

Description**DESCRIPTION OF THE INVENTION**

[0001] The present invention falls under the technical field relating to machinery used in the ceramic industry for the decoration of ceramic tiles or slabs.

INVENTION CORRELATED PRIOR ART

[0002] In particular, machines are considered that apply a uniform layer of liquid glaze to the whole face, or to a part of it, of said ceramic tiles or slabs, these machines being also known by those skilled in the art as curtain coater heads.

[0003] Inside one of these curtain coater heads there is a hopper, into which a liquid glaze, preferably the one so-called 'in solution', is fed.

[0004] In its lower part, the hopper is provided with a calibrated outlet slot, from which a curtain of said liquid glaze goes out and is deposited by falling onto the underlying ceramic tiles or slabs in transit, arranged in orderly succession and advanced, with constant speed, by a straight conveyor line.

[0005] The hopper, like other organs involved in the passage of the glaze, must be thoroughly cleaned every time the colour of the glaze is to be changed, as a matter of course, but also at regular intervals, even if the colour of the glaze remains the same, in order to remove any lumps or incrustations that may have formed and that could alter the quality of the layer of glaze applied.

[0006] The hopper is preferably washed with liquid (water with detergent added if necessary) sprayed under pressure from one or more nozzles.

[0007] To this end, the hopper must be made up of two parts, so that it can be opened during the washing phase, both to allow the introduction and manipulation of the aforementioned nozzles thereinside and to facilitate the drainage of the washing liquid from the lower part of the same hopper.

[0008] In a known technical solution, the two parts of the hopper are hinged to each other to allow a book-like opening.

[0009] With such a construction, after the hopper has been washed, it is difficult to find the correct closed position of the two parts, which restores the correct size of the calibrated outlet slot and which, therefore, guarantees the dispensing of a glaze curtain equal to the one before the washing.

OBJECTS OF THE INVENTION

[0010] Therefore, it is an object of the present invention to propose a curtain coater head opening device, to carry out the washing phase of the hopper, designed so that the hopper is easily accessible when open and, at the same time, as to avoid, upon the subsequent closing, the drawbacks inherent in known solutions and, in particular,

those concerning the restoring of the previous operating conditions.

[0011] Another object of the invention is to propose a device with whose movements are precise and without clearance, both when opening and closing.

[0012] A still further object of the invention is to propose a device which keeps stable all the positions reached by the two parts of the hopper.

[0013] Another object of the invention is to provide the device with measuring means suitable for verifying in real time the extent of the movements made by the two parts of the hopper when opening and closing.

[0014] A still further object of the invention is to propose a device which is shaped in such a way as to allow optimal coexistence and cooperation with the means for washing the hopper.

SUMMARY OF THE INVENTION

[0015] These and other objects are fully achieved by means of a curtain coater head opening device, with said curtain coater head positioned above a straight conveyor line on which ceramic tiles or slabs, arranged in orderly succession, advance with constant speed, with said curtain coater head defining thereinside a hopper being fed with liquid ceramic glaze and formed by a funnel-shaped upper zone and two vertical walls, parallel to each other and placed at a suitable distance one from the other, so as to define, in the lower part, a calibrated outlet slot, from which comes out a curtain of said liquid ceramic glaze, aimed at uniformly covering a part or the whole upper side of said ceramic tiles or slabs.

[0016] The above mentioned device comprises:

- 35 - said hopper formed by two parts, a first stationary part and a second movable part, with said first stationary part defining an inclined wall of said funnel-shaped upper zone and a stationary vertical wall of said vertical walls, and with said second movable part defining the remaining inclined wall of the funnel-shaped upper zone and a movable vertical wall of said vertical walls;
- 40 - drive means, associated with said second movable part of the hopper and intended to move the same second movable part in a horizontal, rectilinear direction, to establish an operating position of said hopper, in which said second movable part is disposed close to said first stationary part, so that said stationary and movable vertical walls are set at a predetermined distance from each other, to define the aforementioned calibrated outlet slot, with the same drive means also provided for configuring an open position of said hopper, in which said second movable part is moved away from said first stationary part.
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BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The characteristics of the invention under discussion will become evident from the following description of a preferred embodiment of the curtain coater head opening device, in accordance with what has been proposed in the claims and with help of the enclosed figures, in which:

- Fig. 1 is a schematic side view of a portion of a conveyor line for ceramic tiles or slabs, and a curtain coater head;
- Fig. 2 is a plan view of the portion of the conveyor line and the curtain coater head of Fig. 1;
- Fig. 3 is an axonometric view of the curtain coater head;
- Fig. 4 is a front view of the curtain coater head and an underlying cleaning unit operating therein;
- Fig. 5 is a plan view of the curtain coater head, in cross section along the plane V-V of Fig. 4;
- Fig. 6A illustrates a first side section, obtained according to the plane VI-VI of Fig. 5, where the hopper of the curtain coater head can be seen in operating position;
- Fig. 6B illustrates a second side section, obtained according to the plane VI-VI of Fig. 5, where the hopper of the curtain coater head can be seen in open position;
- Fig. 7 is a view similar to Fig. 4, where a cleaning unit is arranged under the curtain coater head to clean the hopper;
- Fig. 8 is a side view similar to Fig. 6B, showing schematically the organs cleaning the inside of the hopper.

DETAILED DESCRIPTION OF THE INVENTION

[0018] In the above figures, the device proposed by the present invention, as a whole, has been indicated by reference 1.

[0019] The device 1 is associated with a known curtain coater head 2, situated above a straight conveying line 3, on which ceramic tiles or slabs 4, arranged in orderly succession, advance with constant speed V, interspersed with an empty space 5 (Figs. 1 and 2).

[0020] The curtain coater head 2 (Fig. 3), according to known technique, defines therein a hopper 20, provided in its lower part with a calibrated outlet slot 21, from which a curtain of liquid ceramic glaze goes out, which is aimed at uniformly covering a part or, preferably, the whole upper face 4A of said ceramic tiles or slabs 4.

[0021] The hopper 20 includes, for example, a funnel-shaped upper zone 22 into which the liquid ceramic glaze is fed at the inlet, by means of a system associated with the curtain coater head 2, not illustrated as not relevant in the context of the present invention.

[0022] The funnel-shaped upper zone 22 conveys, for example due to gravity, the liquid ceramic glaze towards

the underlying calibrated outlet slot 21, defined by two vertical walls 24, 25, parallel to each other and arranged at a suitable distance from each other, depending on the thickness of the curtain of glaze to be obtained.

[0023] In the device 1 according to the invention said hopper 20 is formed by two parts, a first stationary part 20F and a second movable part 20M.

[0024] The first stationary part 20F defines an inclined wall of the above mentioned funnel-shaped upper zone 22 and a stationary vertical wall 24 of said vertical walls 24, 25, whereas the second movable part 20M defines the remaining inclined wall of the funnel-shaped upper zone 22 and a movable vertical wall 25 of said vertical walls 24, 25.

[0025] The first stationary part 20F further comprises two sides 26 and a lid 27, which form a single body with the inclined wall of the funnel-shaped upper zone 22 and the stationary vertical wall 24 and which delimit the same hopper 20 laterally and from above.

[0026] The second movable part 20M couples slidingly and tightly, with said sides 26 and lid 27, so that the hopper 20 is completely closed, apart from the duct feeding the glaze S and the mentioned calibrated outlet slot 21 in the lower part.

[0027] Advantageously, suitable gaskets 29A, 29B are interposed between the first stationary part 20F and the second movable part 20M, to ensure a hermetic seal between the areas in sliding coupling.

[0028] Drive organs 10, associated with the second movable part 20M of the hopper 20, are aimed at translating the same second movable part 20M in a rectilinear horizontal direction, bringing it close to or away from the first stationary part 20F.

[0029] More in particular, an operating position W of said hopper 20 is configured when the second movable part 20M is disposed close to the first stationary part 20F and the stationary vertical wall 24 and the movable vertical wall 25 are at a prefixed distance from each other which regulates said calibrated exit slot 21, while an open position A of said hopper 20 is configured when the second movable part 20M is moved as far as possible from the first stationary part 20F.

[0030] In a preferred embodiment of the device 1, said drive means 10 comprise:

- a screw 100 rotatably supported by the supporting structure of said curtain coater head 2;
- a nut-screw 101, geared with said screw 100 and made integral with said second movable part 20M;
- operating means 102 for rotation of said screw 100 in one direction or the other, and thus causing corresponding translations of the screw nut 101 and second moving part 20M assembly, to define said operating W and open A positions of the hopper 20.

[0031] Advantageously, it is contemplated that the screw 100 and the nut-screw 101 are coupled by means of a recirculating ball system, which is not illustrated in

detail since of known type.

[0032] In the preferred embodiment shown in the figures, the aforementioned operating means 102 are of a motorised type and comprise an electric motor of the brushless or stepper type, equipped with an encoder 103 for controlling the angles of rotation; the electric motor 102 is directly keyed to the screw 100, so that there is a unitary transmission ratio between the two.

[0033] The drive of the electric motor 102 is driven by control and command means 104 which record the rotations imposed on the screw 100 in real time.

[0034] In an variant embodiment of the device 1, not illustrated as intuitively comprehensible, the operating means 102 are of manual type and comprise a crank, made integral with the screw 100, and a mechanical counter, associated with the latter, for controlled rotation of the screw 100.

[0035] Centring and zeroing means 28 are interposed between said first and second parts 20F, 20M of the hopper 20 and are capable of unambiguously determining the condition in which said vertical walls 24, 25 are mutually approached with zero clearance.

[0036] In the illustrated, not limiting, example, the centring and zeroing means 28 comprise two conical tips 28P, rigidly fixed to the sides of the second movable part 20M of the hopper 20, intended to match with corresponding conical recesses (not visible) made in blocks 28B, with the latter made integral with the first stationary part 20F.

[0037] The contact coupling between the conical tips 28P and said conical recesses must coincide with the aforementioned zero clearance coupling between the vertical walls 24, 25: this condition is recorded by the encoder 103 or by the number indicated by the mechanical counter, so as to define the "zero" from which to calculate, and find again at any time, the correct distance between the vertical walls 24, 25 to delimit the aforementioned calibrated exit slot 21, to which corresponds the aforementioned operating position W of the hopper 20.

[0038] When it becomes necessary to wash the hopper 20, either for periodic maintenance or because the colour of the glaze has to be changed, the hopper is arranged in the open position A, so as to allow a known cleaning unit 12 to enter the hopper 20 from below and to deliver detergent fluid under pressure, so as to invest and wash its inner walls.

[0039] The cleaning unit 12 comprises a carriage 13 with at least one rotating spray nozzle 14 of detergent fluid, movable parallel to said calibrated outlet slot 21 along its entire length.

[0040] In order to facilitate the entry into work of the cleaning group 12, in the device 1 lifting means 11 are advantageously associated with said curtain coater head 2 and designed to move the latter vertically between two extreme positions, respectively a lowered working position B, in which the calibrated outlet slot 21 is at a pre-determined height from the ceramic tiles or slabs 4 in underlying transit, and a raised washing position L, in

which the same curtain coater head 2, in an inoperative condition, is placed higher with respect to the transport line 3.

[0041] The lifting means 11 comprise, as a pure example, two pneumatic cylinders 110, arranged at the sides of said curtain coater head 2 and are operated in synchronism by known and not shown operating means.

[0042] Other possible embodiments of the aforesaid lifting means, not illustrated, the application of which is largely within the reach of the average skilled technician of the field, include electric cylinders, one or more recirculating screws driven by a stepper or brushless motor, or manually operated and provided with suitable sensors, capable of allowing fine adjustment of the vertical distance between the tile 4 and the walls 24, 25.

[0043] As it can be easily understood, the raised washing position L of the curtain coater head 2 is set when the hopper 20 is in the open position A.

[0044] From the above description, all the advantageous aspects of the proposed device, which allows the hopper washing phase to be easily carried out by opening it with a different and better geometry than in the prior art, so as to increase its ease of access for the cleaning unit, are very clearly shown.

[0045] In addition, the device is equipped with effective operating means for opening and closing the hopper, which allow a previous adjustment of the calibrated outlet slot to be easily and with absolute certainty restored.

[0046] For this purpose, it proves particularly useful to have equipped the device with suitable measuring devices adapted to verify in real time the extent of the movements made, at the opening and reclosing of the two parts of the hopper.

[0047] It is highlighted that the design features of the device ensure precise and backlash-free movements of the moving part of the hopper, both in opening and closing.

[0048] An additional advantage comes from the fact that great care was taken in the design and manufacture of the device to achieve absolute stability of the two parts of the hopper, in all positions.

[0049] Thanks to the means of lifting the curtain coater head, provided in the device, optimal cooperation with the means in charge of carrying out hopper washing is achieved, without hindering the work of the latter.

[0050] It is understood that what is described above has only an illustrative and not limiting value, therefore, possible detail variations that could become necessary for technical and/or functional reasons, are from now considered within the protective scope as defined in the claims below.

Claims

1. Curtain coater head opening device, with said curtain coater head positioned above a straight transport line (3) on which tiles or ceramic slabs (4) are made

to advance with constant speed (V) and orderly arranged in a row, with the same curtain coater head (2) including a hopper (20) thereinside, that is fed with liquid ceramic glaze and consisting of a funnel-shaped upper zone (22) and two vertical walls (24, 25), which are parallel to each other and arranged at a suitable distance from each other to define a calibrated exit slot at the bottom (21), from which a curtain of said liquid ceramic glaze comes out and goes to uniformly cover a part of or the entire upper face (4A) of said ceramic tiles or slabs (4), said device (1) being characterised by comprising:

- said hopper (20) consisting of two parts, namely a first stationary part (20F) and a second movable part (20M), with said first stationary part (20F) defining a inclined wall of said funnel-shaped upper zone (22) and a stationary vertical wall (24) of said vertical walls (24, 25) and with said second movable part (20M) defining the remaining inclined wall of the funnel-shaped upper zone (22) and a movable vertical wall (25) of said vertical walls (24, 25);
 - drive means (10), associated with said second movable part (20M) of the hopper (20) and intended to move the same second movable part (20M) in a horizontal, rectilinear direction, to establish an operating position (W) of said hopper (20), in which said second movable part (20M) is disposed close to said first stationary part (20F), so that said stationary (24) and movable (25) vertical walls are set at a predetermined distance from each other to define the aforementioned calibrated exit slot (21), with the same drive means (10) also provided for establishing an open position (A) of said hopper (20), in which said second movable part (20M) is moved away from said first stationary part (20F).

2. A device according to claim 1, characterised in that said first stationary part (20F) of the hopper (20) comprises two sides (26) and a lid (27), which are provided for delimiting the sides and top of the hopper (20) so as to form a single body with said stationary vertical wall (24) and inclined wall of the funnel-shaped upper zone (22), and in that said second movable part (20M) mates slidingly and tightly with said sides (26) and lid (27).
3. A device according to claim 1, characterised in that said drive means (10) include: a screw (100) rotatably supported by the supporting structure of said curtain coater head (2); a nut-screw (101), geared with said screw (100) and made integral with said second movable part (20M); operating means (102) for rotation of said screw (100) in one direction or in the other one thus causing corresponding translations of the screw nut (101) and second moving part

(20M) assembly, to define said operating (W) and open (A) positions of the hopper (20).

4. A device according to claim 3, characterised in that said screw (100) and nut-screw (101) are coupled with a recirculating ball system.
5. Device according to claim 3 or 4, characterised in that said operating means (102) are of motorised type and include an electric motor with encoder (103), and in that control and command means (104) are provided, associated with said electric motor with encoder (103) for controlled rotation of said screw (100).
6. Device according to claim 3 or 4, characterised in that said operating means (102) are of manual activation type and comprise a crank, made integral with said screw (100), and a mechanical counter, associated with the latter, for controlled rotation of said screw (100).
7. Device according to claim 3 or 5 or 6, characterised in that centring and zeroing means (28) are interposed between said first and second parts (20F, 20M) of the hopper (20) and are capable of unambiguously determining the condition in which said vertical walls (24, 25) are mutually approached with zero clearance.
8. A device according to claim 7, characterised in that said centring and zeroing means (28) comprise at least two conical tips (28P), associated with said second movable part (20M) of the hopper (20) and intended to match with corresponding conical recesses made in blocks (28B), the latter being made integral with said first stationary part (20F) of the hopper (20).
9. A device according to claim 1, characterised in that lifting means (11) are associated with said curtain coater head (2) and designed to move it vertically between two extreme positions, respectively a lowered working position (B), in which said calibrated exit slot (21) is at a predetermined height from said ceramic tiles or slabs (4) in transit, and a raised washing position (L), in which said curtain coater head (2) is placed at a higher level from said transport line (3) and said hopper (20) is in said open position (A).
10. A device according to claim 1, characterised in that said lifting means (11) comprise two pneumatic cylinders (110), which are arranged on either sides of said curtain coater head (2) and are operated in synchronism.
11. A device according to claim 1, characterised in that said lifting means (11) comprise two electrically-op-

erated cylinders, which are arranged on either sides of said curtain coater head (2) and are operated synchronously.

12. A device according to claim 1, **characterised in that** 5
said lifting means (11) comprise a recirculating-ball screw driven by a stepper motor.

13. A device according to claim 1, **characterised in that** 10
said lifting means (11) comprise a recirculating-ball screw driven by a brushless motor.

14. A device according to claim 1, **characterised in that** 15
said lifting means (11) comprise a recirculating-ball screw driven that is manually operated and is equipped with sensors to allow adjustment of the vertical distance between said tile (4) and said walls (24,25).

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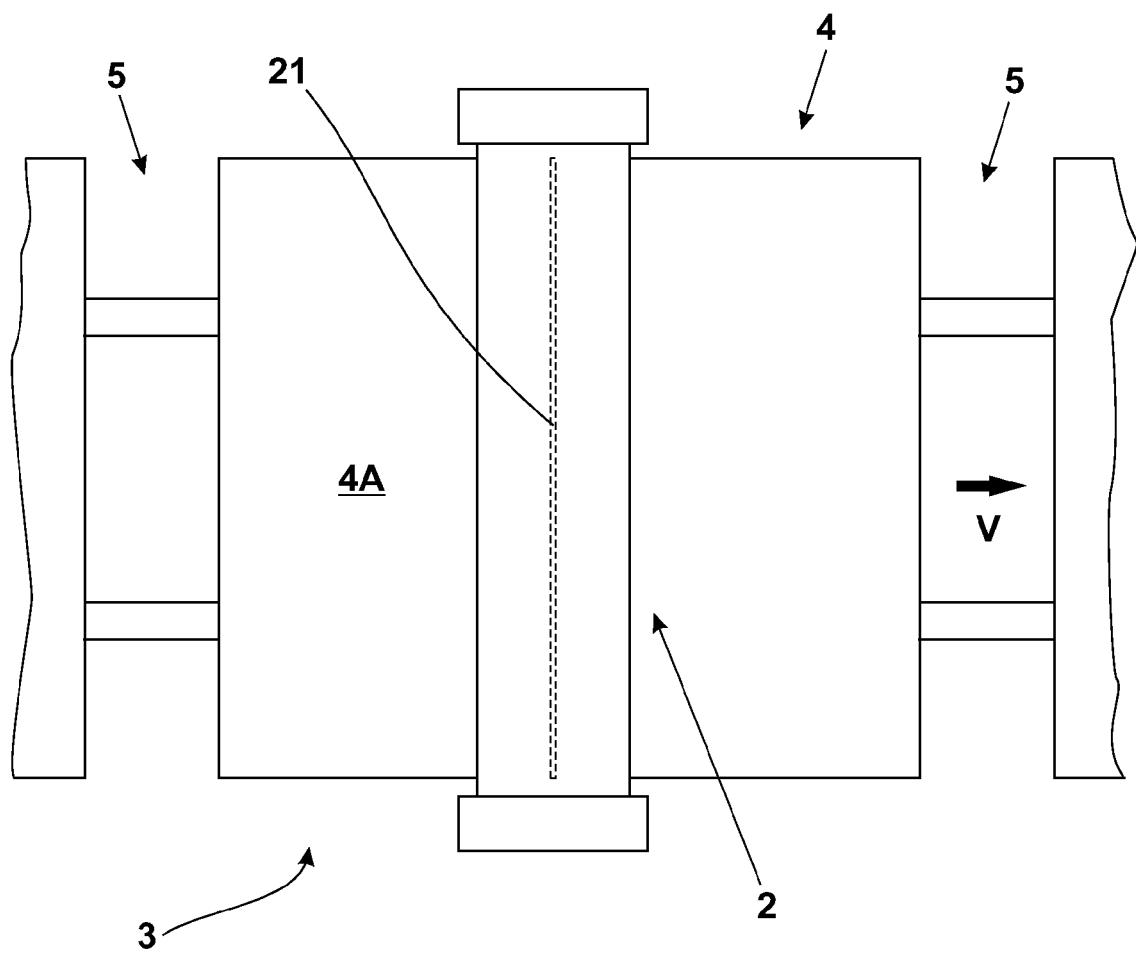
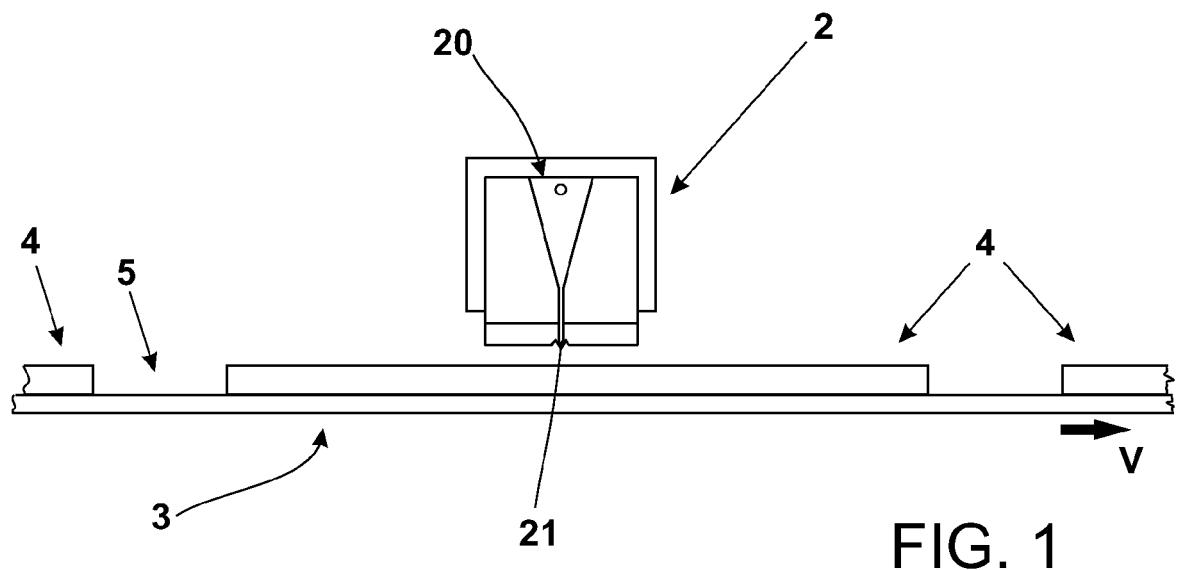
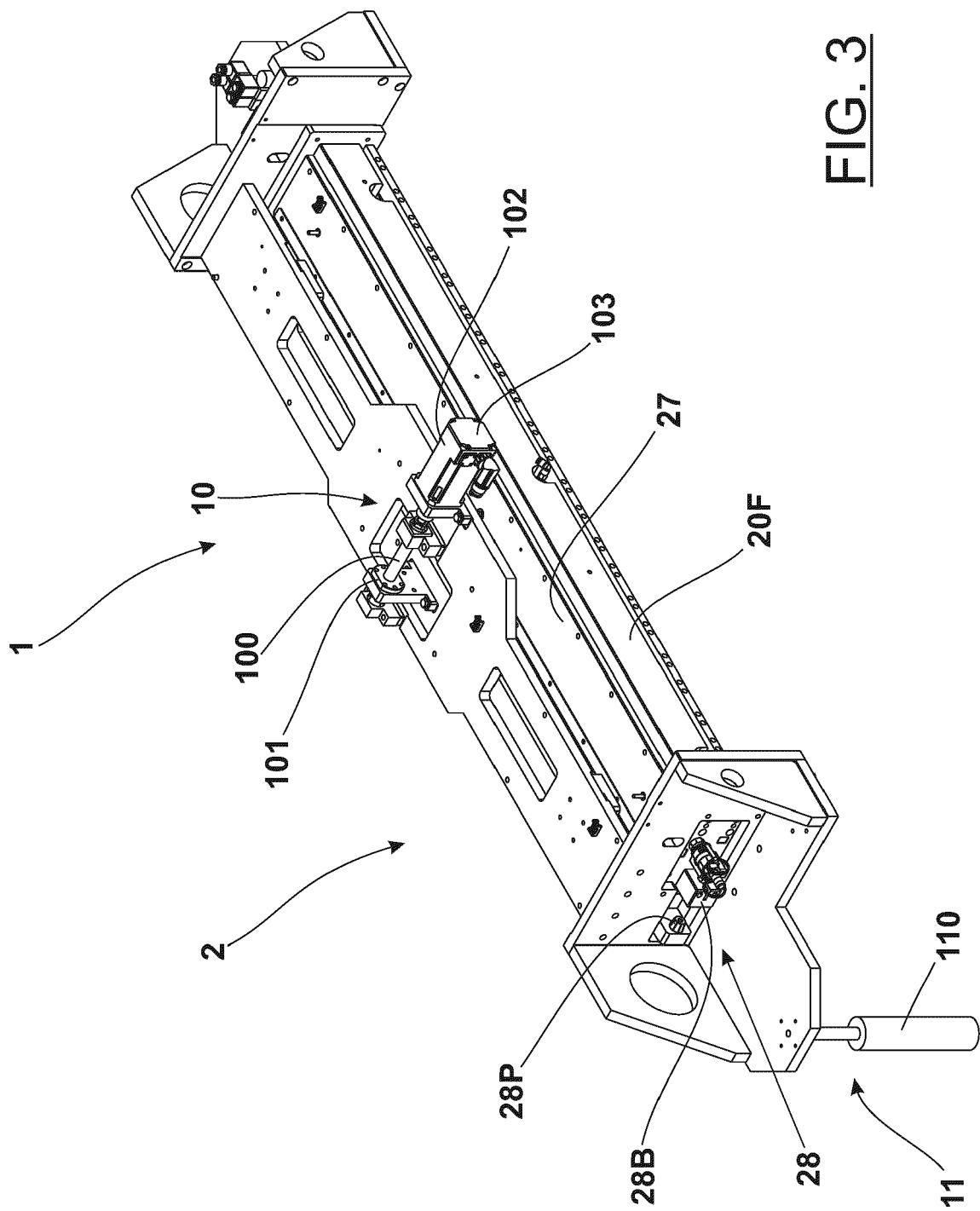


FIG. 3



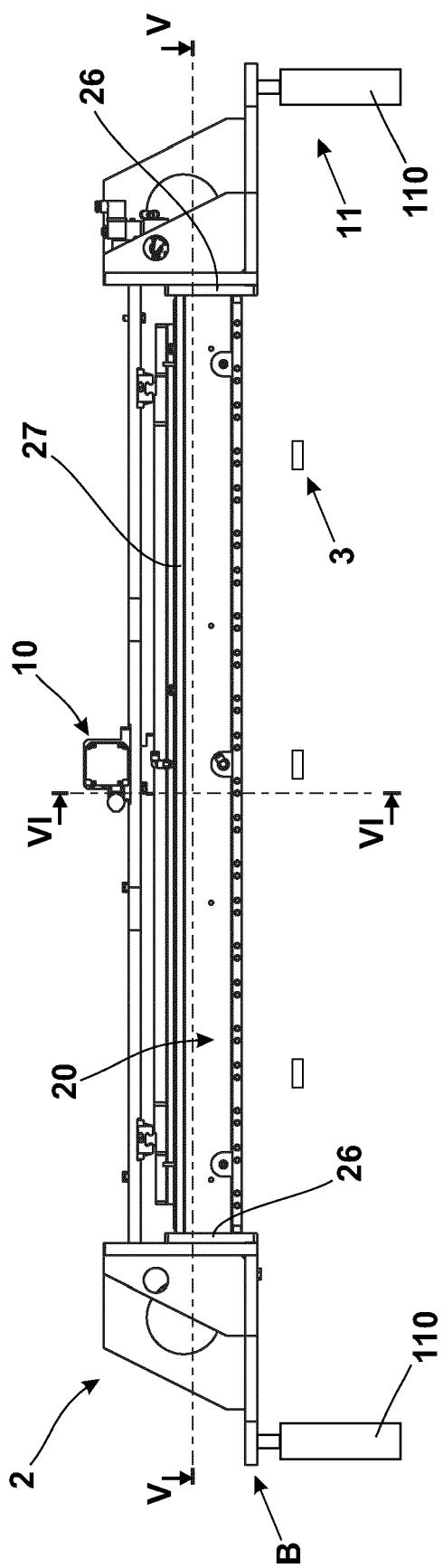


FIG. 4

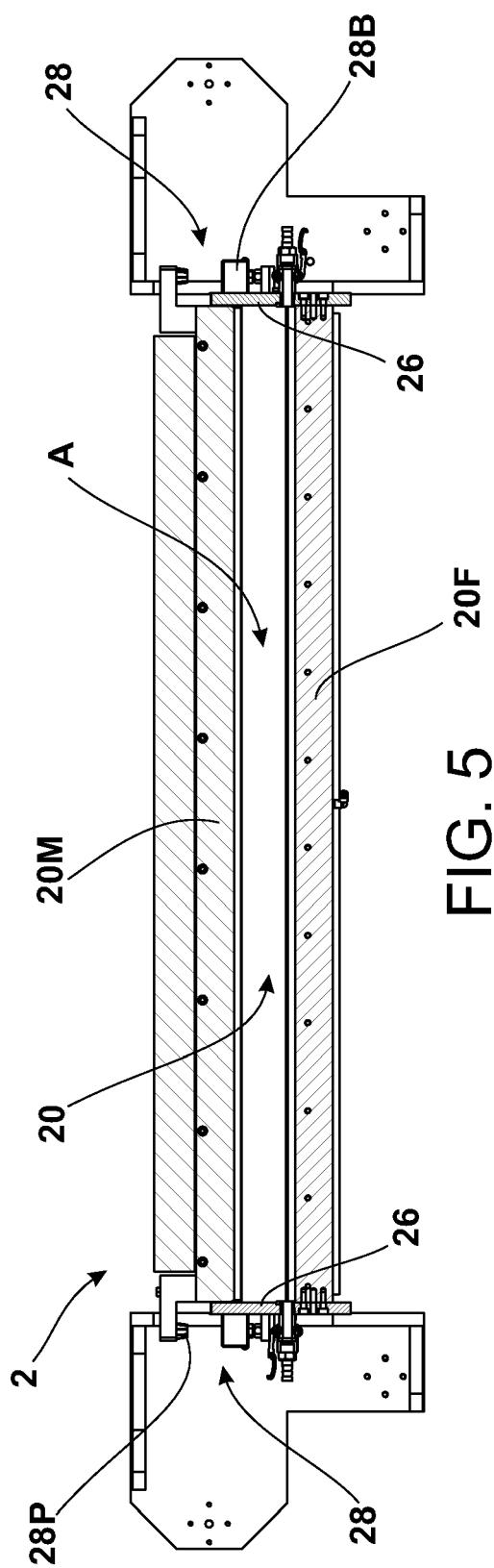
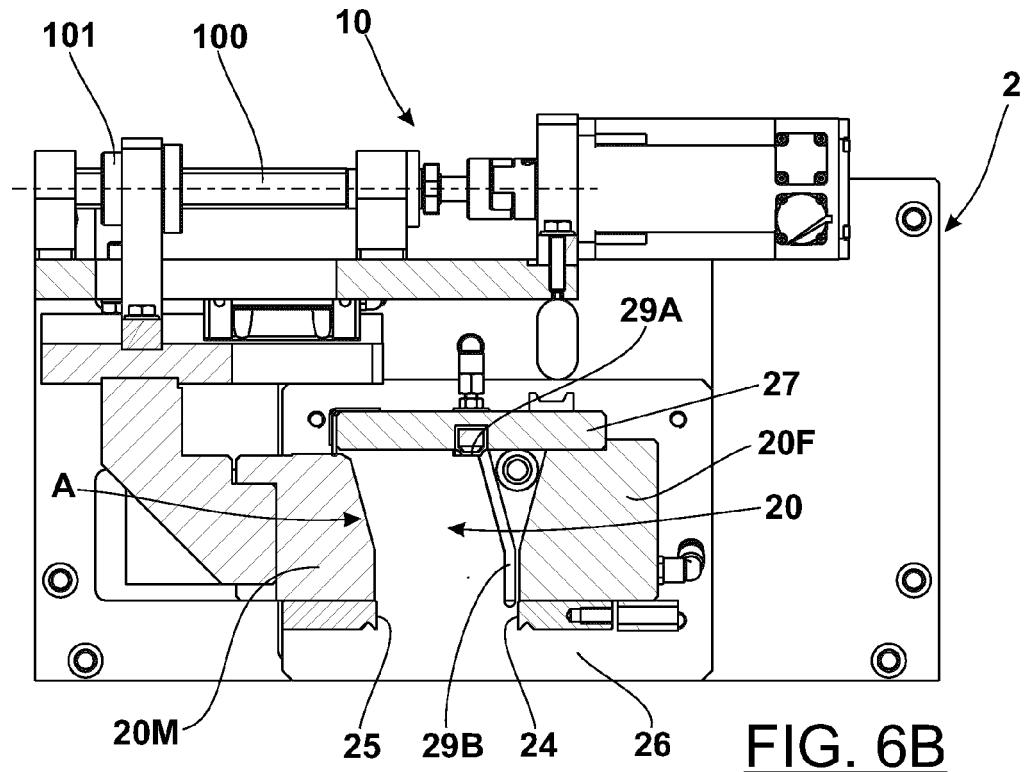
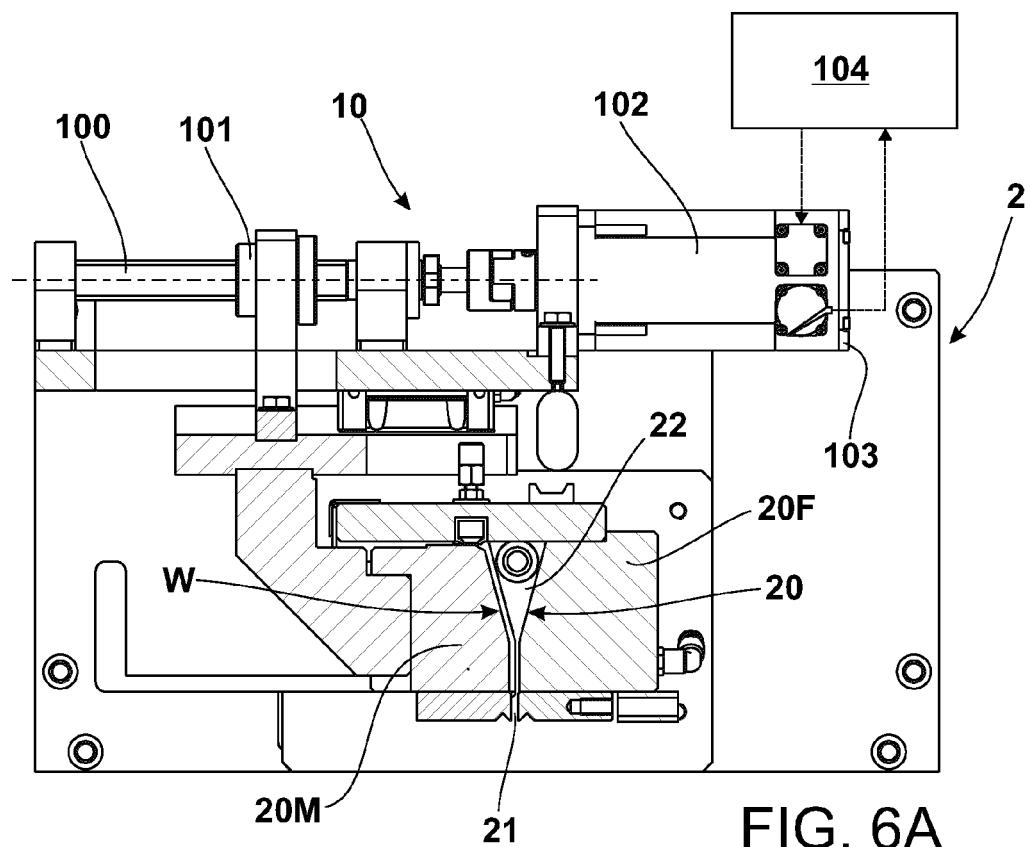
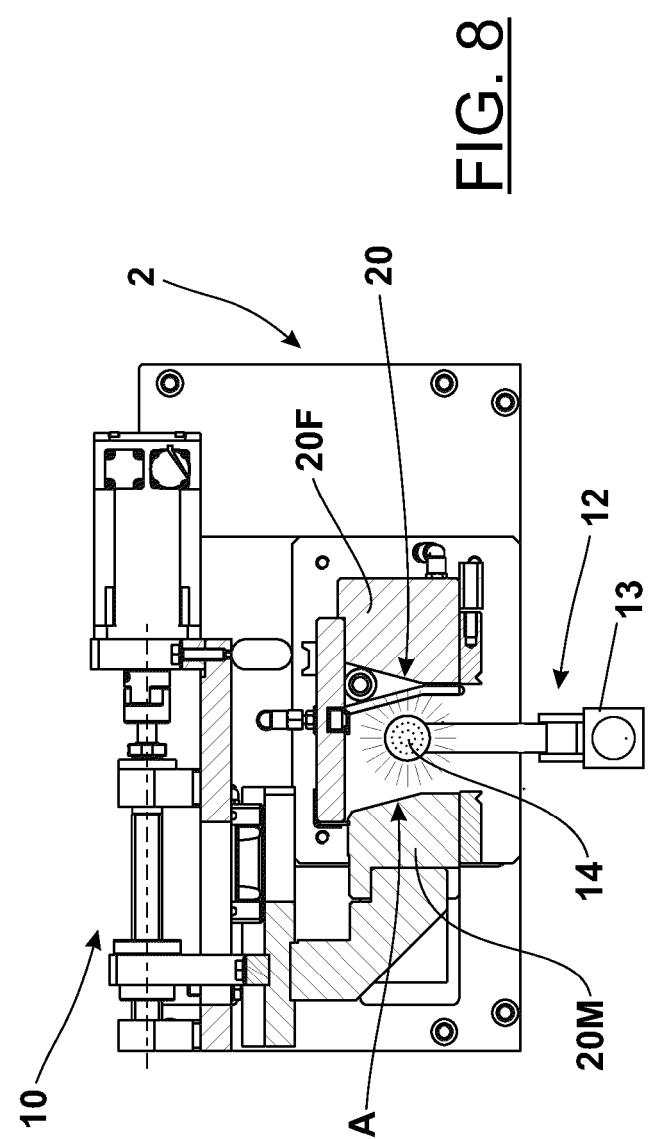
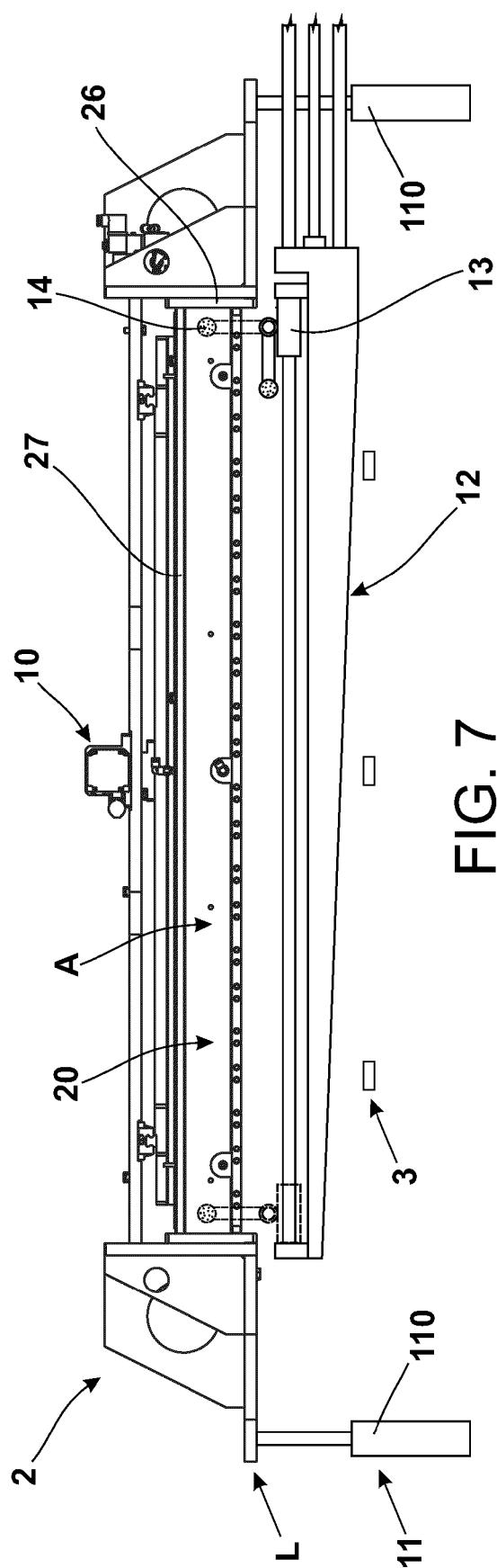


FIG. 5







EUROPEAN SEARCH REPORT

Application Number

EP 22 02 0217

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
10	X DE 10 2015 119818 A1 (VIE SYSTEMS GMBH [AT]) 18 May 2017 (2017-05-18)	1, 3-8	INV. B05C5/00
15	A * paragraph [0025] - paragraph [0027]; figure 2 * * paragraph [0028] *	2, 9-14	B05B15/525 B05B15/555 B28B11/04
20	A IT MO20 060 009 A1 (SIGHINOLFI PAOLO) 14 July 2007 (2007-07-14) * page 18 - page 19 * * figure 3 *	1-14	
25	A US 4 557 217 A (ZINGG HANSKONRAD [CH]) 10 December 1985 (1985-12-10) * column 3, line 11 - line 31 * * figure 1 *	1-14	
30			TECHNICAL FIELDS SEARCHED (IPC)
35			B05C B05B B29C B28B
40			
45			
50	The present search report has been drawn up for all claims		
55	Place of search The Hague	Date of completion of the search 10 October 2022	Examiner Roldán Abalos, Jaime
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
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EP 22 02 0217

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-10-2022

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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