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(54) Device and method for feeding the mould cavity with powder or granular material, in ceramic tile manufacture

(57) The device comprises a loading carriage (10) having at least one loading compartment (11) with plan dimensions equal to those of a mould cavity (6) and being driven with reciprocating movement between a retracted position in which the loading compartment (11) receives the material, and an advanced position in which the loading compartment (11) releases the material into the mould cavity (6). Above the compartment (11) of the carriage when in its retracted position there is positioned an intermediate container (20) having plan dimensions equal to the loading compartment (11) and with its internal space divided by a first series of vertical baffles (22) which define a plurality of shaped regions separated from each other. To the container (20) there are applied means (30', 30", 21) for conveying, into said shaped regions, different materials specific for said regions, and means (23, 24) for closing and opening material passage through the base of the intermediate container (20). Within the carriage loading compartment (11) there is positioned a second series of vertical baffles (12), which define a plurality of mutually separated shaped regions equal in plan view to the regions defined by the first series of baffles (22).

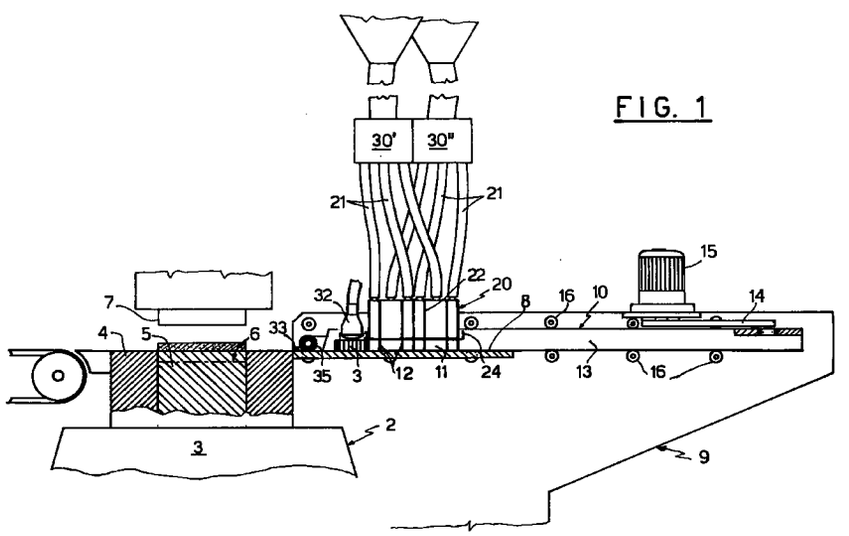

FIG. 1

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Description

[0001] This invention relates to a device and method for feeding the mould cavity with powder or granular material, in ceramic tile manufacture.

[0002] The device comprises a loading carriage having one or more lowerly and upwardly open compartments, and provided with appropriate grids. Each compartment corresponds to a mould cavity and has plan dimensions substantially equal to those of the mould cavity. The carriage is moved forwards and rearwards while slidingly resting on a flat continuous surface positioned as a continuation of the upper surface of the mould die plate comprising the cavity to be filled.

[0003] The carriage is moved synchronously with the press operations between a retracted position in which the loading compartment receives the material, and an advanced position in which the compartment lies above the mould cavity so that the material falls from the compartment and into the cavity. While passing from the retracted position to the advanced position, the loading compartment is closed lowerly by the surface on which it slides.

[0004] In the known art, the carriage is fed by an overlying hopper the lower mouth of which has a transverse dimension (ie perpendicular to the carriage movement) equal to the total transverse dimension of the loading compartments and of the parts which separate them from each other, whereas the longitudinal dimension is less than the corresponding compartment dimension. When the carriage moves within the vicinity of its retracted position, the lower mouth of the hopper covers the entire area of the loading compartments so that the material falling from the hopper fills these compartments.

[0005] To obtain certain aesthetic effects in the tiles, it is known to fill the mould cavity with several materials of different characteristics, in particular in terms of colour. In this manner tile regions are obtained with blurring of different colours (or other characteristics), typically for imitating natural stone.

[0006] For this purpose the different materials, originating from different silos, are fed in the determined proportions into the loading hopper, where they are mixed together to some extent and are released together into the compartment in the loading carriage.

[0007] Said device is however only able to produce blurred aesthetic effects on the tile, which moreover arise in a substantially random and non-repetitive manner, and is not able to form precise and well defined lines, figures or backgrounds.

[0008] An object of this invention is to provide a device which enables determined aesthetic designs with figures, lines or backgrounds to be created having well defined outlines (for example a figure having a precise geometrical shape positioned on a background of different colour).

[0009] This and other objects are attained by the invention as characterised in the claims.

[0010] The invention is described in detail hereinafter with reference to the accompanying figures, which illustrate two embodiments thereof.

Figure 1 shows the device of the invention applied to a press mould in sectional view taken on a longitudinal vertical plane.
Figure 2 is an enlarged detail of Figure 1.
Figure 3 is a section on the plane III-III of Figure 2.
Figure 4 is a section on the plane IV-IV of Figure 2.
Figure 5 is a view of a second embodiment of the device of the invention shown partly sectioned on a vertical longitudinal plane.
Figure 6 shows an enlarged detail of Figure 5.

[0011] Figure 1 shows schematically a press 2 of any known type. On the bed 3 of the press 2 there are positioned a die plate 4 and a lower mould die 5, which together define the forming cavity 6.

[0012] The cavity 6 can be of any shape. In addition one and the same mould can comprise several cavities 6 so that several tiles are formed simultaneously (multiple mould).

[0013] The upper die 7, which is vertically movable, is positioned in the upper part of the press.

[0014] The cavity (or cavities) 6 is filled with materials in powder form which are transferred by a loading carriage 10 having, for each cavity 6, a loading compartment 11 having plan dimensions substantially equal to those of the forming cavity 6.

[0015] The carriage 10 possesses two sidepieces 13 which are constrained by idle wheels 16 or other guide means to the fixed support structure 9 of the device, such as to be able to slide only in a longitudinal horizontal direction. By known means, for example a crank mechanism 14 operated by a motor 15, the carriage is moved forwards and rearwards in said longitudinal direction between a retracted position (shown in Figure 1), in which the loading compartment 11 is fed with the material to be transferred to the cavity 6, and an advanced position, in which the compartment 11 is positioned above the cavity 6 into which it releases the material contained in it.

[0016] If the mould is of multiple type, the number of compartments 11 is equal to the number of cavities 6, they having the same arrangement as the cavities 6.

[0017] The compartment 11 slides on and in contact with a fixed horizontal slide surface 8 coplanar with the upper surface of the die plate 4 and positioned adjacent thereto. The surface 8, together with the upper surface of the die plate 4, keeps the base of the compartment 11 closed when the carriage 10 passes from its retracted position to its advanced position.

[0018] The device of this invention is applied to the fixed structure 9 and operates on the carriage 10 to load its compartment 11 when the carriage is in its retracted position (Figure 1).

[0019] According to the invention, said device comprises an intermediate container 20 located in a fixed position above the carriage compartment 11 when the carriage is in its retracted position, the container 20 having plan dimensions equal to the loading compartment 11, its height being conveniently greater than the compartment 11.

[0020] In the case of multiple moulds, several intermediate containers 20 are provided side by side, one for each compartment 11.

[0021] The interior space of the container 20 is divided into a series of vertical baffles 22 which define a plurality of shaped regions, separated from each other, corresponding to those parts of the figure which are to be reproduced as the aesthetic effect in the tile. If for example a figure formed from a circle positioned at the centre of a uniform background is to be reproduced in the tile, at the centre of the compartment 11 there is placed a baffle bent as a cylindrical surface, the cross-section of which has the dimensions of the circle of the figure to be obtained.

[0022] In the case shown in Figure 3, within the compartment 11 said baffles 22 define several diagonally positioned squares, and within four of these a like number of smaller squares with their sides parallel to the sides of the compartment 11.

[0023] The container 20 is fed by a series of substantially vertical tubes 21 which open separately into the various shaped regions defined by the baffles 22. The upper ends of the tubes 21 branch from two or more upper containers 30', 30" each containing a material of different characteristics. The connections between the regions of the compartment 11 and the upper containers is such that each region defined by the baffles 22 receives the specific material scheduled for it, on the basis of the aesthetic effect to be produced.

[0024] Within the loading compartment 11 of the carriage 10 there are provided a second plurality of baffles 12 which in plan view form a figure exactly equal to that formed by the baffles 22, to hence define a plurality of mutually separated shaped regions identical in plan view to the regions defined by the first series of baffles 22 (see Figure 4).

[0025] The base of the container 20 is closed by a first perforated flat plate 23 having a plurality of apertures 23' in the form of elongate narrow parallel slots for passage of the materials. The apertures 23' are distributed within the plate in accordance with the plan distribution of the shaped regions defined by the baffles 22 and 12, ie no aperture 23' extends beyond the contour of the specific region within which it is located (see Figure 3 in particular).

[0026] Adjacent to and below the first plate 23 there is positioned a movable second perforated flat plate 24 having an equal series of passage apertures 24' to the plate 23 (see Figure 4).

[0027] Said passage apertures 23' and 24' are shaped to enable the two plates 23 and 24 to be arranged in a first mutual position in which the apertures mate, or to be moved slightly one from another into a second mutual position, in which the apertures of one plate are closed by the solid surface of the other plate.

[0028] The lower plate 24 is secured to the container 20 in such a manner as to be able to be slid horizontally relative to the other plate 23 which is fixed, while remaining adjacent to it.

[0029] On the two longitudinal sides of the container 20 there are positioned two pneumatic cylinder-piston units 26 arranged to move the plate 24 horizontally to-and-fro through a short distance relative to the plate 23. This action shifts the plate 24 between said first position, in which the apertures 24' of the plate 24 mate with the apertures 23' of the plate 23 (Figure 2), and a second position in which the apertures 24' are closed by the solid regions of the plate 23, and vice versa.

[0030] Basically the two plates 23 and 24 define a sort of slide valve which opens and closes passage for the materials and is virtually flush with the upper edge of the compartment 11.

[0031] In front of the loading compartment 11 the carriage comprises a second loading compartment 31 provided with usual transverse grids and having a longitudinal dimension less than the compartment 11, its purpose being to contain material for filling the upper layer of the mould cavity.

[0032] Said front loading compartment 31 is fed with powder material by usual known means when the carriage 10 is in its retracted position. For example (as shown in the figures) these means comprise a fixed loading hopper 32, the lower mouth of which is positioned transversely and is open and closed by a rocking shutter 26 positioned in front of the container 20. When the carriage is in its retracted position the hopper 32 lies above the second compartment 31. At that point, the shutter 36 is moved by means of a cylinder-piston unit and the lower mouth of the hopper is opened, so that the material present in it falls into the underlying compartment 31.

[0033] In operation, when the carriage 10 is moved into its retracted position, the plate 24 is moved into said first position relative to the fixed plate 23, so that the apertures 23' and 24' mate, the materials located in the various container regions defined by the baffles 22 of the container 20 hence descending into the loading compartment 11 and being transferred into the corresponding underlying regions defined by the baffles 12.

[0034] At the same time, the hopper 32 loads the front loading compartment 31.

[0035] The plate 24 is then moved into the second position so that the apertures 23' and 24' become offset and closed, the carriage 10 then undergoing outward travel into its advanced position, followed by return travel to its retracted position.

[0036] As is well known, in moving into its advanced position the carriage 10 shifts the previously formed tile forwards by a thrust means 33 positioned at the front

end of the carriage, so freeing the surface of the press mould.

[0037] When the carriage 10 reaches its end of forward travel, the lower die 5 descends through a predetermined distance to form the cavity 6, which during lowering receives the materials contained in the overlying compartment 11. Being separated from each other by the baffles 12 of the compartment 11, these materials fall into the mould cavity 6 by simple gravity action and with the same arrangement. Consequently the same figures created by the different materials in the compartment 11 are recreated in the cavity 6, and specifically in its lower part. These figures are those which will create the desired aesthetic effect on the tile.

[0038] Moreover, the compartment 11 is dimensioned such as to contain, and hence to subsequently release into the cavity 6, a quantity of material less than that required to completely fill the cavity.

[0039] Finally, the cavity 6 is completely filled by the passage of the front compartment 31 above it during the return travel of the carriage 10. In this respect, this compartment releases onto the material deposited by the compartment 11 a quantity of different material, which is scraped by the element 33 (or by other usual scraper means) to hence completely fill the mould cavity 6.

[0040] A rotary brush positioned in the front region of the carriage 10 to clean the surface along which the carriage 10 slides is indicated in the figures by the reference numeral 35.

[0041] The first embodiment is not without a minimum degree of mixing of the powders due to the shaking which occurs during the outward travel of the carriage 10.

[0042] In this respect, the compartment 11 is not completely filled, and during the to-and-fro movement of the carriage 10 there is an accumulation of material against the baffles 12 which divide the internal volume of the compartment 11.

[0043] This can be remedied by the second embodiment described hereinafter and illustrated in Figures 5 and 6.

[0044] It should be noted that in the description of the second embodiment of the device those components common to both embodiments carry equal reference numerals.

[0045] In this second embodiment the intermediate container 20, with its baffles 22, is rigidly fixed to the compartment 11 and hence to the carriage 10.

[0046] As in the preceding embodiment the base of the container 20 is separated from the top of the compartment 11 by a fixed plate 23 and a movable plate 24, both carrying apertures 23' and 24' respectively. In addition, again in this second embodiment the compartment 11 is provided with baffles 12 having the same distribution as the baffles 22 of the container 20.

[0047] This embodiment requires the presence of a shutter for closing the lower mouths of the powder feed tubes 21, which is operated by a usual pneumatic cylinder-piston unit 390.

[0048] In addition, the loading hopper 32 is positioned at a higher level than in the preceding embodiment to enable the intermediate container 20 to pass during the outward and return travel of the carriage 10.

[0049] To the front of the compartment 11 and of the overlying container 20 there is provided a compartment 37 totally similar to the compartment 31 described in the first embodiment except with regard to its height. In this second case the compartment 37 has a greater height than the compartment 31 in order to minimize the distance which separates it from the lower mouth of the loading hopper 32.

[0050] When the carriage 10 is in its retracted position the flat plate 24 is positioned such as to close the apertures 23' of the plate 23. In this position the cylinder-piston unit 390 moves the shutter 39 such as to enable the material contained in the tubes 21 to fill the container 20, with simultaneous filling of the front compartment 37 by the hopper 32.

[0051] When loading of the powder materials into the container 20 and into the compartment 37 is complete, the cylinder-piston unit 390 operates the shutter 39 to close the lower mouth of the tubes 21. At this point the carriage 10 is made to advance into the material discharge position by the motor 15.

[0052] During the advancement of the carriage 10 the lower die 5 is maintained coplanar with the carriage slide surface. When the carriage is in the advanced or material discharge position, ie in the position in which the perimeter of the base of the compartment 11 lies exactly above the perimeter of the cavity 6, the pneumatic cylinder-piston units 26 move the plate 24 into said first position in which the apertures 23' of the plate 23 mate with the apertures 24' of the plate 24.

[0053] In this manner the material contained in the container 20, the inner volume of which is divided by the baffles 22, is deposited in the underlying compartment 11, the volume of which is divided by the baffles 12 which, in plan view, form a figure exactly equal to that formed by the baffles 22. Consequently in falling into the compartment 11 the material maintains the same arrangement and distribution which it had in the container 20.

[0054] It should be noted that in the compartment 11 there is deposited only that quantity of material required to form a powder layer of the required volume. After the material has been deposited in the compartment 11 the pneumatic cylinder-piston units 26 move the plate 24 into said second position, in which the apertures 23' of the plate 23 are closed.

[0055] The lower die 5 is then lowered to form the cavity 6, which during lowering receives the material contained in the overlying compartment 11, without any change in the arrangement and distribution of the material.

[0056] This prevents the material contained in the compartment 11 being subjected to shaking before fall-

ing by gravity into the underlying cavity 6, to the advantage of sharp separation between the powders which in the compartment 11 are separated by the baffles 12.

[0057] It should be noted that the volume of the cavity 6 is such as to receive both the material contained in the compartment 11 and that contained in the compartment 37.

[0058] This latter is poured into the cavity 6 during the rearward travel of the carriage 10, in which respect as the compartment 37 gradually moves above the cavity 6 it releases the material contained in it so as to completely fill the cavity 6.

[0059] Any excess material is then scraped by the element 33 (or by other usual scraper means).

[0060] Numerous modifications of a practical and applicational nature can be made to the invention, but without leaving the scope of the inventive idea as claimed below.

Claims

1. A device for feeding the mould cavity with powder or granular material in ceramic tile manufacture, comprising a loading carriage (10) having at least one loading compartment (11) with plan dimensions equal to those of a mould cavity (6), and being driven with reciprocating movement between a retracted position in which the loading compartment (11) receives the material, and an advanced position in which the loading compartment (11) releases the material into the underlying mould cavity (6), characterised by comprising:

   at least one intermediate container (20) overlying the compartment (11) and with plan dimensions equal to the loading compartment (11), and with its internal space divided by a first series of vertical baffles (22) which define a plurality of shaped regions separated from each other;
   means (30', 30", 21) for conveying, into said shaped regions, different materials specific for said regions;
   means (23, 24) for closing and opening material passage through the base of the intermediate container (20);
   a second series of vertical baffles (12) positioned within the carriage loading compartment (11) to define a plurality of mutually separated shaped regions equal in plan view to the regions defined by the first series of baffles (22).

2. A device as claimed in claim 1, characterised in that said intermediate container (20) is in a fixed position relative to said compartment (11) of the sliding carriage (10).

3. A device as claimed in claim 1, characterised in that said container (20) is rigid with said compartment (11) of the sliding carriage (10).

4. A device as claimed in claim 3, characterised by comprising movable means for closing the lower mouth of the means (21) for feeding powder material to the at least one intermediate container.

5. A device as claimed in claim 4, characterised in that said movable means for closing the lower mouth of the means (21) are a shutter operated by at least one pneumatic cylinder-piston unit (390).

6. A device as claimed in claim 1, characterised in that said closing and opening means comprise a first thin perforated flat plate (23) which closes the base of the intermediate container (20) and has a plurality of material passage apertures (23') distributed within it in conformity with the plan distribution of shaped regions defined by the baffles (22), and a movable second thin perforated flat plate (24) adjacent to the first (23) and having an equal plurality of passage apertures (24');

   said passage apertures (23', 24') being shaped such that the two plates (23, 24) can be arranged in a first mutual position in which the respective apertures (23', 24') mate, or can be displaced one from the other into a second mutual position in which the apertures of one are closed by the solid surface of the other;
   means (26) for moving the movable plate (24) relative to the fixed plate (23) to open and close the apertures (23', 24') in relation to the position of the loading carriage (10).

7. A device as claimed in claim 1, characterised in that to the front of said loading compartment (11) the carriage (10) comprises a second loading compartment (31, 37) having a longitudinal dimension less than the first and arranged to contain material for filling the upper layer of the mould cavity.

8. A method for loading the mould cavity using the device of claims 1, 2, 6 and 7, characterised by comprising the following steps:

   loading the carriage loading compartment (11) by means of the intermediate container (20), and loading the front compartment (31), when the carriage (10) is in its retracted position,
   then moving the carriage (10) into its advanced position and releasing the material present in the loading compartment (11) into the mould cavity (6), the quantity of material released being slightly less than the quantity required to completely fill the cavity (6),

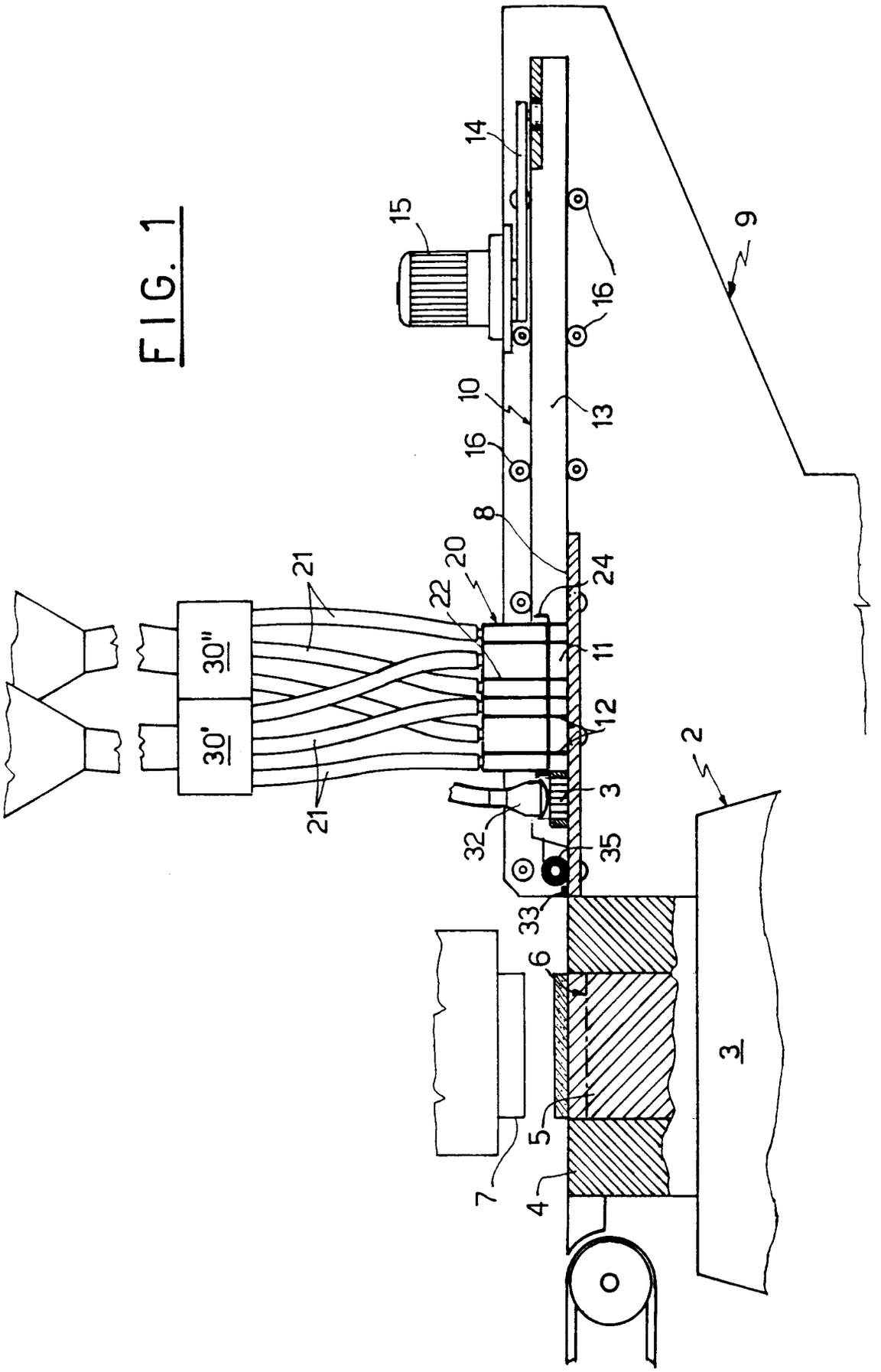
then, during the rearward return of the carriage (10), releasing material from the front compartment (31) into the mould cavity (6) and scraping it to completely fill the cavity (6).

9. A method as claimed in claim 8, characterised in that the carriage is moved into its advanced position while the lower mould die (5) is coplanar with the press surface.

10. A method for loading the mould cavity using the device of claims 1, 2, 6 and 7, characterised by comprising the following steps:

loading said container (20) and said compartment (37),
advancing the carriage (10) into the material discharge position, releasing the material contained in the container (20) into the compartment (11) the lowering the die (5) for receiving the material contained in the compartment (11),
then, during the return travel of the carriage (10), releasing the material contained in the front compartment (31) into the mould cavity (6) and scraping it to completely fill the cavity (6).

FIG. 1



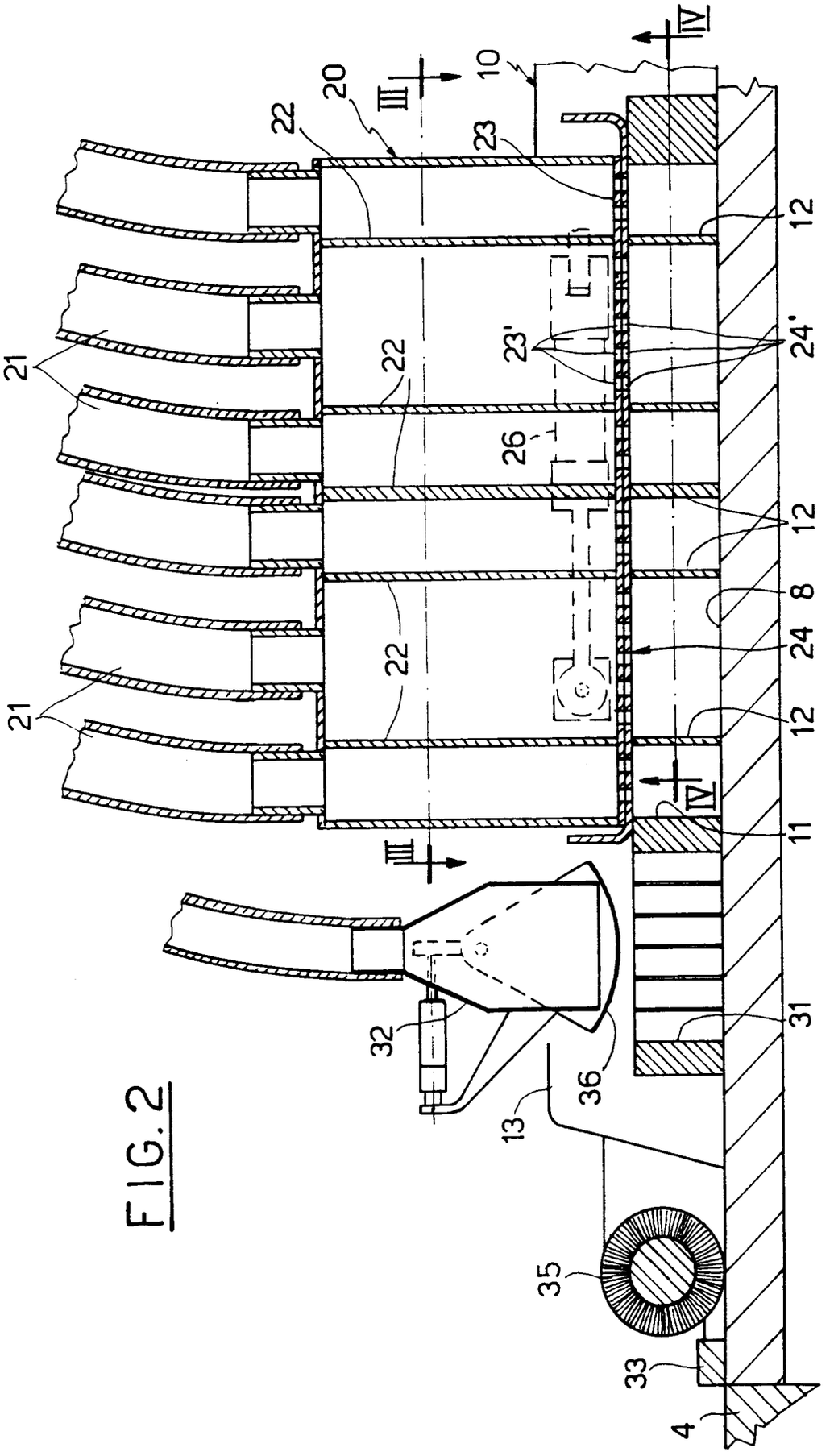

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FIG.2

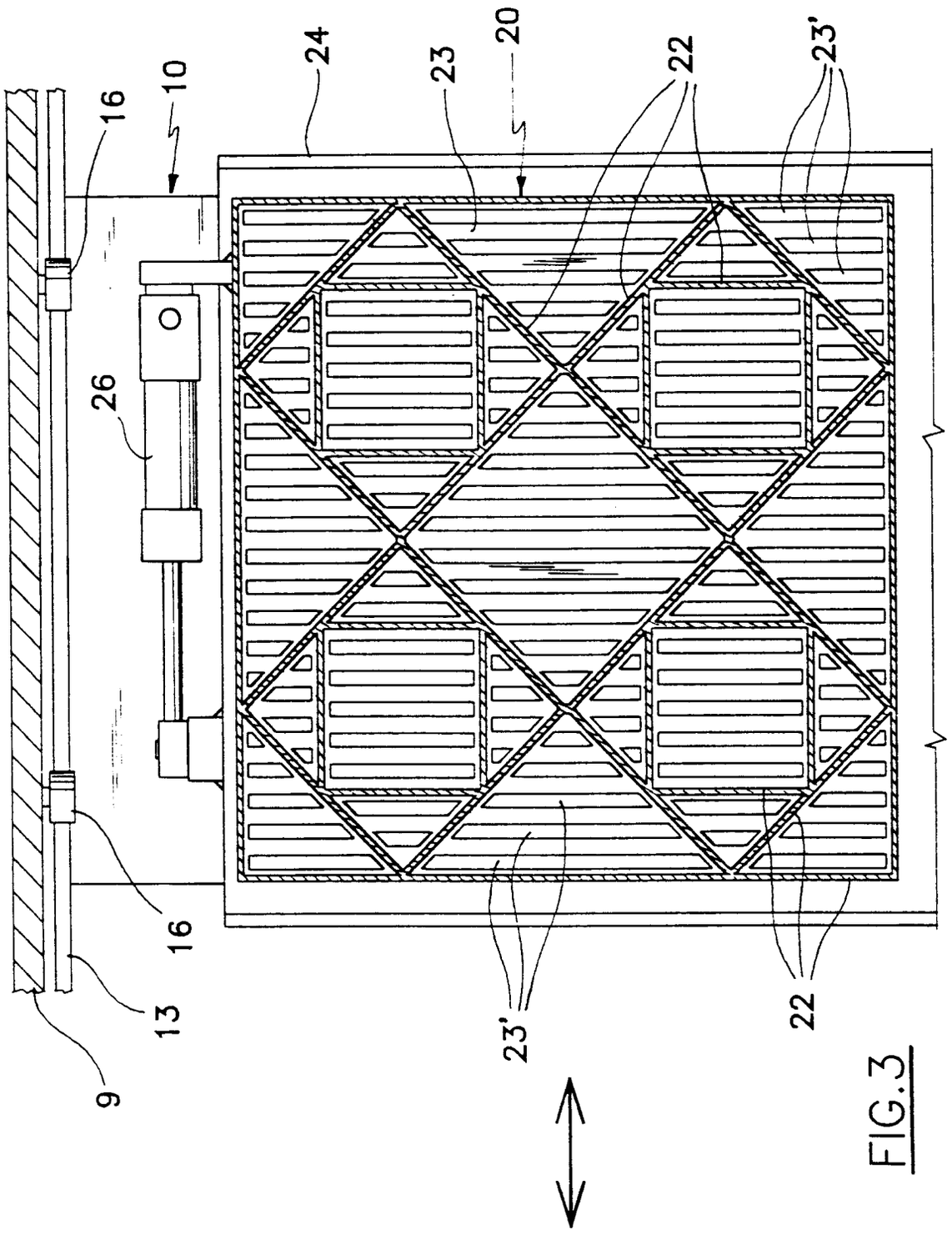


FIG.3

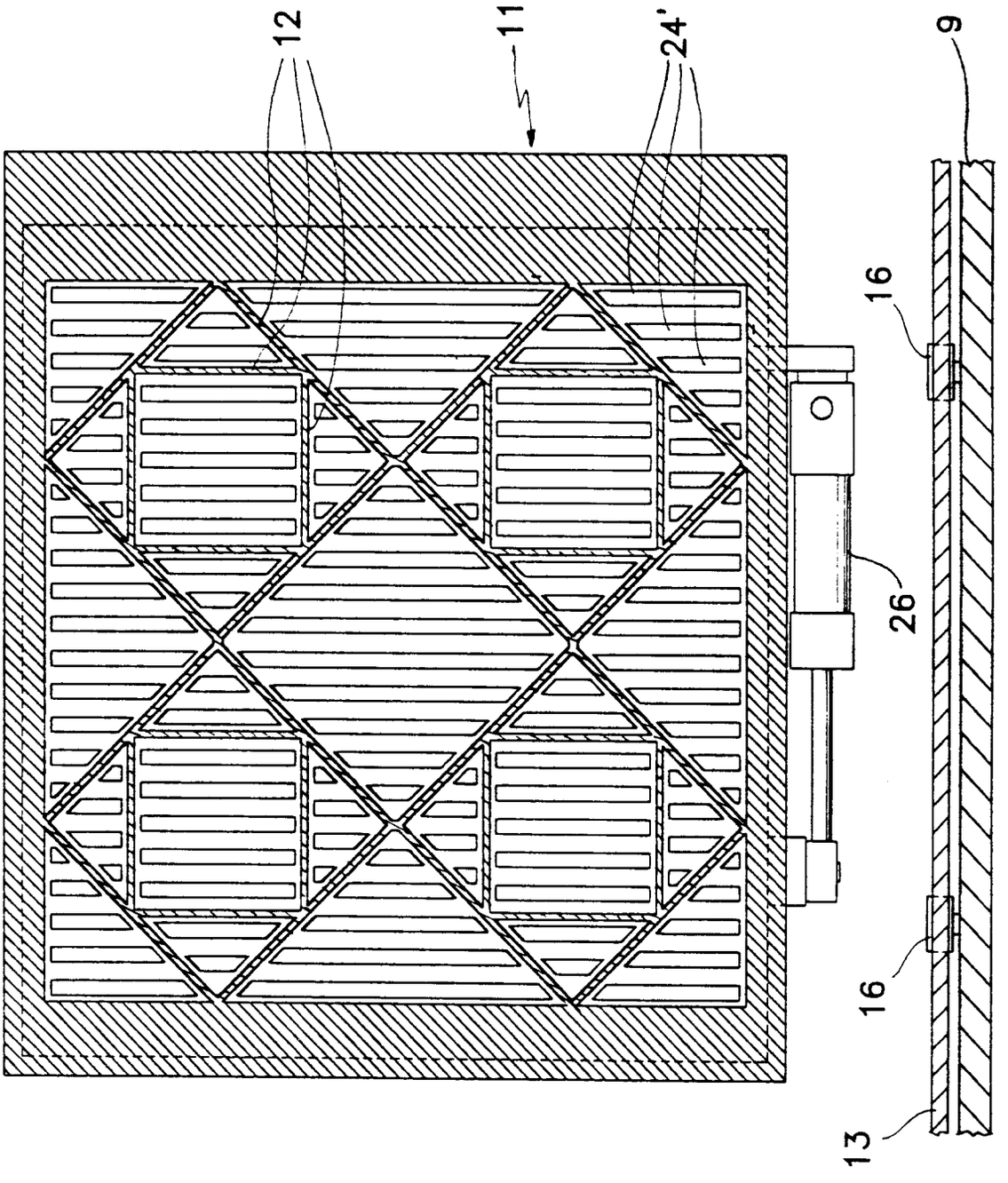


FIG.4

FIG. 5

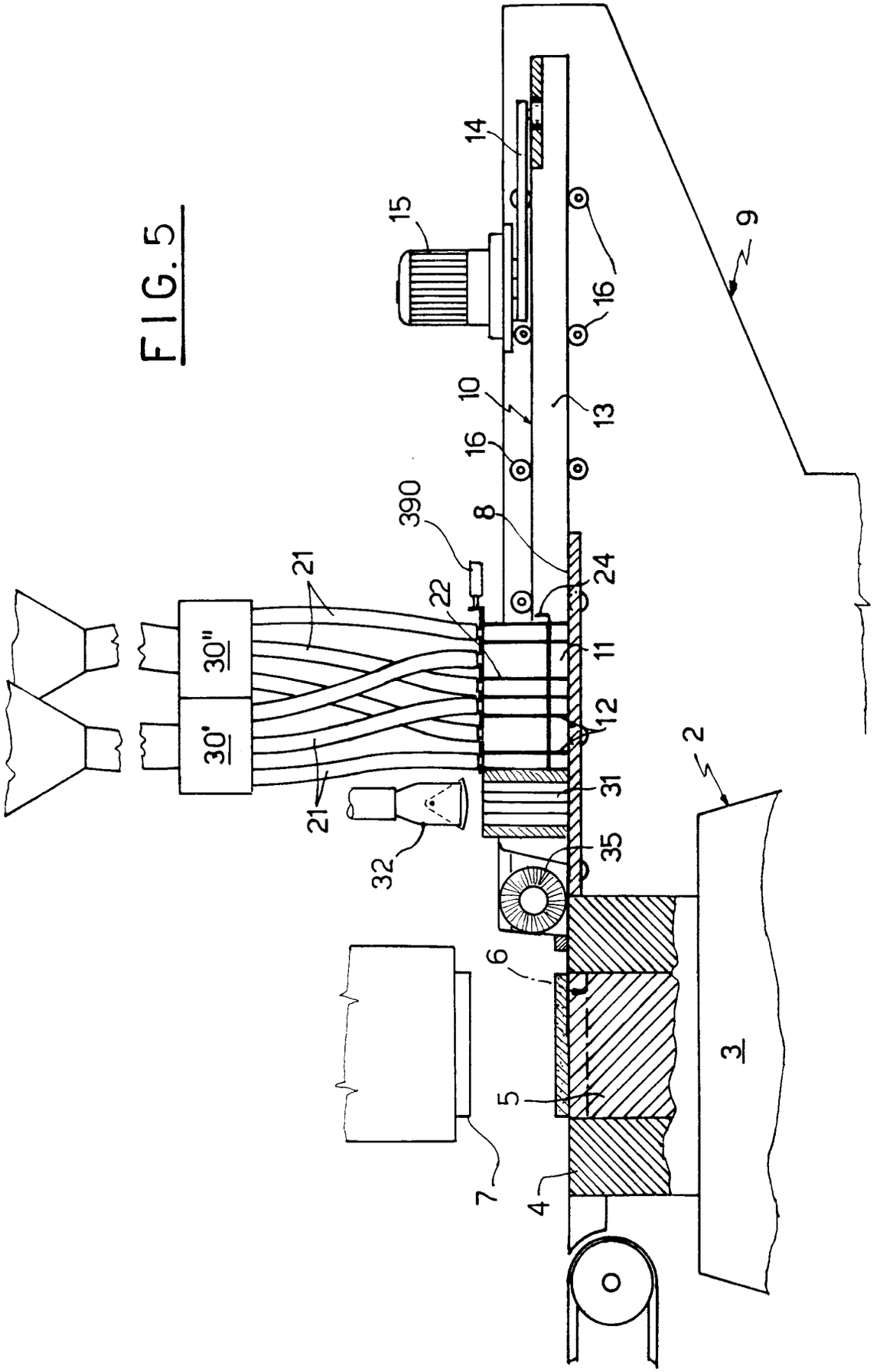
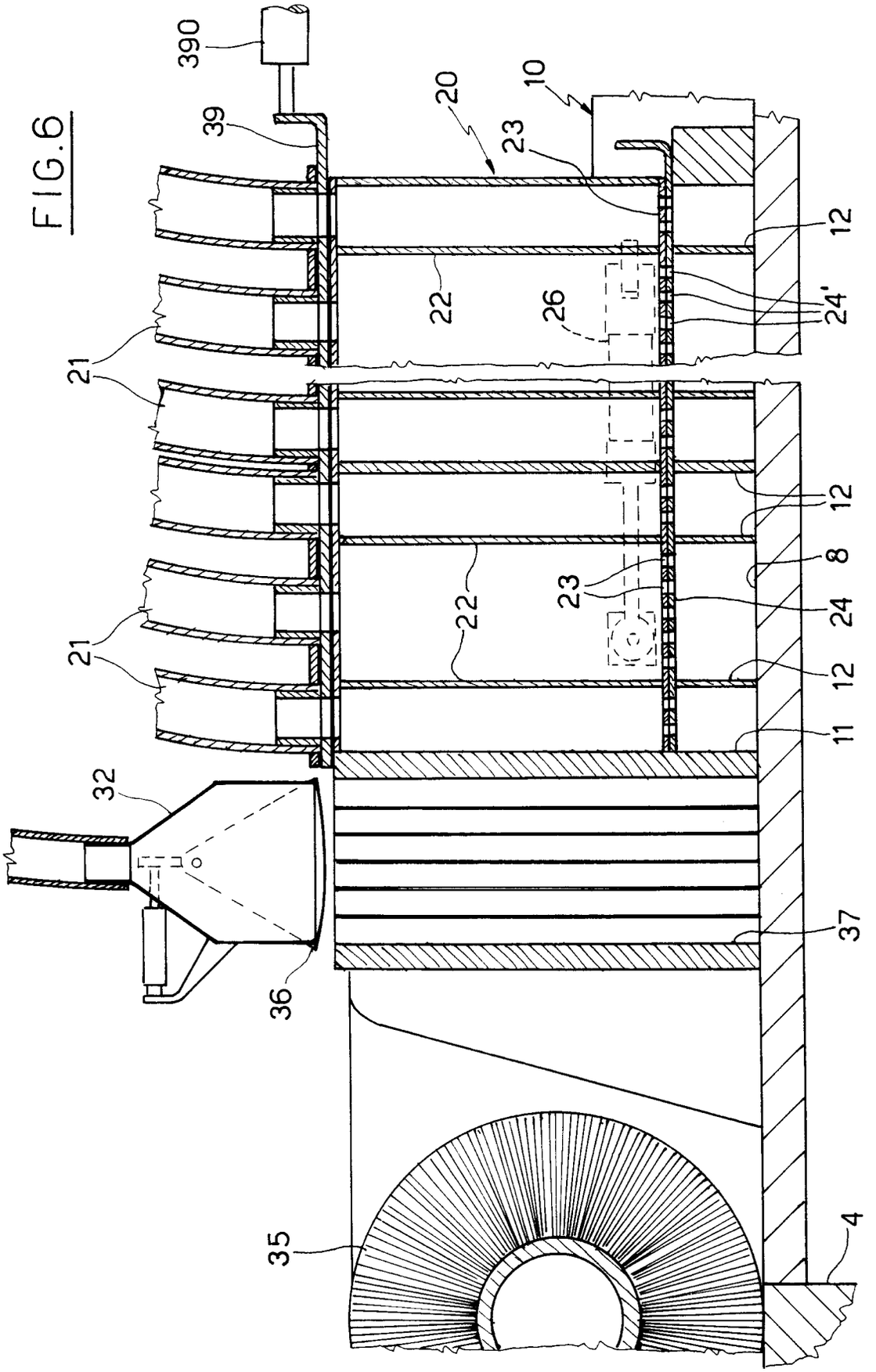


FIG.6



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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 3157

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 January 1999	Gourier, P

CATEGORY OF CITED DOCUMENTS

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EUROPEAN SEARCH REPORT

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 20 3157

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