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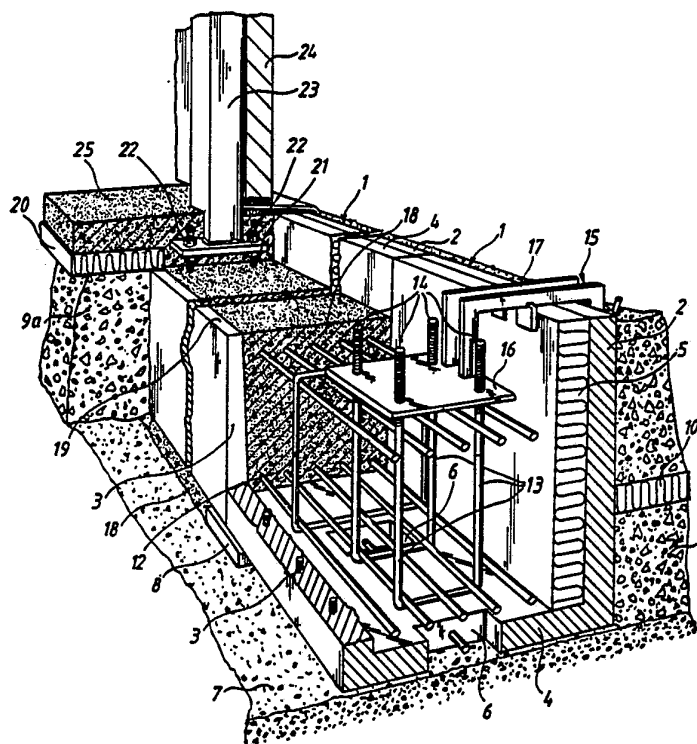
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(54) Title: A METHOD OF ERECTING A FOUNDATION STRUCTURE FOR A BUILDING SUBSTRUCTURE

(57) Abstract

The invention concerns a method of erecting a foundation structure for a building substructure. In accordance with this method joists (1, 1a) comprising a horizontal web (4) interconnecting upright side flanges (2, 2a, 3, 3a) on either side, are positioned butt end against butt end and are fixed in position at a distance of a few centimeters above a substratum (7). Gravel, macadam (9, 9a) or other back fill material is then positioned against the external face of each side flange (2, 2a, 3, 3a), whereupon concrete (18) is poured into the joists (1, 1a) and is allowed to partly flow downwards, through apertures (6) formed in the joist webs (4), and onto the substratum (7).



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A METHOD OF ERECTING A FOUNDATION STRUCTURE FOR A BUILDING
SUBSTRUCTURE

The subject invention concerns a method of erecting a
5 foundation structure for a building substructure.

In erecting concrete building substructures, in situ
casting is the procedure most commonly used today. The use
of finished, prefabricated beams that are delivered to the
building site, is justified only when the building project
10 is a large one and the resources in terms of economy,
machinery and personnel are ample from the start. Other-
wise, i.e. in the case of building projects of small or
medium size, the use of such beams involves highly
specialized equipment, such as specialty vehicles, to
15 transport the beams to the building site and, on the
building site, hoisting cranes having a considerable
lifting capacity, all of which is considered to be too
expensive.

Also in situ casting, however, involves working pro-
20 cesses that are complicated in several respects but are
used since long in the absence of better alternatives.
For instance, following the excavation to accommodate the
the building substructure, and deposition of a bed of
gravel or macadam, the team of carpenters is called upon
25 to set out and erect on the bed the forms necessary for
the casting of the foundation beams. After completion of
the casting operation and setting of the concrete, the
team of carpenters has to return to the building site to
remove the beam forms. Very often, the dismantled forms
30 cannot be re-used. Some of the casting costs thus are
consumed by the used-up form timber. An added complication
is that workmen of several different categories, such as
excavator operators, carpenters, and concrete casters,
must intervene alternately in the working process. The
35 risk for unnecessary delays thus is considerable,
resulting in increased costs.

In accordance with the teachings of the invention a method has been developed by means of which the work involved in erecting a foundation structure for a building substructure is highly facilitated. The features
5 characterizing this novel method are defined in the appended claims.

The invention will be described in closer detail in the following with reference to the accompanying drawings, wherein

10 Fig. 1 is a perspective view of a shuttering joist as seen obliquely from above,

Fig. 2 is a perspective view of the same joist as seen obliquely from below,

15 Fig. 3 is a perspective broken view showing different stages of erecting a building foundation, and

Fig. 4 is a perspective view as seen obliquely from above of a modified embodiment of the shuttering joist.

The shuttering joist 1 that is used in connection with the method in accordance with the invention consists
20 of two upright, mutually parallel side flanges 2 and 3 of concrete, and of a web 4 of concrete, interconnecting the side flanges at the bottom thereof. Side flange 2 is slightly higher than side flange 3 and its inner face is covered with an insulating layer 5. The web is formed with
25 a number of apertures 6 the function of which will be explained in the following. Shuttering joists 1 of this configuration are prefabricated in a factory and are transported to the building site.

When shuttering joists 1 arrive at the building site
30 the excavation work is already completed and a bed 7 of gravel has been laid and, preferably, been compacted. On top of the bed 7 of gravel, slabs 8 of concrete are positioned, spaced apart by a distance equalling the length of the shuttering joist. The thickness of the slabs
35 8 preferably is 5-7 cm. The shuttering joists 1 thereafter are lowered onto the bed so as to be positioned butt end against butt end on top of the slabs 8 and in such a

manner that a slight gap is left between the joist webs 4 and the bed 7 of gravel. The shuttering joists 1 are placed in such positions that the higher side flange 2 comprising the layer of insulating material 5 will form the external wall of the building foundation.

The shuttering joists 1 thus set out are secured in position by back fill material that is placed against the external face of the side flange 2. This back fill material, which preferably consists of gravel or macadam 10 9, is supplied in sufficient amounts for the material to reach the upper edges of the side flanges 2, in addition to which the space separating oppositely positioned external faces of the inner side flanges 3 or such external faces thereof that form an angle is likewise 15 filled with back fill material 9a up to the level of the upper edges 19 of the side flanges 3. In this stage, horizontal insulating frost-protection layers 10 are also laid out.

Prefabricated reinforcement cages 12 are then placed 20 in the shuttering joists 1 thus set out. At the same time, fastening elements 13 are inserted in the joists 1, said fastening elements 13 consisting, in accordance with the embodiment illustrated, of U-shaped iron rods the upwardly directed ends 14 of which are threaded. On top of the iron 25 rod ends 14 are applied a fixing element 15 consisting of an apertured plate 16 which is attached to a clamping yoke 17 by means of which the plate is passed over the threaded rod ends 14. The clamping yoke 17 is clamped in position about the side flange 2 and the insulating layer 5 and 30 thus retains the plate 16 at a predetermined level while at the same time the latter fixes the threaded ends 14 of the fastening elements (13) in predetermined spaced-apart positions.

The shuttering joists 1 are then filled with concrete 35 18. Preferably so called easy-flow concrete is used which is more adaptable than conventional concrete. In the course of the successive filling of the joist with con-

crete, some of the concrete 18 will penetrate through the apertures 6 formed in the joist web 4 and continue onto the bed 7 of gravel. In this manner, the concrete 18 will fill out the gap between the joist web 4 and the bed 7 of gravel and even to some extent penetrate into the bed.

Concrete 18 is filled up to the level of the upper edge 19 of the inner side flange 3 and is subjected to a vibration treatment. This level is positioned somewhat below that of the plate 16. As soon as the concrete 18 has set, an insulating layer 20 is positioned on top of the bed 9a of gravel or macadam and in such a manner that it projects above the upper edges 19 of the side flanges 3, whereupon the fixing element 15 is loosened and removed together with the plate 16. Another plate 21 is passed over the threaded ends 14 of the fastening elements 13 and is secured in position by means of nuts 22. This plate 21 serves as an attachment means for securement of those structural components that are to project above the building foundation, such as a steel column 23 which is welded to the plate 21 and to which column wall elements 24 are thereafter secured.

When columns 23 of this kind as well as other structural components have been put in place, a vault 25 is cast on top of the insulating layer 20, up to the level of the upper edges of the outer side flanges 2. The construction of the building foundation is now completed.

Fig. 4 illustrates a shuttering joist 1a of a particular configuration, comprising an outer side flange 2a including an angular section, a shorter side flange 3a and an inter-flange space 26. This joist 1a is intended for application in a corner of the building foundation and in all other respects it is used and functions in the same manner as the straight joists 1.

The method in accordance with the invention offers considerable advantages. Compared with solid cast concrete beams the shuttering joist 1, 1a is relatively lightweight and consequently it is more convenient to transport

it from the factory to the building site. On the building site, a building foundation may be erected in a more rational manner when the shuttering joist 1, 1a is used than is the case with conventional technology methods.

5 All work connected with the setting out of forms has become superfluous. Instead, the joist 1, 1a in itself serves as forms. Consequently, once the casting work is completed, there is not either any dismantling of forms
10 operative position as indicated, is a perfect bearing beam and it is well anchored to the supporting layer owing to concrete being allowed to penetrate through the apertures 16, which to some extent binds the joists 1, 1a to the supporting layer. Also the application of the insulating
15 layer 5 at the stage of manufacture in the factory, facilitates the erection procedure compared to the work involved in applying this layer internally of a wall of a form that is to be dismantled later on. The attachment members, such as the plate 21, are embedded into the
20 concrete 18, protected against corrosion.

Another, very essential advantage inherent in the novel method is that the preparation of the ground prior to the casting, by applying back fill materials, such as gravel or macadam 9, 9a, will be completed at a very early
25 stage. The contractor responsible for the preparation of the ground thus will have finished his work when the building contractor starts his, and vehicles for supply of concrete as well as of the various building components may drive up to a position close to the building foundation,
30 which facilitates unloading operations and all work connected with the erection of the building.

Yet another advantage is that the walls and the roof may be erected at such an early stage that the vault
35 the need for any separate measures having to be taken for this purpose.

Research has shown that in erecting a building foundation comprising an area of approximately 1000 m², a gain of 2 - 2.5 weeks is obtained compared with the time required to erect a building foundation of this size, using conventional building technology. It is easily understood that considerable economical gains may be made. Furthermore, one has found that the consumption of concrete is reduced, which is attributed to the possibility to carry out the casting operations under more controlled conditions.

The invention is not limited to the embodiment as illustrated and described but a number of modifications are possible within the scope of the appended claims. Obviously, the joist 1, 1a may be given a different shape than the one illustrated and could also be adapted to allow embedment in the concrete 18 of a large number of various structural components. Also the reinforcement 12 could be given a different configuration.

Should one wish to use a wooden pillar instead of the steel column 23, angle irons or plates are welded to the plate 21 so as to extend upwards, through the cast vault 25. Wooden pillars are then placed between the angle irons or plates, and threaded bolts are inserted through holes in the wooden pillar and the angle irons or plates, whereupon nuts are tightened on the bolts.

Alternatively, the back fill material 9a could be applied against the outer face of the side flange 3 only to a level allowing the insulating layer 20 to reach the upper edge 19 of the side flange 3 in cases when one wishes to cast a vault 25 having a thickness exceeding that shown.

CLAIMS

1. A method of erecting a foundation structure for a
5 building substructure, characterized by
placing joists (1a, 1) consisting of two upright,
essentially mutually parallel side flanges (2, 2a, 3, 3a),
and of a web (4) interconnecting the side flanges at the
bottom thereof and being formed with a number of apertures
10 (6), in a butt end to butt end position and securing said
joists in position at a short distance, preferably
amounting to a few centimeters, above a substratum (7),
preferably in the form of a bed of gravel or macadam, on
an excavated surface, and filling back fill material (9,
15 9a), such as gravel, macadam or equivalent materials
against the external face of each side flange (2, 2a, 3,
3a) and pouring concrete (18) into the joists (1, 1a),
whereby some of the concrete (18) is allowed to flow
through said apertures (6) formed in the webs (4) of the
20 joists (1, 1a), and further onto the substratum (7).

2. A method as claimed in claim 1 applicable when
the inner side flanges (3, 3a) of the joists (1, 1a) in
the foundation are lower than the outer side flanges (2,
2a), characterized by pouring, in a first
25 step, concrete (18) up to the upper edges (19) of the
inner side flanges (3, 3a) and, when the concrete (18)
has set, placing an insulating layer (20) on the back fill
material (9a) filled against the inner side flanges (3,
3a), and in a second step casting a vault (25) on top of
30 said insulating layer (20) and the concrete (18) which
has set after the first step.

3. A method as claimed in claim 1, characterized
by positioning fastening elements (13),
such as threaded bolts, at predetermined locations inside
35 the joists (1, 1a) prior to concrete (18) being poured
thereinto, and securing said fastening means in pre-
determined positions, whereupon concrete (18) is filled

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into the joists (1, 1a) up to a level immediately below the upper ends (14) of the fastening elements, said free upper ends (14) serving, after setting of the concrete (18), as attachment means for securement of constructional components (23) extending above the finished building foundation.

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Fig. 1

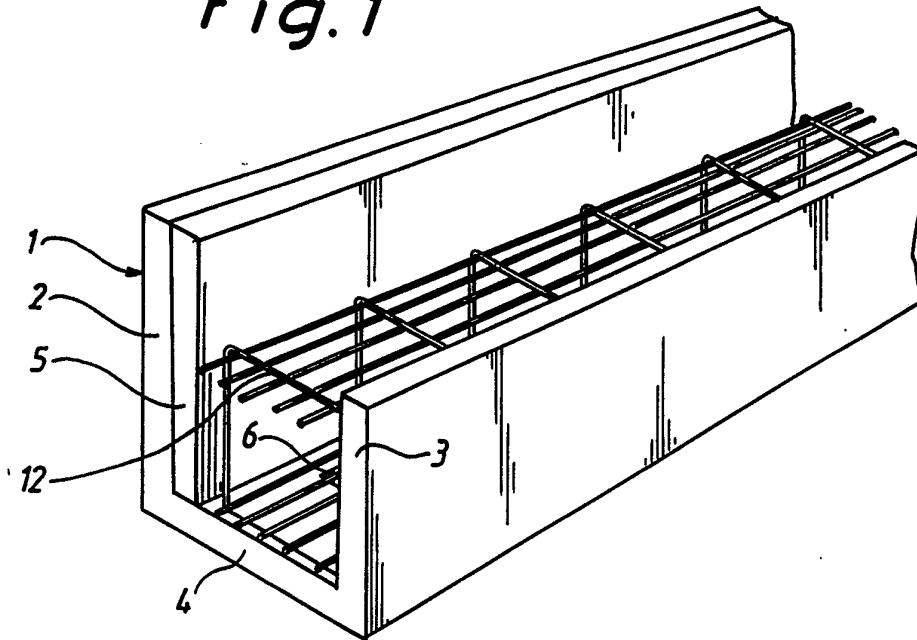
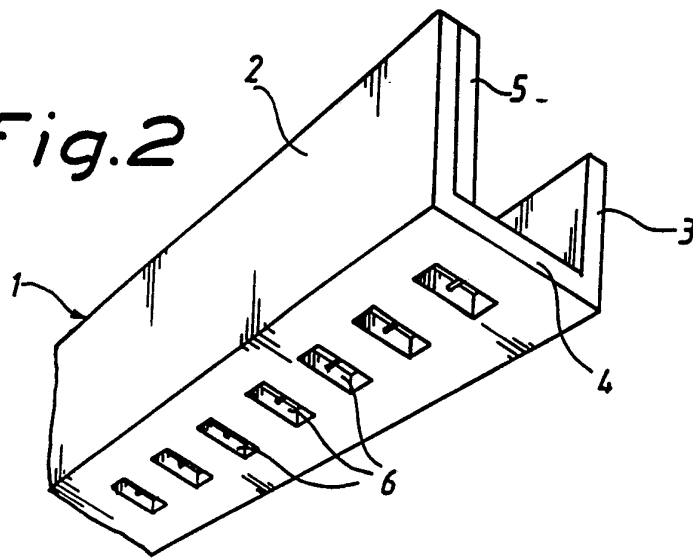
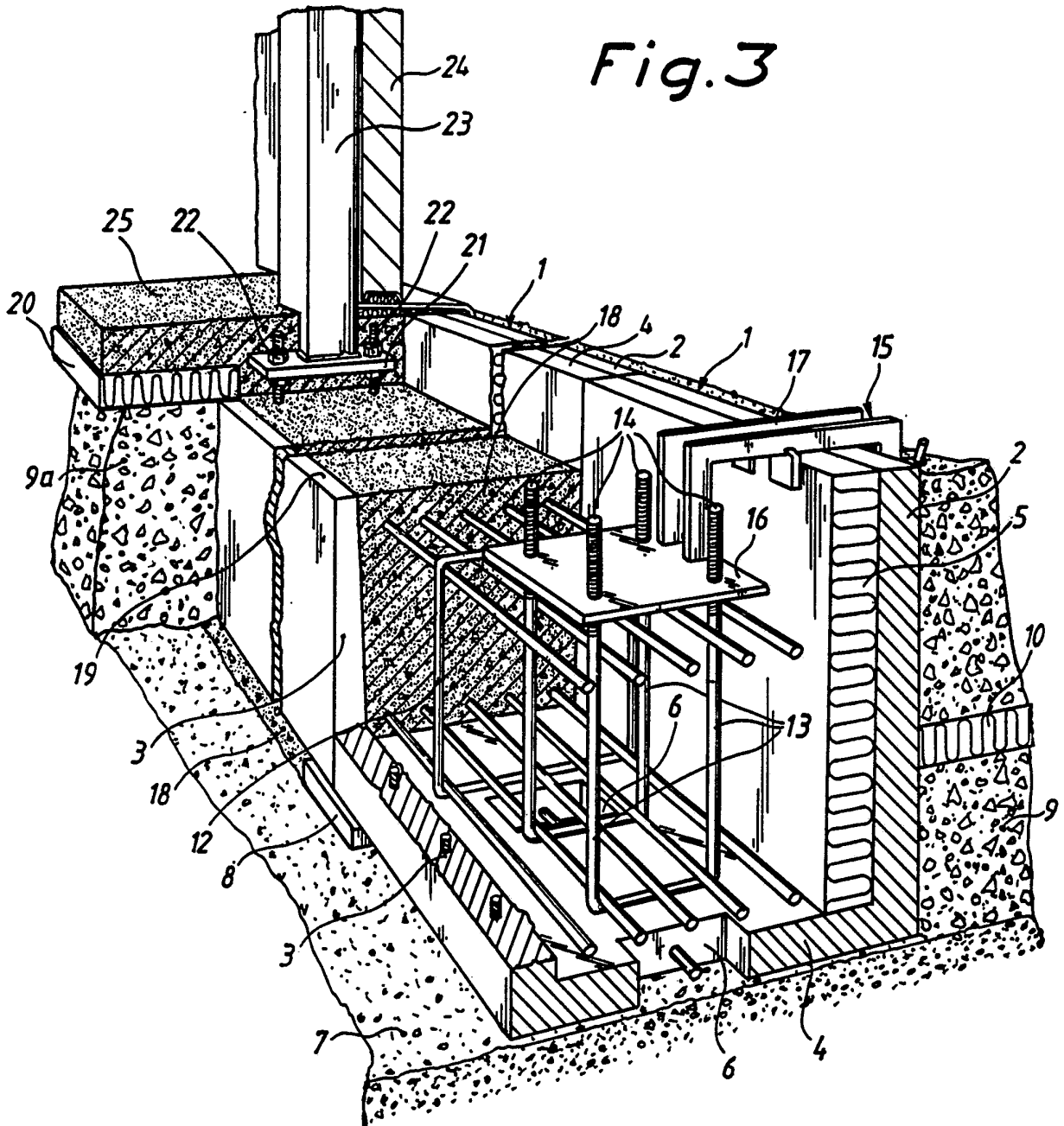


Fig. 2



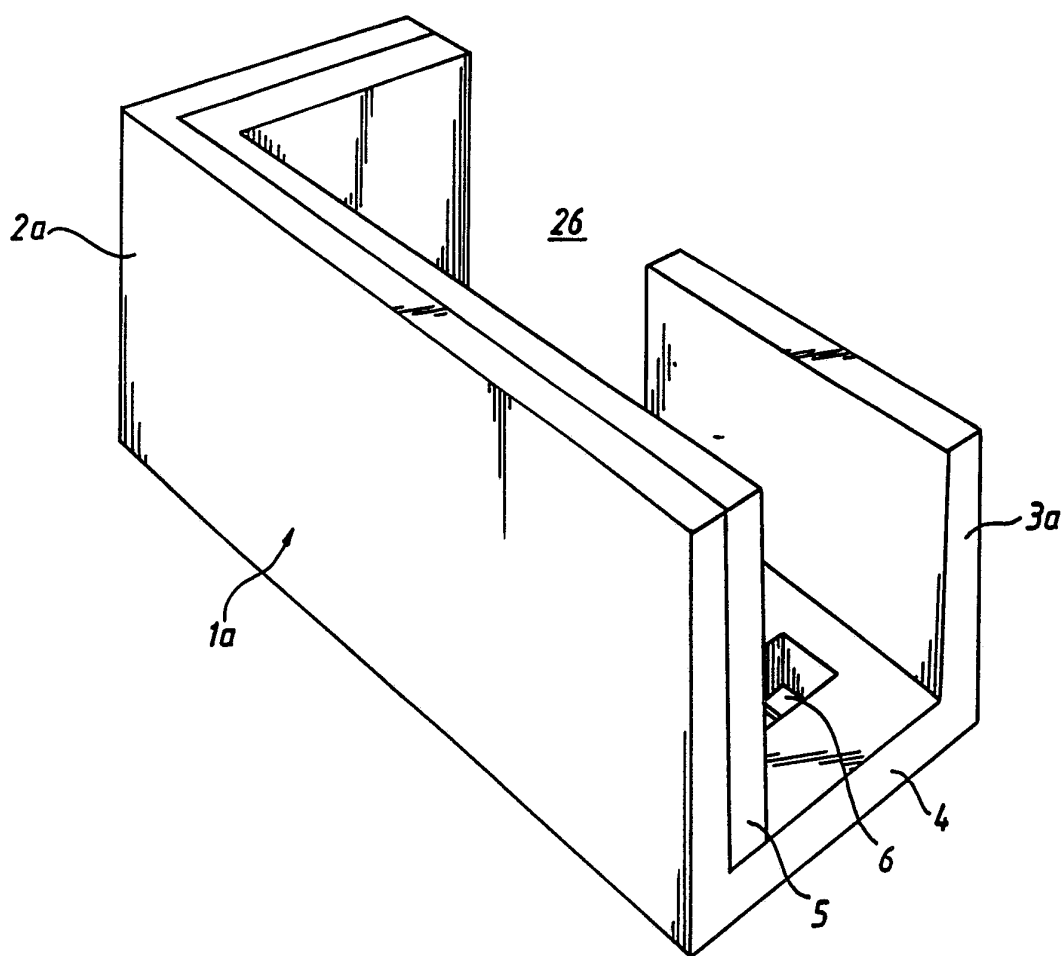
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Fig.3



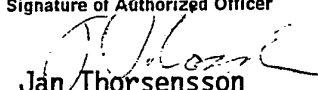
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Fig.4



INTERNATIONAL SEARCH REPORT

International Application No **PCT/SE 91/00373**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC5: E 02 D 27/01		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
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IPC5	E 02 D	
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SE,DK,FI,NO classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	SE, B, 457220 (J.O.L. NILSSON) 5 December 1988, see the whole document --	1-3
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IV. CERTIFICATION		
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ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 91/00373

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 91-06-27
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-B- 457220	88-12-05	SE-A- 8600366	87-07-29
SE-B- 444335	86-04-07	SE-A- 8006240	82-03-09