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(54) Method and device for manufacturing a concrete building component.

(57) The invention provides a method for manufacturing a concrete building component with a number of plate-like parts standing at a mutual angle.

The method comprises of providing a mould (12) having a mould space with corresponding plate-like sections (2-7) which corresponds with the shape of the building component, which mould space has a pouring opening (17) on one side, positioning the mould such that the pouring opening (17) lies at the top and successively filling the plate-like sections (2-7), wherein the mould (12) is in each case positioned for filling each plate-like section (2-7) such that the plate-like section for filling stands at a minimal angle relative to the vertical.

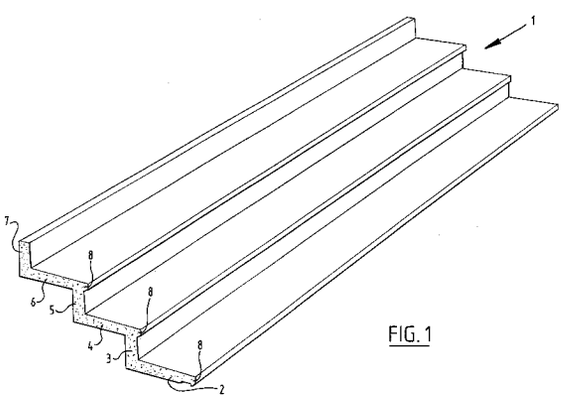

FIG. 1

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The invention relates to a method for manufacturing a concrete building component with a number of plate-like parts standing at a mutual angle. Such a component is for instance a building element with the cross section of a number of stair steps. To enable compliance with minimum quality standards it is usual to assemble such a building component from a number of separate building elements each having the cross section of a single step. Prefabrication of concrete elements with a relatively small wall thickness and a number of plate-like parts standing at a mutual angle has up to the present not been possible to a sufficient level of quality.

The invention now has for its object to provide a method with which such a concrete building component can be manufactured in one operation.

This object is achieved with the method according to claim 1. By placing the mould for each plate-like section of the building element to be filled in an optimum position in each case, each section is successively filled under optimum conditions and each section thereby acquires a good quality. The total building component will therefore likewise have the desired good quality.

The method of claim 2 is preferably applied. It has been found that with applying of this step the desired quality can be achieved under practically all conditions. Air inclusions in the mould which can result in cavities in the component are effectively prevented.

A further favourable development is characterized in claim 3. This ensures that the concrete for pouring flows well to the section for filling without vibrating equipment being necessary for transport of the concrete in the mould. The use of vibrating equipment to displace the concrete is undesired since segregation can therein occur.

According to a further development the method of claim 4 is applied. This contributes to proper filling of the lower-lying sections in reliable manner.

The invention likewise relates to and provides a device for manufacturing a concrete building component having a number of plate-like parts standing at a mutual angle. According to the invention this device comprises a frame, a mould mounted hingedly on the frame and having a mould space with corresponding plate-like sections which corresponds with the shape of the building component, which mould space has a pouring opening at the top, a concrete pouring device disposed above the pouring opening, drive means for tilting the mould into a desired pivot position and control means for the drive means. During pouring of the building component the mould is placed each time in the correct pivot position with the drive means so that the section of the building component being poured at any moment is filled under optimum conditions.

The device according to the invention preferably comprises the step of claim 6. The respective optimum pivot positions of the mould can be predetermined and input into the program memory of the control means. During production the correct sequence of pivot positions is hereby adjusted each time in well reproducible manner.

A suitable further development is characterized in claim 7. What the total weight of concrete for each section amounts to can also be predetermined. Thus, as soon as such a determined quantity of concrete has been poured the corresponding section of the mould will be filled and the control means can activate the drive means to set the correct pivot position for pouring of the following section.

The invention is further elucidated in the following description with reference to an embodiment.

Fig. 1 shows an example of a concrete building component which can be manufactured with the method and a device according to the invention.

Fig. 2 shows a cross section of a device according to the invention for manufacturing the building component of fig. 1.

Fig. 3 shows the device of fig. 2 in another operating position.

Fig. 4 shows the device of fig. 2 in the position for removal of the formed building component.

The building component 1 shown in fig. 1 is a comparatively thin-walled element with a stair-like cross section of three treads. The building component 1 can for instance be used in the building of a stadium.

As shown clearly in fig. 1, the building component 1 has a number of plate-like parts 2-7 standing at a mutual angle. The parts 2, 4 and 6 form the treads and the parts 3, 5 and 7 form the rise portions of the stair profile. A protruding edge 8 is formed as an extension of each part 2, 4, 6.

Fig. 2 shows a device 10 with which the building component 1 of fig. 1 is manufactured.

The device 1 comprises a frame 11. A mould designated integrally with 12 is connected hingedly at 18 to the frame 11. Mould 12 consists of a left mould part 15 and a right mould part 16, each supported by respectively a left mould support construction 13 and a right mould support construction 14. The two mould parts can also pivot relative to each other on the pivoting point 18 in order to enable removal of the formed building component from the mould. This removal will be further described with reference to fig. 4.

Mould 12 comprises between the left and right-hand mould parts 15, 16 a mould space with plate-like sections corresponding with the plate-like parts 2-7 of the component 1 for forming. In the figures these plate-like sections are designated with the

same reference numerals as the corresponding plate-like parts of the component.

As will be apparent from fig. 2, if the special steps according to the invention were not applied, it would be exceptionally difficult to completely fill the mould space with concrete without air inclusions. It is herein noted that a steel reinforcement (not shown here) is arranged in the mould space before pouring is started. The two mould parts are fixed rigidly relative to each other, using inter alia a number of tensioning devices, one of which is indicated in fig. 2 with numeral 28 at the top of the construction. The mould space can be filled at the top via the pouring opening 17.

According to the invention the whole mould 12 is pivotable on the hinge 18 by drive means, which here take the form of hydraulic jacks 20, 21.

The concrete building component 1 is formed as follows. In the position shown in fig. 2 a quantity of concrete sufficient to fill the plate-like section 2 is poured into the mould space via the pouring opening 7. As can be seen, the plate-like section 2 is practically vertical, so that the supplied concrete can effectively displace the air out of section 2. As soon as the correct quantity has been poured into the mould space the poured concrete is compacted with vibrating equipment (not shown) mounted against the mould.

For pouring of the following section 3 the whole mould 12 is tilted into the position shown in fig. 3. The section 3 herein comes to lie, in view of the shape of the element, at a minimal angle relative to the vertical. For good operation this minimal angle generally amounts to a maximum of 45°. As fig. 3 clearly shows, the mould 12 is herein positioned such that the straight line 30 between the pouring opening and the plate-like section 3 for filling encloses a minimal angle with the vertical. Thus is ensured that the concrete fed into the pouring opening 7 flows properly downward into the section 3 for filling. After as much concrete has once again been supplied as is sufficient to fill the section 3 the poured concrete is compacted with vibrating means arranged on the mould.

Using the drive means 19 the mould 12 is then tilted back again into the position shown in fig. 2 and section 4 is poured. For the subsequent pouring of section 5 the mould is tilted once again into the position of fig. 3 and, for the sections 6 and then 7 the mould is again placed in the position of fig. 2. After the mould has been completely filled the end surface at the position of the pouring opening 7, which end surface forms a side wall of the section 7, is finished and the concrete is given the opportunity to cure.

In addition to the fact that due to the described tilting of the mould an optimum angle is adjusted for pouring a particular section in each case, the tilting also has the effect that concrete which may not have flowed fully downward during pouring of a particular section is released again by the tilting and flows further.

As shown in fig. 2 and 3, platforms 27 and 26 are arranged on respectively the left-hand mould support 13 and the right-hand mould support 14. Platform 26 is horizontal in the position of fig. 2 and platform 27 is horizontal in the position of fig. 3. These platforms are used by the personnel filling the mould.

The pivot position of fig. 3 can be determined by a suitable dimensioning of the jack 21. This pivot position can just be reached in the end position of jack 21. This possibility is provided here because only two positions are required since the sections of the component 1 stand only at two different angles. When additional different pivot positions are desired an angle sensor can be connected to the mould and the drive means 19 can be controlled by a control device (not further shown) such that a position detected by the angle sensor is adjusted in each case.

As described in the foregoing, precisely the quantity of concrete is carried into the mould space as is required to fill a particular section. This can be determined in simple manner by providing the concrete pouring device (not shown) with a weighing device. The volume of a particular section can be determined simply by calculation and the weight of the required quantity of concrete can therewith be determined.

The control device (not shown here) is preferably a programmed control device which controls the successive operating commands for pivoting the mould into the correct position and feeding the correct amount of concrete. Switch-on of the vibrating means can likewise be carried out by the control device.

After the concrete in the mould space has become sufficiently hard, it is removed from the mould space. From the position shown in fig. 3 the tensioning devices such as 28 are first released. The support arm 22, which is connected on its free end at 24 to the right-hand mould part 14 by means of a locking pin, is then released and pivoted to the right on the hinge 18 until it can be fixed with the locking pin in the hole 25. The right-hand mould part 15 is hingedly connected at 23 to support arm 22. Due to the described pivoting movement of support arm 22 on the hinge 18, wherein the end of the locking pin position 24 is displaced to 25, the pivoting point 23 and thus the whole right-hand mould support with mould will move downward relative to the left-hand mould support through a distance at least equal to the protruding edges 8. The right-hand mould part can then be pivoted clockwise by retracting the jack 21.

The left-hand mould part is pivoted counterclockwise so that the position of fig. 4 is eventually obtained. The formed concrete building component 1 can then be removed simply from the mould.

After placing of new reinforcement and re-closing of the mould, a following manufacturing cycle can be initiated.

Claims

1. Method for manufacturing a concrete building component with a number of plate-like parts standing at a mutual angle, comprising of providing a mould having a mould space with corresponding plate-like sections which corresponds with the shape of the building component, which mould space has a pouring opening on one side, positioning the mould such that the pouring opening lies at the top and successively filling the plate-like sections, wherein the mould is in each case positioned for filling each plate-like section such that the plate-like section for filling stands at a minimal angle relative to the vertical.

2. Method as claimed in claim 1, wherein the minimal angle amounts to a maximum of 45°.

3. Method as claimed in any of the foregoing claims, wherein positioning of the mould takes place such that all plate-like sections between the section for filling and the pouring opening also stand at an angle smaller than 90° to the vertical.

4. Method as claimed in any of the foregoing claims, wherein positioning of the mould takes place such that a straight line between the pouring opening and the plate-like section for filling also encloses a minimal angle with the vertical.

5. Device for manufacturing a concrete building component having a number of plate-like parts standing at a mutual angle, comprising a frame, a mould mounted hingedly on the frame and having a mould space with corresponding plate-like sections which corresponds with the shape of the building component, which mould space has a pouring opening at the top, a concrete pouring device disposed above the pouring opening, drive means for tilting the mould into a desired pivot position and control means for the drive means.

6. Device as claimed in claim 5, wherein the control means are programmed control means which control the drive means according to program for successively positioning the mould in different pivot positions.

7. Device as claimed in claim 6, wherein the concrete pouring device comprises a weighing device with which the amount of concrete poured each time can be determined, which weighing device is coupled to the control means and wherein the control means activate the drive means in each case to place the mould in a subsequent pivot position after a determined weight of concrete has been poured into the mould.

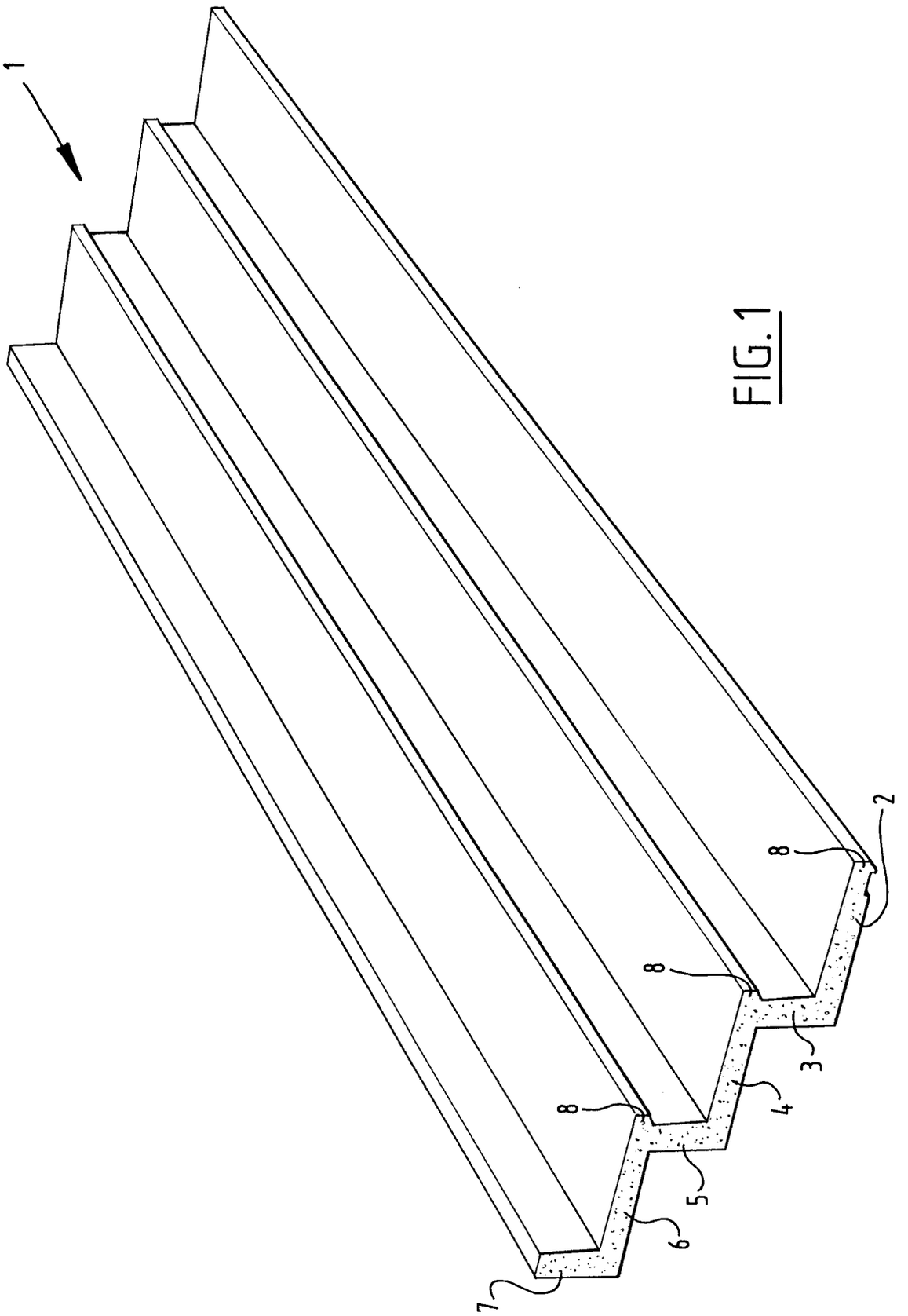

FIG.1

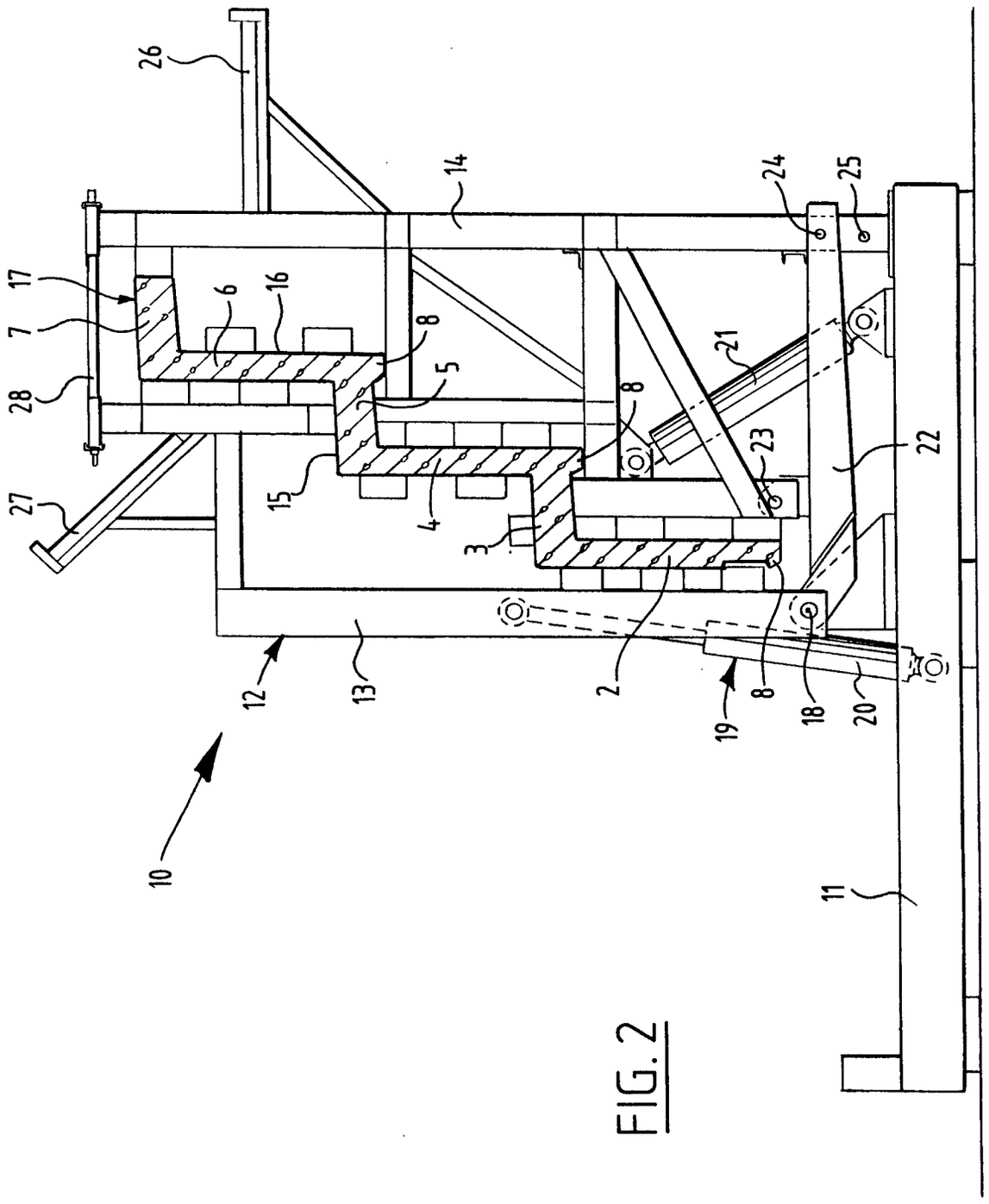

FIG. 2

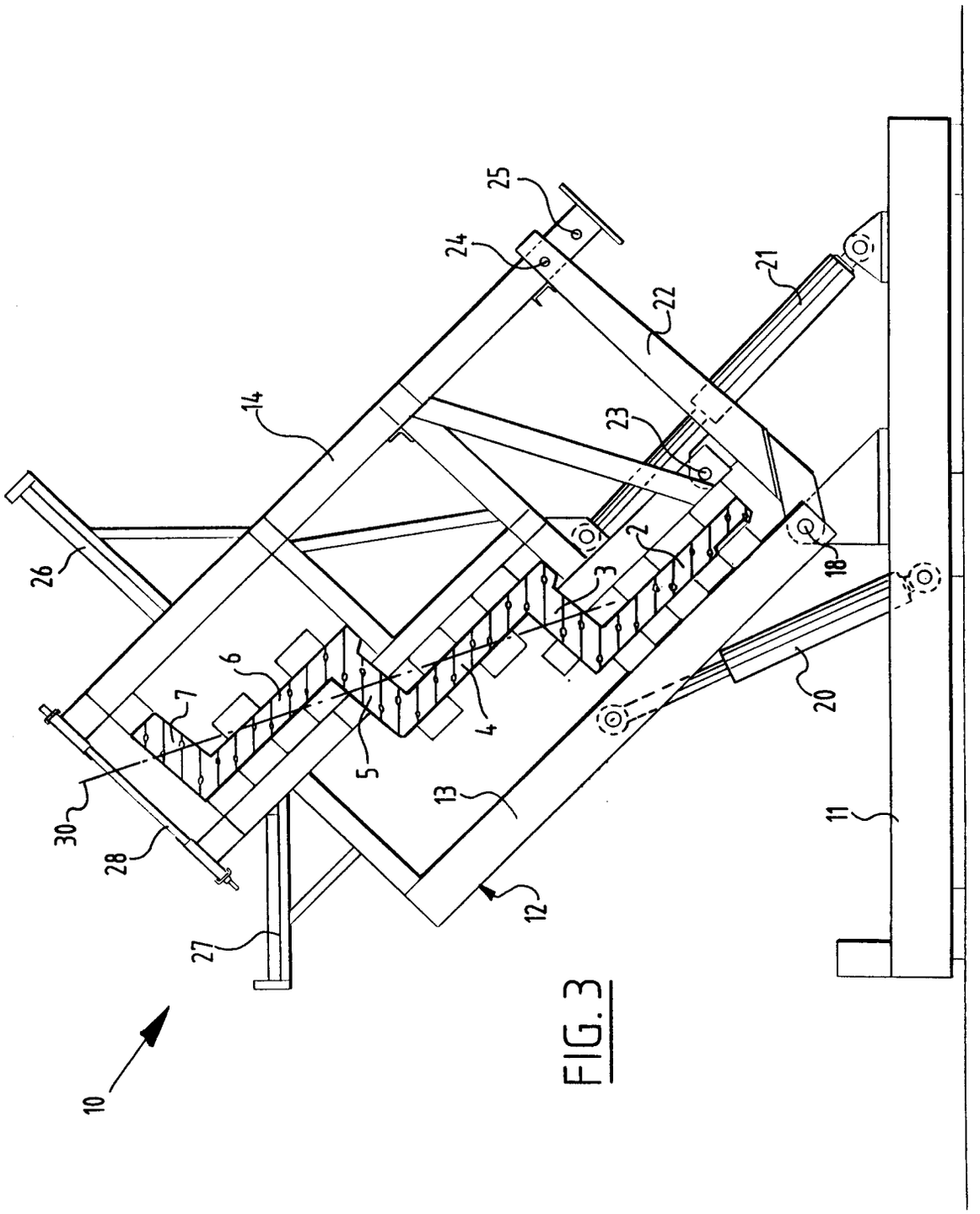

FIG. 3

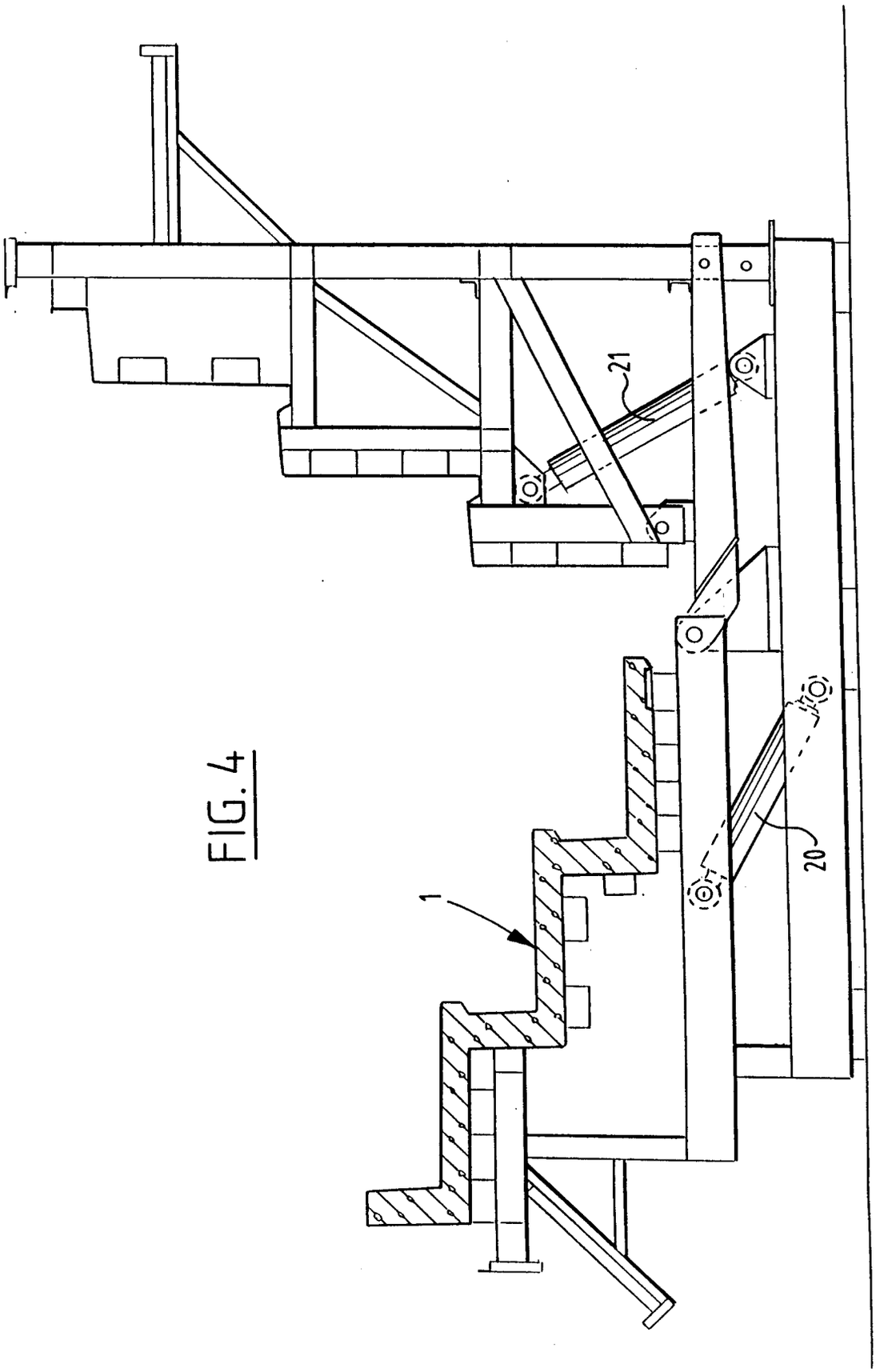

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 94 20 1386

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	US-A-3 055 146 (F. LOBATO) * column 5, line 31 - column 6, line 19; figures 3-6 *	1-5	B28B7/22 B28B13/02
A	SOVIET INVENTIONS ILLUSTRATED Week 8205, 17 March 1982 Derwent Publications Ltd., London, GB; AN B1318 E/05 & SU-A-823 137 (GOSSTROI REINF CONC) 25 April 1981 * abstract *	1-5	
A	SOVIET INVENTIONS ILLUSTRATED Week 8446, 2 January 1985 Derwent Publications Ltd., London, GB; AN 84-287040/46 & SU-A-1 079 447 (KIEV HOUSING DES) 15 March 1984 * abstract *	1,5	
A	DE-B-11 54 751 (P. H. MARSHALL) * the whole document *	1-7	TECHNICAL FIELDS SEARCHED (Int.Cl.5) B28B E04G
A	DE-A-22 53 706 (STETTER GMBH) * page 8, line 9 - page 8, line 19; figures 6A,6B *	1-7	
A	GB-A-1 517 962 (I.-F. PRIMUS) * page 3, line 77 - page 3, line 130; figures 6A-6D *	1-5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	6 September 1994	Gourier, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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