



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.07.2022 Bulletin 2022/30

(21) Application number: **21153065.4**

(22) Date of filing: **22.01.2021**

(51) International Patent Classification (IPC):
B28B 1/087 ^(2006.01) **B28B 3/20** ^(2006.01)
B28B 7/00 ^(2006.01) **B28B 7/46** ^(2006.01)
B28B 3/04 ^(2006.01) **B28B 3/02** ^(2006.01)

(52) Cooperative Patent Classification (CPC):
B28B 1/087; B28B 3/028; B28B 3/04;
B28B 7/0097; B28B 7/46

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **G.M.F. S.R.L.**
50066 Reggello (IT)

(72) Inventor: **Pierattini, Piera**
52026 Pian di Scò (IT)

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.
Viale Europa Unità, 171
33100 Udine (IT)

(54) **MACHINE FORMING CEMENT ARTEFACTS, AND CORRESPONDING FORMING MOLD AND METHOD**

(57) A machine (1) for forming cement artefacts (M) for covering and/or flooring comprises at least one press (2), provided with a frame (3) which comprises an under-frame (5) and a turret (4) which is above the under-frame (5); at least a lower mold (26) which defines at least one concave matrix (25) to contain at least one layer of a mixture suitable to form the artefacts (M), supported by the under-frame (5) and having a bottom (24) and perimeter walls (29) in relief with respect to the bottom (24) and mobile with respect to the latter; and at least an upper mold (7) which is mobile with alternating motion toward or away from the matrix (25).

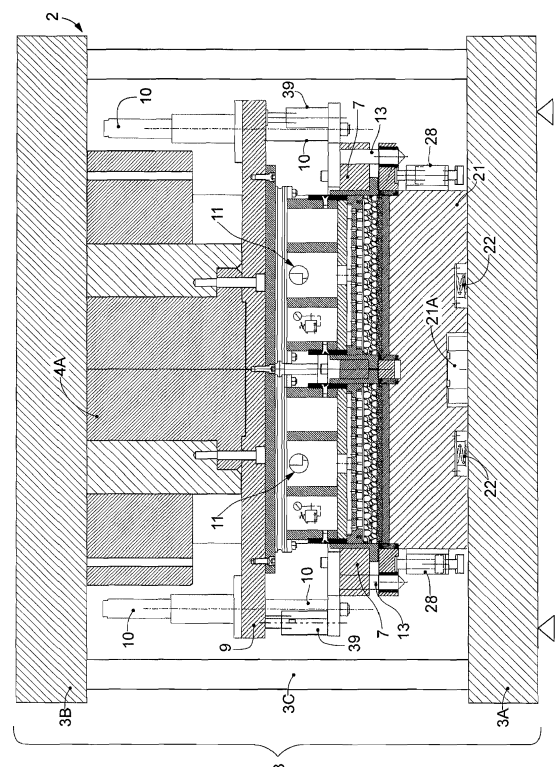


fig. 3

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a machine for forming cement artefacts for covering and/or flooring, generally usable to make cement artefacts suitable to create the covered surfaces of walls and floors. The present invention also concerns a mold and a method for forming said artefacts.

BACKGROUND OF THE INVENTION

[0002] Plants are known which are typically used to form products for covering surfaces, typically in the form of tiles.

[0003] The tiles are made with cement-based mixes that are obtained by mixing water and cement or cement compounds, and inert materials, which, after mixing, are subjected to a pressing step inside molds in order to form the tiles.

[0004] The mixes used to form the tiles can be of two types, namely a wet mix, or a dry mix.

[0005] In turn, a wet mix can be single-layer or double-layer, that is formed by a single layer of wet mix, or by a layer of wet mix and a layer of dry mix, while a dry mix can also be single-layer, that is formed by a single layer of dry mix, or double layer, that is formed by two layers of dry mixes which are superimposed on each other inside the forming matrix.

[0006] Typically, these known plants generally comprise a press, an apparatus to feed materials into the matrices of the press and an extractor unit to extract the formed tiles.

[0007] As is known, a press for making tiles typically comprises a base on which one or more concave matrices are supported and an upper part on top of the base and which supports a pressing cylinder which drives the punch unit intended to couple in a mating manner with the matrices, forming so-called fresh tiles, that is tiles to be subjected to subsequent seasoning.

[0008] As previously said, the mix is loaded into the matrices that have pre-selectable perimeters and depths as needed, in order to form the tiles.

[0009] After forming, the tiles are extracted from their respective matrices and taken away by pick-up and transport devices to further processing and finishing stations.

[0010] From the European patent EP-B1-2.737.984, property of the present Applicant, a method and a machine for the production of tiles are known, in which the binder material is cement, hereinafter referred to in short as cement tiles.

[0011] According to this patent, the method for the production of cement tiles provides to start from a cement mix and to move the mix in a direction of movement, in order to position it under a forming unit which acts in a vertical forming direction.

[0012] Subsequently, the method provides to form at

least one cement tile and to extract it from the forming unit according to a direction of extraction.

[0013] According to the teachings of this patent, the direction of movement of the mix and the direction of extraction lie on staggered, different and overlapping planes, so that the movement of the mix and the movement of extraction do not interfere with each other and the movement and extraction steps can be performed simultaneously, significantly reducing production cycle times and making the production of the cement tiles significantly cheaper.

[0014] However, the state of the art in this specific sector has some disadvantages.

[0015] One of the disadvantages is that the depth of the matrices is fixed and, therefore, in order to be able to produce cement tiles that have variable thicknesses according to the necessities of use, it is necessary to completely replace the matrices of the presses for each specific intended use of the tiles.

[0016] Another disadvantage is that the mix used for forming the tiles contains a quantity of water which, during the forming step, that is, in other words, during the pressing of the mix into the matrices, has to be eliminated.

[0017] Known presses are all equipped with systems for discharging the excess water, however, the strong pressure exerted by the punch on the mix present inside the matrices causes leakages of water containing cement even in areas of the press where mechanical members are located which are not protected from this disadvantage and which, consequently, are subject to continuous abrasion and washout during the forming cycles and to damage over time.

[0018] In document US-A-2002/0109265 a process and an apparatus for producing molded articles are described. The apparatus substantially has a lower matrix, or mold, and one or more upper pressing punches and therefore has no upper counter-matrix intended to accommodate the articles during the forming step.

[0019] Other known pressing processes and apparatuses which substantially comprise molds cooperating with punches, or elements similar to punches, are also described in documents FR-A-2690105, IT-A-MC20110067, CN-A-107186864, DE-C-180475 and US-A-4158533, all without an upper counter-matrix able to define an integral part of the forming cavity of these apparatuses.

[0020] There is therefore a need to provide a machine for forming artefacts for covering and/or flooring that can overcome at least one of the disadvantages of the state of the art.

[0021] One purpose of the invention is to provide a machine for forming artefacts for covering and/or flooring that is equipped with means to press and form the artefacts in an effective and precise manner, in particular thanks to the presence of at least one matrix and at least one counter-matrix which, in the forming process, define at least one forming cavity.

[0022] Another purpose of the present invention is to

provide a machine for forming artefacts for covering and/or flooring that allows to regulate the depth of the matrices of a forming machine in a simple and rapid manner, without having to resort to replacing the matrices themselves, in such a way as to be able to form artefacts with different thicknesses, while maintaining the perimeter sizes unchanged.

[0023] Another purpose of the present invention is to provide a machine for forming artefacts for covering and/or flooring that completely prevents, or at least significantly reduces, any leakage of water toward members of the forming machine which could be damaged by such leakages.

[0024] Another purpose of the present invention is to provide a machine for forming artefacts for covering and/or flooring that allows to make the production cycle of cement tiles more economical.

[0025] The Applicant has studied, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0026] The present invention is set forth and characterized in the independent claims.

The dependent claims describe other characteristics of the present invention or variants to the main inventive idea.

[0027] In accordance with the above purposes, there is provided a machine for forming cement artefacts according to claim 1 attached, as well as a mold and a method to form cement artefacts according to claims 10 and 12 attached.

[0028] In particular, the upper mold comprises at least one concave counter-matrix specular to the at least one concave matrix, so that the matrix and the counter-matrix form at least one forming cavity configured to house the artefact while it is being formed and from which the artefact is subsequently expelled.

[0029] In one version, two or more concave matrices and as many concave counter-matrices are provided. According to some example embodiment, three or four concave matrices and as many counter-matrices can be provided.

[0030] According to one aspect of the present invention, the perimeter walls as above are mobile with respect to the bottom in a direction perpendicular to the bottom itself and parallel to the direction of movement of the upper mold, which drives the perimeter walls in motion.

[0031] According to another characteristic aspect of the present invention, adjustment means are provided associated with the lower mold to adjust the travel of the perimeter walls with respect to the bottom, so as to adjust the height of the matrix/matrices and therefore the quantity of mixture received therein.

[0032] According to some embodiments described here, sealing means are provided associated with the

perimeter walls in correspondence with their opposite upper and lower ends in order to hermetically seal the inside of the matrix when the upper mold is coupled to the lower mold in the forming position.

[0033] In accordance with some embodiments of the present invention, the upper mold comprises guide means configured to guide the movement of the upper mold away from and toward the lower mold, so as to center the molds with respect to each other. In one particular embodiment, the guide means are configured as centering pins intended to be received, according to a sliding coupling, in respective through apertures provided on the lower mold.

[0034] One advantage of the forming machine and mold according to the present invention is therefore that they are equipped with at least one matrix and at least one counter-matrix which form a forming cavity, so that the artefact produced is expelled from the forming cavity. Forming by means of a matrix and counter-matrix proves to be more precise and effective than forming by means of a matrix and punches or elements similar to punches, as described in known systems.

[0035] A further advantage of the forming machine and mold according to the present invention is that of being very flexible, since it allows to change the internal volume of the matrix quickly and easily, so as to be able to form artefacts having a desired thickness. This is made possible by the fact that the perimeter walls of the matrix are mobile with respect to the bottom of the matrix itself, and that it is possible to easily adjust the extent of their travel thanks to the presence of the adjustment means.

[0036] Another advantage of the forming machine and mold according to the present invention is to prevent unwanted leaks of water from the matrix, possibly mixed with other components of the mixture in a solid or soft state, such as aggregates or cement, during the forming step. This is possible thanks to the presence of sealing means associated with the perimeter walls, which allow to hermetically isolate the inside of the matrix, thus preventing the parts of the press adjacent to the mold from being dirtied and damaged.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] These and other aspects, characteristics and advantages of the present invention will become apparent from the following description of some embodiments, given as a non-restrictive example with reference to the attached drawings wherein:

- figs. from 1A to 1C are schematic plan views of some steps of the functioning of a first embodiment of a machine for forming artefacts for covering and/or flooring according to the invention, in an operating forming step;
- fig. 1D is a schematic section view of the machine for forming artefacts as in figs. 1A-1C, in which there can be seen a step of moving formed artefacts away

and of positioning a lower mold of the machine for forming artefacts for covering and/or flooring according to the invention in a press which is part of the machine;

- fig. 2A is a schematic plan view of a forming step of a second embodiment of a machine for forming artefacts for covering and/or flooring according to the invention;
- fig. 2B is a schematic plan view of a step of moving formed artefacts away and of loading a lower mold of the machine for forming artefacts for covering and/or flooring of figure 2A;
- fig. 3 is a schematic and simplified cross-section view of a press which is part of the machine according to the present invention, shown in a pressing step for the formation of artefacts;
- fig. 4 is a cross-section view of the press of fig. 3, where further details, not shown in fig. 3, are also shown;
- fig. 4A is a view, on a highly enlarged scale, of a portion of the press of figure 4;
- fig. 4B is an enlarged view of a detail of figure 4A in a first embodiment;
- fig. 4C is an enlarged view of a detail of figure 4A in a second embodiment;
- fig. 4D is an enlarged view of a detail of figure 4A in a third embodiment;
- fig. 5 is a cross-section view of the press of fig. 4, shown in a step of extracting formed artefacts;
- fig. 6 is an enlarged scale view of a left half-portion of the press of Figure 4;
- fig. 6A is a partial and enlarged view of the press of figure 6;
- fig. 7 is an enlarged scale view of the left half-portion of the press of figure 5;
- fig. 7A is a partial and enlarged view of the press of Figure 7;
- fig. 8 is a view, on a further enlarged scale, of a detail of the left half-portion of the press of Figure 3;
- fig. 9 is a view, on a further enlarged scale, of a detail of the left half-portion of the press of Figure 5.

[0038] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings.

[0039] It is understood that elements and characteristics of one embodiment can conveniently be incorporated into other embodiments without further clarifications.

DETAILED DESCRIPTION OF SOME EMBODIMENTS

[0040] We will now refer in detail to the various embodiments of the invention, of which one or more examples are shown in the attached drawings.

[0041] Each example is supplied by way of illustration of the invention and shall not be understood as a limitation thereof.

[0042] For example, the characteristics shown or de-

scribed insomuch as they are part of one embodiment of the machine according to the invention can be adopted on, or in association with, other embodiments of the components to produce another embodiment of the machine.

[0043] It is understood that the present invention shall include all such modifications and variants.

[0044] Before describing these embodiments, we must also clarify that the present description is not limited in its application to details of the construction and disposition of the components as described in the following description using the attached drawings.

[0045] The present description can provide other embodiments and can be obtained or executed in various other ways.

[0046] We must also clarify that the phraseology and terminology used here is for the purposes of description only, and cannot be considered as limitative.

[0047] Some embodiments described using the attached drawings concern a machine for forming artefacts M for covering and/or flooring, indicated as a whole with reference number 1 in the attached drawings.

[0048] With reference to fig. 3, the machine 1 comprises at least one press 2 which comprises a frame 3 formed by a base 3A, an upper crosspiece 3B and a series of uprights 3C for connection between the upper crosspiece 3B and the base 3A.

[0049] The upper crosspiece 3B supports a turret 4 under which an under-frame 5 can be positioned which is supported by the base 3A and which is mobile with respect to the turret 4, driven by drive means 6. The under-frame 5 and turret 4 define units each comprising a plurality of components, as schematically indicated by the brackets in figs. 4, 5, 6A and 7A.

[0050] In detail, the turret 4 supports an upper mold 7 which, in the preferred version of the invention, comprises a forming buffer 7A which forms two concave counter-matrices 8 disposed symmetrically with respect to a central trace symmetry plane Y and with the concavities facing toward the under-frame 5. However, a single counter-matrix 8 could also be provided.

[0051] The turret 4 also supports an actuator cylinder 4A, that is the cylinder that usually determines the action of pressing the press 2 and forming the tiles.

[0052] This cylinder 4A supports and drives with a vertical reciprocating motion a horizontal crosspiece 9 which in the external zone is equipped with passage apertures in which vertical guide columns 10 can slide parallel to each other.

[0053] The crosspiece 9 is also associated with suction means 11 which are in communication with the inside of the counter-matrices 8 through a plurality of channels 12 provided in the forming buffer 7A.

[0054] The lower ends of the columns 10 are also attached to the upper mold 7 which, as previously mentioned, are intended to slide inside the passage apertures of the horizontal crosspiece 9 in order to guide the upper mold 7 when, in determinate forming steps described below, it is raised or lowered with respect to the counter-

matrices 8.

[0055] The upper mold 7 is also equipped at the ends facing outward with guide means, in the form of respective centering pins 13, the specific function of which will be described below.

[0056] The under-frame 5, as mentioned, is mobile with respect to the turret 4, driven with reciprocating motion by the drive means 6 and moves between a forming position and a loading position of the cement material in order to form the tiles in the matrices, and vice versa.

[0057] The movement of the under-frame 5 can be rectilinear or even circular, according to the embodiment of the machine 1 according to the invention.

[0058] This under-frame 5 comprises a reference platform 14 which on the lower face 14A is equipped with sliding blocks 15 which couple in a sliding manner with respective prismatic guides 16 which are attached on the base 3A of the frame 3 of the press 2.

[0059] On the lower face 14A of the platform 14 there is attached a motor unit 20 from which two motorized semi-axes 19 exit bilaterally, each of which carries a toothed wheel 18 keyed to the respective end opposite the end facing toward the motor unit 20, the toothed wheel 18 engaging in a corresponding rack 17 which is supported on the frame 3, parallel to the other rack.

[0060] Briefly, the platform 14, and therefore the entire under-frame 5, moves on the prismatic guides 16 driven by the motor unit 20 and by means of the mechanical engagements between the motorized toothed wheels 18 and the racks 17.

[0061] The platform 14 supports on its upper face 14B a vibrating box 21, with the interposition of elastic means, typically a plurality of helical springs 22, and which is connected to a vibrating unit 21A.

[0062] In turn, two bottoms 24 are attached at the upper part to the vibrating box 21 which if necessary can be equipped with structured coatings 23.

[0063] The two bottoms 24 are part of two concave matrices 25 which are specular to the counter-matrices 8 and which are obtained in a lower mold 26 which is part of the lower under-frame 5. As an alternative to this description, a single concave matrix 25 could also be provided.

[0064] This concave matrix 25 is specular to the concave counter-matrix 8, so that the matrix 25 and the counter-matrix 8 form at least one forming cavity, and so that the artefact M produced is expelled from the forming cavity.

[0065] The lower mold 26 is equipped on the external edges with through apertures in which bushings 27 are inserted, which are substantially aligned with the centering pins 13 and which are intended to receive the centering pins 13 inside them with a sliding coupling, during some steps of the functioning of the invention, as will be indicated below, in order to maintain a precise vertical alignment between the matrices 25 and the counter-matrices 8.

[0066] The bushings 27 and the centering pins 13 form

means for guiding the upper mold 7 with respect to the lower mold 26.

[0067] As can be seen from the drawings, the lower mold 26 is mobile in a vertical direction with respect to the platform 14, so that in determinate functioning positions of the machine according to the invention, the lower mold 26 can move with respect to the bottoms 24 of the matrices 25, typically downward, compressing the helical springs 22 until the vibrating box 21 rests on the base 3A. In particular, the lower mold 26 is thrust downward by the upper mold 7, which in turn moves downward together with the crosspiece 9.

[0068] With particular reference to Figures from 4A to 4D, 5A, 6A, 7 and 8, it can be seen that the matrices 25, in addition to the bottoms 24, usually comprise perimeter walls 29 which are attached to the lower mold 26 and, consequently, are integrally mobile with it.

[0069] With reference to Figures from 4A to 4D and 7 and 8, it can be seen that the perimeter walls 29 are equipped at the upper and lower ends with sealing means, typically elastic packings indicated respectively with 30 and 31.

[0070] According to alternative embodiments of the perimeter walls 29, the elastic packings 31 can be associated with recesses 32 which are made on the upper edges of the vibrating box 21 (fig. 4C) or can be associated in the proximity of the lower edges of ring nuts 33 which form the lateral walls of the counter-matrices 8 (fig. 4D). In one particular embodiment, shown in fig. 4C, the elastic packings comprise an annular packing 31A, for example in the form of an O-ring, received in a special seating, made in the bottom 24, in particular on a lateral face of the latter facing toward the perimeter walls 29.

[0071] Between the lower mold 26 and the platform 14 there are interposed means for adjusting the depth of the matrices 25.

[0072] In a preferred embodiment, these adjustment means are preferably made in the form of fluid-dynamic cylinders 28, which are attached on the vibrating box 21 and which have the respective rods 28A made through in the respective liners.

[0073] In particular, it can be seen in figures 4A that the heads of the rods 28A, indicated with 28B, are engaged with the lower surface of the lower mold 7 while the opposite bases 28C are free.

[0074] Between the bases 28C and the liners of each cylinder 28, shimming rings 28D can be inserted which allow to adjust, limiting it as desired, the upward travel of the rods 28A which, consequently, move the lower mold 26 and the walls 29 with respect to the bottoms 24 by a selectable height.

[0075] In other words, thanks to the fluid-dynamic cylinders 28 it is therefore possible to adjust the height of the perimeter walls 29 with respect to the bottoms 24, and therefore the volumetric capacities of the matrices 25, that is the final thickness of the artefacts M to be formed.

[0076] In other embodiments, the adjustment means

can comprise, instead of the fluid-dynamic cylinders 28, one or more shimming elements, of a type known in the state of the art and not shown, suitable to increase the height of the perimeter walls 29 or of the bottoms 24. For the person of skill in the art the mode of connection of these shimming elements with the perimeter walls 29 or the bottoms 24 is quite evident, according to modes known in the state of the art which allow the shimming elements to remain firmly constrained to the perimeter walls 29 or to the bottoms 24 respectively, during the normal functioning of the machine.

[0077] It should be noted that a hermetic seal is established between the vibrating box 21 and the packings 31 when the press 2 performs the step of forming artefacts M, as can be seen in Figures from 4A to 4D and 7.

[0078] The same condition of hermetic seal also occurs in the contact between the packings 30 and the upper mold 7, specifically with the ring nut 33, when the upper mold 7 presses on the lower mold 26 in the forming step.

[0079] The machine 1 according to the invention also comprises means 34 to pick up and transport formed tiles indicated with M, in order to move them away from the press 2, according to a distancing plane.

[0080] These pick-up and transport means 34 can comprise a sort of shovel 35 which has a laminar support plane which can be inserted between the upper mold 7 and the lower mold 26 when these are open, after the press 2 has completed the forming step, as shown in Figures 5, 7, 7A and 9.

[0081] The formed artefacts M are released onto the plane of the shovel 35, which is typically horizontal, thanks to the upward lifting, in a vertical direction, of the upper mold 7, which thus frees the artefacts M just formed. If the suction means 11 are provided, these have to be deactivated before or at the same time as the upper mold 7 is lifted, except for artefacts of large sizes compared to the thickness.

[0082] We wish to emphasize that the loading means, that is, the plane of the shovel 35, and the means to load the material into the matrices 25 preferably lie on vertically offset and overlapping planes, so that the steps of depositing the formed artefacts M onto the plane of the shovel 35 and the positioning of the lower mold 26 under the upper mold 7 can occur simultaneously without interfering with the movement, significantly shortening the production cycle times.

[0083] Finally, the machine 1 according to the invention also comprises a station 36 to load the mixture used to form the artefacts M inside the concave matrices 25.

[0084] The functioning of the machine 1 according to the present invention is described below.

[0085] In the first embodiment, at the beginning of the cycle of forming the press 2, the upper mold 7 is lifted by the actuator cylinder 4A and the lower mold 26 is located in the loading station 36 where the concave matrices 25 are loaded with the material in the loose state with which the artefacts M have to be formed.

[0086] When the concave matrices 25 are filled, the

vibrating box 21 is driven which, with the elastic vibrations generated by the vibrator 21A, on the one hand provides to uniformly distribute the material loaded into the concave matrices 25, and on the other hand, when the artefacts M, that is, the tiles to be formed, are of the double-layer type, provides to make the water present in the mixture rise to its surface.

[0087] After completing the vibration step, the platform 14 moves on the prismatic guides 16, moving from the loading station 36 under the turret 4, in order to position the concave matrices 25 under the counter-matrices 8 of the upper mold 7 and in vertical correspondence therewith.

[0088] The press 2 then begins the forming step and the actuator cylinder 4A acts on the crosspiece 9, lowering it progressively and bringing the matrices 25 and the counter-matrices 8 closer to each other.

[0089] The movement of the crosspiece 9 is guided by the same actuator cylinder 4A while the centering between the upper mold 7 and the lower mold 26 is achieved with the centering pins 13 which are progressively introduced into the corresponding bushings 27.

[0090] In order to complete the forming step, the upper mold 7 descends further, thrust by the crosspiece 9 and rests on the lower mold 26 which progressively lowers, compression loading the helical springs 22 until resting on the base 3A of the frame 3.

[0091] The position of the rods 28A of the actuators 28 determines the height of the walls 29 of the concave matrices 25 and, therefore, their volume capacity.

[0092] Therefore, the position of the rods 28A, and therefore of the walls 29 with respect to the bottoms 24, is previously determined before the under-frame 5 is positioned under the loading station 36.

[0093] We should emphasize that, since the forming of the artefacts M generally occurs upside down, that is, with the visible faces facing toward the bottoms 24 of the concave matrices 25, it is possible to provide to position respective structured coatings 23 on the bottoms 24, prior to loading the materials into the loading station 36, these structured coatings 23 being able to imprint, in relief or bas relief, adornments or useful shapes on the faces of the artefacts M that will be visible, such as, for example, anti-slip reliefs.

[0094] When the downward travel of the crosspiece 9 is completed, the artefacts M will have formed between the bottoms 24 of the concave matrices 25 and the counter-matrices 8.

[0095] We should emphasize that, during the step of lowering the upper mold 7 onto the lower mold 26, the perimeter walls 29 follow the lowering movement of the lower mold 26 with respect to the bottoms 24 which instead remain fixed.

[0096] In the event that the articles formed are of the single-layer type, the suction means 11 are activated which extract the surface water from the matrices 25, eliminating it.

[0097] Furthermore, the suction action of the suction

means 11 is also used to lift and hold the formed artefacts M in the counter-matrices 8 when these have large sizes compared to the thickness.

[0098] The actuator cylinder 4A then recalls the cross-piece 9 upward and with it the upper mold 7 which holds the newly formed artefacts M inside the counter-matrices 8.

[0099] The shovel 35 is introduced into the space defined between the upper mold 7 and the lower mold 26, moving underneath the counter-matrices 8, while, in a substantially simultaneous manner, the under-frame 5, that is the platform 14 and all the components connected thereto, once again moves on the guides 16, driven by the motor unit 20 and by the toothed wheels 18 which are engaged in the racks 17 attached on the lower face 14A of the platform 14, and once again is taken in correspondence with the loading station 36 (Figure 1B).

[0100] This simultaneous, or substantially simultaneous, movement can take place thanks to the fact that the shovel 35 and the lower mold 26, which is carried by the platform 14, move on planes that are vertically offset with respect to each other, to be precise, the shovel 35 moves on a higher plane than the plane on which the lower mold 26 with the whole under-frame 5 moves.

[0101] When the shovel 35 is positioned under the counter-matrices 8, the cylinders 39 are activated lifting the upper mold 7 toward the crosspiece 9 and, consequently, also the ring nuts 33 which move upward with respect to the tops of the counter-matrices 8 which, on the other hand, remain fixed.

[0102] If driven previously, the suction means 11 are also deactivated and the formed artefacts M fall onto the shovel 35 which, withdrawing as shown in Figure 1C, sends them toward other work stations.

[0103] In detail, it should also be noted that in the step of forming the artefacts M the sealing packings 30 and 31 interposed between the upper and lower ends of the walls 29, the upper mold 7 and the vibrating box 21 prevent leakages of water which contains cement generated by the strong pressure exerted by the actuator cylinder 4A.

[0104] The hermetic seal is in fact produced between the ring nuts 33, the packing 30 and between the packing 31 and the vibrating box 21.

[0105] In the second version of the invention, the functioning is as follows: two platforms 14 with corresponding concave matrices 25 are associated with a rotating central body 38, disposed resting on suitable mechanical means that allow it to roll, for example configured as a fifth wheel, or as a plurality of rolling bearings or suchlike.

[0106] The rotating central body alternately takes one of the platforms 14 to the forming position in the press 2, while at the same time the other is located in correspondence with the loading station 36.

[0107] The shovel 35 can pick up the artefacts M formed by the press 2 during the alternation of positioning between the two platforms 14.

[0108] It is clear that modifications and/or additions of

parts may be made to the machine for forming artefacts for covering and/or flooring as described heretofore, without departing from the field and scope of the present invention as defined by the claims.

[0109] Furthermore, any shapes and sizes can be used, according to requirements, without departing from the field and scope of protection of the following claims.

[0110] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of a machine for forming artefacts for covering and/or flooring, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

[0111] In the following claims, the sole purpose of the references in brackets is to facilitate reading and they must not be considered as restrictive factors with regard to the field of protection claimed in the specific claims.

Claims

1. Machine for forming cement artefacts (M) for covering and/or flooring starting from a mixture suitable to form said artefacts (M) which includes at least one press (2), said press (2) comprising:

- a frame (3) which comprises a turret (4) which is above an under-frame (5) mobile with respect to said turret (4) between a position where the mixture is loaded and a forming position;
- at least a lower mold (26) which defines at least one concave matrix (25) to contain at least one layer of the mixture, supported by said under-frame (5) and comprising a bottom (24) and perimeter walls (29) in relief with respect to said bottom (24);
- at least an upper mold (7) which is supported by said turret (4) so as to be mobile with alternating motion toward or away from said at least one matrix (25) between a position where the artefact (M) is formed, in which said upper mold (7) is coupled to said lower mold (26), and a position where the formed artefact (M) is extracted, in which said upper mold (7) is decoupled from said lower mold (26);

wherein said perimeter walls (29) of said at least one matrix (25) are mobile with respect to said bottom (24) in a direction perpendicular to said bottom (24) and parallel to the direction of movement of said upper mold (7), wherein said perimeter walls (29) are moved, in particular downward, by said upper mold (7) so that said mixture is gradually released from said lower mold (26) to said upper mold (7) and is pressed in order to form the artefact (M), said machine being **characterized in that** said upper mold (7) comprises at least one concave counter-

matrix (8) specular to said at least one concave matrix (25), so that said matrix (25) and said concave counter-matrix (8) form at least one forming cavity configured to house the artefact (M) while it is being formed and from which the artefact (M) is subsequently expelled.

2. Machine as in claim 1, **characterized in that** said counter-matrix (8) is provided with suction means (11) and is configured to suck and expel the material, wherein said suction means (11) remain activated during said expulsion.
3. Machine as in claim 1, **characterized in that** it comprises sealing means (30, 31) associated with said perimeter walls (29) in correspondence with their opposite upper and lower ends to hermetically seal the inside of said matrix (25) when said upper mold (7) is coupled to said lower mold (26) in said forming position.
4. Machine as in claim 1, 2 or 3, **characterized in that** said under-frame (5) comprises a vibrating box (21) on which said at least one matrix (25) is disposed, and also comprises vibrating means (21A) configured to drive in vibration said vibrating box (21).
5. Machine as in claim 4, **characterized in that** said vibrating box (21) is supported by elastic means (22) interposed between said under-frame (5) and said vibrating box (21).
6. Machine as in any claim hereinbefore, **characterized in that** it comprises adjustment means (28) associated with said lower mold (26) to adjust the position of said perimeter walls (29) with respect to said bottom (24) so as to adjust the height of said at least one matrix (25) and therefore the quantity of mixture loaded therein.
7. Machine as in claim 6, **characterized in that** said adjustment means comprise one or more fluid-dynamic cylinders (28) interposed between said lower mold (26) and said vibrating box (21) and having respective rods provided with a travel that is adjustable with adjustment means; or **in that** said adjustment means comprises one or more shimming elements that are suitable to increase the height of said perimeter walls (29) or of said bottom (24).
8. Machine as in claim 2, **characterized in that** said suction means (11) are communicating with said at least one counter-matrix (8).
9. Machine as in any claim hereinbefore, **characterized in that** said upper mold (7) comprises centering means (13) configured to collimate, with respect to each other, said upper mold (7) and said lower mold

(26) so as to center the molds (7, 26) with respect to each other, wherein said centering means are configured as centering pins (13) intended to be received, according to a sliding coupling, in respective through apertures provided with bushings (27) provided in said lower mold (26).

10. Machine as in any claim hereinbefore, **characterized in that** it also comprises means (34) to pick up and transport formed artefacts (M), configured to receive said artefacts (M) resting in said extraction position, raised above said forming position, in order to move them away from said press (2), **and in that** it comprises means (36) to load said mixture in said at least one matrix (25) in said loading position.
11. Mold for forming cement artefacts (M) for covering and/or flooring, starting from a mixture suitable to form said artefacts (M) comprising at least a lower mold (26) which defines at least one concave matrix (25) to contain at least one layer of the mixture which comprises a bottom (24) and perimeter walls (29) in relief with respect to said bottom (24), and at least an upper mold (7) which is mobile with alternating motion toward or away from said at least one matrix (25) between a position where the artefact (M) is formed, in which said upper mold (7) is coupled to said lower mold (26), and a position where the formed artefact (M) is extracted, in which said upper mold (7) is decoupled from said lower mold (26); wherein said perimeter walls (29) of said at least one matrix (25) are mobile with respect to said bottom (24) in a direction perpendicular to said bottom (24) and parallel to the direction of movement of said upper mold (7), wherein said perimeter walls (29) are moved by said upper mold (7) in such a way that said mixture is gradually released from said lower mold (26) to said upper mold (7), **characterized in that** said upper mold (7) comprises at least one concave counter-matrix (8) specular to said at least one concave matrix (25), so that said matrix (25) and said counter-matrix (8) form at least one forming cavity from which the artefact is expelled.
12. Mold as in claim 11, **characterized in that** it comprises adjustment means (28) associated with said lower mold (26) to adjust the travel of said perimeter walls (29) with respect to said bottom (24) so as to adjust the height of said at least one matrix (25) and consequently the quantity of mixture received therein.
13. Method to form cement artefacts (M) for covering and/or flooring starting from a mixture suitable to form said artefacts (M) which includes at least one press (2), said method comprising:

- loading the mixture into a concave matrix (25)

to contain the mixture in correspondence with a loading position, said concave matrix (25) being comprised in a lower mold (26) and comprising a bottom (24) and perimeter walls (29) in relief with respect to said bottom (24), 5

- taking said concave matrix (25) to a forming position,
- moving at least an upper mold (7) toward said at least one matrix (25), toward said position for forming an artefact (M), in which said upper matrix (7) is coupled to said lower matrix (26), 10
- wherein said movement determines a lowering of said perimeter walls (29) with respect to said bottom (24) in a direction perpendicular to said bottom (24) and parallel to the direction of movement of said upper mold (7), 15
- during said moving, gradually releasing said mixture from said lower mold (26) to said upper mold (7), in particular from said concave matrix (25) to a concave counter-matrix (8), specular 20
- to said concave matrix (25), in such a way that the relative movement during said moving determines a pressing action on the mixture disposed in said counter-matrix (8), thus producing the artefact (M), 25
- moving said upper mold (7) away from said concave matrix (25), so as to decouple said upper mold (7) from said lower mold (26),
- expelling the article (M) from said forming cavity, in particular from said counter-matrix (8), in 30
- correspondence with a position of extraction of the artefact (M).

14. Method as in claim 13, **characterized in that** it is provided to adjust the travel of said perimeter walls (29) with respect to said bottom (24) so as to adjust the height of said concave matrix (25), and consequently the quantity of mixture received therein, by means of adjustment means (28) associated with said lower mold (26). 35 40

45

50

55

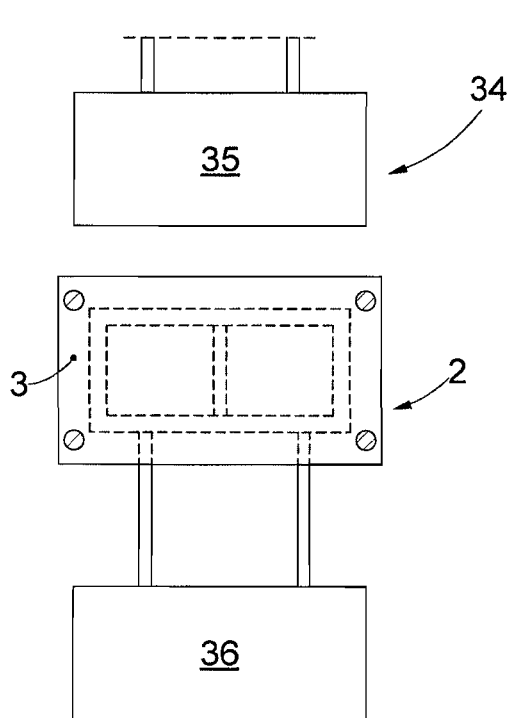


fig. 1a

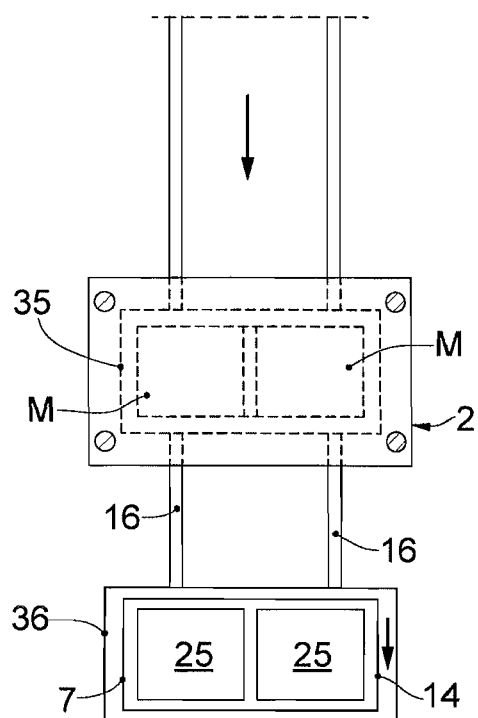


fig. 1b

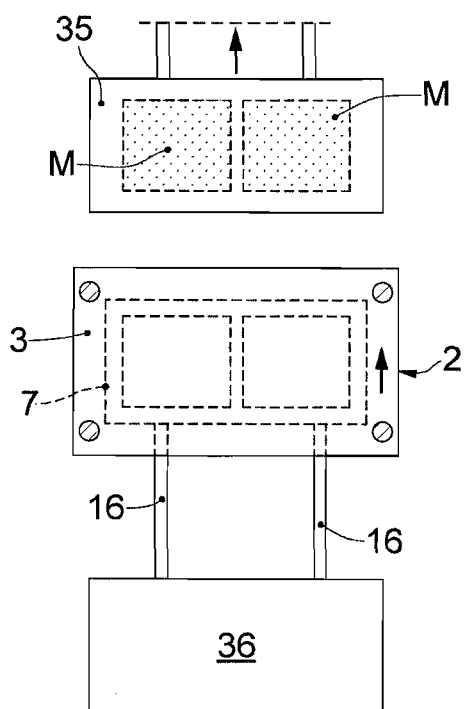


fig. 1c

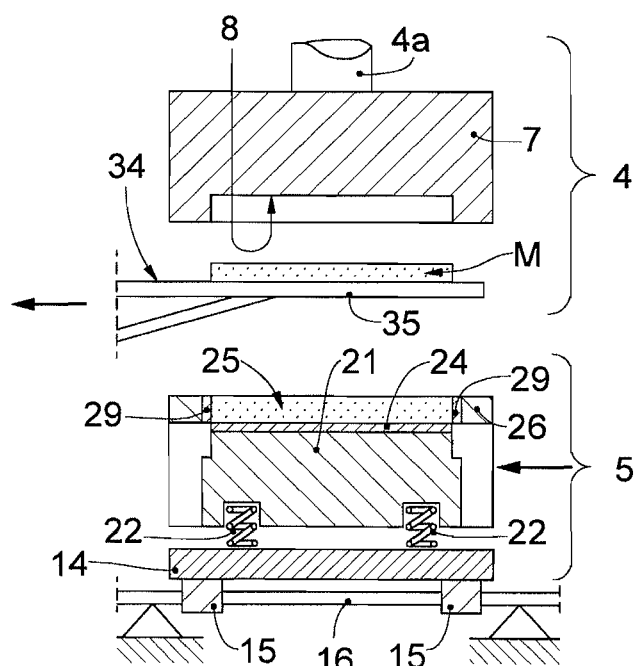


fig. 1d

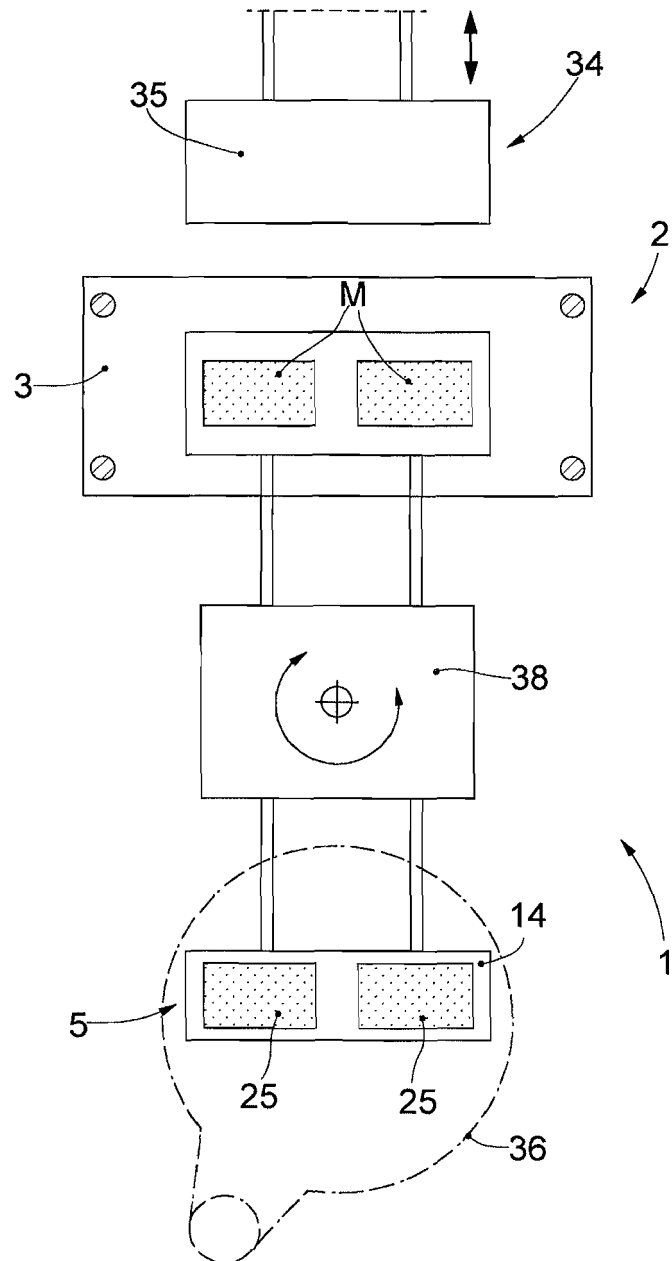


fig. 2a

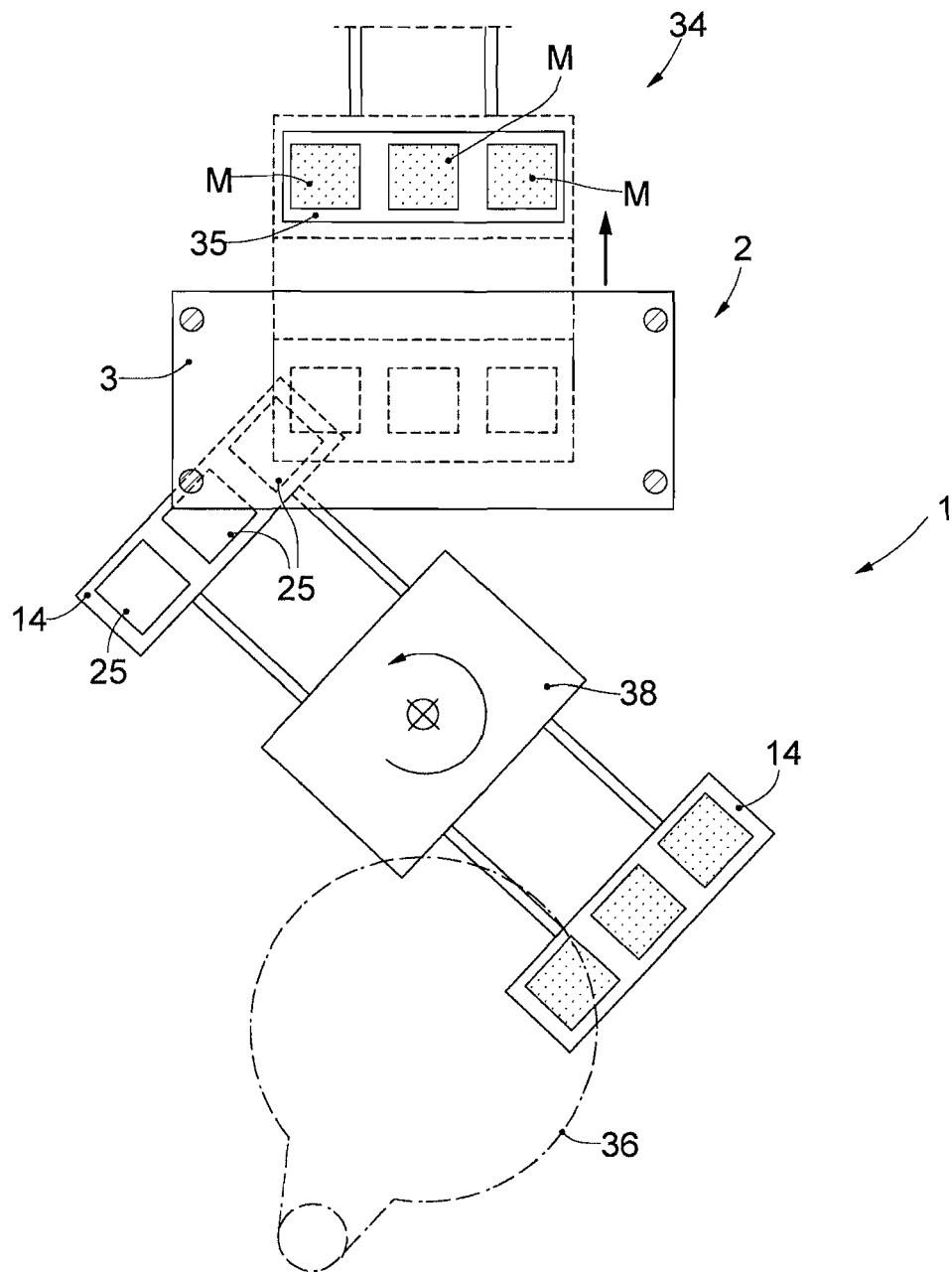


fig. 2B

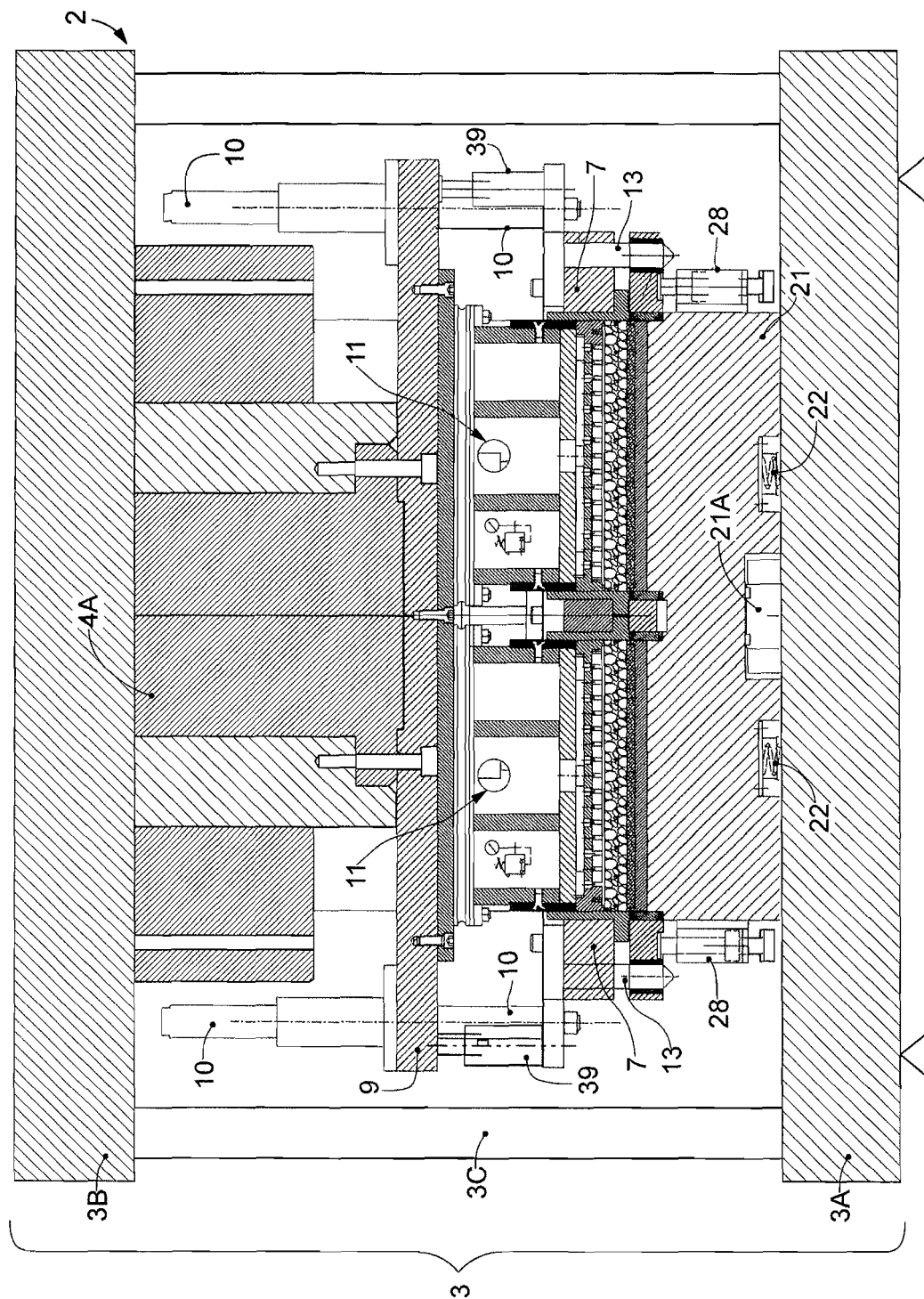
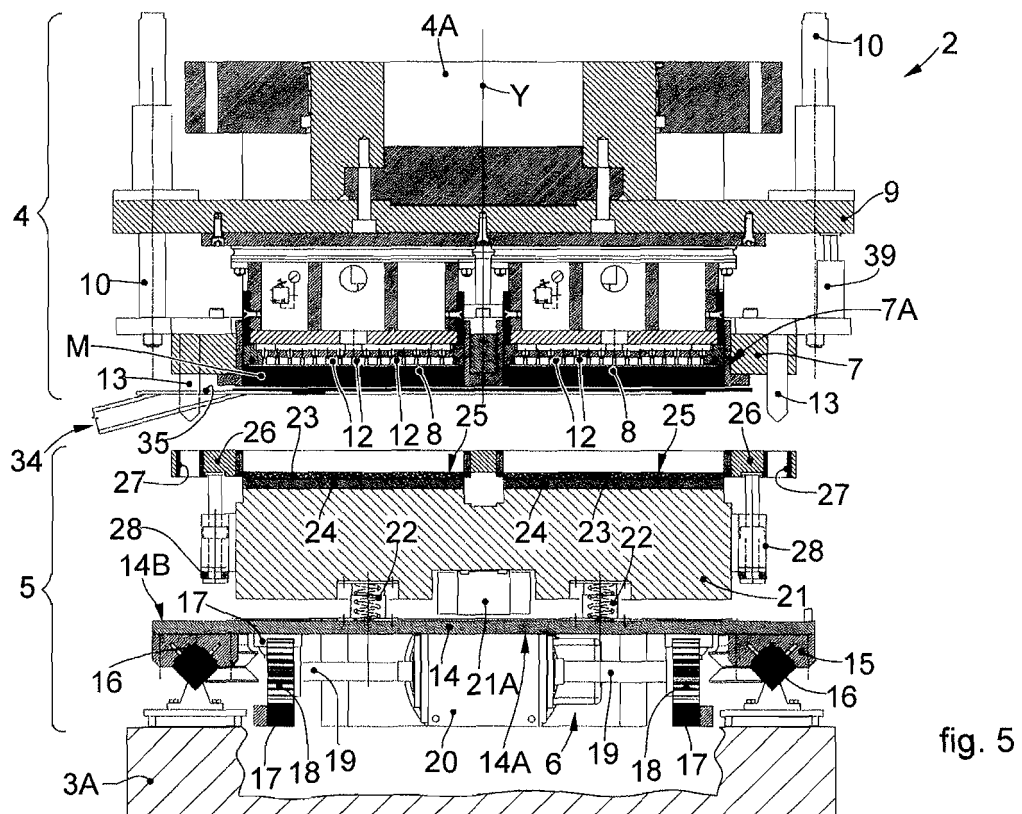
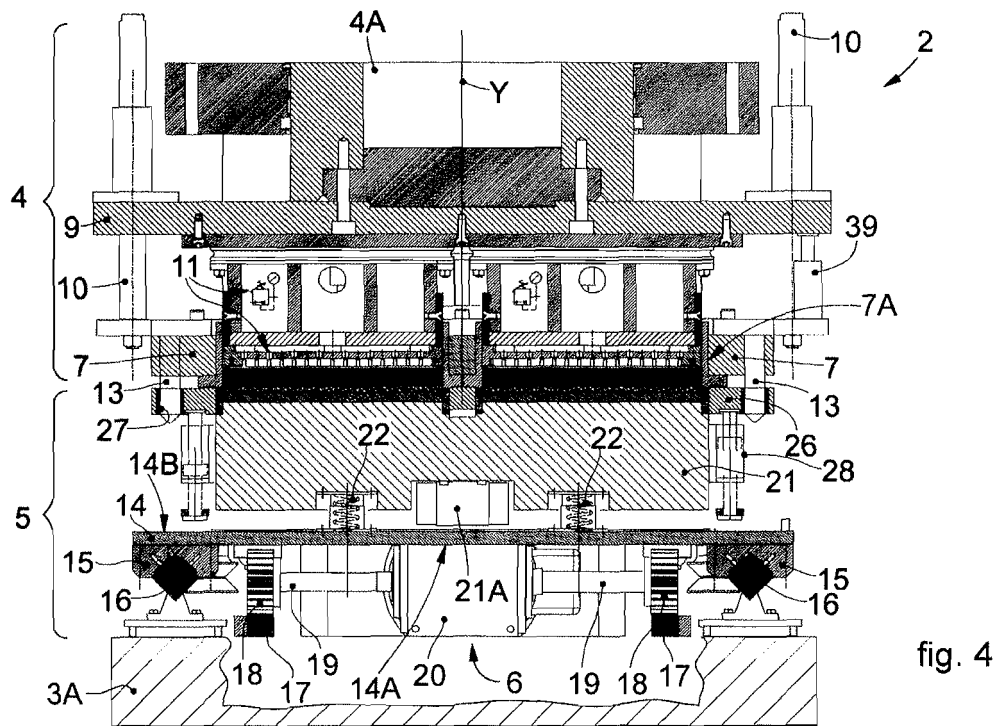


fig. 3



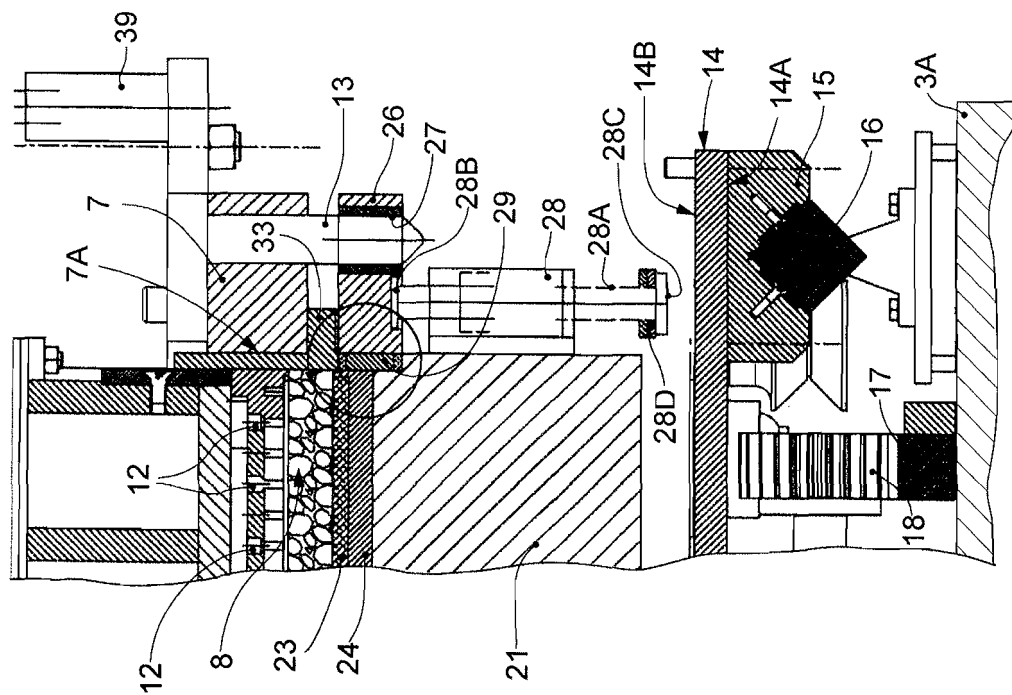


fig. 4A

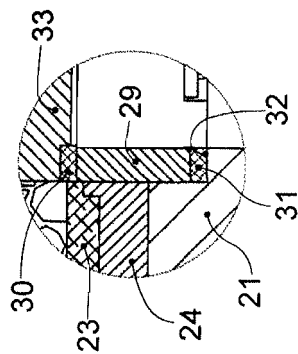


fig. 4D

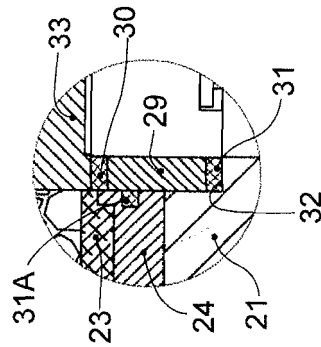


fig. 4C

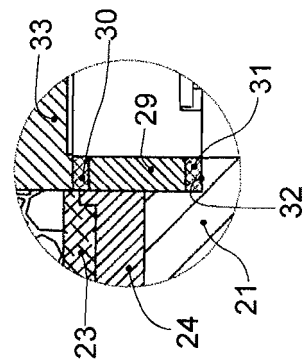
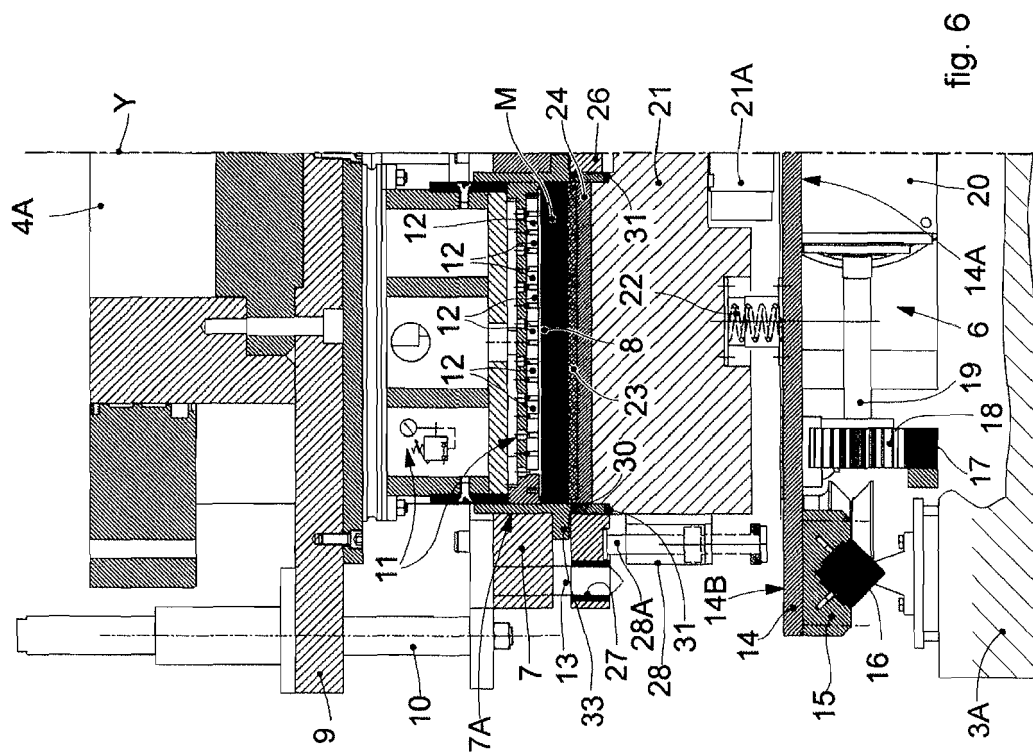
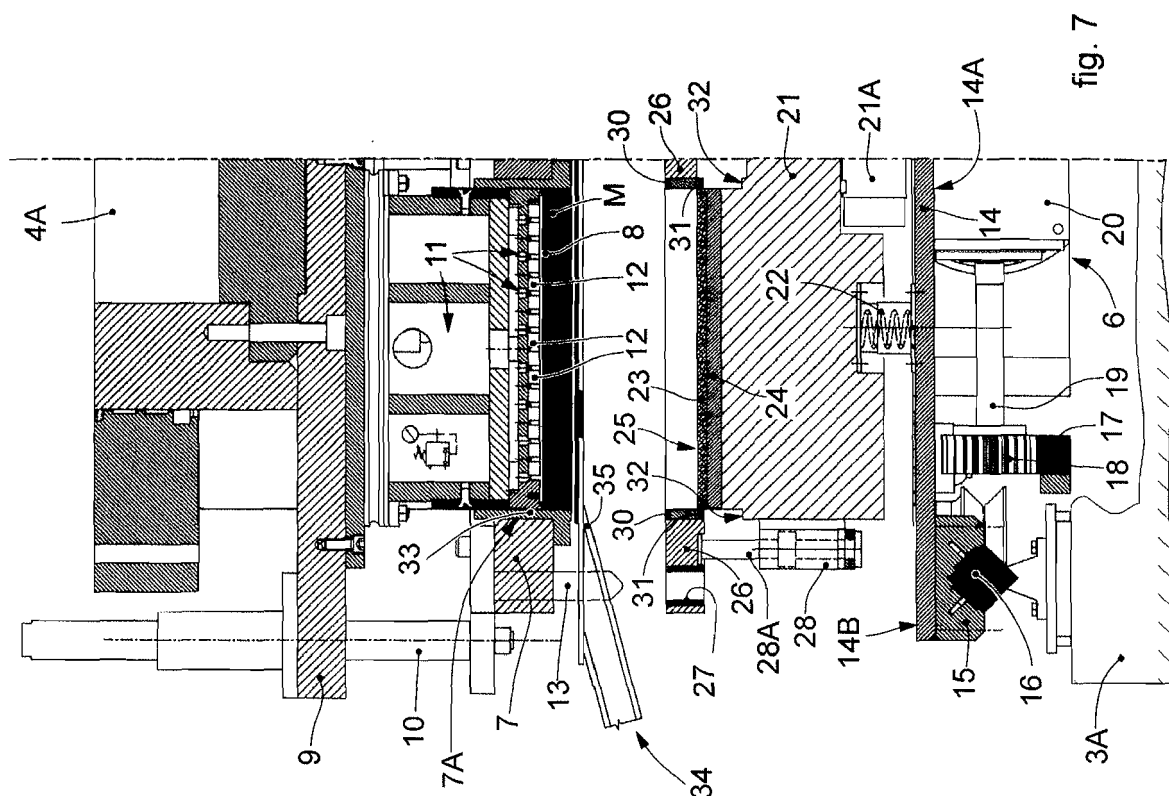
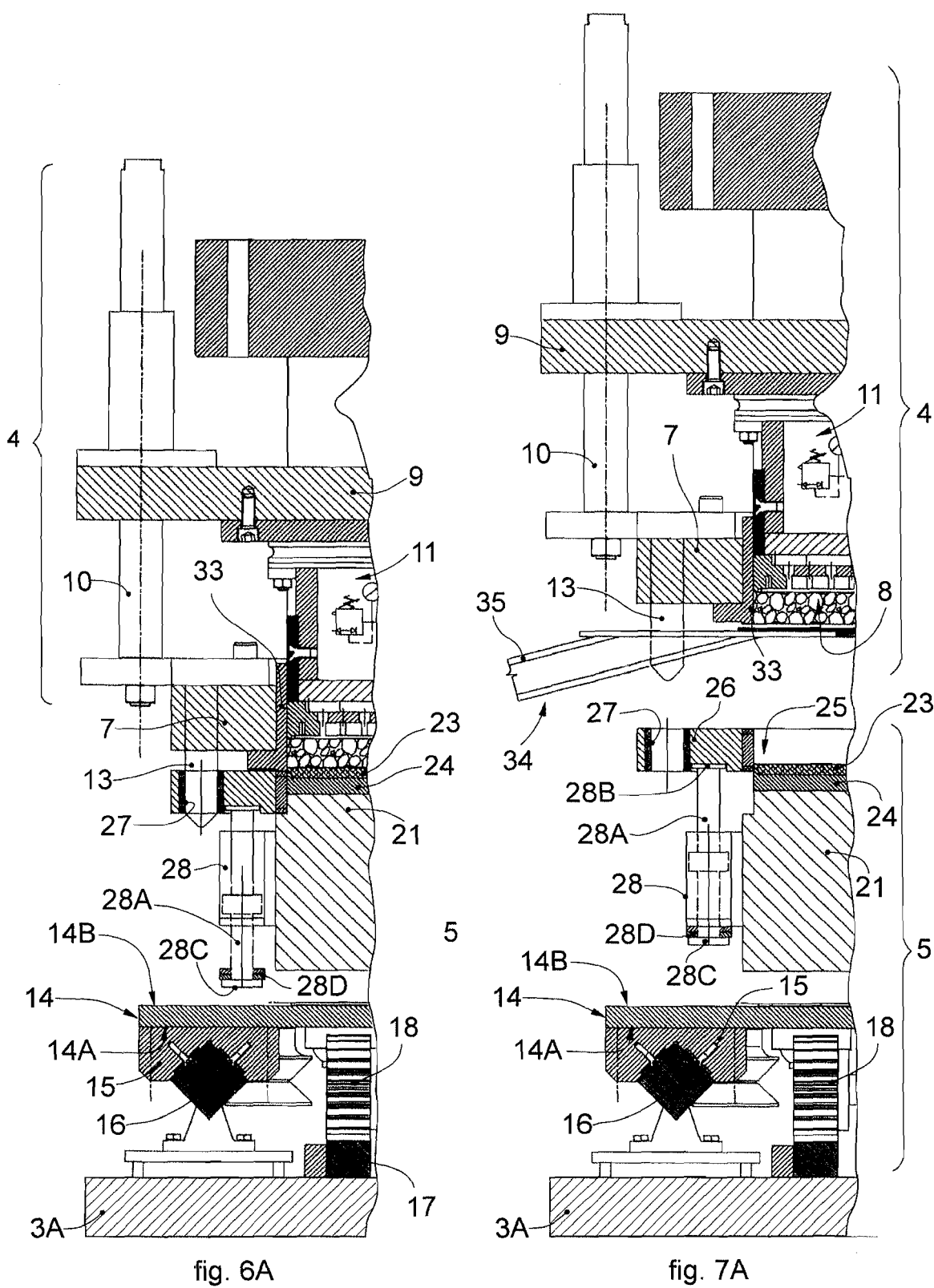


fig. 4B





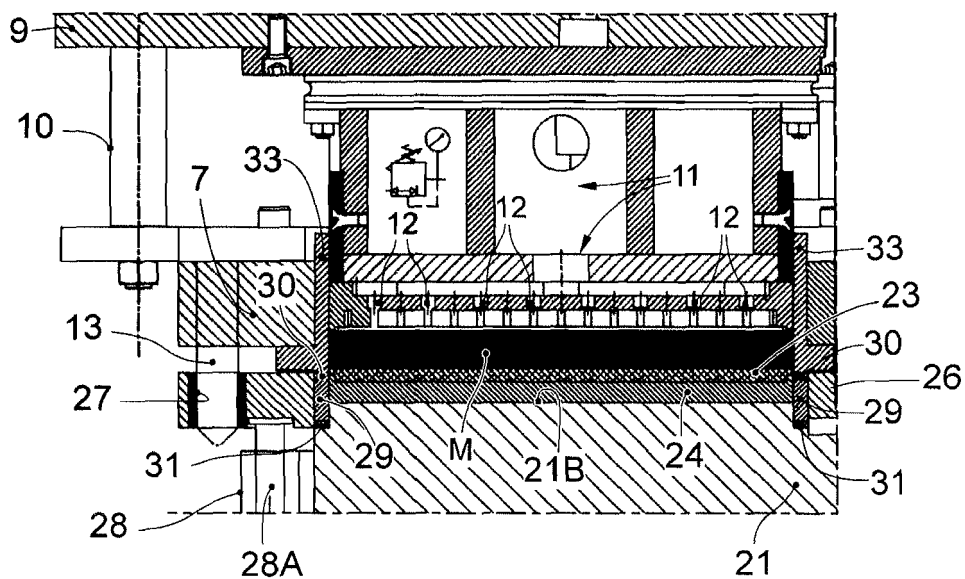


fig. 8

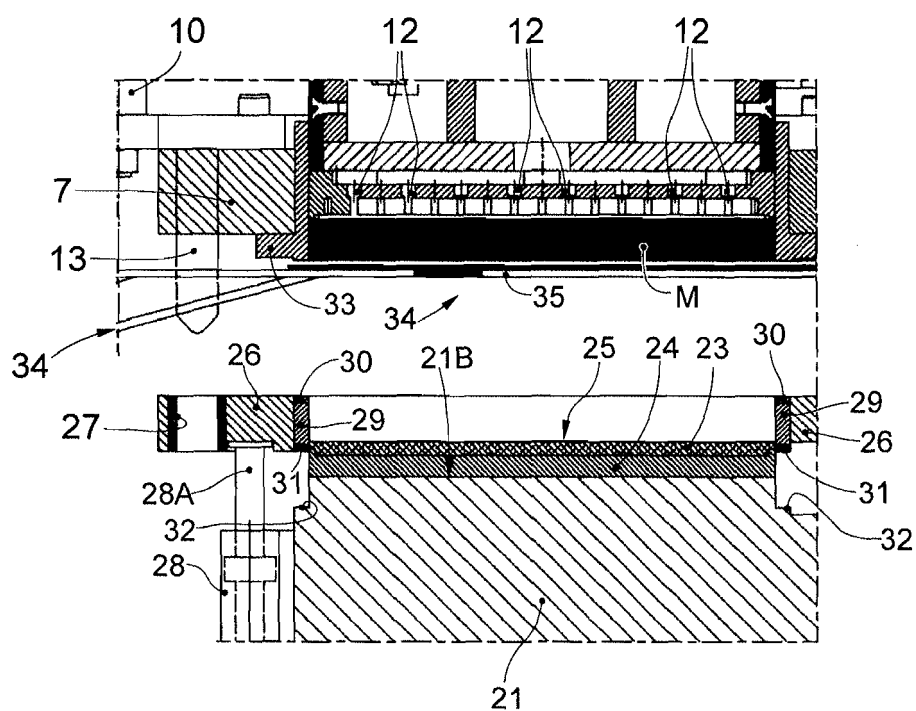


fig. 9



EUROPEAN SEARCH REPORT

Application Number
EP 21 15 3065

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	KR 2015 0131613 A (JUNG HEE DAE [KR]) 25 November 2015 (2015-11-25)	1,10-14	INV. B28B1/087
Y	* paragraph [0002] - paragraph [0007]; figures *	2-9	B28B3/20 B28B7/00 B28B7/46 B28B3/04 B28B3/02
Y,D	* paragraph [0016] - paragraph [0042] * ----- US 2002/109265 A1 (BRAUNGARDT RUDOLF [DE] ET AL) 15 August 2002 (2002-08-15) * paragraph [0016] - paragraph [0026]; claim 1; figures *	4-7	
Y,D	----- EP 2 737 984 A1 (G M F SRL [IT]) 4 June 2014 (2014-06-04) * paragraph [0185] - paragraph [0197]; figures 12-14 *	2,8	
Y,D	----- US 4 158 533 A (LONGINOTTI ENRICO) 19 June 1979 (1979-06-19) * column 6, line 65 - column 7, line 6; figures 14-17 * * column 9, line 4 - column 10, line 66 * -----	3,9	
			TECHNICAL FIELDS SEARCHED (IPC)
			B28B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 June 2021	Examiner Orij, Jack
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		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

 1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 15 3065

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.

30-06-2021

10

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 20150131613 A	25-11-2015	NONE	
US 2002109265 A1	15-08-2002	NONE	
EP 2737984 A1	04-06-2014	EP 2737984 A1 ES 2573086 T3	04-06-2014 06-06-2016
US 4158533 A	19-06-1979	NONE	

15

20

25

30

35

40

45

50

55

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2737984 B1 [0010]
- US 20020109265 A [0018]
- FR 2690105 A [0019]
- IT MC20110067 A [0019]
- CN 107186864 A [0019]
- DE 180475 C [0019]
- US 4158533 A [0019]