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(54) Moulding apparatus.

(57) The invention relates to a moulding apparatus for concrete products for instance, comprising:

i) a column (3) arranged on a ground;

ii) a carriage (4) which is rotatably connected to the column (3);

iii) a mould (5) which comprises:

a) a bottom mould part (7) arranged on a filling position (6) and provided with vibrating means (35);

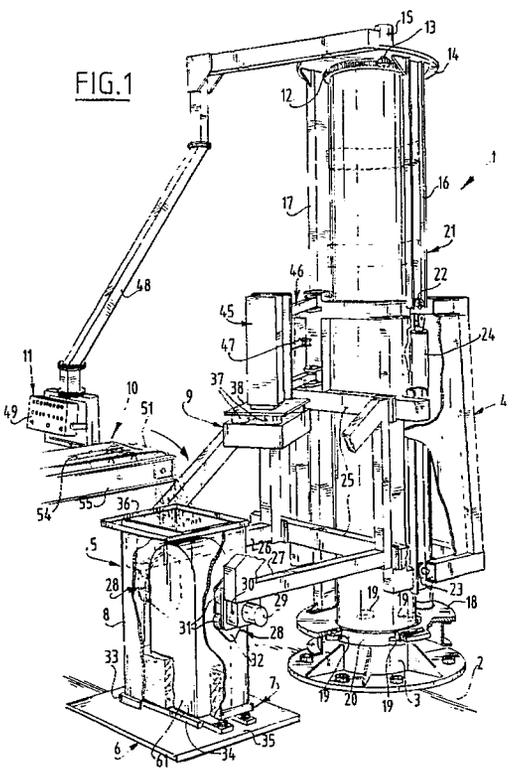
b) a mould jacket (8) which is fixed to the carriage (4) and pivotable between the filling position (6) and a releasing position located at a distance; and

c) a mould cover (9) pivotable to above the filling position (6) and provided with pressing means;

iv) means for filling (10) the mould at the filling position (6); and

v) means (11) for controlling the apparatus.

FIG.1



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The present invention relates to an apparatus for moulding products from a curing, substantially inorganic material such as concrete and cement.

In a known moulding apparatus, the material for curing is arranged in a mould, and compacted under the influence of pressure and vibration energy into a substantially form-retaining mass, which can be released from the mould and can cure outside the mould.

When manufacturing concrete products of different dimensions, particularly length dimensions, and shapes, different moulds or mould parts are necessary each time. Particularly if the compacted product cannot be released from the mould in the moulding situation, but must be tilted or reversed, the moulding apparatus has to become increasingly higher, or these longer products cannot be manufactured in a known moulding apparatus.

The invention has for its object to provide a moulding apparatus with which products with mutually differing shapes can be manufactured quickly, easily and without extremely high costs for modifications. Moreover, the moulding apparatus according to the invention can reduce the curing time for the material and thereby reduce the cycle time of the moulding apparatus. The production speed can thus be increased by at least 30%, and in general by 40 to 60%. Finally, the mould is subdivided into a mould jacket, mould bottom and mould cover such that the exchangeability and the exchange speed is improved for manufacturing different products.

According to the invention this is achieved with a moulding apparatus for manufacturing products from curable inorganic material such as concrete and cement, which moulding apparatus comprises:

i) a column arranged on a ground;

ii) a carriage which is rotatably connected to the column;

iii) a mould which comprises:

a) a bottom mould part arranged on a filling position and provided with vibration means;

b) a mould jacket which is fixed to the carriage and pivotable between the filling position and a releasing position located at a distance; and

c) a mould cover pivotable to above the filling position and provided with pressing means;

iv) means for filling the mould at the filling position; and

v) means for controlling the apparatus.

A moulding apparatus is thus created wherein the moulding position and the releasing position are situated at a mutual distance (pivoting distance), which is beneficial to production logistics. The cycle time is reduced since from the lowest mould part, which usually consists of the mould bottom and a mould edge standing up therefrom, the mass for curing is subjected to vibration energy, while from the mould cover the mass is subjected to pressure. In preference vibration energy is also transferred to the curing mass from the mould cover, whereby this mass is subjected to vibration energy from two sides.

The improved adaptability is realized in that different end shapes of the products for manufacture can be brought about using adaptor pieces which can be fixed to the mould cover and/or to the bottom mould part. An example hereof is the manufacture of tubes and troughs of which both ends are provided with mutually adapted shapes, in particular mutually fitting or gripping shapes. The middle portion of such products only differ in length and not usually in thickness of material.

A stable construction which can pivot easily between the moulding situation and the releasing situation is obtained if the mould jacket is preferably arranged between mould arms fixed to the carriage.

If the moulding situation and the releasing situation of the mould are not the same, that is, the mould has to be reversed to release the moulded product, it is recommended that this mould jacket is fixed to the carriage via reversing means, wherein the mould jacket is preferably fixed to each mould arm via reversing means.

A considerable reduction of the cycle time can be obtained if vibration energy is supplied to the mass for curing in the mould from oppositely located sides. It is therefore preferred that the mould part is provided with vibration means.

If the mould cover is pivotally attached to the column a compact machine results wherein the relative movements between the mould jacket and the mould cover can also be reliably geared to one another using relatively simple control means.

If in preference the carriage is connected to the column for sliding in longitudinal direction, the moulding apparatus is suitable for making substantially the same products, which mutually differ only in length dimensions. With such a moulding apparatus it is moreover possible to make hollow products, for which purpose the bottom mould part is provided with an standing mould mandrel. After the mass for curing has been sufficiently compacted, the mould jacket of this mould mandrel is lifted by sliding the carriage along the column, whereafter the product can be released at the releasing position, with or without tilting of the mould jacket.

The releasing of the moulded product can be improved or can only be performed if an ejector is arranged on the releasing position which ejects the moulded product from the mould jacket when the mould jacket is lowered onto the releasing position. The product ejected by the ejector can then be

removed from the releasing position.

If there is supervision of the moulding apparatus this can be carried out in an ergonomically responsible manner if more preferably control means are arranged on a control panel fixed to a frame connected pivotally to the column. The control panel is thus continuously pivotally connected to the frame at the suitable height and thus within easy reach in both the moulding position and the releasing position.

Mentioned and other features of the moulding apparatus according to the invention will be elucidated hereinafter on the basis of an embodiment which is only given by way of example, while a number of concrete products for moulding are also shown. This embodiment will be elucidated with reference to a drawing, in which:

Figures 1-4 show perspective views of a moulding apparatus according to the invention in the different moulding situations (figures 1-3 on the moulding position, and figure 4 in the releasing position);

figure 5 shows a perspective, partially broken away view of filling means to be used; and

figures 6-8 show products which can be formed in the moulding apparatus according to the invention.

Figure 1 shows a moulding apparatus according to the invention. The moulding apparatus 1 comprises a column 3 placed on a ground 2 and anchored in a concrete footing, a carriage 4 rotatably connected to the column 3, a mould 5 which comprises a bottom mould part 7 disposed on a filling position 6, a mould jacket 8 carried by the carriage 4 and a mould cover 9, further filling means 10 for filling the mould 5 at the filling position 6 and, finally, control means 11 for controlling the moulding apparatus 1.

The substantially cylindrical column 3 is provided on its top end with a gear ring 12, onto which engages a pinion 13 which is mounted in a bearing plate 14, which is mounted rotatably in the top end of the column 3 with, for example, a trunnion bearing (not shown). The pinion 13 can be actuated with a pinion motor 15. The bearing plate 14 is thus attached rotatably on the column 3 and therewith the guide rails 16 and 17 which are connected to the bearing plate 14 and extend along the column 3 and which are fixed onto a plate 18 at the bottom end of the column 3. The plate 18 is provided with rollers 19 which roll over a ring 20, whereby is avoided that the frame 21 formed by the bearing plate, guide rails 16 and 17 and the plate 18 slants during rotation.

The carriage 4 is guided slidably in lengthwise direction of the column 3 with wheels 22, 23 in the guide rails 16 and 17 using cylinders 24 which support on the plate 18.

The carriage 4 comprises a yoke 25 to which are fixed mutually parallel mould arms 26 and 27.

Each mould arm 26, 27 is provided with reversing means 28 wherewith the mould jacket 8 carried by the mould arms 26, 27 can be tilted and reversed.

The reversing means comprise a reversing plate 30 rotatably driven by a hydraulic motor 29, which plate is connected via buffers 31 to a plate 32 fixed on the mould jacket.

The mould jacket 8 which can have any section depending on the product for moulding, in this case a rectangular section, is provided with a lower frame 33 which co-acts with a frame 34 of the bottom mould part. The bottom mould part 7 is fixed to a vibration plate 35, for which the per se known vibrating means (not shown) are sunk into the ground 2, which considerably limits noise nuisance.

The mould jacket is likewise provided at its other end with a frame 35, which co-acts with the mould cover 9. The mould cover 5 envelops vibration means 39 comprising an eccentric 40 and a vibration motor 41. The mould cover 9 is connected via buffers 37 to a plate 38, to which a piston 44 for pressing means 45 is connected via a buffer 43 accommodated in a sleeve 42 (see figure 2). The mould cover 9 is pivotally connected to the carriage 4 via a yoke 46 and a hydraulic cylinder 47. The mould cover is thus pivotable in the direction of the arrow 88 into and out of the filling position 6.

The control means 11, which comprise a control panel 49, are connected to the bearing plate 14 via a pivot arm 48.

Finally, the moulding apparatus 1 according to the invention comprises filling means 10 which can be carried above the filling position 6 in order to fill the mould. The filling means 10 will be discussed later with reference to figure 5.

The filling means 10 shown in figure 5 comprise a bunker 50 for curable material 51 from which the products for moulding are manufactured. The bunker has an open bottom 52, through which the material 51 is released onto a conveyor belt 54 to be driven by a motor 53 and of which a frame 55 with wheels 56 driven by a motor 57 can travel over rails 58, 59 which are arranged on a frame 60.

The operation of the moulding apparatus 1 according to the invention is as follows for forming a hollow product with an open end and a closed end, for example a storm drain.

The mould jacket 5 is situated in the filling position 6 and rests on the bottom mould part 7. If desired a grating cover for the storm drain could be enclosed herein which is placed beforehand in the bottom mould part 7. If desired the mould jacket 8 can further comprise means for accom-

modating an overflow for the storm drain. The bottom mould part 7 further carries a mould mandrel 61, whereby a mould ring is created between the mould jacket 8 and the mould mandrel 61, which ring is filled with a measured amount of material 51 by placing the filling means 10 into the filling situation shown in figure 1. The amount can be measured with a dosing slide 62 in combination with an energizing time for the motor 53.

The filling means 10 are then removed from the filling situation and by energizing the cylinder 47 the mould cover is pivoted in the direction of the arrow 88 into the filling position 6 and directly above the mould jacket 8. The pressing means 45 are then energized whereby the mould cover 9 protrudes into the mould jacket 8 and can compress the mass for curing with a pressure of, for example, 80-90 bar. By actuating the vibration motor 41 of the mould cover 9 and the vibration motor 62 for the vibration plate 35, the mass 63 is compacted and compressed from two sides.

The mould covering is then pivoted away and the cylinders 24 are energized, whereby the mould jacket 8 is lifted from the bottom mould part 7, wherein the carriage 4 is moved guided in the rails 16, 17 upward along the column 3. The bottom mould part 7 and the mould mandrel 61 placed thereon remain behind in the filling position 6. The motor 15 is then energized whereby the carriage 4 pivots in the direction of the arrow 64 to the releasing situation 65 shown in figure 4. An ejector 66 is arranged in the releasing position 65.

Prior to lowering the carriage and therewith the mould jacket 8 over the ejector 66, the reversing means 28 are first energized, whereby the jacket is reversed in the direction of the curved arrow 67. When the mould jacket 8 is lowered according to arrow 68 the moulded product 69, which is sufficiently compacted to a substantially form-retaining shape, is released and rests on the ejector 66.

The product 69 can then be removed from the ejector using means not shown here, whereafter the mould jacket 8 is raised in reverse direction, tilted back to its original position and pivoted back into the filling situation, wherein the mould jacket 8 again rests on the bottom mould part 7 placed on the vibration plate 6.

Figure 6 shows a product 70 with converging legs 71 and 72 and a body 73. Figure 6 shows the release situation of the product, while in the moulding situation the product assumes the reverse position of that in figure 6.

The same applies to the product 74 shown in figure 7, with converging standing surfaces and a top surface 76 provided with a recess 75.

Finally, figure 8 shows a tube 77 with a collar 78 and a necked end 79. The tube 77 is shown in the released position. The necked end 79 can be formed by providing the mould cover 9 with a fitting ring 80 the shape of which is shown by dashed lines in figure 8. The collar 78 can be formed by leaving free a corresponding groove in the mould jacket. It will be apparent that for the manufacture of longer tubes 77 a longer mould jacket 8 is needed, while the fitting ring 80 can be used.

For manufacturing other products the moulding apparatus 1 can be adapted quickly, if necessary by replacing the mould jacket 8 and optionally the mould cover 9 and the bottom mould part 7, or by providing these with adaptor pieces.

The moulding apparatus 1 is preferably used for manufacturing products from a compactable and thereafter curable mass of for example cement or concrete.

Claims

1. Moulding apparatus for concrete products for instance, comprising:
   - i) a column arranged on a ground;
   - ii) a carriage which is rotatably connected to the column;
   - iii) a mould which comprises:
     - a) a bottom mould part arranged on a filling position and provided with vibrating means;
     - b) a mould jacket which is fixed to the carriage and pivotable between the filling position and a releasing position located at a distance; and
     - c) a mould cover pivotable to above the filling position and provided with pressing means;
   - iv) means for filling the mould at the filling position; and
   - v) means for controlling the apparatus.

2. Moulding apparatus as claimed in claim 1, wherein the mould jacket is arranged between mould arms fixed to the carriage.

3. Moulding apparatus as claimed in claims 1-2, wherein the mould jacket is fixed to the carriage for reversing via reversing means.

4. Moulding apparatus as claimed in claims 2-3, wherein the mould jacket is fixed to each mould arm via reversing means.

5. Apparatus as claimed in claims 1-4, wherein the mould cover is also provided with vibrating means.

6. Apparatus as claimed in claims 1-5, wherein the mould jacket is pivotally attached to the

column.

7. Apparatus as claimed in claims 1-6, wherein the carriage is connected to the column for sliding in longitudinal direction .

8. Apparatus as claimed in claim 7, wherein the bottom mould part is provided with a standing mould mandrel.

9. Apparatus as claimed in claims 1-8, wherein an ejector is arranged on the releasing position.

10. Apparatus as claimed in claims 1-9, wherein control means are arranged on a control panel that is fixed to a frame pivotally connected to the column.

FIG.1

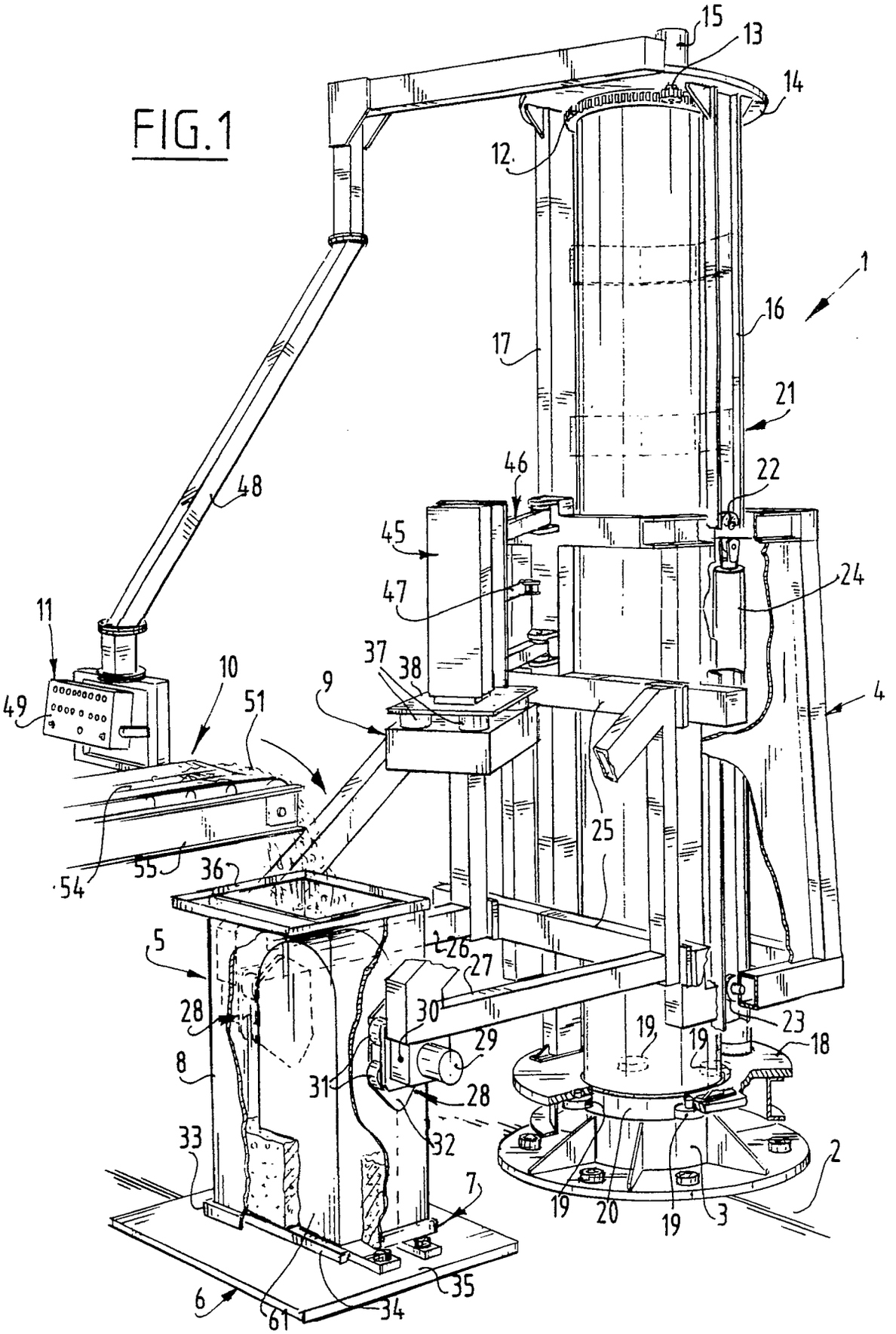
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FIG.2

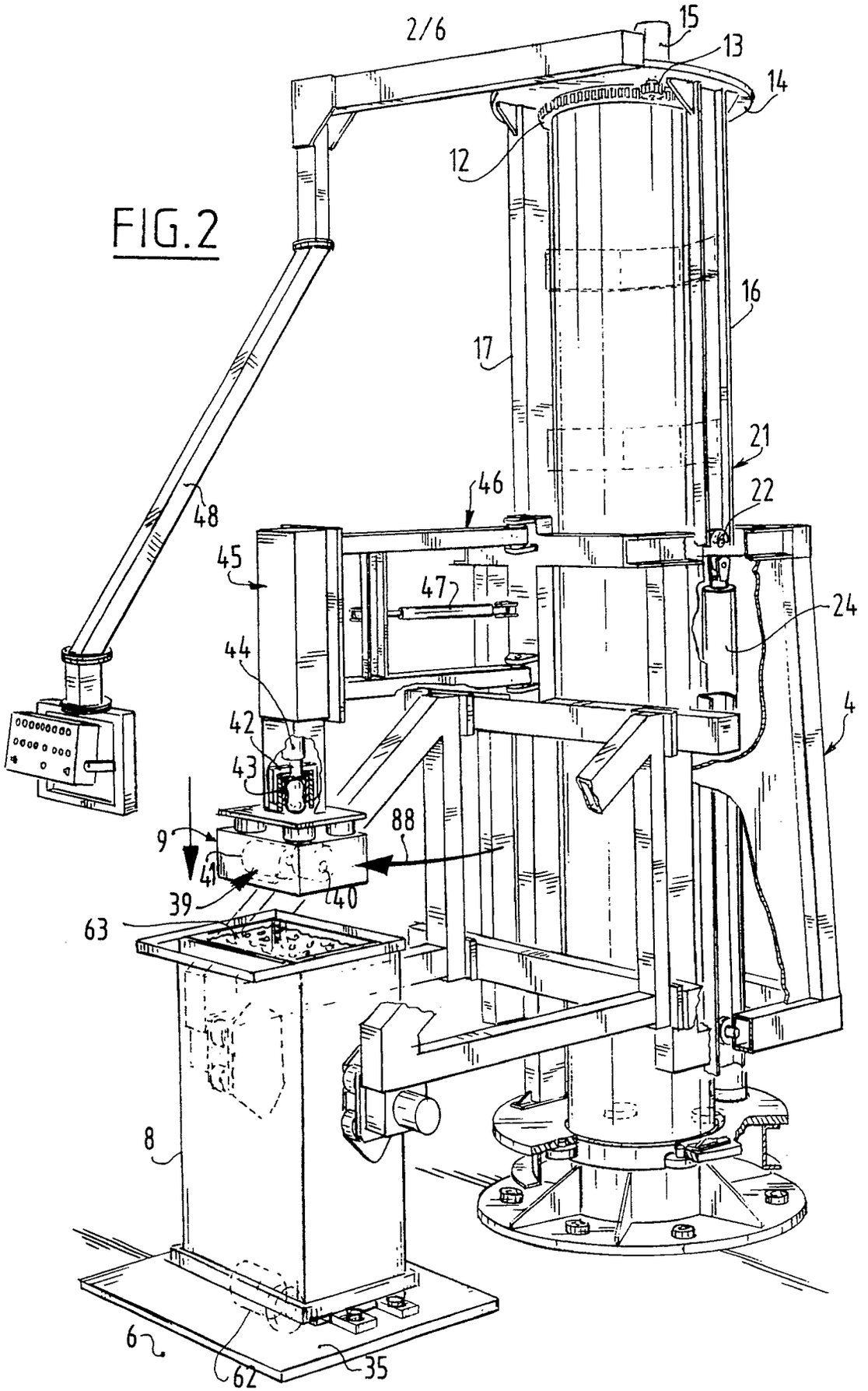
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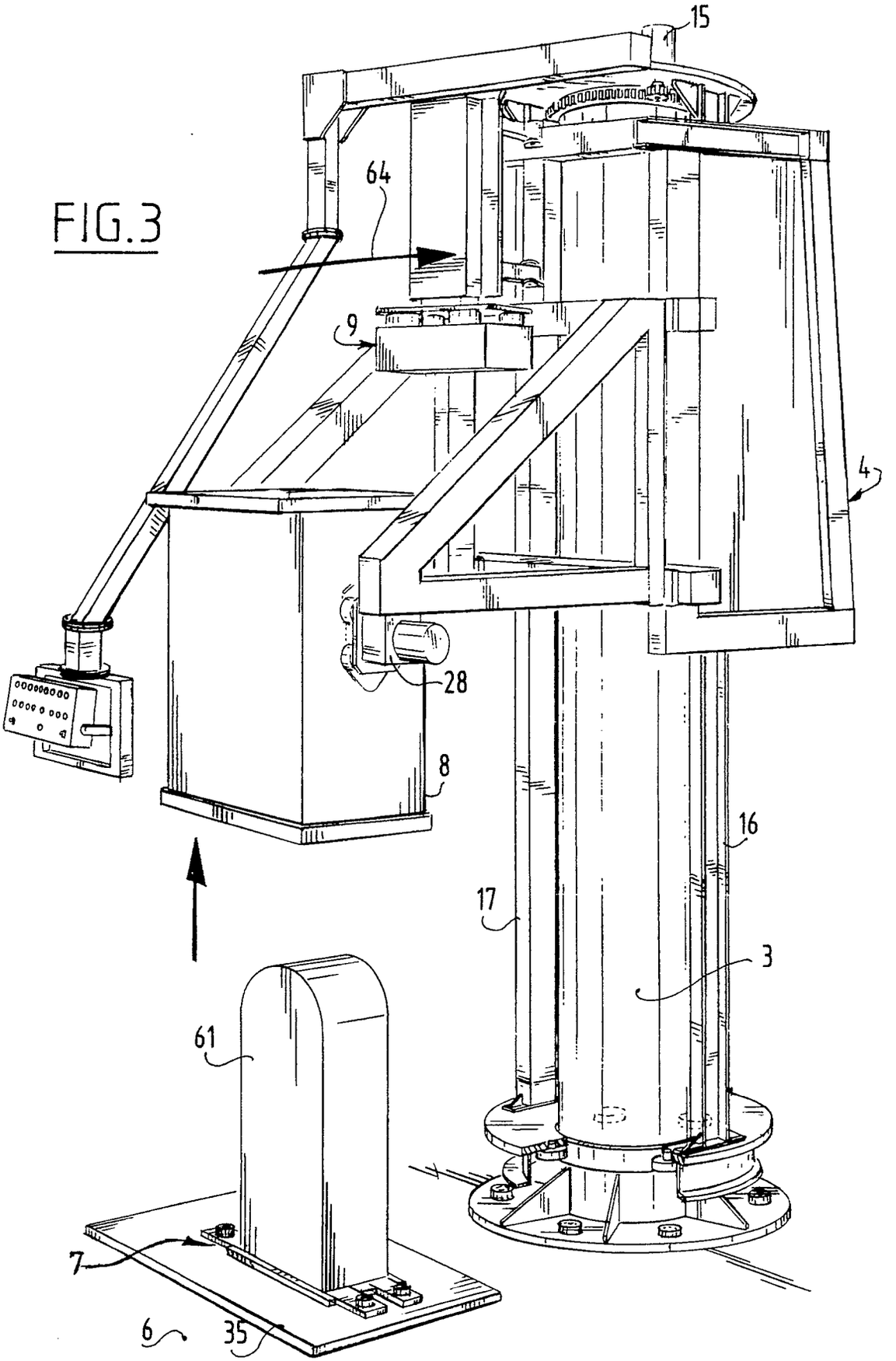
FIG.3



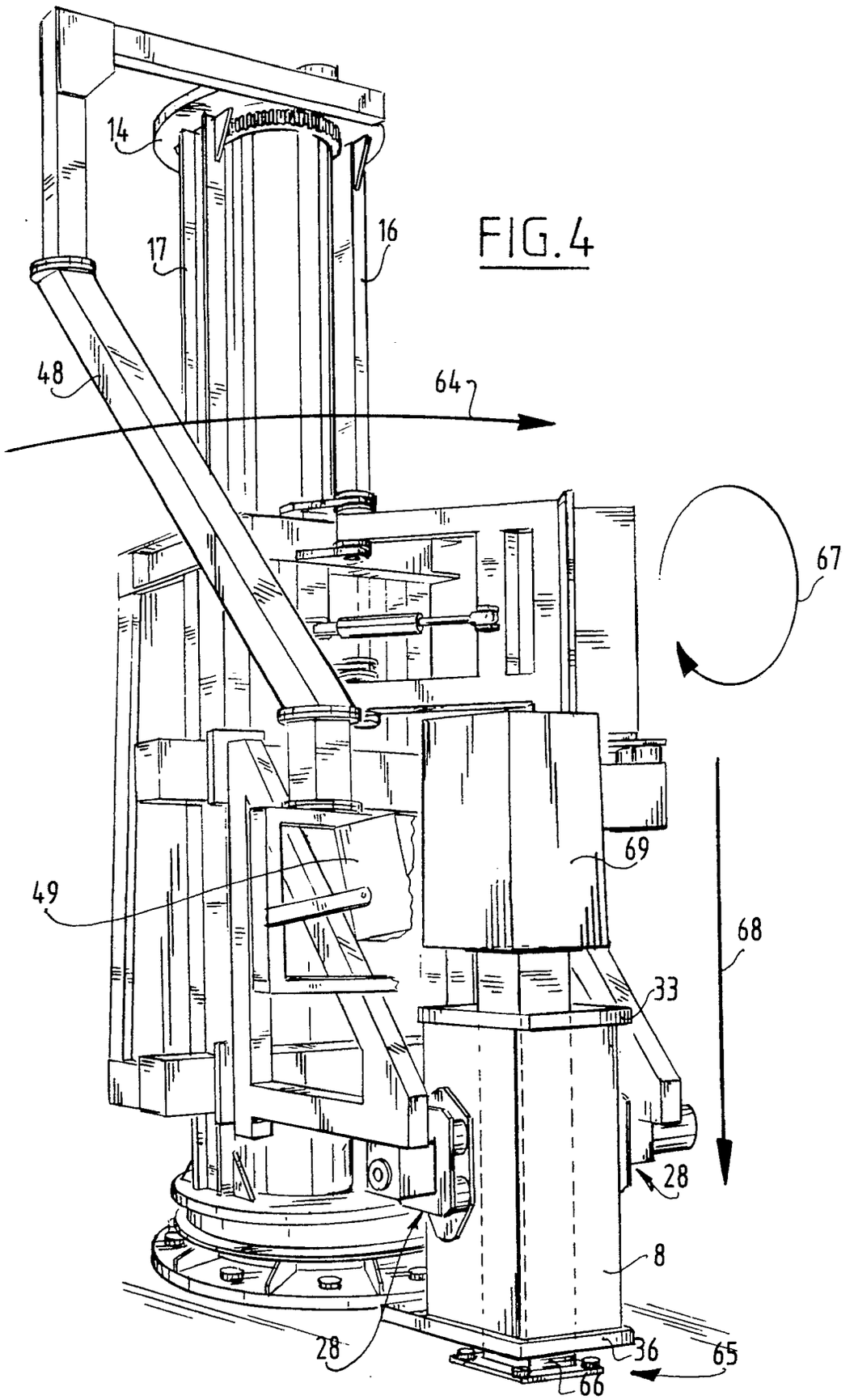


FIG.4

FIG.5

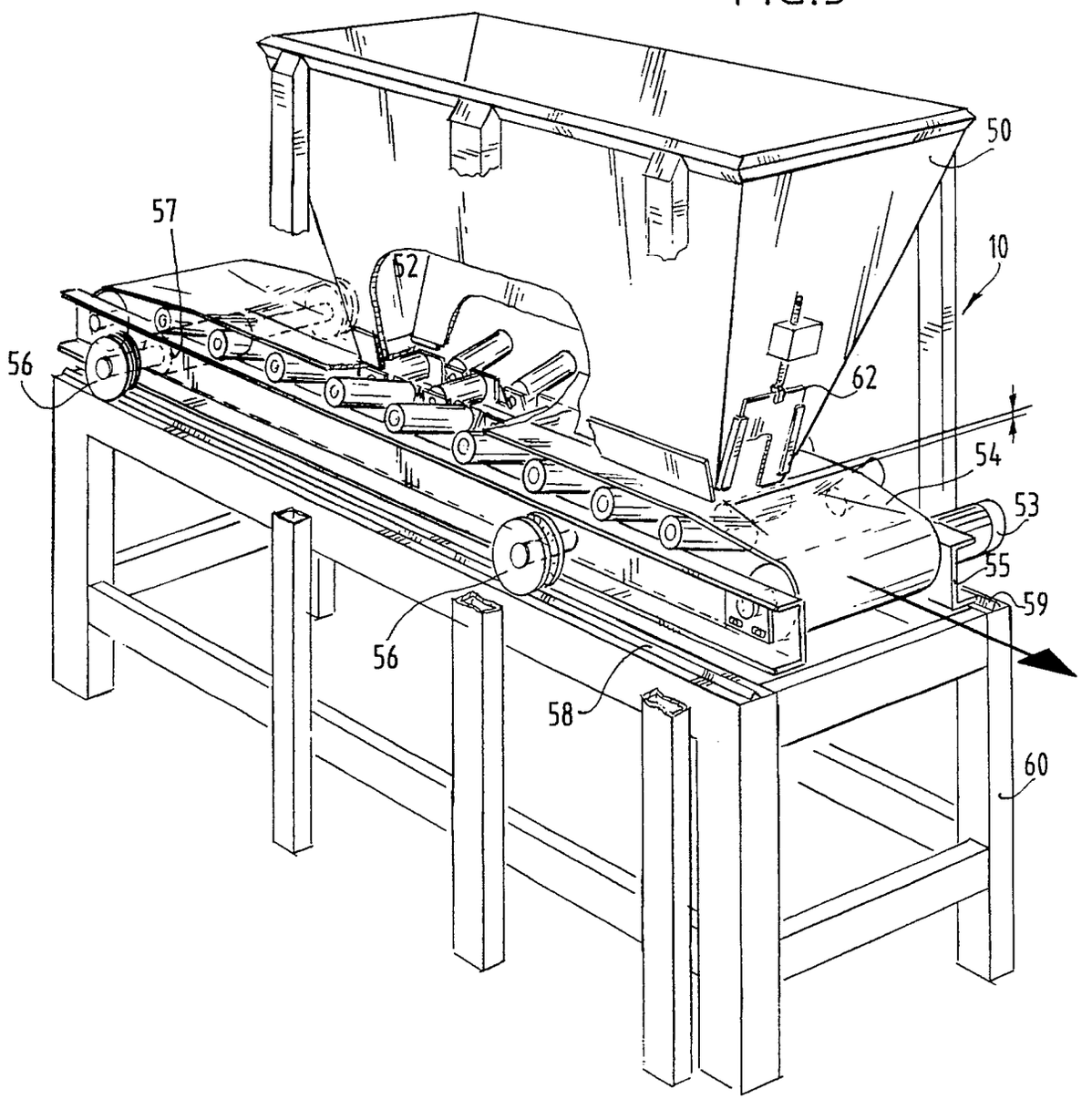


FIG.6

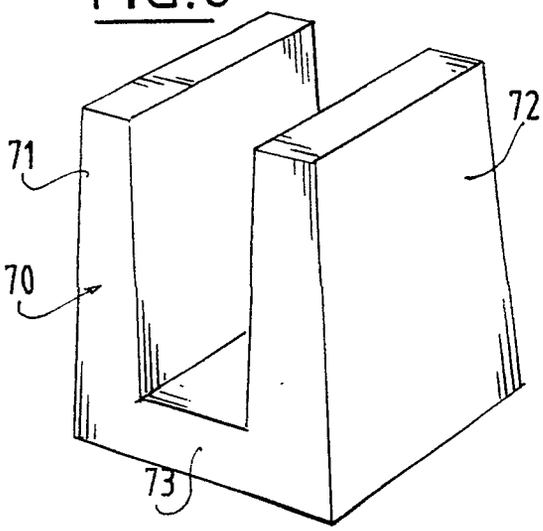


FIG.7

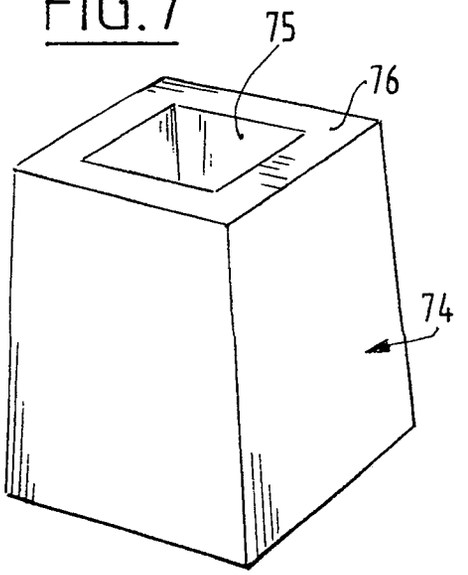
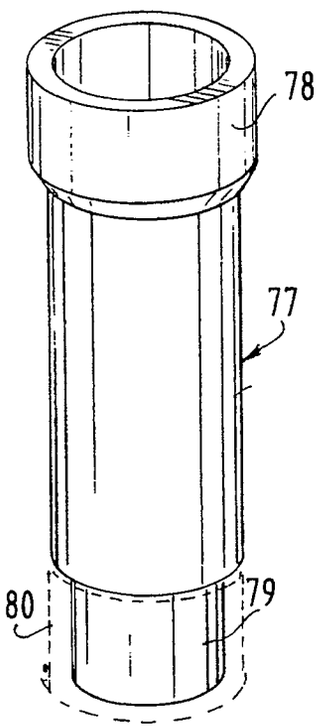


FIG.8



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EUROPEAN SEARCH REPORT

Application Number

EP 91 20 0338

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)
X	NL-C-8 380 2 (E. BUHRER) * Figures 1,2 *	1-4,6-8	B 28 B 1/08 B 28 B 7/08 B 28 B 21/14
A	US-A-2 525 275 (K.C. SCHMIDT) * The whole document *	1,2,7	B 28 B 13/06 B 28 B 21/90
A	US-A-1 359 543 (M.J. SMITH) * The whole document *	1,2,10	
A	DE-U-1 947 936 (MASCHINENFABRIK ETTLINGEN) * The whole document *	1,2,7,8	
A	FR-E-7 812 1 (SOLIETE D'EXPLOITATION DES BREVETS CALAD) * The whole document *	1,2,6,8	
A	DE-B-1 056 027 (H. LINGL) * The whole document *	1-3,7	
A	US-A-4 005 971 (N.H. KNUDSEN) * The whole document *	1,3,5,6	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 28 B

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	13 May 91	GOURIER P.A.

CATEGORY OF CITED DOCUMENTS

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