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(54) **Clamping device for erecting formworks for casting concrete**

Spannvorrichtung zum Aufstellen von Betonschalungen

Tirant de coffrage pour l'érection des coffrages de béton

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**GB-A- 2 133 826**

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## Description

**[0001]** The present invention relates to clamping devices used for erecting casting forms for concreting works and more in particular though not exclusively to realize curved formworks.

**[0002]** The fabrication of formworks into which casting concrete is a basic activity carried out at construction sites. Thence, innumerable formwork erection systems have been developed with the aim of improving the productivity, reliability and/or quality of the finished concrete work.

**[0003]** Many systems make specifically use of standard reusable panels to construct formworks for casting concrete. In other systems these formworks or molds are constructed using less expensive undersized planking for lining the mold.

**[0004]** In any case, the ability of reusing the panels or the timber planks is a factor of great economic importance and for this reason the clamping devices should not severely mark, indent or badly ruin the faces and/or the edges of the panels or of the planks to the extent that they cannot be reused.

**[0005]** Commonly, these clamping systems include specially designed steel risers against which the lining panels or planking bear, linked by spacer blades having terminal slots in which blocking wedges are inserted. In some of these known clamping devices, the spacer blades pass through slots present at regular intervals along the specially designed steel risers so that the blocking wedges bear directly on the steel risers that may have the form of a slotted channel having a "C" shaped cross section.

**[0006]** Other systems use pairs of parallel risers without any slots and made of flat or tubular drawn steel bars. Bridging plates provided with a central slot to accommodate the passage of the end of the spacer blade are then placed over the parallel risers and blocked by wedges abutting on the surface of the bridging plate, as described in the Italian patent application No. 82008 A/89, filed on November 13, 1989.

**[0007]** All these known systems as in CH-A-538 032 require an inventory of coordinated components predefined mechanical and geometrical characteristics in order to provide an operative clamping system. The cost of these inventories of "coordinated" parts (risers, plates, blades, wedges) is rather burdensome, the risers constituting an important item of cost.

**[0008]** Moreover, the erection of curved formworks for concreting work, as needed for example to build supporting walls of curved access ramps to underground garages, of gardens, etc., may be laborious and costly with the presently known clamping systems.

**[0009]** Indeed, curved formworks are almost impossible to build by using standard lining panels and usually the required curved linings of the molds are realized with bendable timber planks.

**[0010]** By itself, this requisite makes most of the

known damping systems practically unusable because they are hardly adaptable to clamp nonstandardized planking or boards.

**[0011]** Other clamping devices, when used to erect curved formworks made of timber planks, require a large number of densely arranged links and because of the curved profile of the lining to be held in place the link and the supporting hardware tend to incise and badly mark the forcibly bent wooden planks.

**[0012]** Altogether, it may be said that with the known clamping devices erecting curved formworks is a rather costly and time consuming job.

**[0013]** It has now been found, and is the object of the present invention, an improved clamping system and relative linking devices that are outstandingly effective also for erecting curved formworks for concreting.

**[0014]** The clamping system of the invention is characterized by employing special reaction plates having a generally undulated or multi-channelled shape, capable of establishing abutment with the external face of the lining over at least two and eventually over three flat surfaces spaced from each other thereof, which directly bear against the external outside surface of the lining planks or boards. Eventually all three spaced abutment surfaces of the reaction plates may bear on the lining bent along a circumference tangent to the three spaced surfaces.

**[0015]** Each reaction plate can be fabricated by stamping from a steel sheet and the stamping mold defines least two parallel channels in the plate. The pair of parallel channels accommodate a pair of parallel risers of the clamping system.

**[0016]** Each reaction plate of the clamping system of the invention presents a first abutment surface (with the exterior of the lining of the formwork) defined between the two parallel channels of the stamped plate, while a second and a third abutment surfaces are provided by the "cantilevered" portions of the reaction plate that extend sideways of the two parallel channels thereof.

**[0017]** An important aspect of the reaction plates of the clamping system of the present invention is that the second and third abutment surfaces are coplanar to each other, but not necessarily coplanar to the central abutment surface defined between the two parallel channels.

**[0018]** The plates may indeed be fabricated in two versions, one with the central abutment surface depressed in respect to the plane of the two lateral abutment surfaces and the other with the central surface raised in respect to the plane of the two lateral abutment surfaces.

**[0019]** The plates fabricated according to the first version are for general use and they are most preferably used to react against the "outer lining of a curved formwork while the plates fabricated according to the second version, are preferably used to react against the "inner" lining of a curved formwork.

**[0020]** The reaction plates of the clamping devices of

the system of the present invention have surfaces bearing against the lining material of the formwork, that typically may be undersized planking, standard boards or equivalent material, that are substantially flat and free of sharp edges that could incise or damage the wooden lining material.

**[0021]** Moreover, the presence of at least two parallel channels in each plate makes them effectively usable in association with relatively inexpensive risers, typically in the form of art segments of steel rods commonly used in reinforced concrete instead of specifically coordinated drawn steel channels. This because the rods, notwithstanding their roughness, are completely accommodated in the channels of the linking plate thus preventing damages to the wooden lining at the highly loaded (Inking points).

**[0022]** Another advantage is that the clamping system of the present invention, while using special though relatively low cost reaction plates in conjunction with a pair of extremely low cost steel rod risers, does not require expendable spacer blades of special shape and lengths, but accepts the use of the same expendable spacer blades that are really available and used in the known damping systems.

**[0023]** The blocking wedges bear against the outer face of the reaction plate, through a hole of which the spacer blade passes, thus protecting the lining from damages.

**[0024]** These and other features and advantages of the clamping system of the invention will become even more evident through the following description of certain preferred embodiments and by referring to the attached drawings, wherein:

**Figure 1** is a cross section that illustrates the clamping system of the invention;

**Figure 2** is a perspective view of a clamping device of the invention;

**Figure 3** shows an alternative embodiment of the reaction plate particularly suited for general use and also for the outer face of a curved formwork;

**Figure 4** shows another embodiment of the reaction plate specifically suited for the inner face of a curved formwork.

**[0025]** With reference to the figures showing preferred embodiments of the invention, a clamping system, particularly suitable for erecting curved formworks, is characterized in that it uses pairs of undulated reaction plates 1 and 2.

**[0026]** Each plate defines a pair of parallel channels, respectively 3, 4 and 5, 6, capable of accommodating cooperating pairs of rod-shaped risers 7, 8 and 9, 10, respectively.

**[0027]** As shown in this figure, though being obviously

possible to use a drawn steel bar having a rectangular cross-section or an equivalent tubular or channel-shaped drawn steel more conveniently, the clamping system of the present invention may readily accept the use of common and relatively cheap reinforced concrete rods as risers.

**[0028]** Each plate presents three flat surfaces that may all lean against the lining material: a first central surface 11 and 12, and two lateral surfaces, 13, 14 and 15, 16, respectively, of "cantilevered" side portions of the reaction plate.

**[0029]** Preferably, the edges of the plates are slightly curved in order to eliminate sharp edges coplanar to the abutment plane which might incise the lining planks or boards.

**[0030]** As observed in the figures, the central abutment surface, 11 and 12, of the two opposed reaction plates 1 and 2 lean against the outer surface of the linings A and B. This permits the use of expendable spacer blades 17 of standard configuration and length as well as of the commonly used blocking wedges 18 and 19 that can be inserted in the end slot of the spacer blade 17, which passes through a slot or, more preferably according to a nontrivial aspect of the present invention, a circular hole 20 of a diameter sufficient to let the spacer blade pass through the central abutment surface 11 and 12 of the reaction plates.

**[0031]** A circular hole (as opposed to a slot) permits any mutual orientation of the spacer blade (which must pass through two abutted timber planks or panels of the lining) and the risers (and consequently the reaction plate coupled thereon). This is important because in fabricating curved molds often such a mutual orientation is not orthogonal.

**[0032]** Moreover, the generation, upon the stamping of the reaction plate of a raised collar 21 around the central hole 20 for the passage of the linking blade, by appropriately configuring the stamping die, provides for a more effective action of the blocking wedges. In fact the raised collar 21 provides a raised reaction surface abutting against the edge of the wedge (18, 19). The raised collar 21 prevents accidental indentations of the rim of the hole 20 from cutting the lining. Moreover, the raised collar 21 provides a certain degree of elasticity that helps mounting and dismantling of the wedges 18, 19, besides spacing them from rubbing on the outer surface of the reaction plate.

**[0033]** Therefore, according to a preferred embodiment, all the reaction plates are provided also with a raised collar 21 around the central hole 20 of the plate through which the linking blade passes.

**[0034]** As highlighted in Fig. 1, according to an embodiment of the present invention, the cooperating plates 1 and 2 may be built in different shapes from one another, specifically for facilitating their coordinated use in erecting curved formworks.

**[0035]** Fig. 3 shows the preferred shape of a plate 1 for general use and specifically suited to be used on the

outer lining of a curved formwork. The plate 1 has the central abutment surface 11 that is depressed in respect to the plane of abutment of the side surfaces 13 and 14.

[0036] Fig. 4 shows the preferred shape of a plate specifically suited to be used on the inner lining of a curved formwork. The plate 2 has the central abutment surface 12 raised in respect to the plane of abutment of the lateral surfaces 15 and 16 (see Fig. 2).

[0037] As shown in Figures 3 and 4, around the central hole 20 for the passage of the linking blade 17, a raised circular collar 21 is preferably formed upon the stamping of the plate, in order to provide a raised circular surface on which the blocking wedges (18 and 19 of Figures 1 and 2) abut, thus remaining slightly spaced from the remaining outer surface of the central portion of the plate.

[0038] In certain situations of erecting curved formworks the reaction plates may have their spaced abutment surfaces substantially tangent to the circumference of the lining so as to react against the outside surface of the lining material with a minimum of stress concentration.

[0039] Though the reaction plates of the linking device of the system of the invention have been described in relation to most common embodiments, it will be evident to the reader that the plates 1 and 2 do not necessarily need to be generally rectangular but they may also be circular or of any other shape. Moreover, special plates may become useful in special situations such as plates that substantially repeat the essential features in two different directions, that is provided with pairs of channels, crossing each other, orthogonally or in any other mutual orientation.

## Claims

1. A clamping device for erecting formworks for casting concrete comprising a pair of reaction plates (1,2) each engaging with at least a pair of risers (7,8,9,10) a linking or spacer blade (17) and a pair of wedges (18,19) blocking the linking or spacer blade on the outer face of the respective reaction plate, **characterized in that** each of said reaction plates (1,2) has an undulated shape defining a pair of parallel channels (3,4,5,6) accommodating said risers and three distinct flat surfaces (11,12,13,14,15,16) on which the outer face of a lining material (A,B) of said formwork may abut.
2. The clamping device according to claim 1, **characterized in that** a first central flat surface (11,12) is defined between said parallel channels and a second (13,14) and a third (15,16) abutment surfaces extend respectively alongside of one and of the other of said two channels.

3. The clamping according to claim 2, **characterized in that** the edge of said portions of the plate providing said second and third surfaces is bent away from the abutment plane.
4. The clamping device according to claim 2, **characterized in that** said central surface is depressed in respect to the plane of abutment of said two lateral surfaces.
5. The clamping device according to claim 2, **characterized in that** said central surface is raised in respect to the plane of abutment of said two lateral surfaces.
6. The clamping device according to claim 2, **characterized in that** each reaction plate is provided with a circular hole (20) through said central surface of a diameter sufficient for the passage of said spacer blade.
7. The clamping device according to claim 6, **characterized in that** around said circular hole is present a collar (21) providing a surface raised in respect to the plane of the outer face of the central surface of the reaction plate onto which said blocking wedge abuts.
8. The clamping device according to anyone of the preceding claims **characterized in that** said reaction plates are die-stamped steel plates.

## Patentansprüche

1. Klemmvorrichtung zur Errichtung von Schalungen zum Gießen von Beton, mit einem Paar Gegendruckplatten (1, 2), die jeweils mit mindestens einem Paar Steigrohren (7, 8, 9, 10) in Eingriff kommen, einem Verbindungs- oder Abstandsblatt (17) und einem Paar Keile (18, 19) zum Arretieren des Verbindungs- oder Abstandsblatts (17) an der Außenseite der jeweiligen Gegendruckplatte, **dadurch gekennzeichnet, dass** jede Gegendruckplatte (1, 2) eine gewellte Gestalt hat, die ein Paar paralleler, die Steigrohre aufnehmender Kanäle (3, 4, 5, 6) und drei eigenständige flache Oberflächen (11, 12, 13, 14, 15, 16) definiert, an denen die Außenseite eines Auskleidematerials (A, B) der Schalung anliegen kann.
2. Klemmvorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** eine erste zentrale flache Oberfläche (11, 12) zwischen den parallelen Kanälen definiert ist und sich eine zweite (13, 14) und eine dritte (15, 16) Anlagefläche entlang der einen bzw. anderen Seite der beiden Kanäle erstrecken.

3. Klemmvorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** der Rand der Abschnitte der Platte, welche die zweite und die dritte Oberfläche bilden, von der Anlageebene weggebogen ist.
4. Klemmvorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** die zentrale Oberfläche in Bezug auf die Anlageebene der beiden seitlichen Oberflächen vertieft ist.
5. Klemmvorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** die zentrale Oberfläche in Bezug auf die Anlageebene der beiden seitlichen Oberflächen erhöht ist.
6. Klemmvorrichtung nach Anspruch 2, **dadurch gekennzeichnet, dass** jede Gegendruckplatte ein durch die zentrale Oberfläche gehendes kreisrundes Loch (20) mit einem Durchmesser aufweist, der für den Durchtritt des Abstandsblatts ausreichend ist.
7. Klemmvorrichtung nach Anspruch 6, **dadurch gekennzeichnet, dass** um das kreisrunde Loch herum ein Kragen (21) vorgesehen ist, der eine Oberfläche bildet, welche in Bezug auf die Ebene der Außenseite der zentralen Oberfläche der Gegendruckplatte, an welcher der Arretierkeil anliegt, erhöht ist.
8. Klemmvorrichtung nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Gegendruckplatten Gesenkstahlplatten sind.

## Revendications

1. Un dispositif de serrage pour coffrages de bâtiment pour la coulée de béton, comprenant un couple de plaques de réaction (1, 2) qui s'engagent chacune avec au moins un couple de colonnes montantes (7, 8, 9, 10), une lame de connexion ou entretoise (17) et un couple de coins (18, 19) bloquant la lame de connexion ou entretoise sur la face extérieure de la plaque de réaction respective, **caractérisé en ce que** chacune desdites plaques de réaction (1, 2) présente une forme ondulée qui définit un couple de canaux parallèles (3, 4, 5, 6) qui accueillent lesdites colonnes montantes et est pourvu de trois surfaces plates distinctes (11, 12, 13, 14, 15, 16) contre lesquelles ledit coffrage peut aboutir.
2. Le dispositif de serrage selon la revendication 1, **caractérisé en ce qu'**une première surface plate centrale (11, 12) est définie entre lesdits canaux parallèles et une deuxième (13, 14) et une troisième (15, 16) surfaces d'aboutissement s'étendent respecti-

vement lelong de l'un et de l'autre desdits deux canaux.

3. Le dispositif de serrage selon la revendication 2, **caractérisé en ce que** le bord desdites portions de la plaque qui fournissent lesdites deuxième et troisième surfaces est pliée en éloignement du plan d'aboutissement.
4. Le dispositif de serrage selon la revendication 2, **caractérisé en ce que** ladite surface centrale est baissée par rapport au plan d'aboutissement desdites deux surfaces latérales.
5. Le dispositif de serrage selon la revendication 2, **caractérisé en ce que** ladite surface centrale est soulevée par rapport au plan d'aboutissement desdites deux surfaces latérales.
6. Le dispositif de serrage selon la revendication 2, **caractérisé en ce que** chaque plaque de réaction est pourvue d'un trou circulaire (20) qui traverse ladite surface centrale, ce trou ayant un diamètre suffisant pour le passage de ladite lame entretoise.
7. Le dispositif de serrage selon la revendication 6, **caractérisé en ce qu'**autour dudit trou circulaire il y a un collet (21) qui fournit une surface soulevée par rapport au plan de la face extérieure de la surface centrale de la plaque de réaction, sur laquelle aboutit ledit coin de blocage.
8. Le dispositif de serrage selon l'une quelconque des revendications précédentes, **caractérisé en ce que** lesdites plaques de réaction sont des plaques d'acier estampées à la virole.

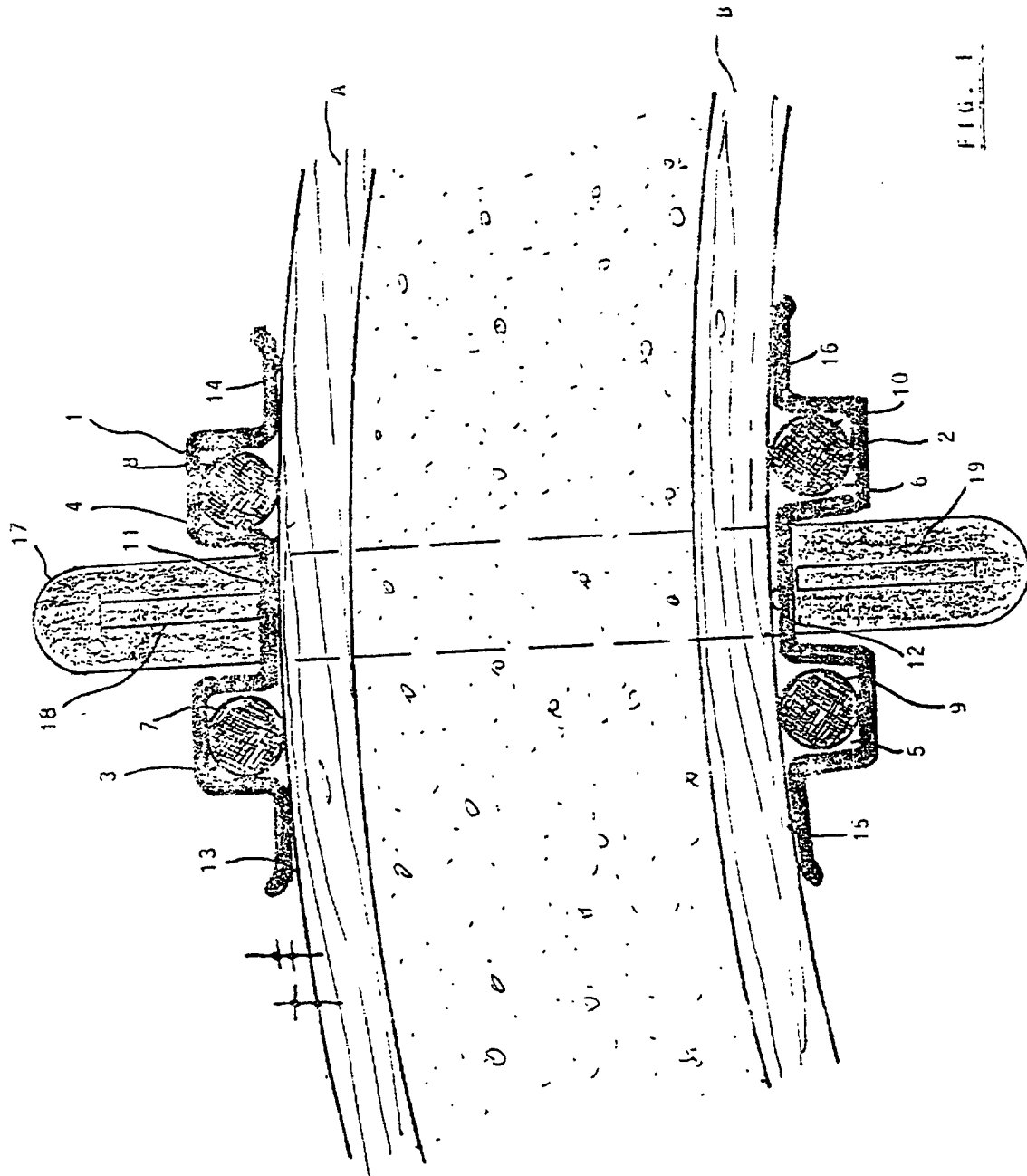


FIG. 1

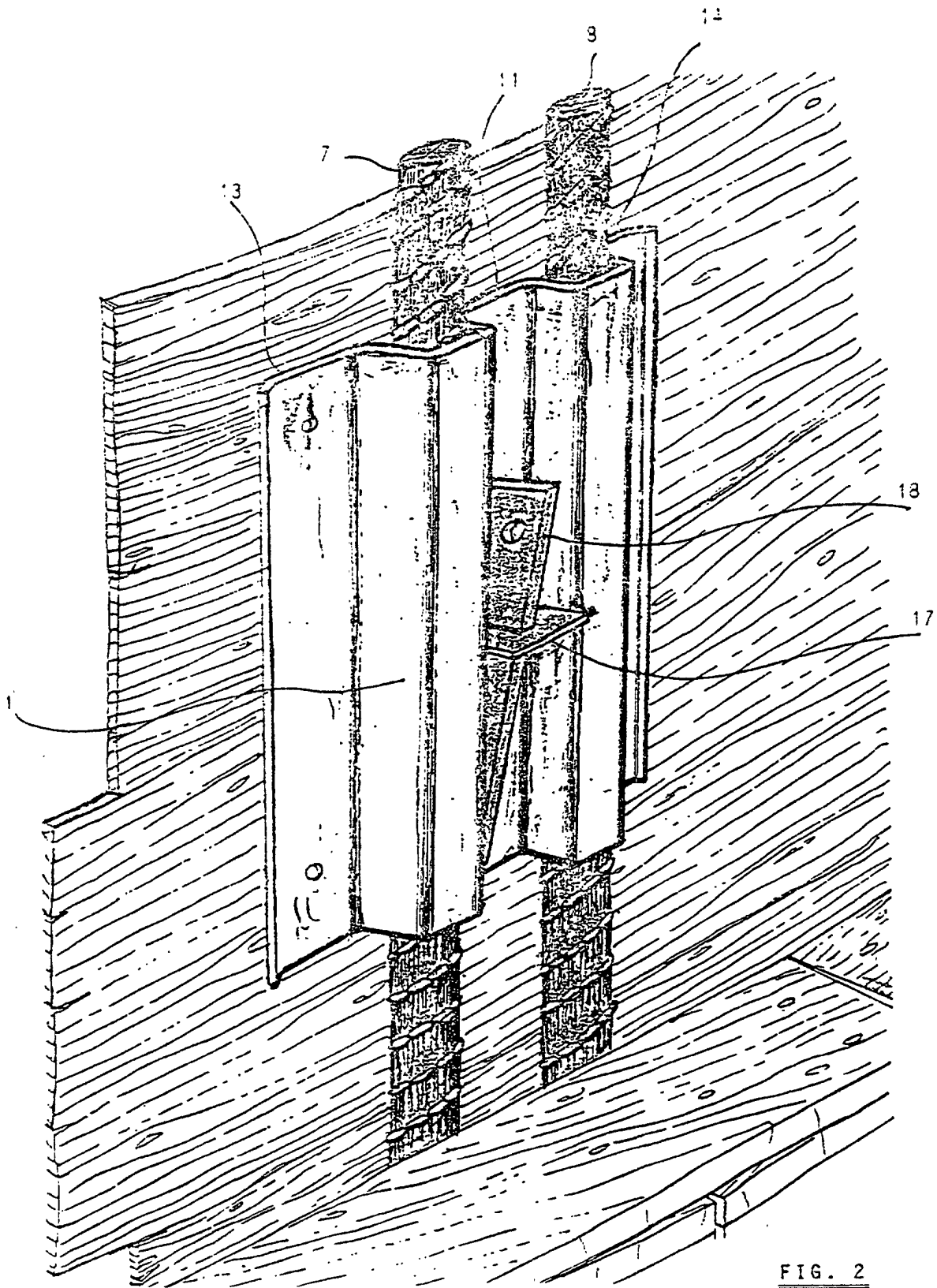


FIG. 2

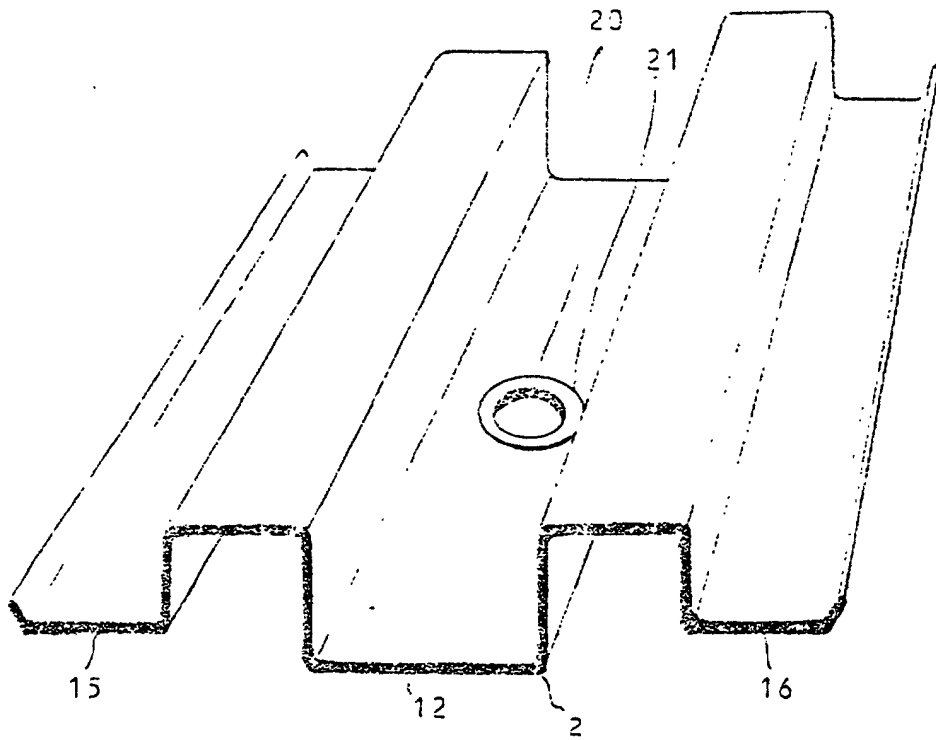


FIG. 4

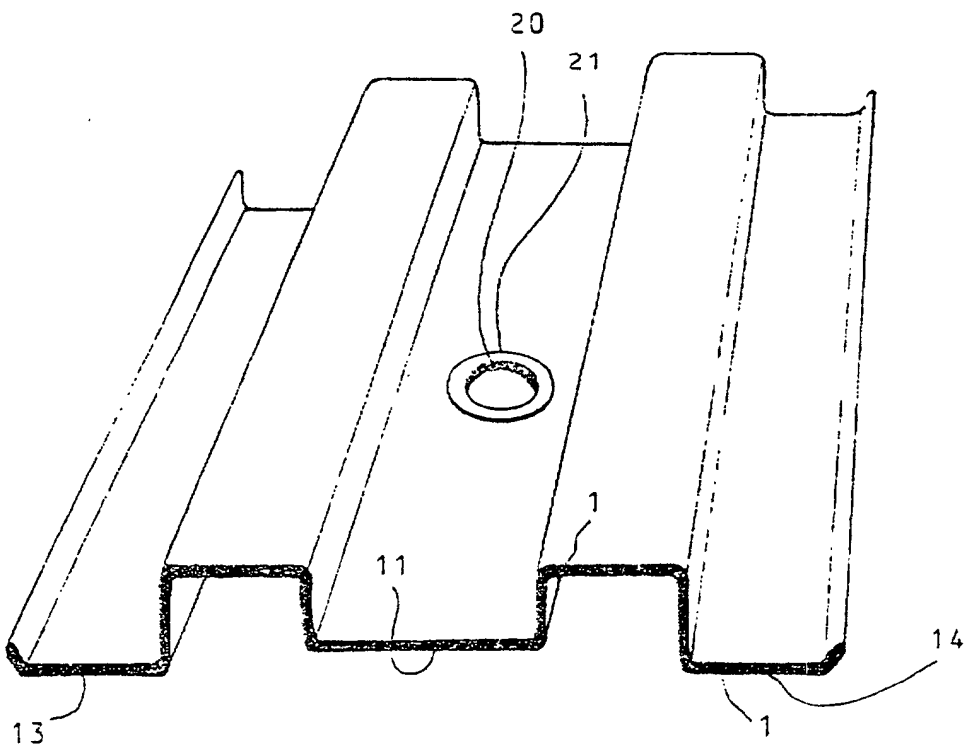


FIG. 3