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## (54) Apparatus for forming tiles

(57) An apparatus for depositing a flowing material on a support (3) comprises flexible screen means (14) provided with openings (16) through which said flowing material flows, the screen means being wound on winding means (18a, 18b), and independent actuating means (19) for actuating said screen means (14).

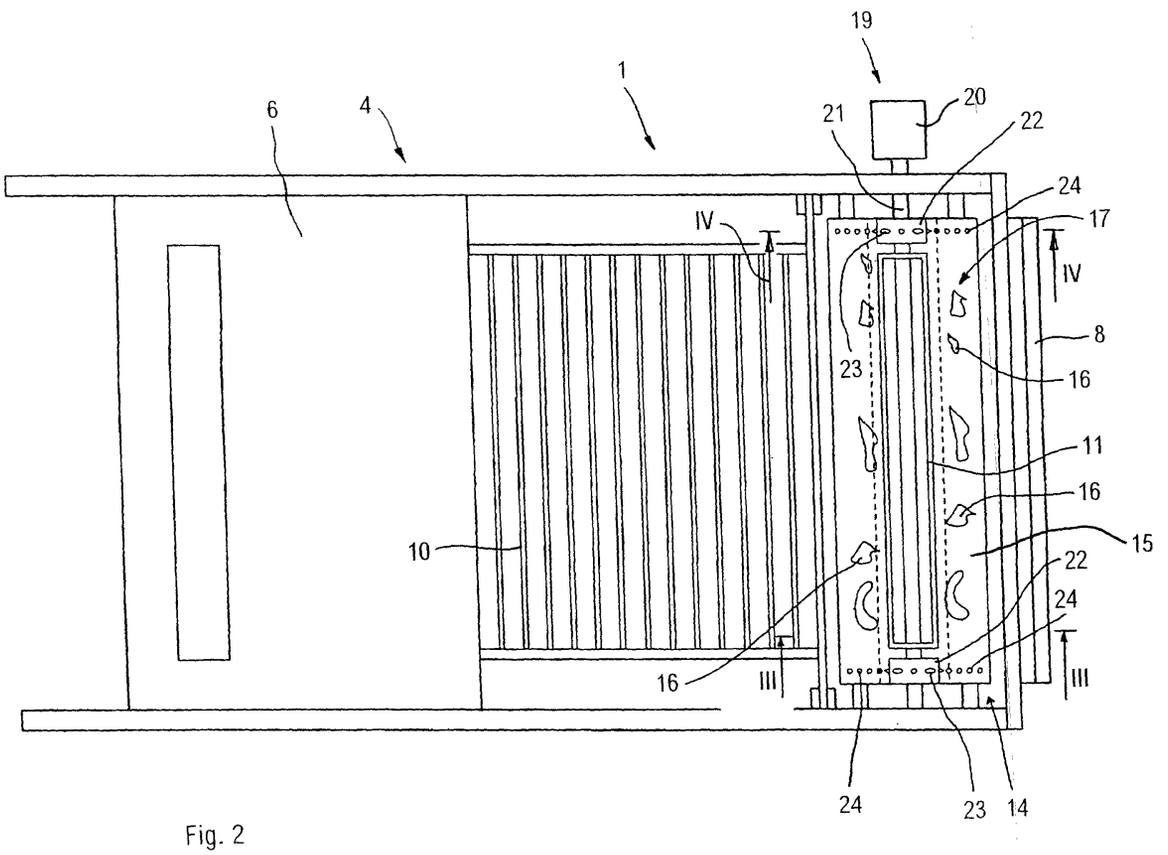


Fig. 2

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## Description

**[0001]** The invention concerns an apparatus for forming tiles by pressing ceramic powders and, more in particular, for forming tiles composed of a base layer and of decorative material distributed on the base layer.

**[0002]** Italian patent application n. MO99A000141 discloses an apparatus for forming tiles, comprising transfer means provided with cells that are open at the top and bottom for being filled with basic ceramic material and pouring said basic ceramic material into cavities of a ceramic mould, and flexible screen means provided with openings that enable a flowing decorative material to pass through them, the screen means being supported by winding means on said carriage transfer means.

**[0003]** The screen means comprise a lamina, the ends of which are coupled with support rollers with which said winding means are provided. Said support rollers are rotatably coupled to the transfer means, the rotation of said support rollers being contrasted by return springs. During operation, during each mould cavity feed cycle, the lamina is unwound from one of the rollers and is wound onto the other roller, or vice versa, at each passing through, thereby ensuring that the openings of the lamina go underneath container means of the decorative material and allow particles of decorative material to exit from the container means.

**[0004]** The lamina is actuated by a shaft on which a pair of wheels is fitted, the edge of said wheels being provided with dragging pegs engaged in holes obtained in side strips of the lamina.

**[0005]** The apparatus further comprises synchronising means suitable for synchronising the screen means with the transfer means.

**[0006]** The synchronising means comprise mechanical actuating means that control the rotation of the above-mentioned shaft, thus being suitable for synchronising the sliding speed of the lamina underneath the container means with the translation speed of the carriage means.

**[0007]** A drawback of the apparatus described above is that, during actuating of the screen means by the wheels the holes obtained in the lamina tend to deteriorate when the pegs disengage from them; this drawback is aggravated when the lamina is made of a material with limited mechanical resistance, for example, of an elastomer.

**[0008]** A further drawback of the above apparatus is that the synchronising means are rather complicated as they comprise a large number of mechanical parts mutually interacting to adjust the sliding speed of the lamina. This makes the construction of the apparatus somewhat complicated and may cause operating faults that will limit the productivity of the apparatus.

**[0009]** An object of the present invention is to improve the known apparatus for forming tiles.

**[0010]** Another object of the invention is to obtain an apparatus for forming tiles that enables tiles to be obtained that have a decoration on their visible face that is clear and well defined.

**[0011]** A further object of the invention is to obtain an apparatus for forming ceramic tiles that is highly reliable and productive.

**[0012]** A still further object of the invention is to obtain an apparatus for decorating ceramic tiles that has a significantly simple construction.

**[0013]** According to the invention, an apparatus is provided for depositing a flowing material on a support, comprising flexible screen means provided with openings through which said flowing material flows and preferably transfer means on which said screen means are supported by winding means, characterised in that it further comprises actuating means suitable for actuating said screen means independently, in particular, from said transfer means.

**[0014]** In an advantageous version, the actuating means comprise a motor arranged for actuating a driving shaft on which a pair of wheels is fitted, each of said wheels being provided with pegs that protrude from an external surface of the wheels to engage in holes obtained in end areas of the screen means. Advantageously, this motor can be a stepper motor or a brushless motor.

**[0015]** In another advantageous version, the actuating means can be associated with an electronic driving and controlling device that is suitable for detecting the translation speed of the transfer means and therefore controlling the rotation speed of said driving shaft.

**[0016]** In a further advantageous version, the pegs can be retracted inside the wheels in order not to interfere with the respective holes during disengagement from the screen means.

**[0017]** In a still further advantageous version said support is a ceramic tile.

**[0018]** Owing to the invention, it is possible to obtain an apparatus for forming ceramic tiles that enables a vast range of decorations of great aesthetic appeal to be created on the visible face of said ceramic tiles. It is in particular possible to obtain a highly reliable apparatus of limited constructional complexity that is relatively simple to use.

**[0019]** The invention will be better understood and carried out with reference to the attached drawings, which show some exemplifying and not restrictive embodiments thereof, in which:

Figure 1 is a schematic section of the apparatus according to the invention taken along a vertical plane;
Figure 2 is a schematic top view of the apparatus of Figure 1;
Figure 3 is an enlarged and interrupted partial section taken along a plane III-III of Figure 2, showing shutter means in a distributing position;
Figure 4 is an enlarged and interrupted section taken along a plane IV-IV of Figure 2;
Figure 5 is a partial section taken along a vertical

plane showing shutter means of the apparatus in a closing position.

**[0020]** As shown in Figure 1, an apparatus 1 for feeding a ceramic press 2 that forms tiles 3 comprises transfer means 4 arranged for feeding loose ceramic material into the cavities 5 of a mould 6 of the press 2, said loose ceramic material comprising base material suitable for constituting a body of the tiles 3 to be formed and decorative material arranged for forming an ornamental pattern on the visible face of the tiles 3. The transfer means 4 comprise a carriage 6 reciprocatable between a retracted position in which it receives the base material from a hopper 7 and an advanced position in which it pours said base material into the cavities 5. The carriage 6 supports a pusher 8 at the front, which pusher pushes the tiles 3 that have already been formed and ejected from the cavities 5 towards an evacuation line 9 and comprises a grid 10 that defines a plurality of cells arranged for containing the base material during transferring. Between the grid 10 and the front area of the carriage 6 bearing the pusher 8, on the carriage 6, a container 11 is provided into which the decorative material is poured from a further hopper 12, fixed and arranged to be above the container 11 when the carriage 6 is in the loading position of the grid 10, in other words when the grid 10 is arranged below the hopper 7.

**[0021]** The container 11 can be divided into different noncommunicating compartments, or be replaced by a plurality of independent containers, each one of which is arranged for containing a decorative material with a particular colour and/or granulometry.

**[0022]** In this way polychrome decorations can be achieved maintaining optimal control of the distribution of decorative materials.

**[0023]** As shown in Figure 3, the container 11 is internally provided with sides 13 that converge downwards to promote the further descent of the decorative material towards a body 33 of said container 11. Said body 33 consists of a tubular element 34 welded to the sides 13, open at the top and provided at the bottom with an outlet 12 located at the lower part of the container 11, said lower part having an external rounded profile on which the screen means 14 are wound.

**[0024]** Inside the body 33 a shutter 30 is inserted comprising a further tubular element 31 that is coaxial to the tubular element 34 and rotatable around its longitudinal axis through a pneumatic actuator that is not shown.

**[0025]** The shutter 31 is provided with a further outlet 32 that, in a distributing position in which it is aligned on the outlet 12, enables the decorative material to exit from the container 11 to interact with the screen means 14. When the shutter 30 is rotated, as shown in Figure 5, the further tubular element 31 closes the opening 12 to prevent the transfer of the decorative material through it and to allow the transfer of the screen means 14 without any undesired exit of decorative material from container 11 occurring.

**[0026]** The screen means 14 comprise a lamina 15 in which openings 16 are obtained, consisting, for example, of a plurality of through microholes that define a decorative pattern 17 to be obtained on the visible face of the tiles 3 to be formed. The lamina 15 acts therefore as control means of the exit of the decorative material from the outlet 12.

**[0027]** The decorative pattern 17 can be formed by a plurality of designs, or incisions, that are the same as one another or different from one another, said designs, or incisions, corresponding to the plurality of cavities 5 of the mould 6 of the press 2.

**[0028]** As shown in Figure 4, the lamina 15 has a first end that is coupled with a first support roller 18a, and a second end coupled with a second support roller 18b, the first roller 18a and the second roller 18b being rotatably coupled with the carriage 6. The first roller 18a and the second roller 18b are provided with elastic return means arranged for inducing the lamina 15 to wind on each of said support rollers as indicated by arrows F1 and F2 respectively, to tension the lamina means 15 so enabling an optimal transfer of the decorative material.

**[0029]** The apparatus 1 further comprises actuating means 19 arranged for moving the lamina 15 to overcome the resistance of the elastic return means: during operation the lamina 15 is in fact unwound from one of the support rollers, for example the second roller 18b, and is wound onto the other support roller, for example the first roller 18a, or vice versa, the openings 16 of the lamina 15 thus pass underneath the outlet 12 and let particles of decorative material pass through said outlet 12.

**[0030]** The actuating means 19 comprise a motor 20, for example a stepper motor, that actuates a shaft 21 that passes through the container 11 and on which a pair of wheels 22 is fitted said wheels being peripherally provided with dragging pegs 23 engaged in holes 24 obtained in side strips of the lamina 15.

**[0031]** The pegs 23 have a rounded end 29 and are preferably retractable inside the wheels 22: in each one of said wheels there is in fact a plurality of seats 25 arranged for receiving said pegs 23 in a position of noninterference with the holes 24.

**[0032]** Pressing roller means 26 are associated with the wheels 22, said pressing roller means 26 are arranged for interacting with the pegs 23 and cause them to retract inside the respective seats 25 after overcoming the resistance of contrast springs 27 positioned inside the seats 25 and interacting with an end of the pegs 23.

**[0033]** The pressing roller means 26 are rotatably supported to first support means 28a, or second support means 28b, movable in the direction indicated by the arrow F4, which first support means 28a and second support means 28b enable the pressing roller means 26 to be brought up to or to be taken away from the wheels 22 to adjust the interaction between the pegs 23 and the pressing roller means 26.

**[0034]** As shown in Figures 3 and 4, the lamina 15 moves in the direction shown by the arrow F3 and is unwound from the second roller 18b to be wound onto the first roller 18a. In this case the pressing roller means 26 are fitted onto the first support means 28a and are therefore positioned in the area of the wheel 22 nearest the first roller 18a, in such a way as to facilitate the disengagement from the holes 24 of the pegs 23 when the lamina 15 is detached from the wheels 22: this prevents deformation of the holes 24 and limits the risk of breakage of the lamina 15, thereby prolonging working life thereof.

**[0035]** If the lamina 15 is unwound from the first roller 18a to be wound onto the second roller 18b and therefore is translated in the opposite direction to the one indicated by the arrow F3, the contrast roller means 26 have to be fitted on the first support means 28b.

**[0036]** The apparatus 1 also comprises an electronic driving and controlling device such as an encoder that detects the translation speed of the carriage and therefore controls the rotation of the shaft 21 to synchronise the sliding speed of the lamina 15 underneath the container 11 with the transfer speed of the carriage 6, thereby enabling optimal exiting of the decorative material from the container 11 to obtain tiles 3 that have a clear and well-defined design on their visible surface.

**[0037]** Alternatively, the sliding speed of the lamina 15 underneath the container 11 may be different from the translation speed of the carriage 6: in this way ceramic tiles 3 are obtained that have a decorative pattern that is "stretched" or "compressed" with respect to the dimensions of the openings 16.

**[0038]** A working cycle of the apparatus takes place in the manner described below.

**[0039]** First, by operating the motor 20, the desired decorative pattern 17 may be chosen from those obtained on the lamina 15 and is brought near the outlet 12 of the container 8 after rotation of the shaft 21.

**[0040]** Subsequently, during the forward stroke of the carriage 6, the grid 10 deposits the base material in the cavities 5.

**[0041]** During the return stroke, the encoder detects the transfer speed of the carriage 6 and controls the rotation of the shaft 21, and subsequent movement of the lamina 15, by means of the stepper motor 20.

**[0042]** Alternatively, the motor 20 may be a brushless motor controlled by a signal sent by the encoder of a further brushless motor arranged for actuating the transfer means 4. In this case, said encoder detects the speed of the carriage 6 of the transfer means 4 and subsequently controls the rotation of the shaft 21.

**[0043]** At the end of the return stroke of the carriage 6, the apparatus is ready to form a tile 3 provided with a decorative pattern 17 that on the extension of the lamina 15 follows the one that has just been made.

**[0044]** Alternatively, the lamina 15 can be repositioned to repeat the same decorative pattern 17 or one of the other decorative patterns 17 incised on it.

**[0045]** The apparatus 1 also enables the lamina 15 to be easily replaced with another lamina 15 that, for example, has decorative patterns 17 that have a different conformation.

## Claims

1. Apparatus for depositing flowing material on a support (3) comprising flexible screen means (14) provided with openings (16) through which said flowing material flows, said flexible screen means being wound on respective winding means (18a, 18b), **characterised in that** it further comprises independent actuating means (19) for actuating said screen means (14).

2. Apparatus according to claim 1, wherein said actuating means (19) comprise a motor (20) actuating driving shaft means (21) of said screen means (14).

3. Apparatus according to one of the preceding claims, and further comprising transfer means (4) to which said screen means (14) are rotatably supported together with said respective actuating means (19).

4. Apparatus according to claims 2 and 3 wherein said actuating means (19) comprise electronic driving and controlling means arranged for detecting the translation speed of said transfer means (4) and subsequently controlling the rotation of said driving shaft (21) means around a respective axis thereof.

5. Apparatus according to claim 4, wherein said driving shaft means (21) causes said screen means (14) to pass underneath outlet means (12) of container means (11) of said flowing material at a speed set by said electronic driving and controlling means.

6. Apparatus according to claim 5, and further comprising shutter means (30) arranged for preventing said flowing material from passing through said outlet means (12).

7. Apparatus according to claim 5, or 6, wherein said container means (11) comprise, near said outlet means (12), a tubular element (34) on the external surface of which said screen means (14) are wound.

8. Apparatus according to claim 7 as appended to claim 6, wherein said shutter means comprise a further tubular element (31) arranged inside said tubular element (34) coaxially to said tubular element (34) and provided with further opening means (32).

9. Apparatus according to claim 8, wherein said fur-

ther tubular element (31) is rotatable around a longitudinal axis thereof to transfer said further opening means (32) from an distributing position in which said further opening means (32) are aligned on said opening means (12) to a closing position in which said further opening means (32) face a continuous zone of said tubular element (34).

**10.** Apparatus according to one of claims 2 to 9, wherein dragging means (22) are associated with said driving shaft means (21).

**11.** Apparatus according to claim 10, wherein said dragging means comprise wheel means (22) provided with peg means (23) protruding from the external surface of said dragging wheel means (22) to engage in holes (24) obtained in end areas of said screen means (14).

**12.** Apparatus according to claim 11, wherein said peg means (23) comprise an end arranged for interacting with said screen means (14), said end having a rounded profile (29).

**13.** Apparatus according to claim 11, or 12, wherein said peg means (23) are retractable into seats (25) obtained in said dragging means (22).

**14.** Apparatus according to one of claims 11 to 13, wherein pressing roller means (26) arranged for pushing said peg means (23) inside said seats (25) are associated with said dragging means (22).

**15.** Apparatus according to claim 14, wherein said pressing roller means (26) are rotatably supported by adjustable support means (28a, 28b) suitable for varying the distance between said pressing roller means (26) and said dragging means (22).

**16.** Apparatus according to claim 14, or 15, wherein said peg means (23) are associated with contrast spring means (27) arranged for allowing said peg means (23) to exit from said seats (25) when said peg means (23) are not pressed by said pressing roller means (26).

**17.** Apparatus according to one of claims 2 to 16, wherein said motor (20) is a stepper motor.

**18.** Apparatus according to one of claims 2 to 16, wherein said motor (20) is a brushless motor.

**19.** Apparatus according to one of the preceding claims, wherein said winding means comprise a first roller (18a) arranged for receiving a first end of said screen means (14) and a second roller (18b) arranged for receiving a second end of said screen means (14).

**20.** Apparatus according to claim 19, wherein elastic return means arranged for alternately winding said screen means (14) onto said first roller (18a) or onto said second roller (18b) are associated with said first roller (18a) and said second roller (18b).

**21.** Apparatus according to claim 20, wherein said elastic return means rotate said first roller (18a) and said second roller (18b) in mutually opposite directions to tension said screen means (14).

**22.** Apparatus according to one of claims 3 to 21, wherein said transfer means (4) comprise carriage means (6) movable between a retracted position in which said trolley means (6) receive a base ceramic material and a forward position in which said carriage means (6) pour said base ceramic material into cavities (5) of a ceramic mould (6).

**23.** Apparatus according to one of preceding claims, wherein said support comprises a ceramic product (3).

**24.** Apparatus according to claim 21, wherein said flowing material comprises a decorative material suitable for decorating a visible face of said ceramic product (3).

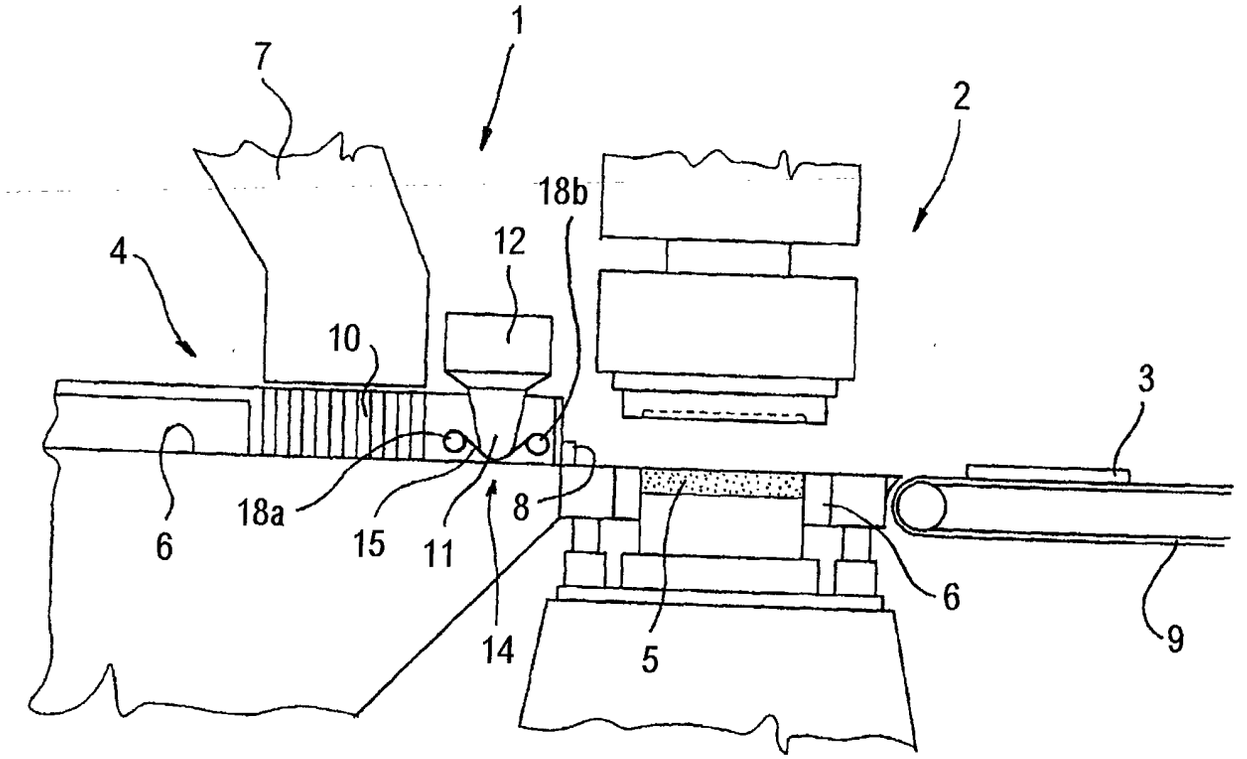


Fig. 1

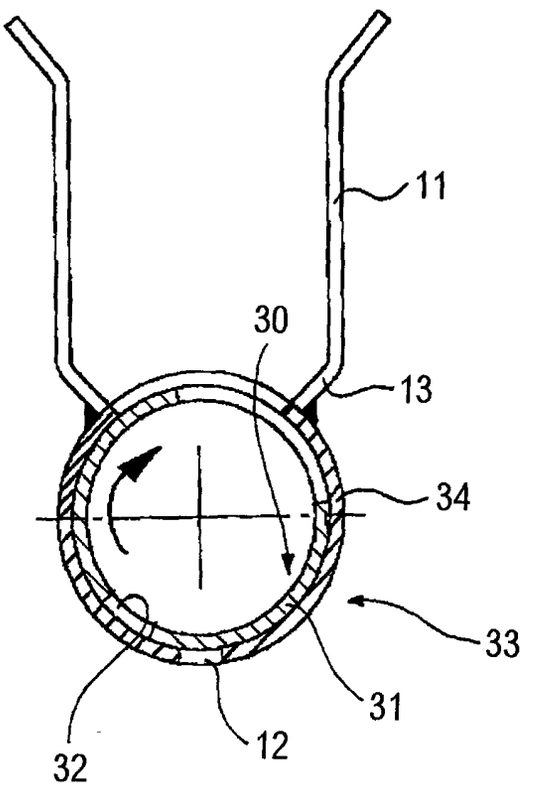


Fig. 5

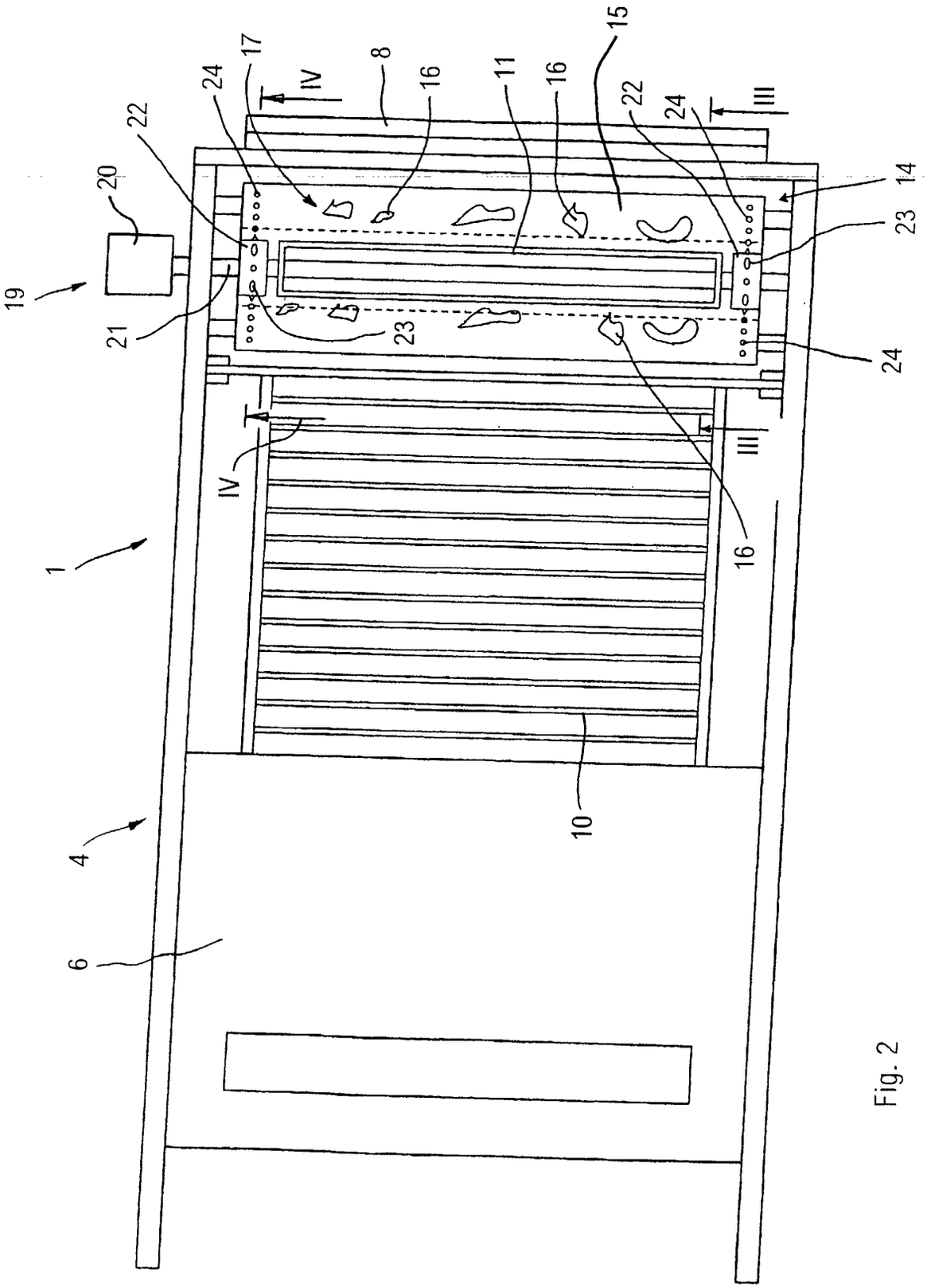


Fig. 2

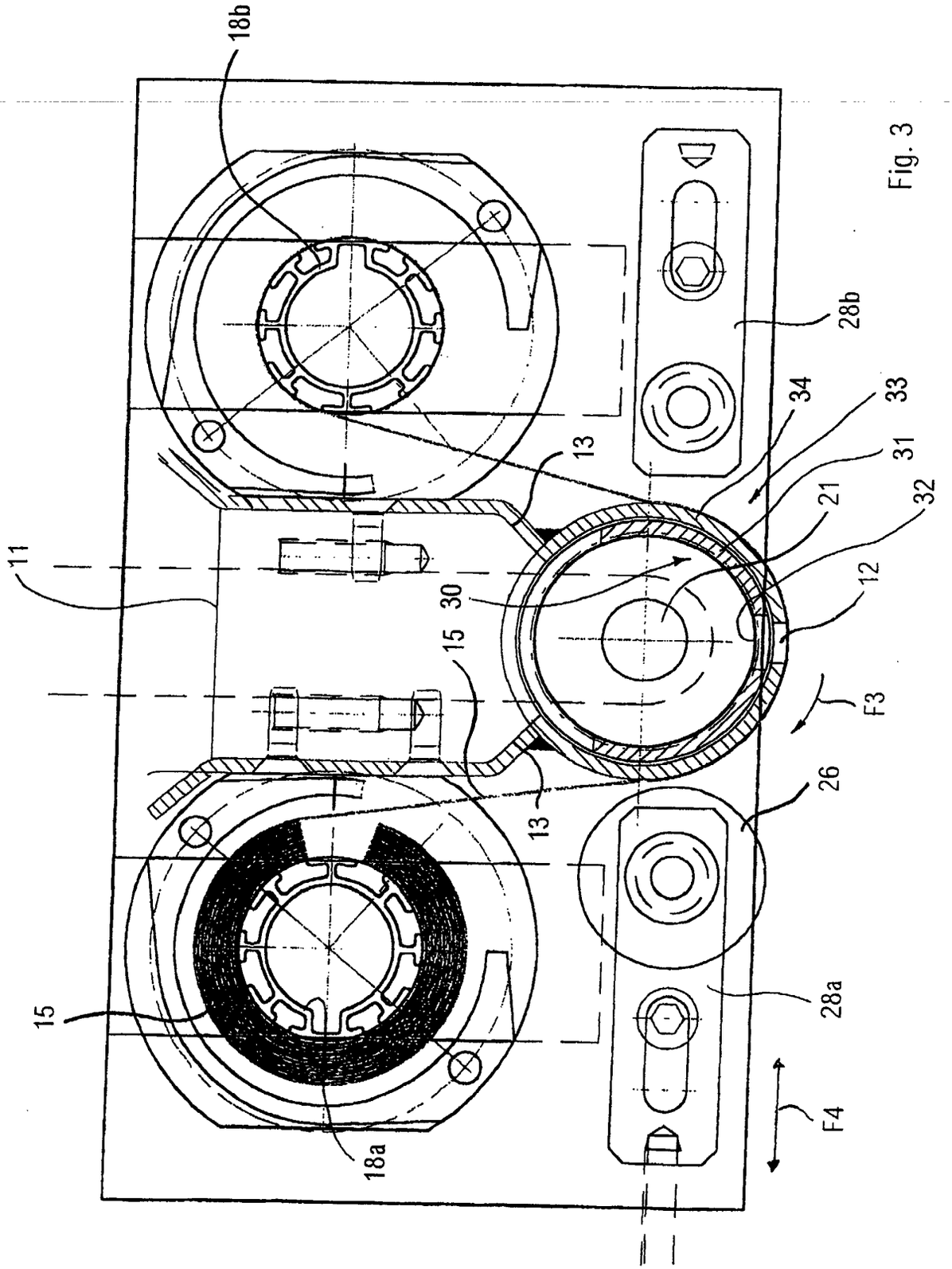


Fig. 3

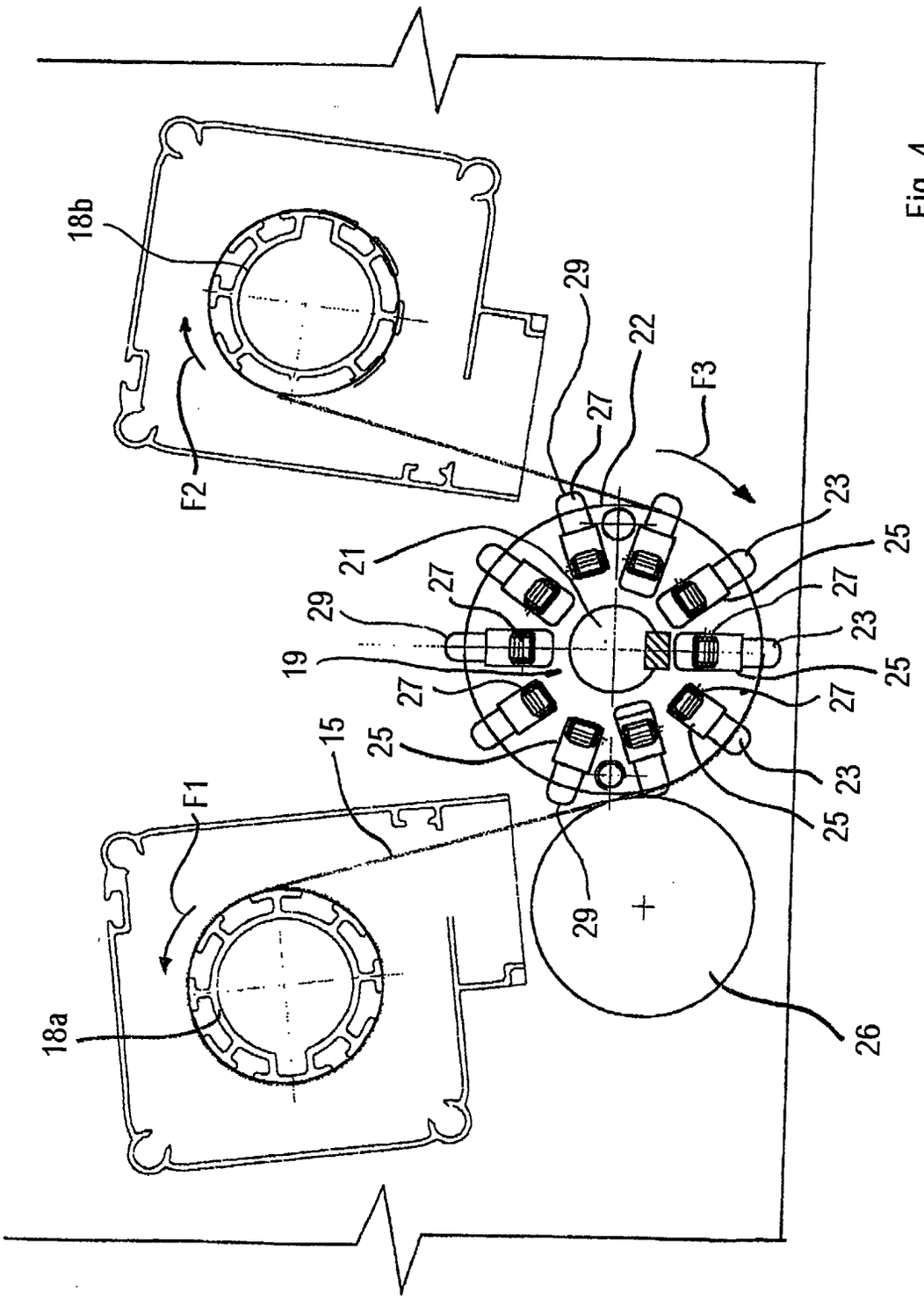
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Fig. 4