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(54) Title: EJECTION ASSEMBLY FOR PRESSES FOR CERAMIC PRODUCTS

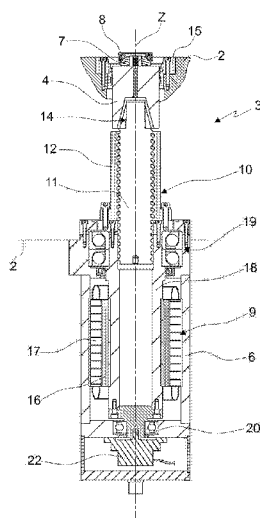


FIG. 4

(57) Abstract: An assembly (1) for ejecting a mould of a press for making a ceramic product, for example a ceramic tile and the like, comprises plurality of jacks (3) fixed to a plate (2) of the mould; each jack (3) has a stem (4) that thrusts on a movable part of the mould intended for ejecting the ceramic product after it has been made inside the mould; for moving the stem (4), each jack (3) comprises a motor (9) that is autonomous and independent from the motors (9) of the other jacks (3) and a transducer of the stem (4) position that provides a signal of the stem (4) position; the transducers are connected to a control unit (13) which provides, on the basis of the signals received from the transducers, the power supply to the motor (9) of each jack (3), controlling that the stem (4) of each jack (3) is moved in a completely independent manner in terms of position, peak speed, displacement dynamics, acceleration ramps and intervention times.

SITI – B&T GROUP S.p.A.

Description of the Industrial Invention Patent having as title:

“EJECTION ASSEMBLY FOR PRESSES FOR CERAMIC PRODUCTS”

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5 Veronese

TECHNICAL FIELD OF THE INVENTION

The present invention refers to an ejection assembly for presses intended for obtaining ceramic products, e.g. tiles and the like.

STATE OF THE PRIOR ART

10 Presses are known for making ceramic products, in particular tiles, provided with one or more forming seats, each delimited between two opposite portions, i.e. a mould, lower in use, and a punch, upper in use.

As is known, at the end of the process of forming a ceramic product, which is not the subject of the present invention, a step is provided for removing or
15 ejecting the product thus obtained, which is sent to the subsequent processing steps.

For such purpose, the mould of a press for making ceramic products of conventional type comprises a portion that is fixed in use, rigidly constrained to a fixed portion of the press, in which a plurality of seats are obtained for
20 housing the jacks with fluid-dynamic actuation, and a portion that is movable in use, which serves for ejecting the ceramic product made inside the mould.

Generally, such ejection assemblies of fluid-dynamic type comprise four single- or double-acting jacks, on one side anchored to the portion of the mould that is fixed in use and on the other side connected to a movable plate thereof.

25 Once such jacks are actuated, by means of a suitable fluid-dynamic actuation system, they move the plate of the mould between a first work position, where the forming of the ceramic product occurs, and a second work position, where the plate is lifted and the formed ceramic product is ejected in order to be sent to the subsequent processing steps.

30 In order to lift the plate of the mould without jamming, such plate maintained

horizontal, fluid-dynamic jacks are provided uniformly arranged with respect to the surface of the plate, e.g. in zones adjacent to the four vertices in the case of a rectangular mould, and must be actuated in a manner such that they are moved substantially simultaneously with respect to each other and with equivalent displacements.

It is difficult to obtain the simultaneous movement, with equivalent displacements, of the jacks of the ejection assemblies with fluid-dynamic actuation.

For example, if one jack encounters greater resistance than the other jacks, the aforesaid jack remains behind with respect to the others and the ejection plate being tilted could jam, since it is not uniformly thrust.

In order to solve these problems, devices have been proposed for correcting the actuation of the jacks, which, on one hand, are not always able to completely correct the time displacement and movement displacement between the jacks and, on the other hand, make the system for actuating the jacks more complicated and delicate.

For example, correction devices have been proposed that, by detecting the actual position of the movable portion of the mould via two position transducers, actuate the four fluid-dynamic jacks by means of two proportional valves, in a manner so as to obtain displacement speeds and amounts of the movable portion according to what was set.

These devices, by making use of proportional valves, are rather delicate and sensitive to the impurities that can be present in the actuation fluid.

The difficulty in controlling the actuation of the jacks of the mould is even more accentuated in the case of large-size moulds, for example provided for making tiles having at least one of the sides of one meter or greater.

In certain cases, for example with large-size tiles, but not only, there may be a non-uniformity or asymmetry of distribution of the soft soil in the mould, and thus it may be necessary to compensate for the conduct variations of the carriage for loading soil in the mould, deriving from aging, wear or different

characteristics of the soils used.

OBJECTS OF THE INVENTION

Thus, the main object of the present invention is to improve the state of the art relative to the ejection assemblies of the presses for making ceramic products.

5 Another object of the present invention is to provide an ejection assembly for presses for making ceramic products that allows lifting/lowering the mould ejection plate in a precise and controlled manner.

Still another object of the present invention is to provide an ejection assembly for presses for making ceramic products that can compensate for the non-
10 uniformities or asymmetries of distribution of the soil in the mould with different displacements for each jack that constitutes the ejection assembly itself.

A further object of the present invention is to provide an ejection assembly for presses for making ceramic products which avoids the abovementioned
15 drawbacks of the ejection assemblies of fluid-dynamic type.

Still another object of the present invention is to provide an ejection assembly for presses for making ceramic products which is easy to make and at competitive costs.

Not least object of the present invention is to provide a kit for converting an
20 ejection assembly of conventional type into an ejection assembly according to the present invention.

According to one aspect of the present invention, an ejection assembly for presses is provided for making ceramic products according to claim 1.

The dependent claims refer to preferred and advantageous embodiments of the
25 invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the present invention will be clearer from the detailed description of a preferred but not exclusive embodiment of an ejection assembly for presses for making ceramic products, illustrated as a non-
30 limiting example in the set of drawings in which:

figure 1 is a top schematic view of a mould part for a press for making ceramic products provided with an ejection assembly according to the present invention;

figure 2 shows a cross section view of the mould of Fig. 1 taken along the section line II-II in which two ejection assemblies according to the present invention are illustrated;

figure 3 illustrates a cross section view of the mould of Fig. 1 taken along the section line III-III in which two ejection assemblies according to the present invention are illustrated;

figure 4 is a section view in enlarged scale of a jack of the ejection assembly according to the present invention; and

figure 5 shows a longitudinal section view, not in scale, of a variant of the jack of the ejection assembly according to the present invention.

EMBODIMENTS OF THE INVENTION

With reference in particular to figures 1-3, an assembly for ejecting a mould of a press (not illustrated) for making ceramic products, such as tiles and the like, according to the present invention is indicated overall with the reference number 1.

The ejection assembly 1 comprises a fixed portion (fixed in use) of the mould that is fixed in use, namely a fixed plate 2 in which four jacks 3 are inserted, equally distributed over the surface of the mould.

It must be observed that, as will be clearer from the characteristics of the present invention, there can be any number of jacks 3, and in particular there could even be more than four jacks 3 of the ejection assembly 1 according to the present invention.

For the following discussion, reference will be made to an embodiment of an ejection assembly with four jacks 3; nevertheless, this must not be considered as a limitation.

Each jack 3 is housed in the plate 2 of the mould in a respective seat 5 (figures 2 and 3), and essentially comprises a fixed portion, specifically a cylinder 6

provided for being fixed in the seat 5, and a portion that is movable in use, i.e. stem 4 that axially moves along a longitudinal axis Z, in an entirely analogous manner to a fluid-dynamic actuator of conventional type.

5 The stem 4 is connected by means of connection means 7, 8 to a part of the mould that is movable in use on which it exerts a thrust, such movable part being intended for ejecting the ceramic product that is made inside the mould; for greater clarity in the illustration of the present invention, the aforesaid movable part is not shown in the figures.

10 More in detail, see figure 4, the stem 4 of the jack 3 is connected, as stated above, to the movable part of the mould by means of connection means which comprise a ball joint, i.e. a spherical cap 7 and a ring 8 with spherical seat complementary to the corresponding spherical portion of the cap 7.

15 Such ball joint 7, 8 thus allows a certain adaptation between the stem 4 and the movable part of the mould (not illustrated), also in the case of an imperfect correspondence between the surfaces of the aforesaid elements.

According to one version of the present invention, the size of the jack 3 allow the interchangeability with the normal fluid-dynamic actuators currently used in the ejection assemblies of conventional type; for this reason, the ejection assembly 1 can also constitute a kit for converting a conventional ejection
20 assembly into an ejection assembly according to the present invention.

According to the embodiment illustrated in the figures, in each jack 3, the respective stem 4 is moved along the axis Z by means of motor means that are autonomous and independent from the other jacks 3, and more particularly the stem 4 is translated by means of motor means 9 of rotary and reversible type
25 coupled to a mechanical motion conversion device 10 which transforms the rotary motion of the motor means 9 into a translating motion of the stem 4.

According to the version illustrated in figure 4, the mechanical conversion device can comprise a screw 11 and nut 12 assembly of the type used for transmitting an established force, for example: a recirculating ball screw or a
30 roller screw, or a screw-nut assembly in which the screw has a generating

profile having a rectangular or trapezoidal rectangular section.

Due to a suitable selection of the average angle of the screw helix, it is possible to obtain a substantially irreversible motion of the screw 11 which is therefore only actuated by the rotation of the nut 12, and an opposite or retrograde
5 movement is not possible, i.e. by axially thrusting the screw 11 it is not possible to rotate the nut 12.

In figure 4, it can also be observed that the screw 11 is connected to the stem 4 by means of fastening means 14, for example an interference connection as illustrated in figure 4, thus preventing the screw 11 from being rotated by the
10 nut 12.

Indeed, it must be noted that the stem 4, to which the screw 11 is fixed, has an oval section and is inserted in a corresponding flange 15 with oval sliding seat (for the oval shape, see figure 1).

Consequently, the stem 4 cannot rotate and it also prevents the undesired
15 rotation of the same screw 11.

In order to prevent the rotation of the screw 11, the stem 4 can also have a different shape in section, or other anti-rotation devices (not illustrated) can be provided.

It must be noted that of course the rotation screw 11 must be prevented so that
20 the rotation of the nut 12 can be transformed into a translating displacement along the axis Z of the screw 11 itself.

Alternatively, other devices of mechanical type can be used for converting rotary motion into translating motion, such as a rack and pinion mechanism (not illustrated).

25 As another alternative, other devices of fluid-dynamic type can also be used for converting rotary motion into translating motion, e.g. by coupling motor means to a reversible fluid-dynamic volumetric pump in turn connected to a respective single hydraulic jack.

It must in fact be noted that, according to the present invention, it is important
30 to make the motion of the stem 4 of each jack 3 independent and controllable

via feedback, in a manner so as to ensure that all the stems 4 are moved simultaneously and with amounts equivalent to each other.

This objective is obtained by powering each jack 3 with autonomous and independent motor means 9, which in the specific case comprise an electric motor.

The aforesaid motor means 9 are in turn connected to the device 10 for converting the rotary motion into translating motion of the stem 4.

By means of position transducers (not illustrated), with which each jack 3 is provided, it is possible to control the displacement amount, and possibly also the displacement speed of the stem 4 of each jack 3, obtaining, according to modes explained more in detail hereinbelow, the abovementioned simultaneous and equivalent movement of the stems 4 of all the jacks 3 that constitute the ejection assembly 1.

According to one version of the present invention, the motor means 9 also comprise the position transducer, through which it is possible to indirectly obtain a signal relative to the displacement, and possibly to the speed, of the stem 4.

The motor means 9 can therefore comprise a position transducer, and possible speed transducer, that is for example an encoder 22 (illustrated for example in figure 4 connected in any suitable manner to a flange 26 of connection of the motor means 9), which allows indirectly obtaining the amount of movement and speed of the stem 4.

According to still another version of the present invention, the jack 3 comprises a position transducer (not illustrated), and possibly speed transducer, directly connected to the stem 4.

Optionally, the ejection assembly according to the present invention comprises braking means 23, of any suitable type; according to one version of the present invention, the aforesaid braking means are of automatic type, i.e. they are automatically activated when the motor means are stopped.

The braking means 23 are coupled to the motor means 9, for example between

the motor means 9 and the position transducer device 22 (see in particular figure 5). Such braking means 23 are provided housed in a respective housing chamber 24 delimited by a containment sleeve 25, and in use are set to maintain, locked in position, the motor means 9 when they are situated in a rest position, i.e. when they do not move the device 10 for converting rotary motion into translating motion of the stem 4. The braking means 23 are provided mounted around the flange 26 of connection of the motor means 9. Schematically illustrated in figure 1 is a control unit 13 that receives in inlet, from each jack 3, the signal relative to the actual displacement amount attained, and possibly also a signal relative to the actual displacement speed, from each stem 4, such signal coming from the abovementioned transducer present in each jack 3.

It must be noted that with regard to the signal of the displacement speed of each stem 4, this signal can come directly from the relative transducer present in each jack 3, or it can be obtained from the control unit 13 by deriving it from the current displacement signal of each stem 4 compared with the elapsed tempo.

The control unit 13 provides for suitably power supplying the motor means 9 of each jack 3 on the basis of the signals received by the transducers, controlling that for each of the stems 4, the movement occurs according to predetermined displacement amounts and speeds.

Generally, by means of the control unit 13 the stem 4 of each jack 3 is capable of being moved in a completely independent manner in terms of position, peak speed, displacement dynamics, acceleration ramps and intervention times according to predetermined actuation modes.

All these quantities are managed by the control unit 13 on each stem 4, in a manner such that the overall movement is synchronous and uniform overall.

For example, if it is desired to ensure that the plate of the mould is maintained substantially horizontal during lifting, then the stems 4 are actuated with displacement amounts that are equivalent to each other and simultaneously, i.e.

with equivalent displacement speeds.

According to another version of the present invention, the stems 4 are actuated in a manner so as to compensate for the conduct variations of the carriage for loading soil in the mould; such conduct variations for example deriving from
5 aging, wear or different characteristics of the soils used.

Due to the possibility of independently actuating each stem 4 of the jack 3, the control unit 13 can coordinate the displacement and speed of each stem 4 with the carriage for loading the soft soil in the mould.

If non-uniformity or asymmetry of distribution of the soft soil in the mould is
10 encountered, or defects in the tile are encountered after the pressing, the control unit 13 can modify the displacement and speed of each stem 4 in a manner so as to correct such defects and reduce the production waste.

With reference in particular to figure 4, the jack 3 as stated above comprises a cylinder 6 which at its interior encloses an actuation device that serves to
15 impart a translating motion to the stem 4 along the axis Z.

The cylinder 6 is fixed to the plate 2 by means of, for example, a flanged connection with screws 21 (figures 2 and 3).

It must be noted that, according to one version of the present invention, the size and type of connection are obtained in a manner so as to make the jack 3
20 completely interchangeable with the fluid-dynamic actuators of the ejection assemblies of conventional type with fluid-dynamic actuation.

The actuation device comprises a screw 11 connected to the stem 4 and a nut 12 connected to the motor means 9, which by rotating the nut 12 cause a translation along the axis Z of the screw 11 itself.

25 The motor means can be of any type, and in particular it can comprise an electric motor 9 with alternating current or direct current, with brushes or without brushes.

In any case, the electric motor 9 must be reversible in order to allow the screw 11 and the stem 4 to translate along the axis Z in both directions, i.e. exiting for
30 the ejection phase and returning for a subsequent ceramic product production

phase.

According to a non-illustrated version of the present invention, the motor means 9 can also be of another type, e.g. of fluid-dynamic type.

In the version of figure 4, the electric motor 9 comprises permanent magnets 16 and stator windings 17; the permanent magnets 16 are fixed to a rotatable sleeve 18 which is in turn connected to the nut 12.

The entire jack 3 assembly according to the present invention is very compact, since the screw 11 in the return movement comes to be at least partly inside the rotatable sleeve 18 and the motor 9 is of hollow type, being arranged around the sleeve 18.

According to another version of the present invention, not illustrated in the figures, the sleeve 18 is connected to the nut 12 by means of a gear reducer, for example a planetary gear reducer, in a manner so as to increase the drive torque for rotating the nut 12, if that available from the electric motor 9 with a direct connection to the nut 12 was not sufficient.

The sleeve 18 is rotatably mounted on a first support 19, axially fixed and placed in proximity to the screw 11 - nut 12 coupling, and a second support 20 in this case of axially slidable type in order to compensate for the expansion of the sleeve 18 due to the possible heating thereof.

The first support 19 can for example comprise a pair of opposite oblique ball bearings, and the second support 20 can for example comprise a single ball bearing, fixed in a slidable manner.

The above-described ejection assembly for presses is susceptible of numerous modifications and variants within the protective scope of the following claims.

Hence, for example, the nut 12 can be made directly in the sleeve 18, and it is also possible to provide, always as an example, that the permanent magnets 16 of the motor are incorporated in the sleeve 18 itself.

CLAIMS

1. Assembly (1) for ejecting a mould of a press for making a ceramic product, in particular a ceramic tile and the like, said ejection assembly (1) comprising a fixed plate (2), in use, a plurality of jacks (3), each jack (3) comprising a fixed cylinder (6) and a stem (4) movable along a longitudinal axis (Z), said cylinder (6) being housed in a respective seat (5) of said fixed plate (2), said stem (4) being connected through connecting means (7, 8) to a movable part, in use, of the mould on which it exerts a thrust, such movable part of the mould being intended for ejecting the ceramic product after it has been made inside the mould, **characterised in that** in said ejection assembly (1) each jack (3) comprises motor means (9) adapted to translate their respective stem (4), said motor means (9) being autonomous and independent from the motor means (9) of the other jacks (3), a transducer of the stem (4) position adapted to provide a signal of the stem (4) position **and in that** said ejection assembly (1) comprises a control unit (13) receiving the position signal of each stem (4) and in response to said signal it provides for supplying motor means (9) of each jack (3) controlling that the stem (4) of each jack (3) moves in a completely independent way in terms of position, peak speed, displacement dynamics, acceleration ramps and intervention times according to predetermined activation modes.
2. Ejection assembly according to claim 1, wherein said control unit (13) activates stems (4) with displacement amounts equal to one another and simultaneous, i.e. with equal displacement speeds, so as to ensure that the mould plate is kept substantially horizontal while being lifted.
3. Ejection assembly according to claim 1, wherein said control unit (13) activates each stem (4) in an independent way with different displacements and speeds, in a coordinated way with the carriage for loading soft soil in the mould for obtaining, after pressing, a product having even characteristics, or in order to correct any fault in the product after pressing.
4. Ejection assembly according to any one of the previous claims,

wherein said jack (3) comprises motor means (9) of the rotary and reversible type coupled with a mechanical motion converting device (10) transforming the rotary motion of the motor means (9) into a translating motion of the stem (4).

5 5. Ejection assembly according to any one of the previous claims, wherein said jack (3) comprises an electric motor (9) of the reversible type.

6. Ejection assembly according to claim 4 or 5, wherein said motion converting device (10) comprises a screw (11) and nut (12) assembly of the type used for transmitting a force, for example a recirculating ball screw or a
10 roller screw, or a screw-nut assembly wherein the screw has a generating profile having a rectangular or trapezoidal cross section.

7. Ejection assembly according to claim 6, wherein said stem (4) comprises an anti-rotation device and it is connected to said screw (11) through fastening means (14), thus preventing the undesired rotation of said
15 screw (11).

8. Ejection assembly according to claim 7, wherein said anti-rotation device is obtained making said stem (4) with an oval section and inserting it in a corresponding flange (15) with oval sliding seat, thus preventing an undesired rotation of the stem (4) and of said screw (11) connected thereto.

20 9. Ejection assembly according to any one of claims from 5 to 8, wherein said electric motor (9) is of the hollow type.

10. Ejection assembly according to any one of claims from 5 to 9, wherein said electric motor (9) comprises permanent magnets (16), said permanent magnets (16) being connected to said nut (12).

25 11. Ejection assembly according to any one of claims from 5 to 10, wherein said electric motor (9) comprises stator windings (17), said stator windings (17) being connected to said cylinder (6).

12. Ejection assembly according to claim 10 or 11, when this latter depends on claim 10, wherein said permanent magnets (16) are connected to
30 said nut (12) through a rotatable hollow sleeve (18) pivotably supported by

two supports (19, 20).

13. Ejection assembly according to any one of the previous claims, wherein said transducer of the stem (4) position comprises an encoder (22).

14. Ejection assembly according to any one of the claims from 1 to 13,
5 comprising at least braking means (23) of automatic type, coupled to said motor means (9).

15. Kit for converting a traditional ejection assembly, comprising an ejection assembly (1) according to any one of claims from 1 to 14.

16. Mould for press for making ceramic products, such as ceramic tiles
10 and the like, comprising an ejection assembly (1) according to any one of claims from 1 to 14.

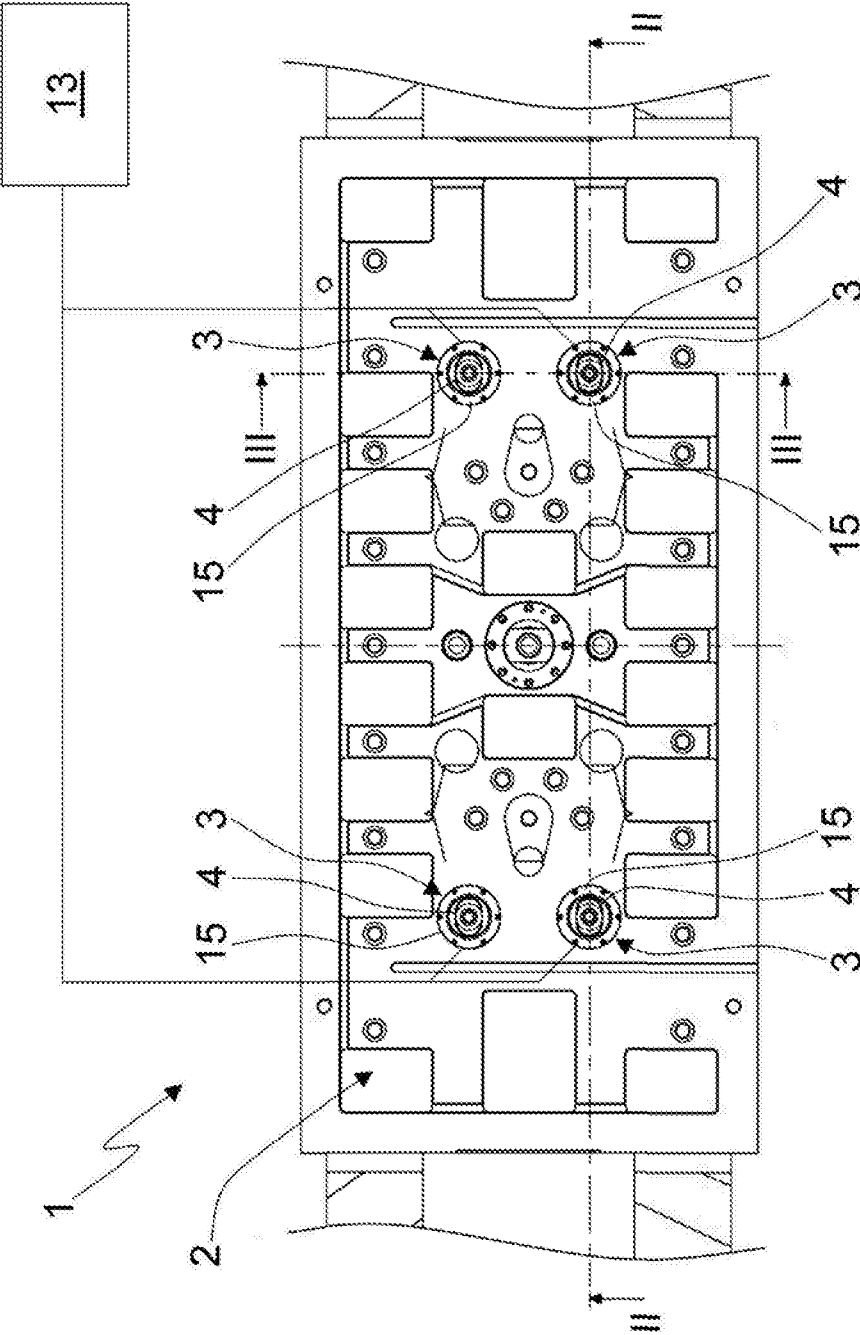


FIG. 1

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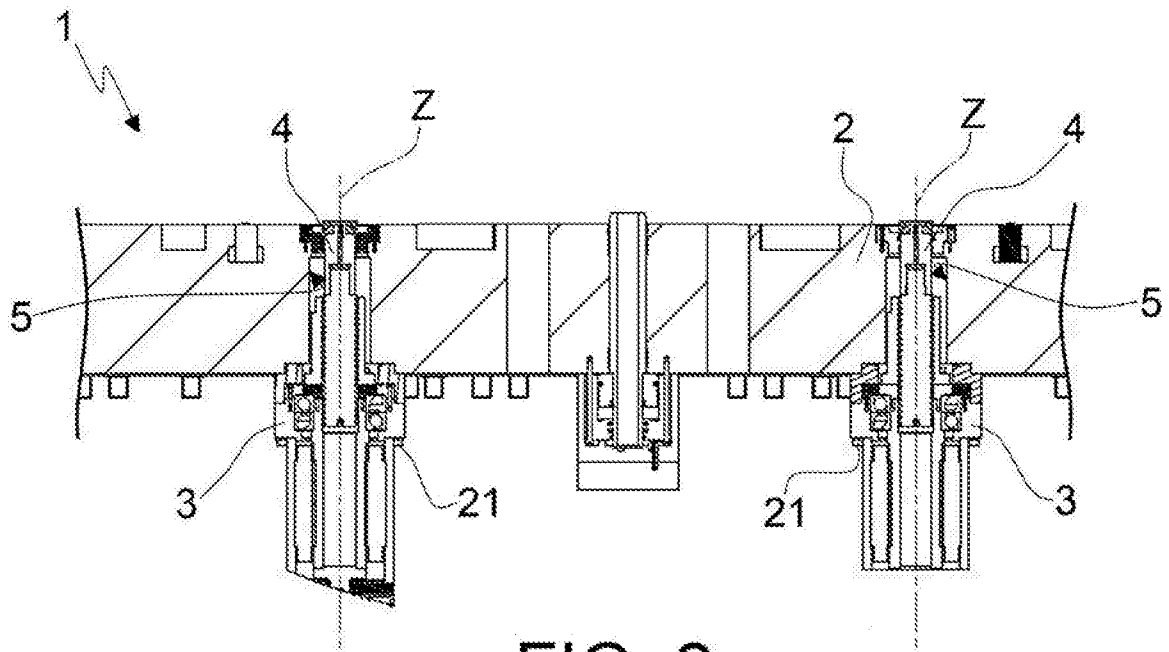


FIG. 2

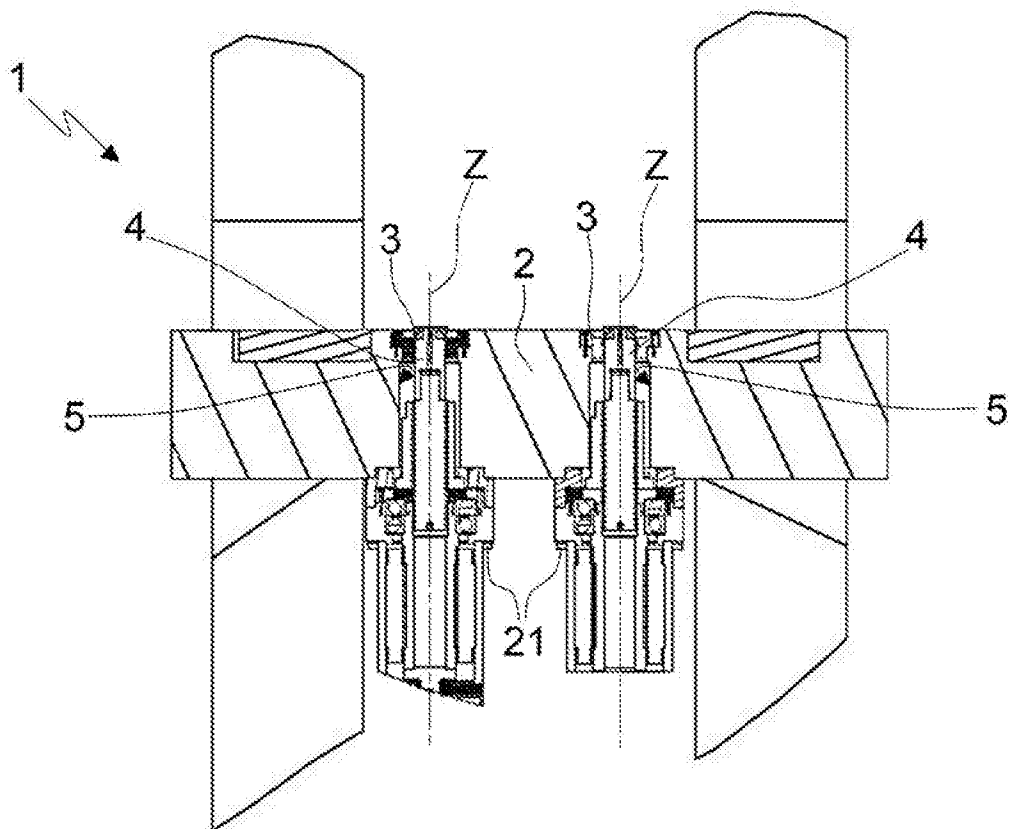


FIG. 3

3/4

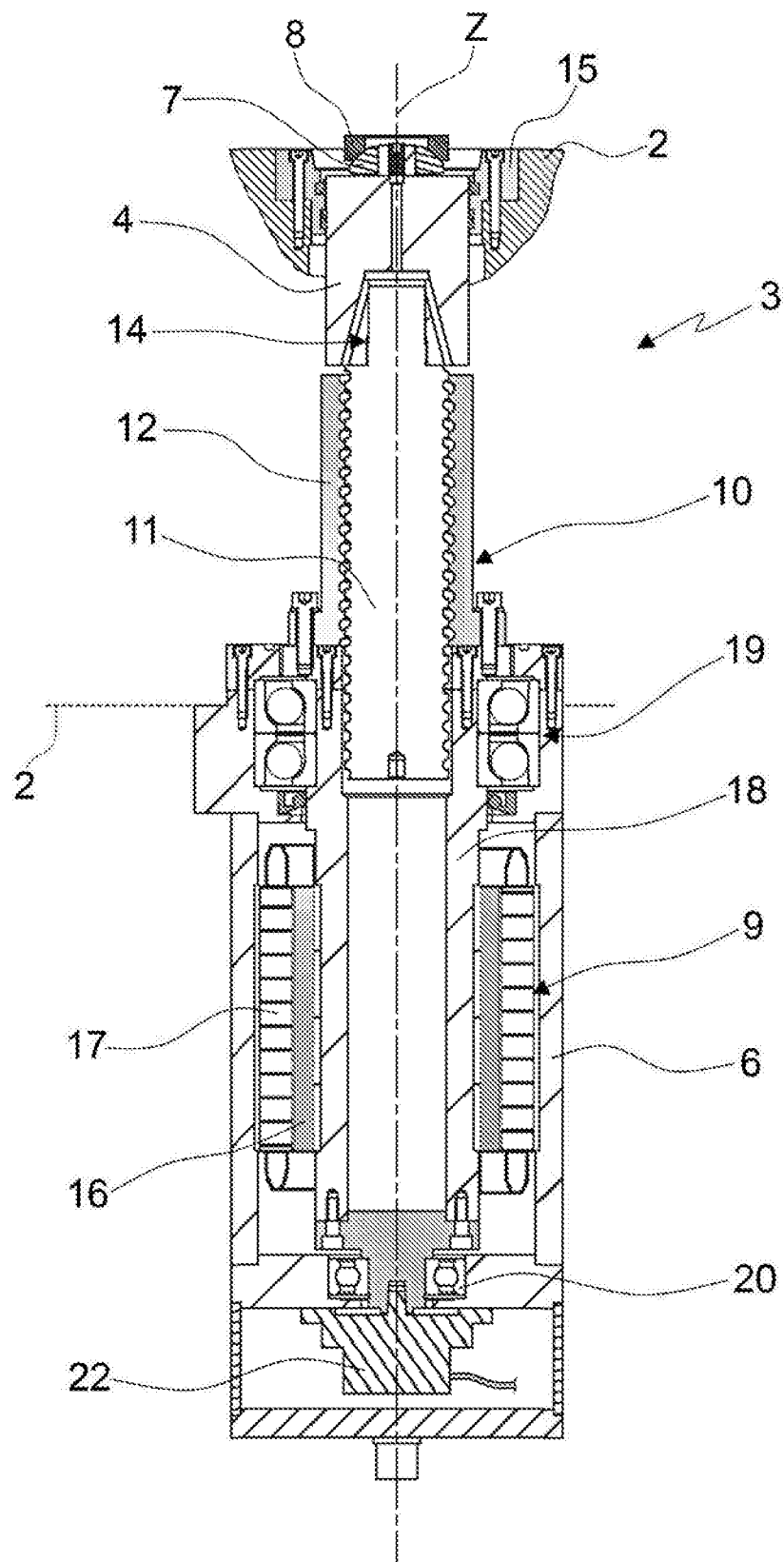


FIG. 4

4/4

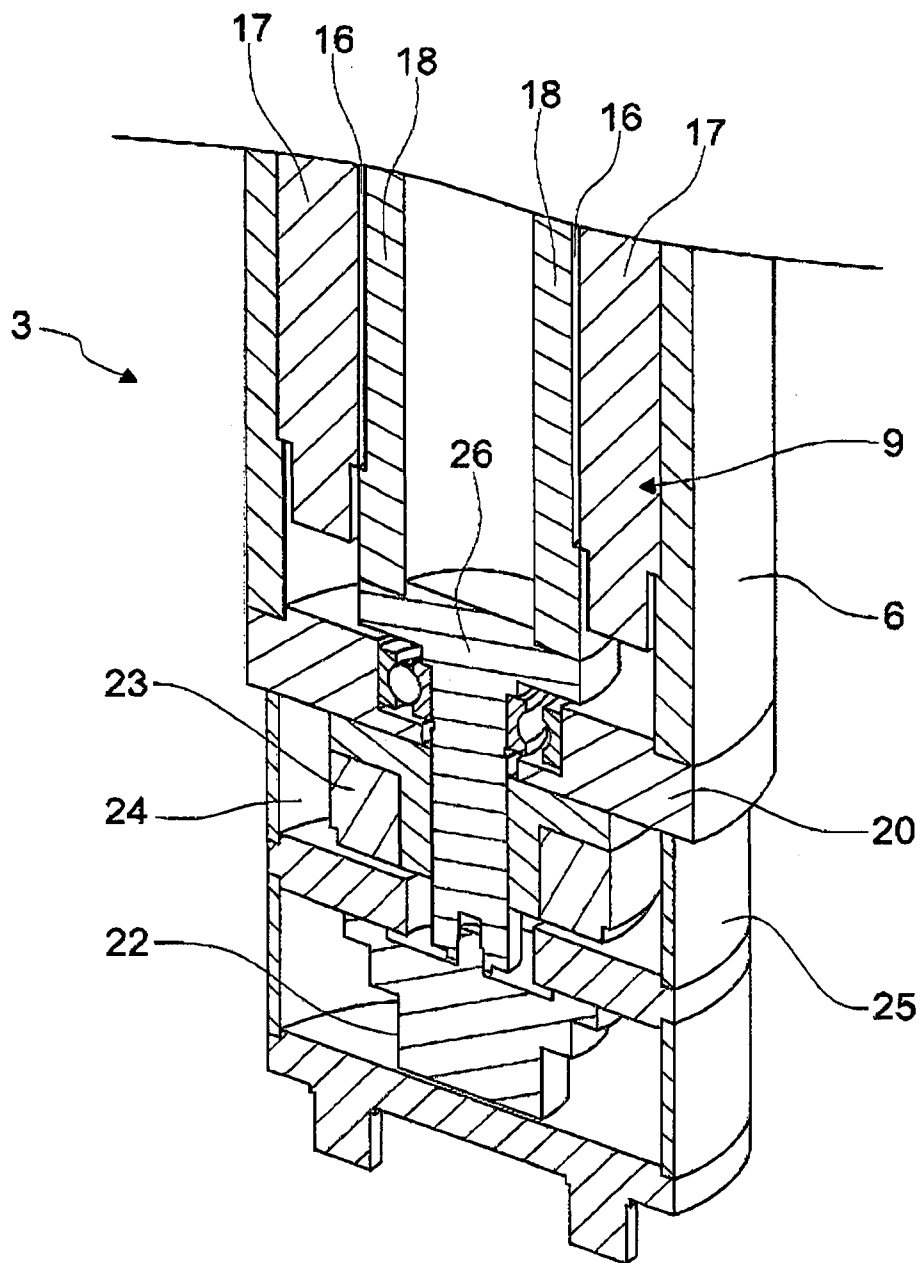


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/052140

A. CLASSIFICATION OF SUBJECT MATTER
INV. B28B7/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B28B B30B B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99/58311 A1 (VELCRO IND [NL]; BUZZELL KEITH G [US]; DOWD CLINTON [US]) 18 November 1999 (1999-11-18) In the embodiment of Fig. 5, a series of small individual actuators 60 are pneumatically or hydraulically driven to independently move rows 26,28, 30,32. The individual actuators 60 are set to push rows 26,28,30,32 of ejector pins 24 through mold surface 34 in a progressive sequence to eject molded product 4.; page 11, line 34 - page 12, line 4; figures 1a,1b,5 ----- -/--	1,15,16



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search

7 July 2015

Date of mailing of the international search report

31/08/2015

Name and mailing address of the ISA/

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Boone, John

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/052140

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2012/129614 A1 (BONTE INTERNATIONAL BV MET BEPERKTE AANSPRAKELIJKHEID DE [BE]; BLOMMAE) 4 October 2012 (2012-10-04) no transducer To this end the valves 8 are, for example, affixed to a vertically movable rod 13 that can be moved in a vertical guide, not shown in the drawings, whereby the valve for example is held in the retracted position by a spring or similar .; page 8, paragraphs 2,5 -----	1,15,16
A	US 6 533 972 B1 (STIRN ANDREW K [US]) 18 March 2003 (2003-03-18) Numeral 56 = ejectors; paragraph [0025] - paragraph [0026]; claims 1-5 -----	1,15,16
A	JP H05 245883 A (NIPPON DENSO CO) 24 September 1993 (1993-09-24) abstract; figure 1 -----	1
A	US 5 376 315 A (FRICKE OBED M [US]) 27 December 1994 (1994-12-27) Independent jacks, no transducer; column 4, line 14 - line 36; claims 1,4; figures 2,9,10,12 -----	1
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