be used as structural wall elements.

[0004] In previously known building components of said kind, the anchoring means mounted on the tension bars have usually been formed by nuts, mounted on threaded end portions of said bars, and washers placed behind said nuts.

[0005] DE 2 316 899 B2 discloses a similar building component. However, in this case, the tension bars are provided with threaded end portions and nuts mounted thereon only at their one ends, while, at their other ends, they are provided with fixed bolt heads.

[0006] During the production of the abovementioned known building components, the desired elastic compression of the laminations has been obtained by successively tightening the nuts mounted on the various tension bars in several consecutive steps. This has resulted in a manufacturing process which, as a whole, is very slow and labour-consuming.

[0007] The invention therefore has for its purpose to provide an improved and more rational method for the production of a prestressed plate-shaped building component of the kind initially specified.

[0008] The method, according to the invention proposed for said purpose, is primarily characterized by placing the laminations in desired side-by-side positions upon a substrate and subjecting the laminations so placed to an edge pressing operation, during which they are elastically compressed in a direction transverse to their longitudinal direction by means of press jaws, bearing against the two outer laminations, and then holding the laminations in an elastically compressed state by means of said press jaws until a lasting elastic compression of the laminations has been secured by means of tension bars, inserted each through one row of holes in the laminations, and anchoring means, mounted at the ends of said bars.

[0009] During the edge pressing operation, the laminations may preferably be held in close contact with the substrate by holding-down means, applied against the upper sides of the laminations.

5 **[0010]** In order to avoid the need for very long press jaws, extending along the entire length of the building component, and in order to make it possible, in an easy manner, during the edge pressing operation, to obtain a convenient access to the outer laminations within the regions of the tension bars and the anchoring means, 10 the edge pressing operation may preferably be performed by means of two rows of consecutive press jaws which, within each row, bear against one of the two outer laminations and which, within each row, define intermediate free gaps therebetween, located within the regions 15 of the tension bars and the anchoring means.

[0011] The insertion of the tension bars through said holes may preferably be effected after the edge pressing operation. Furthermore, the tension bars may suitably 20 be provided with anchoring means at their one ends before the insertion of said bars through said holes in the laminations, while anchoring means are mounted at the other ends of said bars after the insertion of the bars through said holes.

25 **[0012]** In accordance with the invention, the tension bars may preferably be provided with anchoring means formed by metal plates, welded to the tension bars at the ends of said bars. These metal plates may suitably be welded to the end surfaces of the tension bars in butt 30 contact with said surfaces through a flash-welding process.

[0013] Below the invention is further described with reference to the accompanying drawings, in which:-

35 Figure 1 shows a perspective view of a prestressed plate-shaped building component produced by a method according to the invention.

40 Figure 2 shows a perspective view which only very diagrammatically illustrates an edge pressing equipment usable for the production of the building component according to Figure 1,

45 Figures 3 - 6 show end views, in cross-section, of the building component according to Figure 1, illustrating different stages during its production, and Figure 7 shows a partial cross-sectional view of two building components according to Figure 1, placed in side-by-side relationship.

50 **[0014]** The building component shown in Figure 1 and generally designated 10 comprises a plurality of elongate laminations 11 of wood, placed in side-by-side relationship and held in contact under pressure with each other in an elastically compressed state by a plurality of mutually spaced transverse tension bars 12 of metal, 55 which extend each through one row of through holes 13 (Figure 3) in laminations 11 and which at their ends are provided with anchoring means 14, projecting in lateral directions therefrom and bearing under pressure

against cooperating bearing surfaces 15 of the two outer laminations, provided at the outer sides of said laminations.

[0015] Anchoring means 14 are formed by metal plates having a generally square or rectangular shape, which are welded to the tension bars 12 in butt contact with the end surfaces of said bars. At their outer sides, the two outer laminations 11 are provided with longitudinally extending grooves 16, in which metal plates 14 may be received in a fully countersunk state and in contact with the bottom surfaces of said grooves, which form said bearing surfaces 15.

[0016] Below a method according to the invention for the production of the building element 10 shown in Figure 1 will be described in further detail with reference to Figures 2 - 6.

[0017] In Figure 2 there is shown an edge pressing equipment comprising a press table 17, upon which laminations 11 are placed in side-by-side positions with their one ends in contact with a transverse elongate stop 18 and with one of the two outer laminations in close contact with a row of stationary press jaws 19.

[0018] The laminations 11, now being in the state illustrated in Figure 3, are then subjected to an edge pressing operation, during which they are elastically compressed in a direction transverse to their longitudinal direction by means of a row of movable press jaws 20, which may be applied against the other one of the two outer laminations 11 by means of hydraulic cylinders 21. Through this elastic compression, laminations 11 are brought to assume the state shown in Figure 4.

[0019] By means of one or more holding-down means, applied against the upper sides of the laminations, laminations 11 are, during the edge pressing operation, held in close contact with press table 17, which serves as a substrate therefor. In Figure 2, a plate 22, serving as a holding-down means, has been indicated in dash-dotted lines. Said plate may be brought into contact under pressure against the upper sides of laminations 11 by any suitable means not shown.

[0020] The movable press jaws 20 and the cooperating fixed press jaws 19 may preferably be arranged to apply the desired compression pressure to the outer laminations 11 by being brought into close contact with the bottom surfaces of the longitudinal grooves 16 provided in said laminations.

[0021] Once laminations 11 have been compressed to the state shown in Figure 4, they are maintained in this state by press jaws 19 and 20 while the tension bars 12 are inserted each through one row of holes 16 in laminations 11 in the manner shown in Figure 5. At this stage, tension bars 12 may already be provided with metal plates 14, previously welded thereto, at their one ends. These metal plates, which serve as anchoring means, are brought into close contact with the bearing surface 15 of one of the two outer laminations. The other, free ends of tension bars 12 will then project a short distance from the bearing surface 15 of the other one of

the two outer laminations. A second anchoring means 14, consisting of a metal plate, is then welded to the latter end of each tension bar 12 through an electric flash-welding process. In order to make it possible to carry out the welding operations in an unobjectionable manner, a porcelain sleeve 23 is mounted in a central position on each plate 14.

[0022] In order to secure the required access to the outer laminations within the regions of tension bars 12 and anchoring means 14, the fixed press jaws 19 and the movable press jaws 20 are designed so as to cause adjacent jaws of each kind to define free gaps therebetween within said regions.

[0023] Once anchoring means 14 have been welded to all tension bars 12, the compression pressure previously exerted on laminations 11 by means of press jaws 19 and 20 is removed. Laminations 11 then expand slightly to the state shown in Figure 6 and cause an elastic elongation of tension bars 12 which hereby, by means of anchoring means 14, will hold the laminations contained in building component 10 in a prestressed permanently elastically compressed state.

[0024] Figure 7 shows two building components 10 which are located side-by-side and have their adjacent lateral surfaces in close contact with each other. Reference numeral 24 designates blocks of wood, serving as guide means between the two building components 10 and received in portions of the two opposite grooves 16 located between adjacent anchoring means 14.

Claims

1. Method for the production of a prestressed plate-shaped building component (10) of the kind comprising a plurality of elongate laminations (11) of wood, placed in side-by-side relationship and held in contact under pressure with each other in an elastically compressed state by a plurality of mutually spaced transverse tension bars (12) of metal, which extend each through one row of through holes (13) in the laminations (11) and which, at their ends, are provided with anchoring means (14), projecting in lateral directions therefrom and bearing under pressure against cooperating bearing surfaces (15) of the two outer laminations (11), provided at the outer sides of said laminations, **characterized by** placing the laminations (11) in desired side-by-side positions upon a substrate (17) and subjecting the laminations so placed to an edge pressing operation, during which they are elastically compressed in a direction transverse to their longitudinal direction by means of press jaws (19, 20), bearing against the two outer laminations (11), and then holding the laminations (11) in an elastically compressed state by means of said press jaws (19, 20) until a lasting elastic compression of the laminations has been secured by means of tension bars (12), inserted each

through one row of holes (13) in the laminations (11), and anchoring means (14), mounted at the ends of said bars.

2. Method according to claim 1, **characterized by** holding the laminations (11), during the edge pressing operation, in close contact with the substrate (17) by means of holding-down means (22), applied against the upper sides of the laminations. 5
3. Method according to claim 1 or 2, **characterized by** performing the edge pressing operation by means of two rows of consecutive press jaws (19, 20) which, within each row, bear against one of the two outer laminations (11) and which, within each row, define intermediate gaps therebetween, located within the regions of the tension bars (12) and the anchoring means (14). 10
4. Method according to any of the preceding claims, **characterized by** inserting the tension bars (12) through said holes (13) in the laminations (12) after the edge pressing operation. 15
5. Method according to any of the preceding claims, **characterized by** providing the tension bars (12) with anchoring means (14) at their one ends before the insertion of said bars through said holes (13) in the laminations (11) and mounting anchoring means (14) at the other ends of the bars after the insertion of the bars through said holes (13). 20
6. Method according to any of the preceding claims, **characterized by** providing the tension bars (12) with anchoring means formed by metal plates (14), welded to the tension bars (12) at the ends of said bars. 25
7. Method according to claim 6, **characterized by** welding the metal plates (14) to the end surfaces of the tension bars (12) in butt contact with said surfaces through a flush-welding process. 30
8. Method according to claim 6 or 7, **characterized by** providing the two outer laminations (11) with recesses (16) at their outer sides for receiving said metal plates (14) in a fully countersunk state in said recesses. 35

Patentansprüche

1. Verfahren zur Herstellung eines vorgespannten plattenförmigen Bauteils (10) der Bauart, umfassend eine Vielzahl länglicher Schichten (11) aus Holz, die nebeneinander angeordnet und unter Druck in einem elastisch zusammengedrückten Zustand miteinander in Berührung gehalten sind 40

durch eine Vielzahl voneinander beabstandeter querverlaufender Zugstangen (12) aus Metall, die sich jeweils durch eine Reihe von Löchern (13) in den Schichten (11) erstrecken und die an ihren Enden mit Verankerungsmitteln (14) versehen sind, die in Querrichtung zu denselben verlaufen und unter Druck an zusammenwirkenden Lagerflächen (15) der beiden äußeren Schichten (11) anliegen, die an den Außenseiten dieser Schichten vorgesehen sind, **gekennzeichnet durch** Anordnen der Schichten (11) in der gewünschten nebeneinanderliegenden Position auf einer Unterlage (17) und Ausüben eines Kantenpreßvorgangs auf die dermaßen angeordneten Schichten, während dem sie in einer Richtung quer zu ihrer Längsrichtung elastisch verdichtet werden mit Hilfe von Preßbacken (19, 20), die an den beiden äußeren Schichten (11) anliegen, und anschließendes Halten der Schichten (11) in einem elastisch verdichteten Zustand mit Hilfe der Preßbacken (19, 20), bis eine dauerhafte elastische Verdichtung der Schichten mit Hilfe der in jeweils eine Reihe von Löchern (13) der Schichten (11) eingesetzten Zugstangen (12) und der an den Enden der Zugstangen angebrachten Verankerungsmittel (14) gewährleistet ist.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, daß** die Schichten (11) während des Kantenpreßvorgangs in enger Berührung mit der Unterlage (17) gehalten werden mit Hilfe von Niederhaltungsmitteln (22), die auf die Oberseite der Schichten aufgebracht werden. 45
3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** der Kantenpreßvorgang mit Hilfe von zwei Reihen aufeinanderfolgender Preßbacken (19, 20) durchgeführt wird, die in jeder Reihe an einer der beiden äußeren Schichten (11) anliegen, und die in jeder Reihe zwischenliegende Lücken begrenzen, die in den Bereichen der Zugstangen (12) und der Verankerungsmittel (14) angeordnet sind. 50
4. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die Zugstangen (12) nach dem Kantenpreßvorgang in die Löcher (13) der Schichten (11) eingesetzt werden. 55
5. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die Zugstangen (12) an ihren einen Enden mit Verankerungsmitteln (14) versehen werden, bevor die Stangen in die Löcher (13) der Schichten (11) eingesetzt werden, und daß die Verankerungsmittel (14) an den anderen Enden der Zugstangen angebracht werden, nachdem diese in die Löcher (13) eingesetzt wurden.

6. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die Zugstangen (12) mit Verankerungsmitteln versehen werden, die von Metallplatten (14) gebildet sind, die mit den Enden der Zugstangen (12) verschweißt sind. 5
7. Verfahren nach Anspruch 6, **dadurch gekennzeichnet, daß** die Metallplatten (14) an den Endflächen der Zugstangen (12) mit einem Flachnahtschweißverfahren angeschweißt werden, wobei sie an diesen Flächen stumpf anliegen. 10
8. Verfahren nach Anspruch 6 oder 7, **dadurch gekennzeichnet, daß** die beiden äußeren Schichten (11) an ihren Außenseiten mit Aussparungen (16) versehen werden, um die Metallplatten (14) vollkommen versenkt aufzunehmen. 15

Revendications

1. Procédé de fabrication d'une pièce de construction (10) sous forme de plaque précontrainte, du type comprenant une pluralité de couches allongées (11) en bois, disposées côte-à-côte et maintenues en contact l'une avec l'autre sous pression, dans un état de compression élastique, par une pluralité de barres de tension (12) transversales en métal espacées les unes des autres, qui s'étendent chacune au travers de trous traversants (13) dans les couches (11) et qui, à leurs extrémités, sont pourvues de moyens d'accrochage (14), faisant saillie latéralement et portant sous pression sur des surfaces d'appui complémentaires (15) des deux couches extérieures (11), disposées sur les côtés extérieurs desdites couches, **caractérisé en ce que** l'on place les couches (11) dans les positions côte-à-côte désirées sur un substrat (17) et on réalise sur les couches ainsi disposées une opération de pressage en bordure, durant laquelle elles sont comprimées élastiquement dans une direction transversale à leur direction longitudinale au moyen de mâchoires de pressage (19, 20) qui portent sur les deux couches extérieures (11), et on maintient ensuite les couches (11) dans un état comprimé élastiquement au moyen desdites mâchoires de pressage (19, 20) jusqu'à ce que l'on assure une compression élastique permanente des couches au moyen de barres de tension (12), insérées chacune au travers d'une rangée de trous (13) dans les couches (11), et de moyens d'accrochage (14), montés aux extrémités desdites barres. 20 25 30 35 40 45 50
2. Procédé suivant la revendication 1, **caractérisé en ce qu'on** maintient les couches (11) durant l'opération de pressage en bordure, en contact étroit avec le substrat (17) au moyen de moyens de verrouillage (22), appliqués contre les faces supérieures des 55

couches.

3. Procédé suivant la revendication 1 ou 2, **caractérisé en ce qu'on** réalise l'opération de pressage en bordure au moyen de deux rangées de mâchoires de pressage consécutives (19, 20) qui, dans chaque rangée, portent sur l'une des deux couches extérieures (11) et qui, dans chaque rangée, définissent entre elles des espaces intermédiaires, situés à l'intérieur des régions des barres de tension (12) et des moyens d'accrochage (14).
4. Procédé suivant l'une quelconque des revendications précédentes, **caractérisé en ce qu'on** insère les barres de tension (12) au travers desdits trous (13) dans les couches (11) après l'opération de pressage en bordure.
5. Procédé suivant l'une quelconque des revendications précédentes, **caractérisé en ce qu'on** équipe les barres de tension (12) avec des moyens d'accrochage (14) à leurs premières extrémités afin d'insérer lesdites barres au travers desdits trous (13) dans les couches (11), et de monter des moyens d'accrochage (14) aux autres extrémités des barres après l'insertion des barres au travers desdits trous (13).
6. Procédé suivant l'une quelconque des revendications précédentes, **caractérisé en ce qu'on** équipe les barres de tension (12) avec des moyens d'accrochage formés par des plaques de métal (14), soudées aux barres de tension (12) aux extrémités desdites barres.
7. Procédé suivant la revendication 6, **caractérisé en ce qu'on** soude les plaques de métal (14) aux surfaces d'extrémité des barres de tension (12) par rabouillage avec lesdites surfaces au moyen d'un procédé de soudage à plat.
8. Procédé suivant la revendication 6 ou 7, **caractérisé en ce que** les deux couches extérieures (11) sont pourvues d'évidements (16) dans leurs faces extérieures destinées à recevoir lesdites plaques de métal (14), de façon que lesdites plaques de métal (14) soient entièrement noyées dans lesdits évidements.

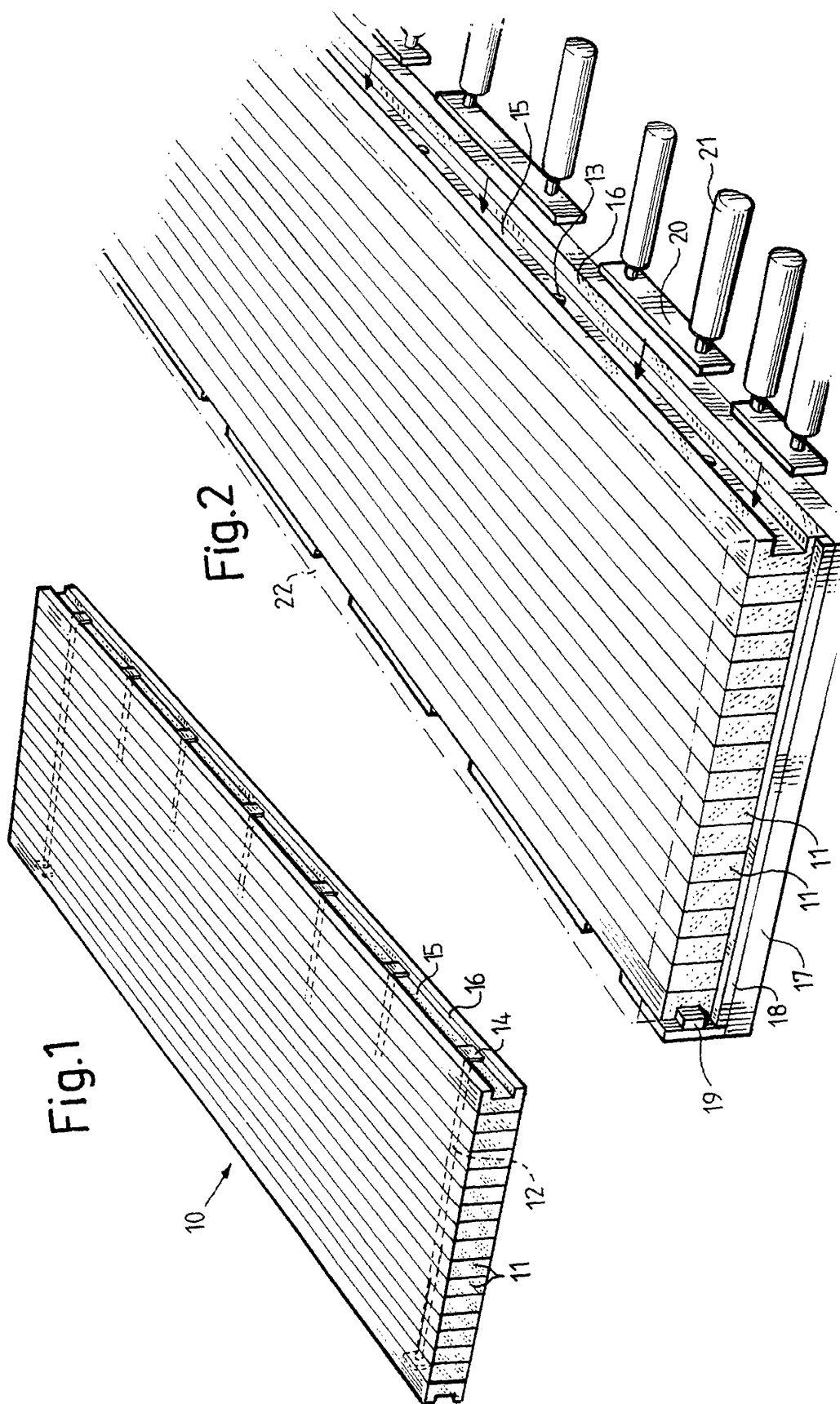


Fig. 3

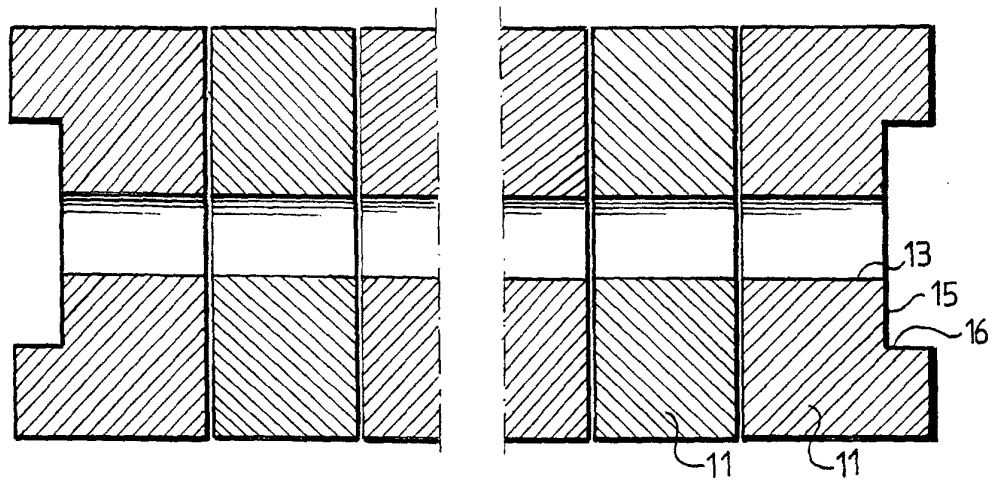


Fig. 4

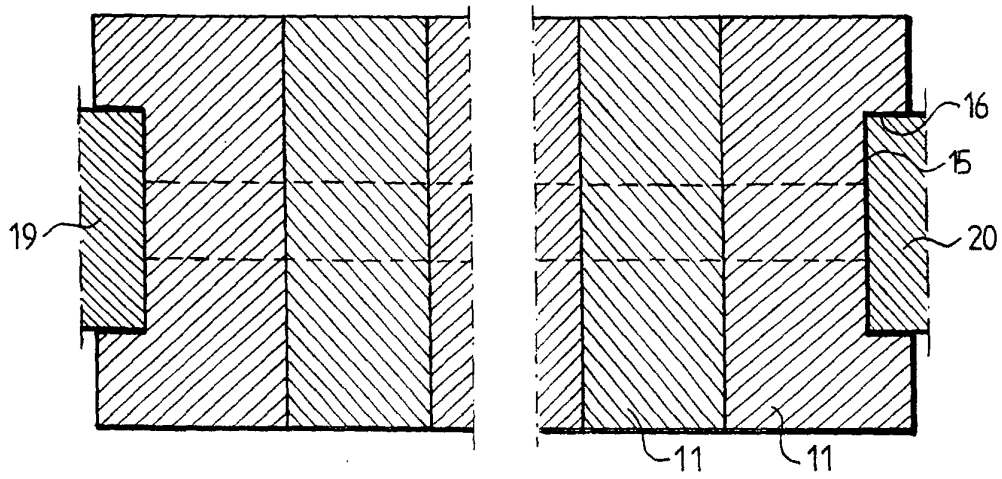


Fig. 5

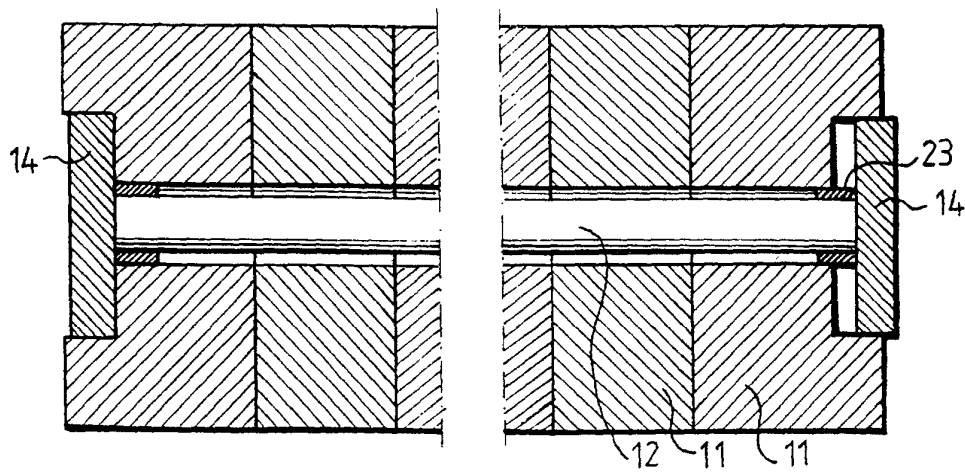


Fig.6

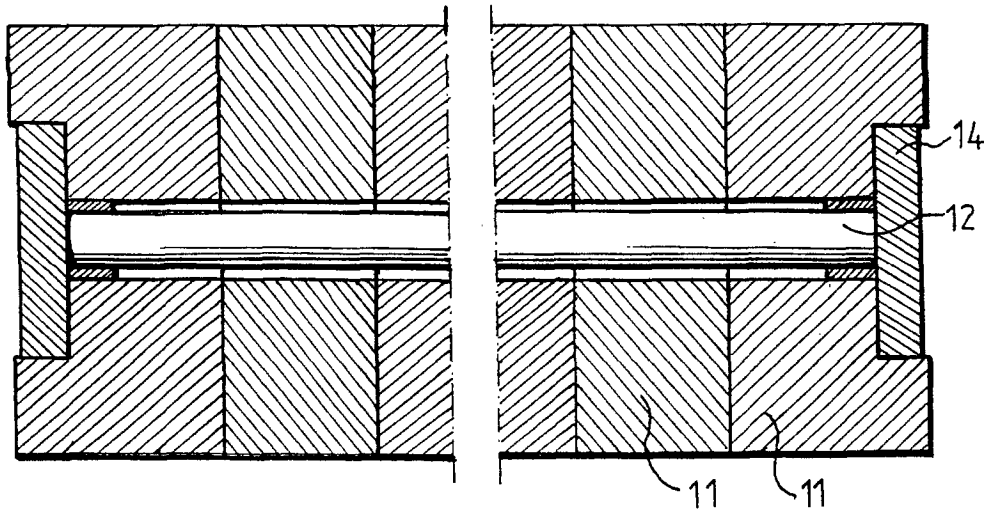


Fig.7

