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(54) **CERAMIC POWDER FEEDING DEVICE**

(57) A feeding device (1) for feeding a hopper (T) with incoherent ceramic powders that are intended to be formed by compacting into a ceramic slab, the hopper (T) being suitable for containing the incoherent ceramic powders. The incoherent ceramic powders comprise a first powder ceramic material, a second powder ceramic material and a third powder ceramic material. The feeding device (1) is connectable to an inlet (25) of the hopper (T) and comprises a carriage (2) drivable to be positioned in different zones of the inlet (25). The carriage (2) is provided with a first conduit (3a) and with a second conduit (3b) arranged to be crossed respectively by the first powder ceramic material and by the second powder ceramic material, and with a container (5) positioned between the first conduit (3a) and the second conduit (3b). The container (5) is conformed to define a dividing element to keep separate the first powder ceramic material and the second powder ceramic material at the inlet (25). The container (5) is arranged to contain the third ceramic material and is further provided with an opening (7) that is traversable by the third powder ceramic material to allow the third powder ceramic material to exit by gravity from the container (5) and, in use, to be arranged between the first powder ceramic material and the second powder ceramic material inside the hopper (T) in order to produce a vein made of the third powder ceramic material in the hopper.

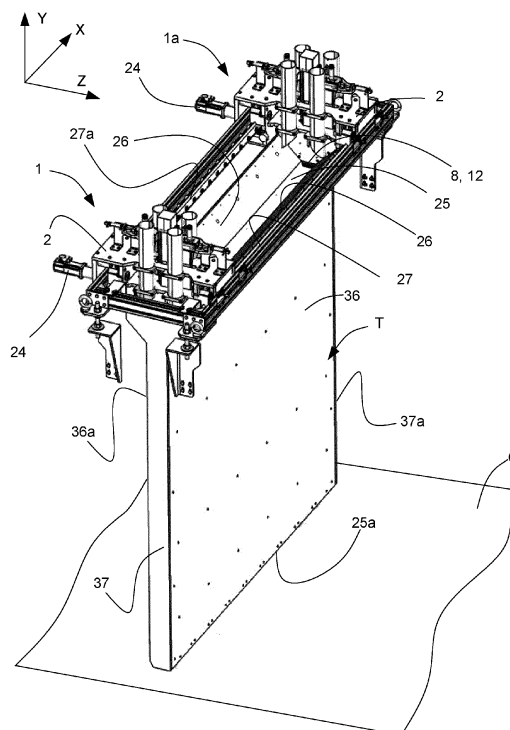


Fig. 1

Description

[0001] The invention is part of the field of producing decorations on slabs of ceramic material. The invention relates to a feeding device for feeding a hopper with incoherent ceramic powders.

[0002] In particular, the invention relates to a feeding device for arranging incoherent ceramic powders in a hopper according to a predefined reciprocal spatial position, the latter causing a desired decorative drawing or model.

[0003] In the field of the production of ceramic slabs or tiles and, in particular, of slabs or tiles suitable for cladding indoor or outdoor surfaces such as floors or walls of railway stations, airports, buildings, private dwellings or other places decorative effects are often requested that reproduce a decorative vein of natural stone or marble.

[0004] A decorative vein means a decoration that imitates in shape, colour and dimensions the appearance of veining of natural stone that is appreciable on the visual surface of the ceramic slab or tile and also in the thickness of the ceramic slab or tile.

[0005] A first step of the production of large size ceramic slabs or tiles having for example plan dimensions measuring 120 x 120, 160 x 160, 200 x 200 centimetres provides the use of a feeding device, which is also called a movable baffle, which is arranged to feed a hopper with ceramic powders. The hopper has two dimensions, for example length and width, which are prevalent with respect to a third dimension, for example the thickness. The hopper is fitted below to the feeding device and is so oriented that a prevalent dimension, for example the length, is oriented parallel to the direction of the force of gravity.

[0006] The feeding device is connected to an inlet of the hopper. The feeding device comprises a carriage, movable along an operating axis to be positioned in different zones of the opening of the hopper. To the carriage a conduit is fitted that is provided with an outlet port facing the inlet of the hopper. The conduit is arranged to enable the ceramic powders to exit from the feeding device and to be deposited inside the hopper by falling by gravity. The carriage is positioned in a first zone of the inlet of the hopper; a first ceramic powder suitable for defining a portion of body of the ceramic slab, crosses the conduit and is arranged inside the hopper. During this step, the carriage may not be moved along the operating axis. As the first ceramic powder is still incoherent, in the hopper it tends to flow with respect to the side walls and the base wall of the hopper, arranging itself according to a certain angle that depends on the rest angle of the incoherent powder. The shape of a volume of this first ceramic powder in the hopper is substantially similar to that of a prism with a triangular base.

[0007] Subsequently, a second ceramic powder is deposited in the form of a strip intended to become the decorative vein of the tile and of the slab; the strip is

deposited above the volume of the first ceramic powder; the strip extends at least in a direction that is substantially oblique inside the hopper, following the profile of a layer of the first ceramic powder below. The second ceramic powder is deposited in the hopper passing through the conduit of the carriage.

[0008] Lastly, a third ceramic powder suitable for defining a remaining portion of body of the tile or ceramic slab is deposited inside the hopper, this third ceramic powder being able to be different from the first ceramic powder. Before the third ceramic powder is deposited, the carriage is moved along the operating axis to another zone of the opening of the hopper. The strip of ceramic material is thus interposed between the first and the second ceramic powder.

[0009] The strip of ceramic material can extend along a direction that is substantially oblique to the inside of the hopper. Further, by moving along the strip of the ceramic material, a width of the strip of ceramic material inside the hopper is substantially constant.

[0010] When it is desired to deposit ceramic powders in a hopper so that a strip of ceramic material extends in a substantially longitudinal direction inside the hopper, using such a feeding device is not suitable. A substantially longitudinal direction means, in the fitting configuration disclosed above, a direction substantially parallel to the length of the hopper, i.e. a direction that is substantially parallel to the direction of the force of gravity. Using such a feeding device is not suitable either for obtaining a decorative strip inside the hopper that has visibly a variable width along this longitudinal direction.

[0011] One object of the present invention is to provide a feeding device that is able to overcome the aforesaid limits of the prior art.

[0012] Another object of the invention is to improve known feeding devices for feeding a hopper with ceramic powders according to a predefined reciprocal spatial position to obtain a desired decorative effect.

[0013] A further object of the invention is to provide a feeding device for feeding a hopper with ceramic powders so that a strip of ceramic material intended to reproduce a decorative vein extends in a substantially longitudinal direction inside the hopper.

[0014] A still further object of the invention is to deposit powders in the hopper so that the strip has a variable width inside the hopper along this longitudinal direction.

[0015] A yet further object of the invention is to deposit powders in the hopper so that the width of the strip of ceramic material is well controllable.

[0016] According to the invention, a feeding device is provided, as defined by claim 1.

[0017] Owing to the feeding device according to the invention it is possible to feed a hopper with incoherent ceramic powders, intended to be compacted in a forming press, that has, on the finished product, i.e. on the ceramic slab obtained from compacting the incoherent ceramic powders, a shape and dimensions that are comparable with the decorative veins of natural stones or

marble.

[0018] Owing to the feeding device according to the invention, it is possible to deposit a ceramic material in powder form intended to become the decorative vein inside the hopper, adjusting the volume of the deposited ceramic material in powder form. This enables a decorative vein to be produced that extends in a substantially longitudinal direction inside the hopper and has variable width in the hopper along this substantially longitudinal direction.

[0019] Further, owing to the feeding device according to the invention, depositing of the powders that constitute the vein is more controlled than in known systems, this permitting greater control of the shape and dimensions of the decorative vein.

[0020] The invention can be better understood and implemented with reference to the attached drawings that illustrate some embodiments thereof by way of non-limiting example, in which:

Figure 1 is a prospective view of a feeding assembly for incoherent ceramic powders according to the invention;

Figures 2 and 3 are two transverse sections of Figure 1;

Figure 4 is a prospective view of a feeding device for feeding incoherent ceramic powders according to the invention;

Figure 5 is a frontal view of the device of Figure 4;

Figure 6 is a side view of the device of Figure 4;

Figure 7 and 8 are longitudinal sections of the device of Figure 5 that illustrate some positions adopted by adjusting means of the feeding device;

Figure 9 is a cross section of the device of Figure 4 in which the adjusting means adopts an open position;

Figures 9A and 9B are two enlarged details of Figure 9 that show an end zone of a container provided in the feeding device;

Figure 10 is a cross section of the device of Figure 4 in which the adjusting means adopts a closed position;

Figure 10A and 10B are two enlarged details of Figure 10 that show the end zone of the container, the container being provided in the feeding device;

Figures 11 and 12 are bottom views of the longitudinal sections of the device of Figure 4 in which the adjusting means is illustrated in an open position and in closed position;

Figures 13 and 14 are longitudinal sections that show some constructional details of the container of the device of Figure 4.

[0021] With reference to Figure 1, a feeding assembly is shown comprising at least one feeding device 1 and one hopper T.

[0022] The feeding device 1 is arranged to feed incoherent ceramic powders to the hopper T; the hopper T

is suitable for containing, at least temporarily, the incoherent ceramic powders and depositing the incoherent ceramic powders on an operating plane O. The feeding device 1 can be fitted to the hopper T; the hopper T is in turn positioned above an operating plane O, schematically illustrated in Figure 1. The operating plane O is substantially defined by a movable conveying surface of a conveyor belt, for example a feed belt arranged to feed a forming press that is not illustrated.

[0023] The hopper T can be oriented transversely to the operating plane O. One arrangement of the incoherent ceramic powders in the hopper T substantially determines how the incoherent ceramic powders are arranged on the operating plane O to form a bed of powders. This bed of incoherent ceramic powders is formed by compacting in a ceramic slab or a ceramic tile in a forming press, where a pressed semi-finished product is formed by compacting the incoherent ceramic powders. Subsequently, the pressed semi-finished product is fired in a kiln, for example a roller kiln, to produce a finished tile or ceramic slab.

[0024] In Figure 1, two feeding devices 1 and 1a fitted to the hopper T are shown by way of example; obviously, also a single feeding device 1 or alternatively also more than one can be fitted. In one embodiment that is not shown, three, or four feeding devices can be fitted. This number can also vary. The incoherent ceramic powders can comprise a first powder ceramic material, a second powder ceramic material and a third powder ceramic material. The first powder ceramic material and the second powder ceramic material can comprise an atomized ceramic powder, i.e. consisting of ceramic granules, which can be rounded, of a dimension that is comprised on average for example between 0.2 and 0.9 mm and having a residual water content, i.e. humidity, for example around 4-7%. The first powder ceramic material can be different from the second powder ceramic material, for example can have a different colour. The first powder ceramic material can be identical to the second powder ceramic material. The first and the second powder ceramic material are suitable for defining a body, or parts of the body, of a ceramic slab formed by pressing.

[0025] The third powder ceramic material is on the other hand suitable for defining a decorative vein in the slab. The third powder ceramic material can be an atomized or granulated ceramic powder with an average dimension of the atomized or granulated grains that are comparable with those of the layer of ceramic powders S. The third powder ceramic material can be a micronized powder or a mixture of atomized or granulated powder with micronized powder. The third powder ceramic material can generally have a different colour from that of the powder ceramic material. In fact, in the third powder ceramic material there can be metal oxides that during the firing step change colour, thus giving the decorative vein a different colour from the colour of the body of the ceramic slab. The difference in colour that is visible on the finished product, may not be visible in the pressed and not yet

fired semi-finished product. The third powder ceramic material can be deposited in the form of strip of ceramic material.

[0026] The hopper T comprises a plurality of walls 36, 36a, 37, 37a that define an inner space that is suitable for containing the incoherent ceramic powders. The inner space can have a substantially parallelepipedon or frustum pyramid shape having a dimension, known hereinafter as "thickness", which is substantially less than another two dimensions, known hereinafter as "length" and "width".

[0027] The width of the hopper T can be measured along an operating axis X, the width of the hopper T can be measured along another operating axis Z, and the length of the hopper T can be measured along a further operating axis Y.

[0028] The operating axes X, Y, Z define a trio of axes arranged transversely to one another, in particular a trio of orthogonal axes. The further operating axis Y is transverse, in particular orthogonal to the operating plane O. In the embodiment shown in Figure 1, the further operating axis Y is substantially parallel to the direction of the force of gravity.

[0029] The inner space is substantially open both above and below, i.e. in the hopper T there is an inlet 25 arranged to be traversed by the incoherent ceramic powders exiting feeding device 1, and an outlet 25a that enables the ceramic powders to exit by gravity from the hopper T and to be arranged on the operating plane O. A closing device, which is also not shown, closes or opens an outlet passage 25a so as to enable the ceramic powders to exit or prevent the ceramic powders from exiting the hopper T.

[0030] Inside the hopper T, the incoherent ceramic powders are arranged to occupy substantially the entire thickness of the inner volume of the hopper T.

[0031] The third powder ceramic material can be deposited in the hopper T in the shape of a strip, can be interposed between two volumes of powder ceramic material and can extend in a substantially longitudinal direction inside the hopper T, i.e. substantially parallel to the further operating axis Y, as will be explained in detail further on in the description.

[0032] The third ceramic material in the form of a strip can have a rectilinear or mixed shape, i.e. partially undulating and partially rectilinear shape, as will be explained below.

[0033] The hopper T comprises a pair of side walls 36, 36a opposite and substantially parallel to one another and extending parallel to the operating axis X and to the further operating axis Y, and a pair of base walls 37, 37a opposite and substantially parallel to one another and extending transversely to the pair of side walls 36, 36a parallel to the other operating axis Z and to the other further operating axis Y.

[0034] On one edge of the inlet 25 parallel to the operating axis X, in particular on two opposite edges of the inlet 25 parallel to the operating axis X, an inlet portion

26 extends that is suitable for conveying the ceramic powders exiting the feeding device 1 facing the inlet 25. The inlet portion 26 extends upwards and in a direction that is transverse to the pair of side walls 36, 36a of the hopper T.

[0035] To the hopper T, guide means 27, 27a is connected that extends parallel to the operating axis X and is positioned symmetrically with respect to the inlet 25; the guide means 27, 27a can comprise a pair of linear guides 27, 27a. One of the two linear guides, for example the linear guide 27, is positioned parallel to and near the side wall 36, the other linear guide 27a is positioned parallel to and near the side wall 36a.

[0036] The feeding device 1 can be fitted to the hopper T so as to feed the hopper T with the incoherent ceramic powders exiting by gravity from the feeding device 1. The feeding device can be connected to the inlet 25 of the hopper T.

[0037] The feeding device 1 can comprise a carriage 2 fitted slidably to the guide means 27, 27a to slide along the operating axis X. The carriage is slidable to be positioned in different zones of the inlet 25. Each of the linear guides 27, 27a can in fact comprise at least one sliding surface to allow the carriage 2 to slide along the operating axis X. For example, in the embodiment shown in Figures 2 and 3, each linear guide 27, 27a can comprise two sliding surfaces, an upper sliding surface 50 and a lower sliding surface 51, the upper sliding surface 50 being operationally opposite the lower sliding surface 51. The upper sliding surface 50 can have a cusp shape, or swallow tail shape, and so on; on the lower sliding surface 51 a plurality of teeth can be obtained, the teeth being arranged in succession/in a row parallel to the operating axis X.

[0038] The carriage 2 can comprise a first plate 28 and a second plate 29 arranged parallel to one another and to the operating plane O, the first plate 28 being operationally positioned above the second plate 29. The carriage 2 can further comprise a first side bracket 30 and a second side bracket 31 parallel to one another and to the operating axis X, i.e. oriented transversely to the first plate 28. On the first side bracket 30 and on the second side bracket 31 rotating means can be provided that is arranged to slide on the guide means 27, 27a, as explained below.

[0039] The feeding device 1 is motorised, i.e. the carriage 2 is connected to a motor unit 24 that is drivable to slide the carriage 2 along the guide means 27, 27a. The motor unit 24 can comprise speed reducing members and an output shaft 32 connected to the rotating means. The rotating means can comprise a pair of pinions 33, a pinion being fitted to the first side bracket 30 and another pinion on the second side bracket 31. Each pinion of the pair of pinions 33 is arranged to engage, or clutch, the lower sliding surface 51 of the respective linear guide 27, 27a. The rotating means can further comprise a pair of pulleys 34, a pulley provided on the first side bracket 30 and another pulley provided on the second side bracket

31; the pair of pulleys 34 being positioned above the pair of pinions 33. The pair of pulleys 34 is arranged to engage the upper sliding surface 50 of the respective linear guide 27, 27a. The output shaft 32 can be connected to the pair of pinions 33 or alternatively to the pair of pulleys 34.

[0040] In one embodiment that is not shown, the pair of pulleys can be positioned below the pair of pinions, or only one of the two pairs can be provided.

[0041] Figure 4 shows a detailed view of a feeding device 1 according to the invention. On the carriage 2, a first conduit 3 can be positioned that is arranged to be traversed by the first powder ceramic material. On the carriage, a second conduit 3a can be positioned arranged to be traversed by the second powder ceramic material; the second conduit 3a can be structurally the same as the first conduit.

[0042] The first conduit 3 and the second conduit 3a can be oriented transversely with respect to the first plate 28, i.e. parallel to the further operating axis Y, so that the first powder ceramic material and the second powder ceramic material traverse and exit the first conduit 3 and the second conduit 3a, by falling by gravity. The first conduit 3 can be housed on an edge portion 39 of the first plate 28. For example, the edge portion 39 of the first plate 28 can comprise a concave surface, in particular a semicircular surface, which acts as a seat for the first conduit 3. The first conduit 3 is fixed to the edge portion 39 by clamping means. For example, in the disclosed embodiment the clamping means can comprise a clamping plate 35 comprising a further concave surface, which is also semicircular, which acts as a seat for the first conduit 3, in particular for the portion of the conduit that is not housed in the edge portion 39 of the first plate 28.

[0043] The clamping plate 35 is clamped to the edge portion 39 of the first plate 28, for example by screws or other known threaded connecting means, so as to lock the first conduit 3 in position.

[0044] The first conduit 3 can be fitted to and fixed on an edge portion of the second plate 29, in the same manner disclosed above. What has been disclosed above can also refer to fitting the second conduit 3a.

[0045] The number of conduits 3, 3a provided on the at least one carriage 2 can vary and can be greater than two. For example, in Figure 4 a feeding device 1 is shown in which four conduits are fitted, which are structurally the same as one another, along the edge portion of the first plate 28 and of the second plate 29. In particular, the four conduits are fitted in pairs on two opposite edge portions 39, 39a of the first plate 28 and of the second plate 29. The first conduit 3 is provided with an outlet port 38, when the feeding device 1 is fitted to the hopper T, facing the inlet 25 of the hopper T. In particular, the outlet port 38 can face the inlet portions 26. The second conduit 3a is further provided with a further outlet port 38a facing, when the feeding device 1 is fitted to the hopper T, the inlet 25 of the hopper T. In particular, the further outlet port 38a can face the inlet portions 26. The outlet port 38 and the further outlet port 38a are arranged to allow the

first powder ceramic material and the second powder ceramic material to exit the first conduit 3 and the second conduit 3a by falling by gravity, to rest on the inlet portions 26 to be conveyed to the inlet 25 and to traverse the inlet 25 of the hopper T to be arranged in the inner space.

[0046] The feeding device 1 further comprises a container 5 fitted to the carriage 2 and positioned between the first conduit 3 and the second conduit 3a. The container 5 is conformed to define a dividing element to keep separate the first powder ceramic material and the second powder ceramic material at the inlet 25. When the feeding device 1 is fitted to the hopper T the container 5 can be considered to be arranged at the inlet 25 of the hopper T.

[0047] The container 5 is arranged to contain the third powder ceramic material.

[0048] The feeding device 1 can comprise a third conduit 4 connected to the container 5. The third conduit 4 and the container 5 are fitted to the carriage 2, in particular to the first plate 28 and to the second plate 29, so that the third ceramic material traverses the third conduit 4 and the container 5 by falling by gravity.

[0049] The third conduit 4 and the container 5 are oriented transversely with respect to the first plate 28 and to the second plate 29, i.e. parallel to the further direction Y.

[0050] On the first plate 28 and on the second plate 29, in particular on a central portion of the first plate 28 and of the second plate 29, a through hole can be obtained that is sized to insert the third conduit 4. The third conduit 4 is locked in position in the hole obtained both on the first plate 28 and on the second plate 29.

[0051] The third conduit 4 is connected to the container 5, the latter is operationally fitted and fixed below to the second plate 29. The container 5 can be fixed in a central portion of the second plate 29. Obviously, other fitting portions of the container 5 can be provided.

[0052] The third conduit 4 is provided with a dispensing port 6 facing an inlet of the container 5; the dispensing port 6 is arranged to allow the third powder ceramic material to exit by gravity the at least one third conduit 4 and enter the container 5.

[0053] The third conduit 4 is further provided with an inlet port 22, opposite the dispensing port 6, arranged to receive the third ceramic material from feeding means that is known and not illustrated and to allow the third powder ceramic material to enter by gravity the third conduit 4. The feeding means for example comprises gravity feeders, conveyor belts and so on. Between the inlet port 22 of the at least one second conduit 4 and the feeding means a gate valve 23 can be provided that is switchable between a first configuration in which it closes a passage of the inlet port 22 to prevent the third powder ceramic material from entering the third conduit 4, and a second configuration, in which the gate valve 23 leaves the passage of the inlet port 22 free to enable said powder ceramic material to enter the third conduit 4.

[0054] There can also be a number of third conduits

that is greater than one. For example, in the embodiment of the feeding device 1 shown in the attached Figures, there are two third conduits 4 fitted to at least one carriage 2, in particular in the central portion of the first plate 28 and of the second plate 29; the two second conduits 4 can be structurally identical and fitted parallel to one another and can be both connected to the container 5.

[0055] The container 5 is provided in an end zone of an opening 7 that is crossable by the third powder ceramic material to enable the third powder ceramic material to exit by gravity from the container 5. In use, the opening 7 enables the third ceramic material to be arranged between the first powder ceramic material and the second powder ceramic material inside the hopper T in order to produce a vein made of third powder ceramic material in the aforesaid hopper T.

[0056] The container 5 operates as a movable separating baffle that feeds the hopper T with the third incoherent ceramic material, the carriage 2 being able to move along the operating axis X.

[0057] In one fitted configuration, i.e. when the feeding device 1 is fitted to the hopper T, the opening 7 faces the inlet 25 of the hopper T. The opening 7 can be substantially aligned with the inlet 25 along the further operating axis Y, i.e. along a plane substantially parallel to the operating plane O. In this manner, the third ceramic material exiting the opening 7 of the container 5 enters directly into the hopper T passing through the inlet 25. In the fitted configuration, the opening 7 of the container 5 can also be aligned with the inlet 25 along the other operating axis Z. The opening 7 can be provided with adjusting means that is operable to adjust a volume of the third powder ceramic material exiting the opening 7, as explained below. In one embodiment that is not shown, the container 5 can also not be provided with the adjusting means.

[0058] The container 5 comprises a plurality of panels that define an inner chamber 9 suitable for containing the third powder ceramic material. The plurality of panels can comprise a first panel 11, a second panel 14 opposite and parallel to the first panel 11, a third panel 41 and a fourth panel 42, arranged transversely to the first panel 11. In the configuration in which the feeding device is fitted to the hopper, the first panel 11 and the second panel 14 can be oriented parallel to the other axis Z and to the other further axis Y.

[0059] The third panel 41 and the fourth panel 42 can be tilted with respect to the operating plane O so that the container 5 assumes an upturned flared shape, i.e. so that the inlet of the container 5 has a greater size than the opening 7, this size being measured parallel to the other operating axis Z. A felt coating/seal can be applied to the third panel 41 and to the fourth panel 42 to ensure high containment by the container 5 of the third powder ceramic material and to avoid dispersion thereof. In the fitted configuration, the container can interact with the inlet portion 26 of the inlet 25. In other words, the container 5 has an upturned flared shape, whereas the inlet portion 26 of the inlet 25 takes on a flared shape. The

two shapes complement each other. In the fitted configuration, one of the two faces of the inlet portion 26 is parallel to the third panel 41, the other face is parallel to the fourth panel 42; the distance between the two faces of the inlet portion 26 and the third panel 41 and the fourth panel 42 is minimal. If the elements are in contact, the felt seal reduces friction during movement of the carriage 2 with respect to the hopper T.

[0060] The adjusting means is provided in the inner chamber 9 of the container 5 as illustrated in the section view of Figures 7 and 8; the adjusting means is further fitted to the plurality of panels 11, 14, 41 and 42, in particular to the first panel 11 and to the second panel 14.

[0061] The adjusting means comprises a first closing element 8 and a second closing element 12. The feeding device 1 further comprises a first plate 10. The first plate 10 is connected to the first panel 11 of the container 5, in particular the first plate 10 is fixed, by screws or bolts, to the first panel 11. The first plate 10 and the first panel 11 define/bound a first housing zone H arranged to house the first closing element 8, as explained below. With reference to Figures 13 and 14, on the first panel 11 a first pocket 43 is obtained; the first pocket 43 can be made for example by chip-removing machining. The first pocket 43 is open, i.e. extends as far as the opening 7 of the container 5 along the further operating axis Y. The dimensions of the first pocket 43 are substantially equivalent to the dimensions of the first closing element 8 to allow the first closing element 8 to be inserted into the first pocket 43.

[0062] The first plate 10 is fixed to the first panel 11 so as to cover the closing element 8 inserted into the first pocket 43.

[0063] The first housing zone H is thus bounded by the walls of the first pocket 43 obtained on the first panel 11 and by a face of the first plate 10.

[0064] The feeding device 1 further comprises a second plate 13 connected to the second panel 14 of the container 5. The second plate 13 is in particular fixed, by screws or bolts, to the second panel 14. The second plate 13 and the second panel 14 define/bound a second housing zone J arranged to house the second closing element 12, similarly to what has been explained previously.

[0065] On the second panel 14 a second pocket, which is not shown, is obtained, which is similar in shape and dimensions to the first pocket 43. The second pocket can be made by chip-removing machining and can have a preset depth. The dimensions of the second pocket are substantially equivalent to the dimensions of the second closing element 12 to allow the second closing element 12 to be inserted into the second pocket. Also the second pocket is open, i.e. extends as far as the opening 7 of the container 5 along the further operating axis Y. The second plate 13 is fixed to the second panel 14 so as to cover the second closing element 12 inserted into the second pocket. The second housing zone J is thus bounded by the walls of the second pocket obtained on the second panel 14 and by a face from the second plate

13.

[0066] The first plate 10, thus also like the second plate 13, has a prevalent dimension, with respect to other dimensions thereof measured for example along the further operating axis Y.

[0067] The first plate 10, thus also like the second plate 13, can comprise a concave surface in an end portion thereof so that a section of the first housing zone H, thus also as a section of the second housing zone J, increases by proceeding parallel to the further operating axis Y. This detail is visible for example in Figure 9B.

[0068] The first closing element 8 is movable between the first plate 10 and the first panel 11; also the second closing element 12 is movable between the second plate 13 and the second panel 14. The first closing element 8 and the second closing element 12 are movable to be positioned between a closed position in which an end of the first gate element 8 and a respective end of the second closing element 12 are in contact between themselves to reduce the opening 7, and an open position in which the end of the first closing element 8 and the respective end of the second closing element 12 are at a distance from one another to leave the opening 7 free. In the closed position the first gate element 8 and the second closing element 12 can close a transit area of the opening 7, whereas in the open position the first closing element 8 and the second closing element 12 can leave this transit area of the opening 7 free. In other words, in the closed position the third ceramic material is hindered from leaving the container 5 by the contact between the ends of the first closing element 8 and of the second closing element 12. In the open position, the first closing element 8 is contained completely in the first housing space H, i.e. in the first pocket 43; the second closing element 12 is contained completely in the second housing space J, i.e. in the second pocket.

[0069] In the closed position, the first closing element 8 exits the first housing space H, i.e. exits the first pocket 43, and the second closing element 12 exits the second housing space J, i.e. exits the second pocket.

[0070] In the intermediate positions that are adoptable both by the first closing element 8 and the second closing element 12, these two elements protrude respectively from the first housing space H, i.e. from the first pocket 43, and from the second housing space J, i.e. from the second pocket, but are not in contact with one another.

[0071] The first closing element 8 and the second closing element 12 cooperate with the opening 7 to bound a transit area for the third powder ceramic material, the transit area being adjustable on the basis of a position of the adjusting means with respect to the opening 7. For example, with reference to Figures 10A and 10B, when the first closing element and the second closing element are in contact, a projection thereof orthogonal on the plane defined by the axes X and Z closes/covers the transit area of the opening 7 and hinders the third ceramic material from traversing the opening 7.

[0072] In the intermediate positions, the orthogonal

projection on the plane defined by the axes X and Z of a virtual segment that joins the edges of the first closing element and of the second closing element along the operating axis X, closes/covers partially the transit area of the opening 7. In the open position on the other hand the transit area of the opening 7 is left free, as shown in Figure 9B.

[0073] The first closing element 8 and the second closing element 12 can comprise a gate. The gate can be a plate made of a metal material.

[0074] Before being inserted, or housed, in the first pocket 43, the first closing element 8 can be in a deformed configuration, for example folded with a preset folding range.

[0075] When the first closing element 8 is contained inside the first pocket 43 and the first plate 10 covers the first closing element 8, the first closing element 8 is deformed elastically and has a substantially planar shape.

[0076] When the first closing element 8 exits the first pocket 43, or at least one portion of the first closing element 8 exits the first pocket 43, it undergoes an elastic return and returns to the substantially folded configuration.

[0077] What has just been disclosed can refer, in the same manner, to the second closing element 12. The first closing element and the second closing element can be deformed plastically so that, in the closed position, they close the transit area of the opening 7 preventing the third powder ceramic material exiting the opening 7.

[0078] In the fitted configuration, the first closing element 8 and the second closing element 12 can be inserted or housed, inside the hopper T, as illustrated in Figure 1. The first closing element 8 and the second closing element 12 are oriented parallel to the operating axes Y and Z. A dimension of the first closing element 8 and of the second closing element 12 measured along the other operating axis Z is substantially equal to the thickness of the inlet 25 of the hopper T.

[0079] The first closing element 8 is fitted between the first plate 10 and the first panel 11 by first connecting means 44, 45. Similarly, the second closing element 12 is fitted between the second plate 13 and the second panel 14 by second connecting means 44a, 45a; the second connecting means is structurally equivalent to the first connecting means.

[0080] The first connecting means can comprise a screw 44; the screw 44 is inserted inside a hole obtained in the first closing element 8. The first connecting means can further comprise a nut screw element 45 that is suitable for receiving the screw 44 internally. In the same manner, the second connecting means can comprise a screw 44a inserted inside a hole obtained in the second closing element 12, and a nut screw element 45a that is suitable for receiving the screw 44a internally.

[0081] With reference to Figures 9A, 10A, 13 and 14, on the first panel 11, a first blind slot 19 is obtained that is arranged to enter into contact/abut on the first connecting means 44, 45. The first blind slot 19 defines a first

guide path for the first connecting means 44, 45 during positioning of the first closing element 8 between the aforesaid open position and the aforesaid closed position.

[0082] In particular, the first blind slot 19 has dimensions that are such as to enable the screw 44, in particular the head of the screw 44, to be inserted internally, to contact a base surface of the first blind slot 19, and to slide along the first guide path when the first closing element 8 is positioned between the open position and the closed position.

[0083] On the first plate 10, a first through slot 17 is obtained arranged to be traversed and by the first connecting means 44, 45. In particular, the first through slot 17 is dimensioned to be traversed by the nut screw element 45. The first through slot 17 defines a further first guide path for the first connecting means 44, 45, in particular for the nut screw element 45. In other words, the nut screw element 45 can slide along the further first guide path defined by the first through slot 17 during positioning of the first closing element 8 between the open position and the closed position.

[0084] The first through slot 17 has the same dimensions and the same shapes as the first blind slot 19; the first through slot 17 is further substantially aligned with the first blind slot 19 along the operating axis X.

[0085] On the second panel 14, a second blind slot 20 is further obtained arranged to enter into contact with/abut on the second connecting means 44a, 45a. The second blind slot 20 defines a second guide path for the second connecting means 44a, 45a during positioning of the second closing element 12 between the aforesaid open position and the aforesaid closed position.

[0086] In particular, the second blind slot 20 has dimensions that are such as to enable the screw 44a, in particular the head of the screw 44a, to be inserted internally, a base surface of the second blind slot 20 to be contacted and to be slid the second guide path when the second closing element 12 is positioned between the open position and the closed position. Further, on the second plate 13, a second through slot 18 is obtained arranged to be traversed and by the first connecting means 44a, 45a. In particular, the second through slot 18 is dimensioned to be traversed by the nut screw element 45a. The second through slot 18 defines a further second guide path for the second connecting means 44a, 45a, in particular for the nut screw element 45a. In other words, the nut screw element 45a can slide along the further second guide path defined by the second through slot 18 during positioning of the second closing element 12 between the open position and the closed position.

[0087] The second through slot 18 has the same dimensions and the same shapes as the second blind slot 20; the second through slot 18 is further substantially aligned with the second blind slot 20 along the operating axis X.

[0088] The first through slot 17 has the same shapes and dimensions as the second through slot 18, further to

the fact that the first through slot 17 is substantially aligned with the second through slot 18 along the operating axis X.

[0089] The first through slot 17, the second through slot 18, the first blind slot 19 and the second blind slot 20 can have a substantially linear shape and extend substantially parallel to the further operating axis Y.

[0090] The feeding device 1 is provided with an actuating unit 21 connected to the first closing element 8 and to the second closing element 12, the actuating unit 21 is operable to position the first closing element 8 and the second closing element 12 between the closed position and the open position, as explained below. The actuating unit 21 can be a linear motor of known type, for example a permanent magnet linear motor. The actuating unit 21 can be fitted to the at least one carriage 2; for example, in the embodiment shown in the attached Figures, the actuating unit 21 is fitted to the central portion of the first plate 28 and of the second plate 29, between the two second conduits 4. Obviously, other fittings of the motor unit can be provided, which are not shown. The actuating unit 21 can be positioned transversely to the first plate 29, and thus be oriented parallel to the further operating axis Y. The actuating unit can be connected to the first connecting means 44, 45 and to the second connecting means 44a, 45a.

[0091] The actuating unit 21 can comprise a stem 46 extending in the direction transverse to the first plate 28, i.e. along the further operating axis Y. The stem 46 is further movable along the further operating axis Y, i.e. transversely to the first plate 28, between one of two end positions of the actuating unit 21. By operating the actuating unit 21, both the first closing element 8 and the second closing element 12, can be moved simultaneously, as explained below.

[0092] The nut screw elements 45 and 45a can be inserted inside a bush 47, for example a bush of cylindrical shape. The bush 47 is in fact provided with a through hole the axis of which is substantially parallel to the operating axis X; the nut screw element 45 is inserted into an inlet of the hole, the nut screw element 45a is inserted into the other inlet of the hole. The bush 47 can be so orientated that the through hole thereof is parallel to the first plate 28. On the side surface of the bush 47, for example along the further operating axis Y, a further hole can be obtained. An end portion of the stem 46 can be inserted inside the further end of the bush 47. One surface of the end portion of the stem 46 can be threaded, thus also as an inner surface of the further hole of the bush 47; the stem 46 is thus arranged to be inserted and tightened inside the further hole of the bush 47. The stem 46 can be further adjusted and clamped to the bush 47 by a nut 48; this nut 48 being screwed to the threaded portion of the stem 46 until it abuts substantially on the side surface of the bush 47. With one movement of the stem 46, a movement of the bush 47 is thus associated and thus of the first connecting means 44, 45 and of the second connecting means 44a, 45a along the further op-

erating axis Y. Consequently, also the first closing element 8 and the second closing element 12 are moved along the further operating axis Y to be positioned between the open position and the closed position.

[0093] In the operative configuration, i.e. when the feeding device 1 is fitted to the hopper T, the outlet port 38 of the first conduit 3 and the further outlet port 38a of the second conduit 3a face the hopper T, in particular face the inlet portion 26. The first powder ceramic material and the second powder ceramic material, intended to form the ceramic slab, traverse the first conduit 3 and the second conduit 3a and are deposited inside the hopper. In the operative configuration, in particular the first closing element 8 and the second closing element 12 are inserted inside the hopper T.

[0094] In particular, the first closing element 8 and the second closing element 12 are arranged transversely to the pair of side walls 36, 36a of the hopper T - i.e. parallel to the other operating axis Z and to the other further operating axis Y - so that the side edges of the first closing element 8 and of the second closing element 12 interact with the side walls 36, 36a. The side edges of the first closing element 8 and of the second closing element are in contact with the side walls 36, 36a.

[0095] The side walls 36, 36a, the first closing element 8 and the second closing element 12 define a containing chamber 49 suitable for containing the third powder ceramic material coming from the opening 7 of the container 5.

[0096] The first closing element 8 and the second closing element 12 are positionable between the closed position in which the first gate element 8 and said second closing element 12 are in contact with one another and prevent the exiting of the third powder ceramic material from the containing chamber 49, and the open position in which the first closing element 8 and the second closing element 12 are at a distance from one another and enable the third powder ceramic material to exit by gravity from the containing chamber 49 and be arranged in the hopper T.

[0097] The exit area of the containing chamber 49 has an extent along the other operating axis Z that is substantially equal to the thickness of the hopper T; the third powder ceramic material exiting the containing chamber has a dimension along the other operating axis Z that is substantially equal to the thickness of the hopper T.

[0098] The third conduit 4 can be provided with a level sensor that is able to detect a quantity of ceramic powders present; the container 5 can be further provided with sensors that are able to measure an exit speed of the ceramic powders exiting the opening 7. The sensors are further able to transmit a digital or analogue signal to a control device, for example a programmable logic controller, such as a PLC. The PLC is configured to process digital and analogue signals coming from the sensors and manage automatically all the operations that are necessary for the feeding device 1 to feed the hopper T by adjusting the dispensing of the third powder ceramic material.

[0099] In particular the PLC is configured to drive the actuating unit 21 and control the positioning of the first closing element 8 and of the second closing element 12 between the open and closed position. The PLC is further configured to drive the motor unit 24 and control a movement of the feeding device 1 on the guide means 27, 27a along the operating axis X.

[0100] In other words, by driving the actuating unit 21, it is possible to adjust the dispensing of the third powder ceramic material inside the hopper T so that at the same time as the deposit of the first powder ceramic material deposited by the at least one first conduit 3 and of the second powder ceramic material deposited by the second conduit 3a, the third powder ceramic material is deposited in the form of a strip having a rectilinear shape or partially rectilinear shape and partially undulating shape. The third ceramic material is interposed between the first ceramic material and the second ceramic material and can extend in a substantially longitudinal direction inside the hopper T, i.e. parallel to the further operating axis Y.

[0101] The third ceramic material has a variable width, where the width is measured with reference to the operating axis X and moves along the further operating axis Y. The rectilinear and undulating shape depends substantially on the feeding device 1 movement along the operating axis X. The variable width of the third powder ceramic material fed into the hopper T is associated with reciprocal positioning of the first closing element 8 and of the second closing element 12, inasmuch as the dimension of another transit area of the containing chamber 49 along the operating axis X depends on this reciprocal positioning. The width of the decorative vein in the slab of ceramic material thus depends on the width of the third powder ceramic material arranged in the hopper T.

[0102] Obviously, by moving the feeding device along the operating axis X, the third ceramic material is however interposed between the first and the second ceramic material. As already said previously, the number of feeding devices 1 fitted to the hopper T can be greater than one, for example in Figure 1 two feeding devices 1 are shown fitted to the hopper T fitted in succession parallel to the operating axis X.

[0103] If there are two or more feeding devices 1 on the hopper, each feeding device will be movable on the guide means 27, 27a for a respective portion. The ceramic powders exiting each feeding device will be deposited in the hopper T and will occupy inside the hopper T a portion of the predefined inner space, having an extent along the operating axis X proportional to the portion travelled by each feeding device.

[0104] Some experiments have shown that the feeding device disclosed above enables a hopper to be fed with a preset volume of ceramic powders, and the hopper to be filled so that the ceramic powders are deposited so as to produce a decorative strip extends or several decorative strips that extend in a substantially longitudinal

direction inside the hopper. Further, by adjusting the transit area of the opening of the container and/or the other transit area of the containing chamber 49 during depositing of the third powder ceramic material, the strip of the third powder ceramic material has a variable width in the hopper. Depositing of the powders in the hopper will be substantially identical to depositing of the powders on the operating plane that are intended to form the decorated slab.

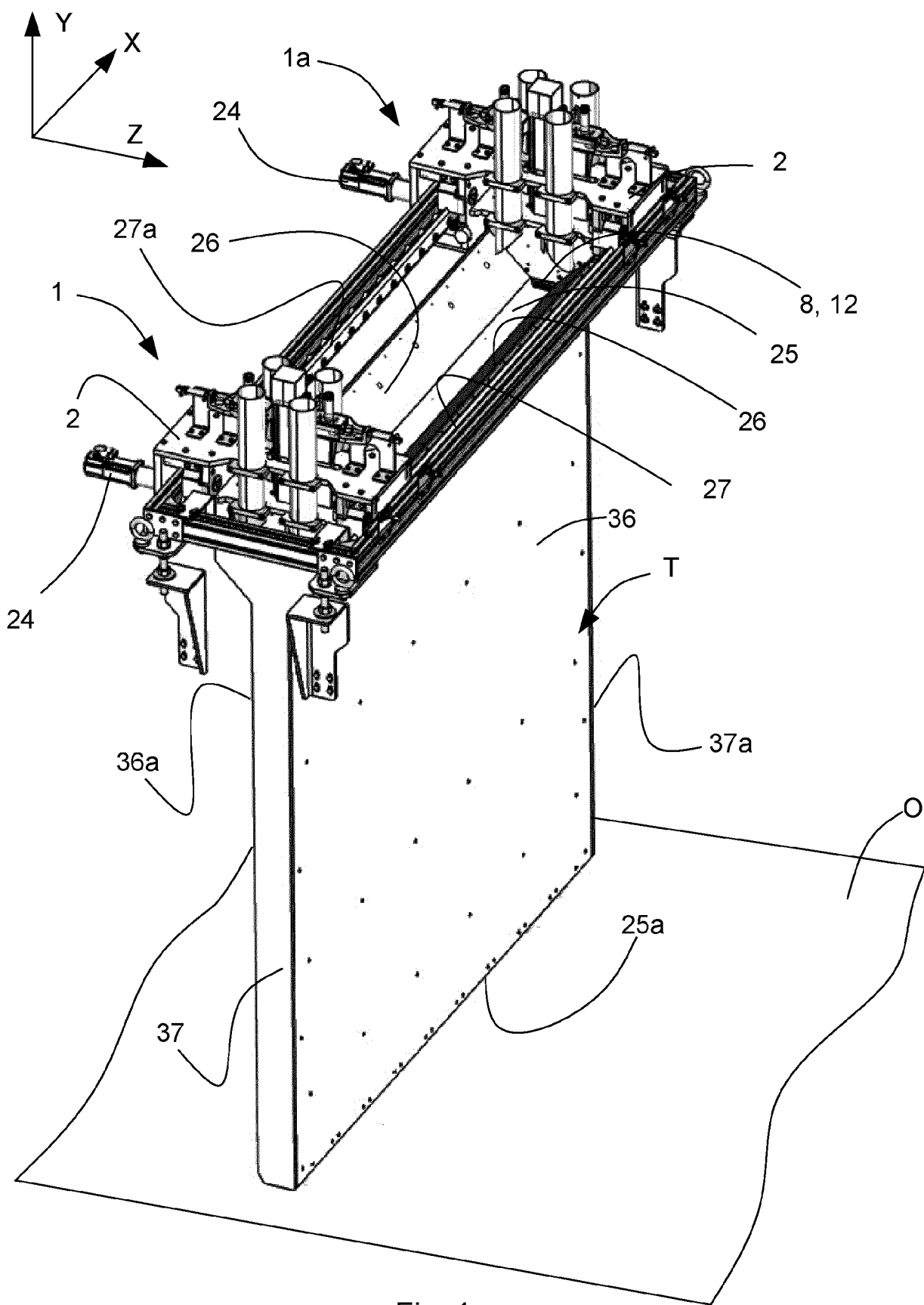
Claims

1. Feeding device (1) for feeding a hopper (T) with incoherent ceramic powders, intended to be formed by compacting into a ceramic slab, said hopper (T) being suitable for containing said incoherent ceramic powders; said incoherent ceramic powders comprising a first powder ceramic material, a second powder ceramic material and a third powder ceramic material, said feeding device (1) being connectable to an inlet (25) of said hopper (T), said feeding device (1) comprising a carriage (2) drivable to be positioned in different zones of said inlet (25), **characterized in that** said carriage (2) is provided with a first conduit (3) and a second conduit (3a) arranged to be crossed respectively by said first powder ceramic material and said second powder ceramic material, and with a container (5) positioned between said first conduit (3) and said second conduit (3a), said container (5) being conformed to define a dividing element to keep separate said first powder ceramic material and said second powder ceramic material at said inlet (25), said container (5) being arranged to contain said third powder ceramic material and being also provided with an opening (7) adjustable to be crossed by said third powder ceramic material to allow said third powder ceramic material to exit said container (5) by gravity and, in use, to be arranged between said first powder ceramic material and said second powder ceramic material inside said hopper (T) in order to produce a vein made of said third powder ceramic material inside said hopper (T).
2. Feeding device (1) according to claim 1, wherein said opening (7) is provided with adjusting means (8, 12) operable for adjusting a volume of said third powder ceramic material exiting said opening (7).
3. Feeding device (1) according to claim 2, wherein said adjusting means (8, 12) comprises a first closing element (8) and a second closing element (12), said first closing element (8) and said second closing element (12) being positionable between a closed position in which one end of said first closing element (8) and a respective end of said second closing element (12) are in contact with one another to reduce said opening (7), and an open position in which said

first closing element (8) and said second closing element (12) are spaced apart from one another to leave said opening (7) free.

4. Feeding device (1) according to claim 3, wherein said first closing element (8) is connected to a first panel (11) of said container (5) and said second closing element (12) is connected to a second panel (14) of said container (5), said second panel (14) being opposite said first panel (11).
5. Feeding device (1) according to claim 4, wherein said first closing element (8) is housed in a first pocket (43) obtained on said first panel (11), and said second closing element (12) is housed in a second pocket obtained on said second panel (14).
6. Feeding device (1) according to claim 5, wherein in said open position said first closing element (8) is contained in said first pocket (43) and said second closing element (12) is contained in said second pocket, whereas in said closed position said first closing element (8) protrudes from said first pocket (43) and said second closing element protrudes from said second pocket.
7. Feeding device (1) according to any one of claims 2 to 6, and further comprising an actuating unit (21) operable to adjust a position of said adjusting means (8, 12) with respect to said opening (7).
8. Feeding device (1) according to claim 7 as appended to claim 3, wherein said actuating unit (21) is operable to position said first closing element (8) and said second closing element (12) between said closed position and said open position.
9. Feeding device (1) according to claim 8, wherein said actuating unit (21) is connected to said first closing element (8) and to said second closing element (12) respectively by first connecting means (44, 45) and second connecting means (44a, 45a).
10. Feeding device (1) according to claim 5 or 6 or to any one of claims 7 to 9 as claim 7 is appended to claim 5, wherein there is provided on said first pocket (43) a first blind slot (19) arranged to abut on said first connecting means (44, 45), and on said second pocket a second blind slot (20) arranged to abut on said second connecting means (44a, 45a), said first blind slot (19) and said second blind slot (20) defining respectively a first guide path for said first connecting means (44, 45) and a second guide path for said second connecting means (44a, 45a) during positioning of said first closing element (8) and said second closing element (12) between said open position and said closed position.

11. Feeding device (1) according to any one of claims 4 to 10, further comprising a first plate (10) connected to said first panel (11) and a second plate (13) connected to said second panel (14).
12. Feeding device (1) according to claim 11 as appended to claim 5, wherein said first plate (10) covers said first closing element (8) housed in said first pocket (43) and said second plate (13) covers said second closing element (12) housed in said second pocket.
13. Feeding device (1) according to claim 11 or 12, wherein there is provided on said first plate (10) a first through slot (17) arranged to be crossed by said first connecting means (44, 45), and on said second plate (13) a second through slot (18) arranged to be crossed by said second connecting means (44a, 45a), said first through slot (17) and said second through slot (18) defining respectively a further first guide path for said first connecting means (44, 45) and a further second guide path for said second connecting means (44a, 45a) during positioning of said first closing element (8) and of said second closing element (12) between said open position and said closed position.
14. Feeding device (1) according to any of the claims 2 to 13, wherein said first closing element (8) and said second closing element (12) each comprise a gate made of deformable metallic material.
15. Feeding device (1) according to any one of the preceding claims, further comprising at least a third conduit (4) connected to said container (5) and arranged to be crossed by said third powder ceramic material, said third conduit (4) being provided with an inlet port (22) arranged to allow said third powder ceramic material to enter said third conduit (4) by gravity, said inlet port (22) being also provided with a gate valve (23) switchable between a first configuration in which said gate valve (23) closes a passage of said inlet port (22) to prevent said third ceramic powder material from entering the third conduit (4), and a second configuration, in which said valve gate (23) leaves said passage free to allow said third powder ceramic material to enter said third conduit (4).
16. Feeding assembly (1, T) comprising:
- at least one feeding device (1) according to any one of the preceding claims;
 - a hopper (T) mounted below said feeding device (1) and provided with an inlet (25) arranged to be crossed by said incoherent ceramic powders exiting said feeding device (1) by gravity.
17. Feeding assembly (1, T) according to claim 16, further comprising guide means (27, 27a) connected to said hopper (T), said guide means (27, 27a) being arranged to slidably support along an operating axis (X) said at least one feeding device (1).
18. Feeding assembly (1, T) according to claim 16 or 17, wherein said container (5) interacts with an inlet portion (26) of said inlet (25).
19. Feeding assembly (1, T) according to claim 16 or 18, wherein said first closing element (8) and said second closing element (12) extend across said inlet (25) and are inserted into an inner space of said hopper (T), said first closing element (8) and said second closing element (12) interacting with two side walls (36, 36a) of said hopper (T) to define a containing chamber (49) suitable for containing said third ceramic powder material exiting said opening (7).
20. Feeding assembly (1, T) according to any one of claims 17 to 19, wherein said at least one feeding device (1) is connected to a motor unit (24), operable to slide said at least one feeding device (1) on said guide means (27, 27a) along said operating axis (X).
21. Feeding assembly (1, T) according to any one of claims 16 to 20, comprising a plurality of feeding devices (1, 1a) according to any one of claims 1 to 15, in particular four feeding devices (1, 1a).
22. Feeding assembly (1, T) according to claim 21 as appended to 17, wherein the feeding devices of said plurality of feeding devices (1, 1a) are arranged in succession along said operating axis (X) on said guide means (27, 27a).



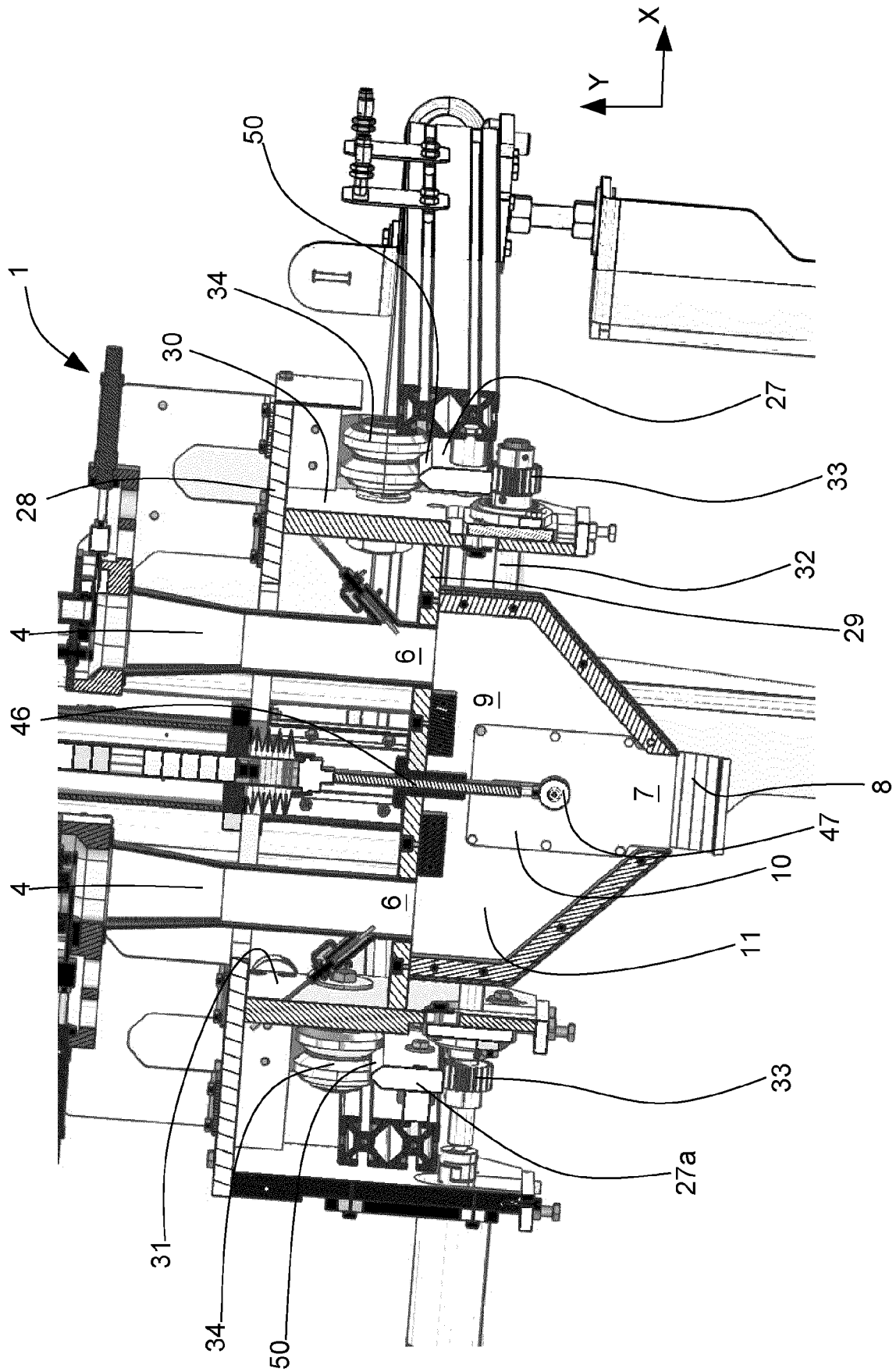


Fig. 2

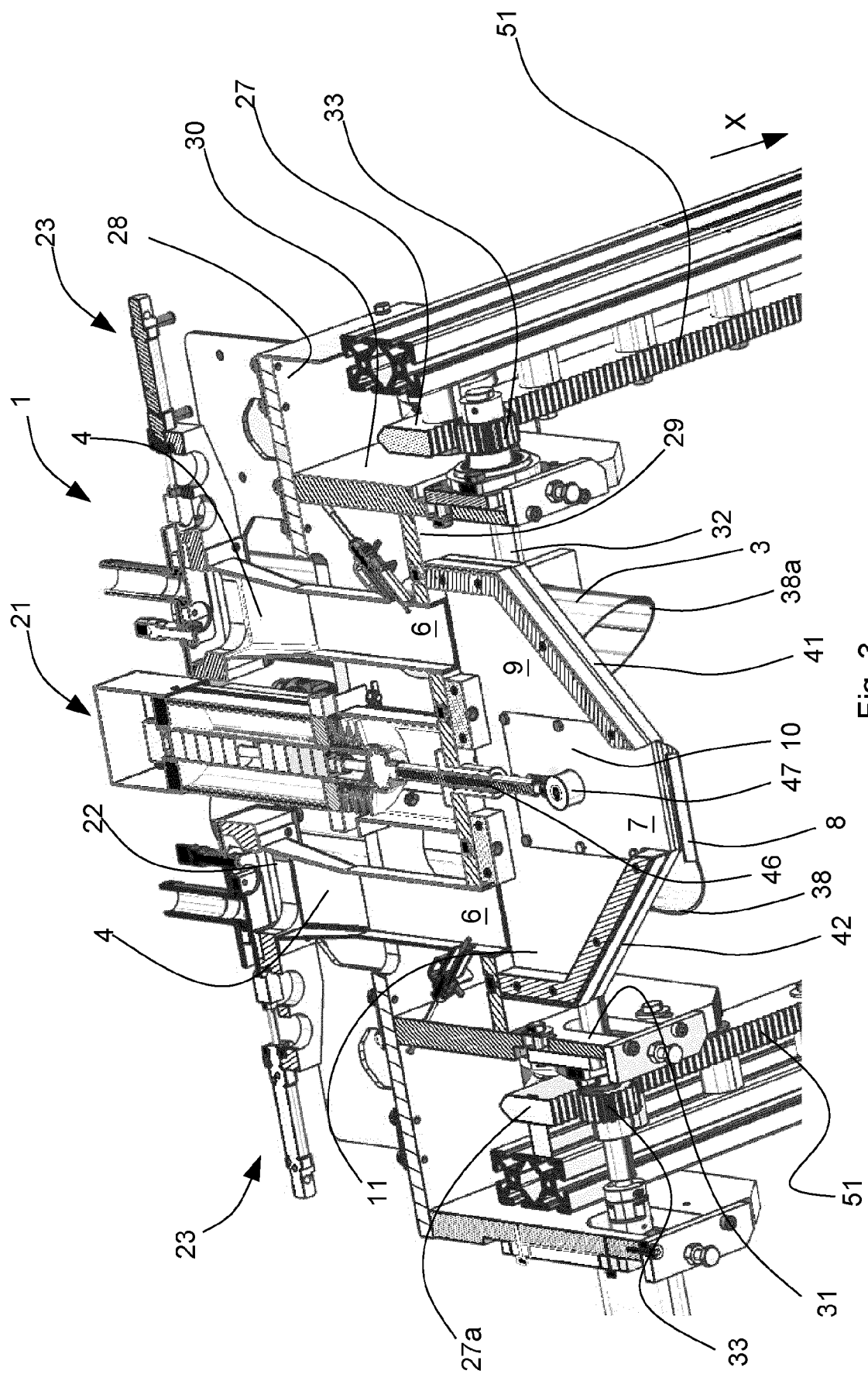


Fig. 3

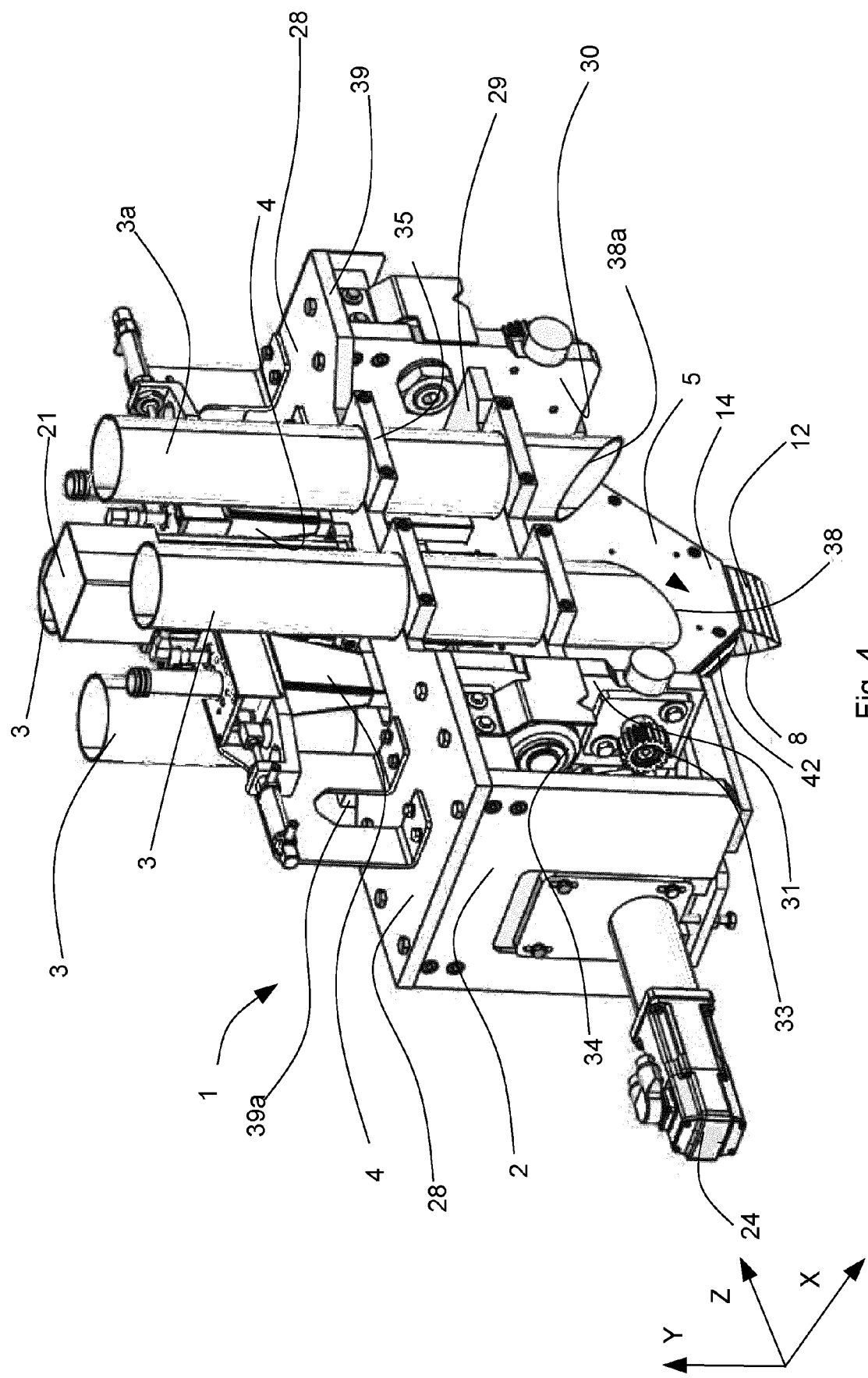


Fig. 4

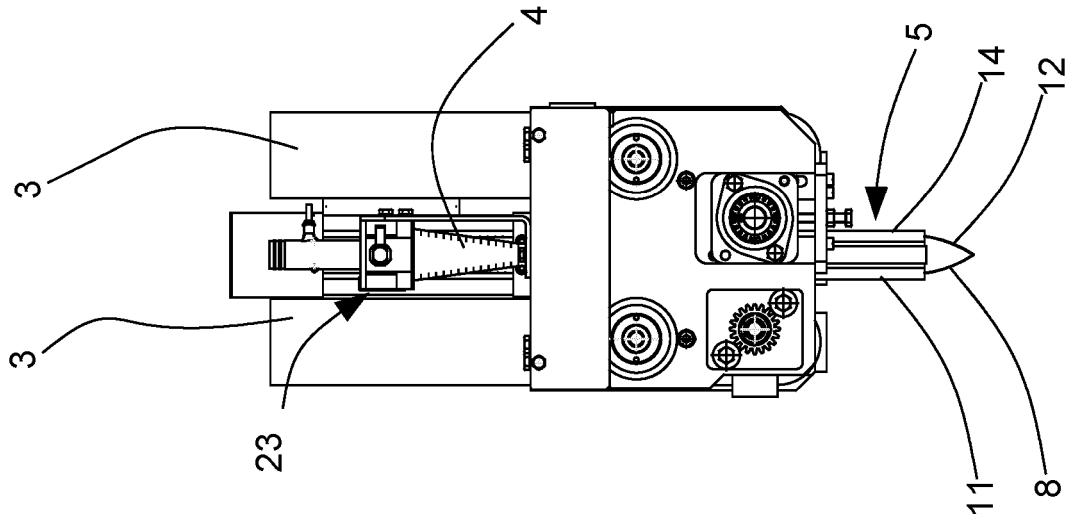


Fig. 6

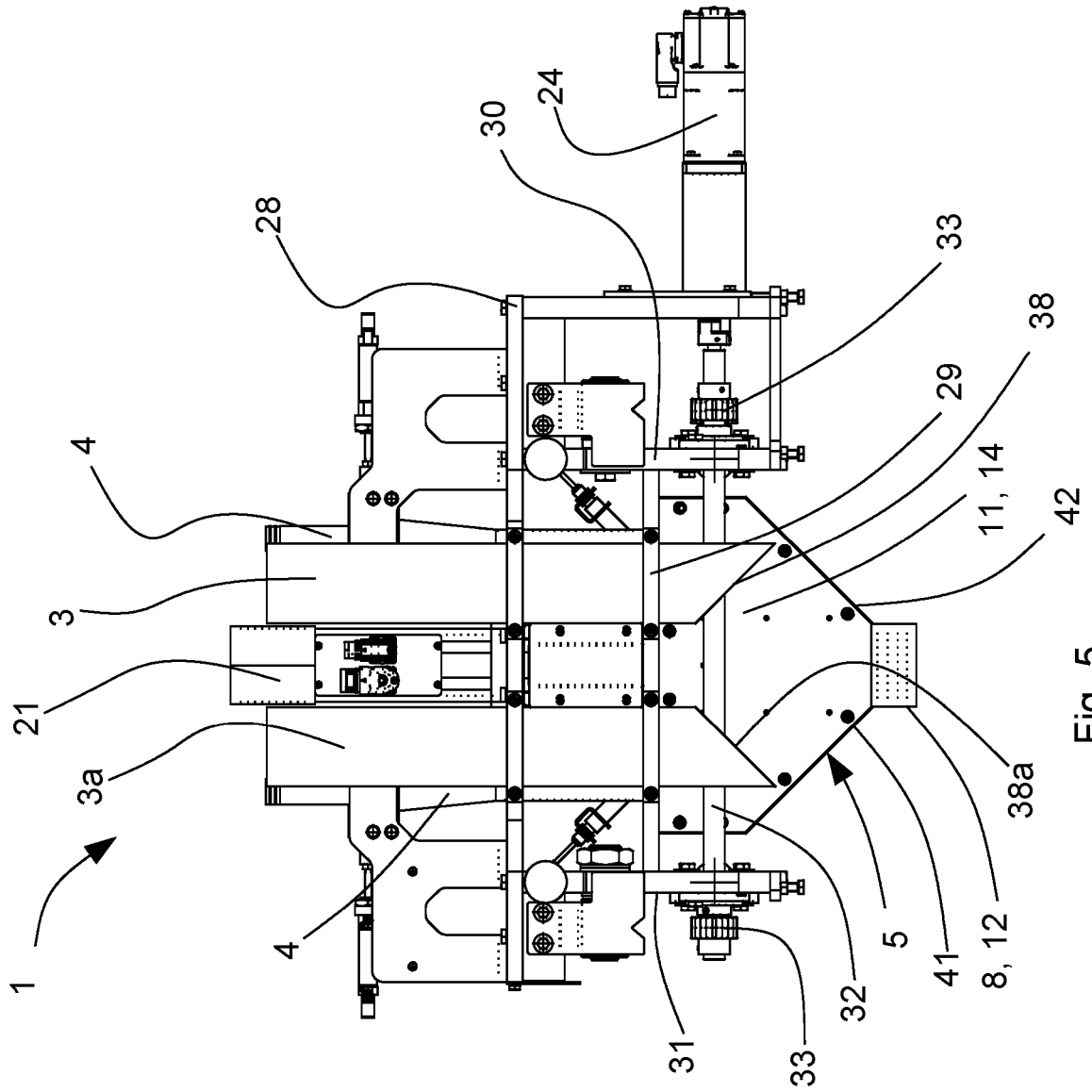


Fig. 5

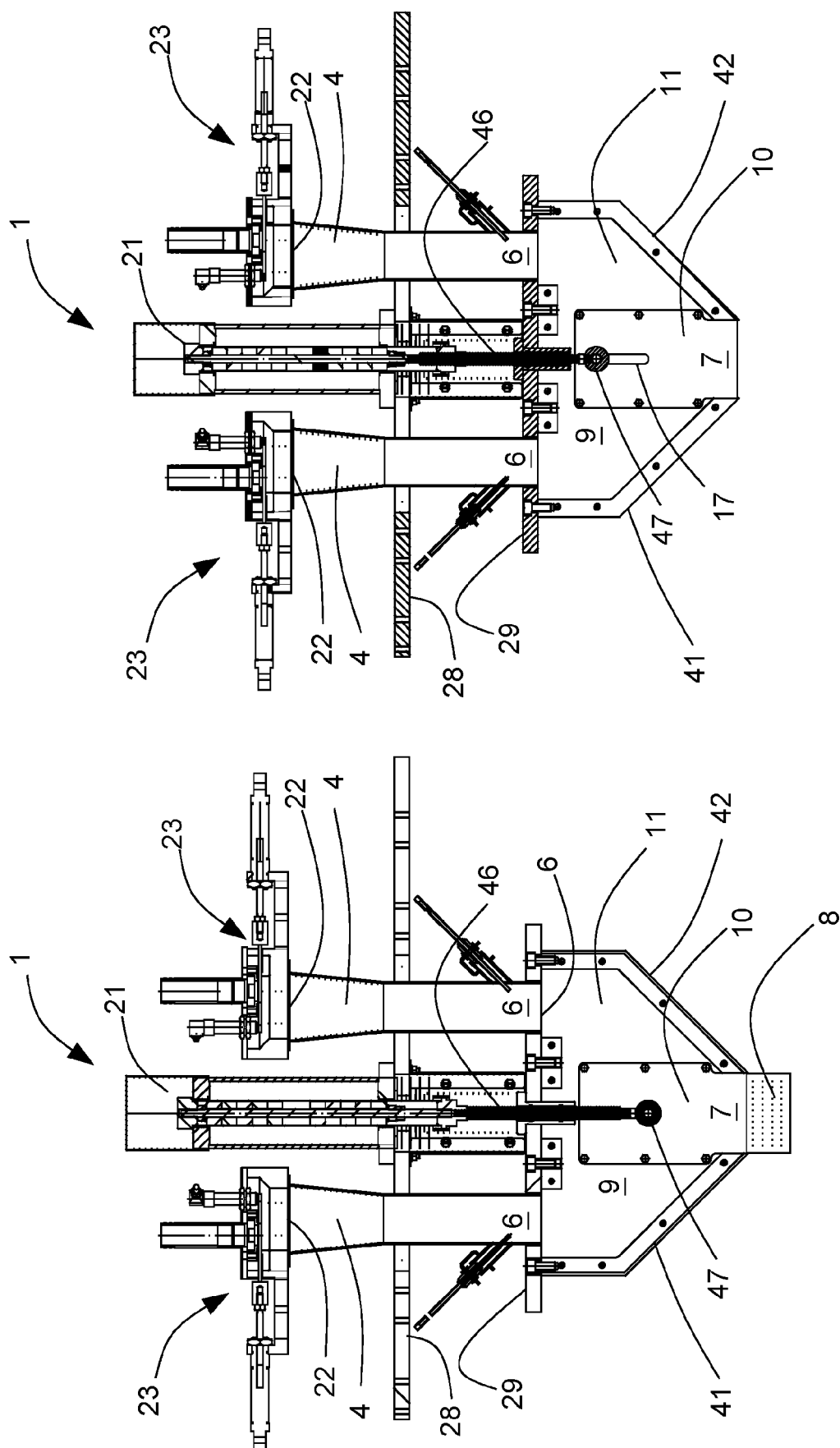


Fig. 7

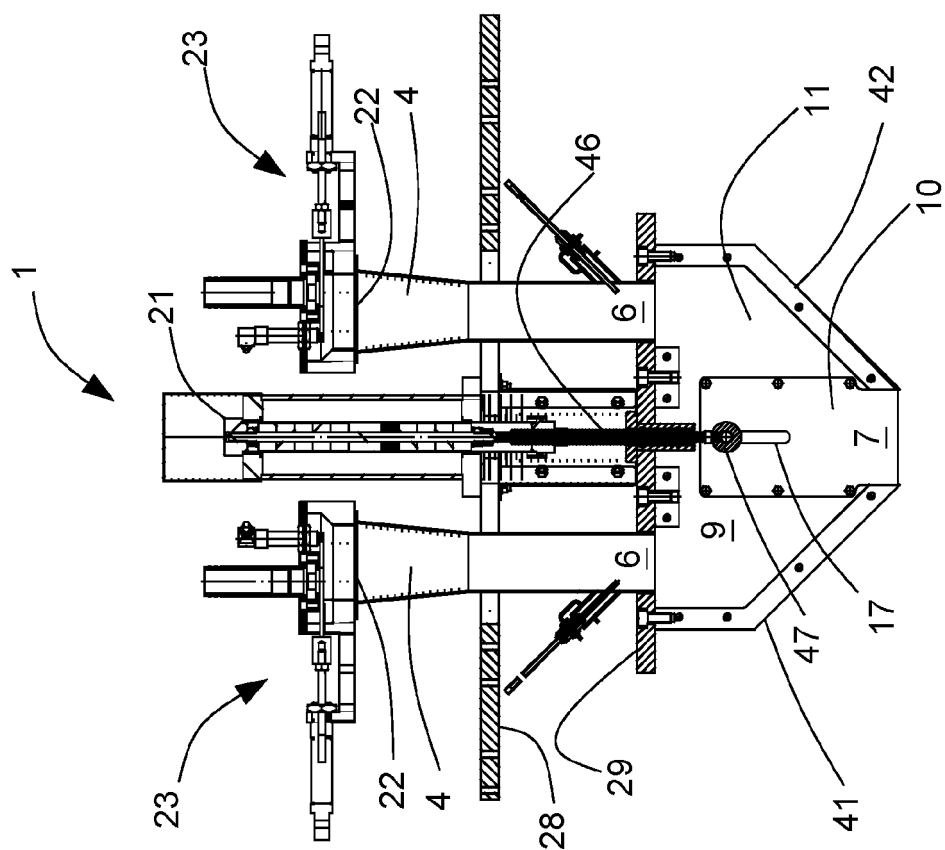


Fig. 8

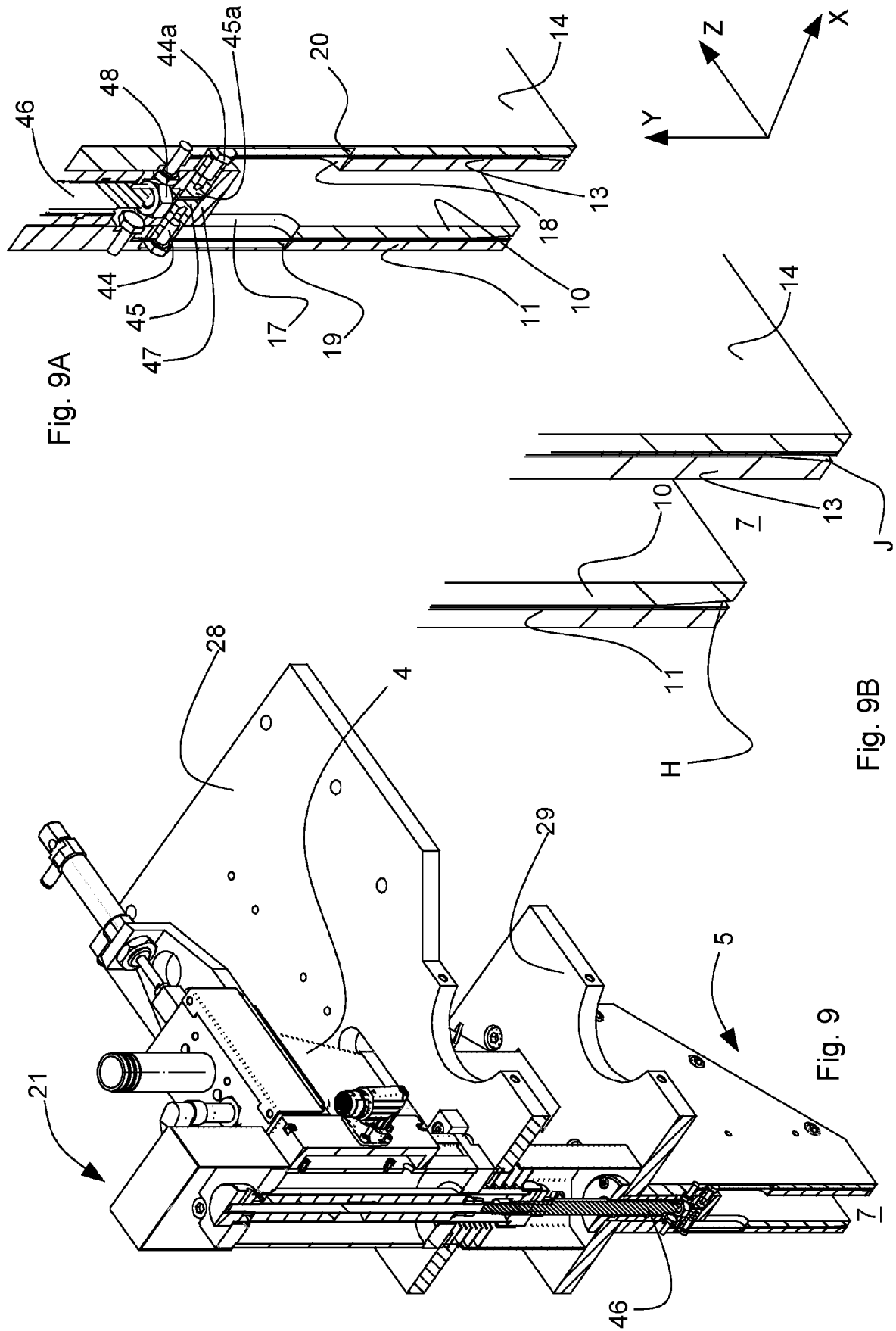


Fig. 10A

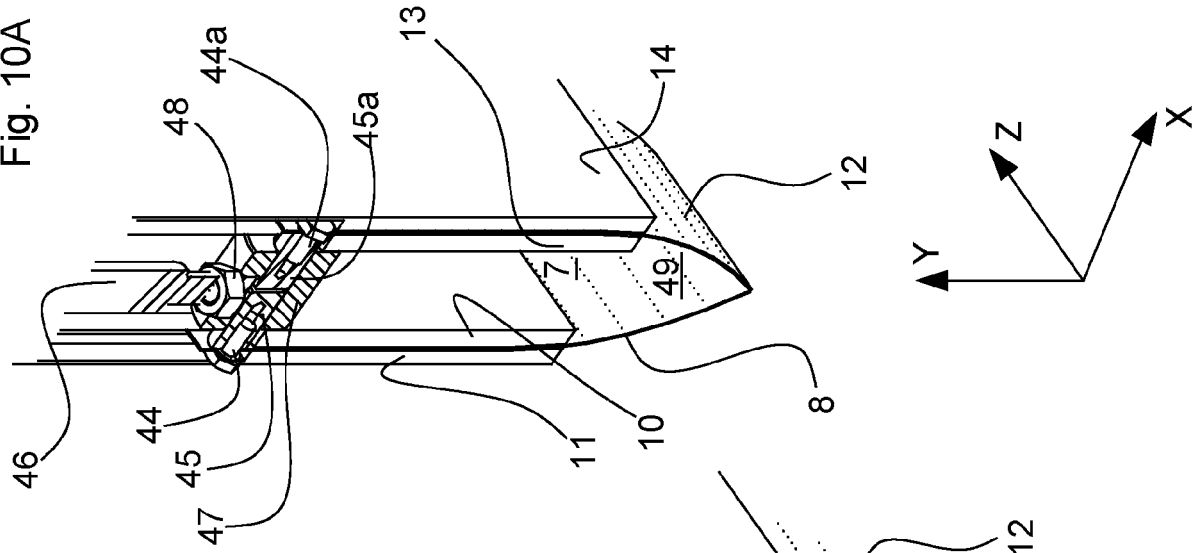


Fig. 10B

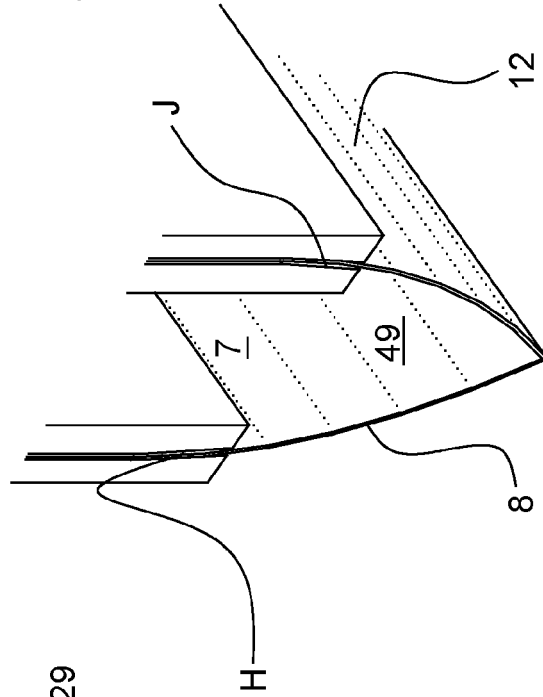
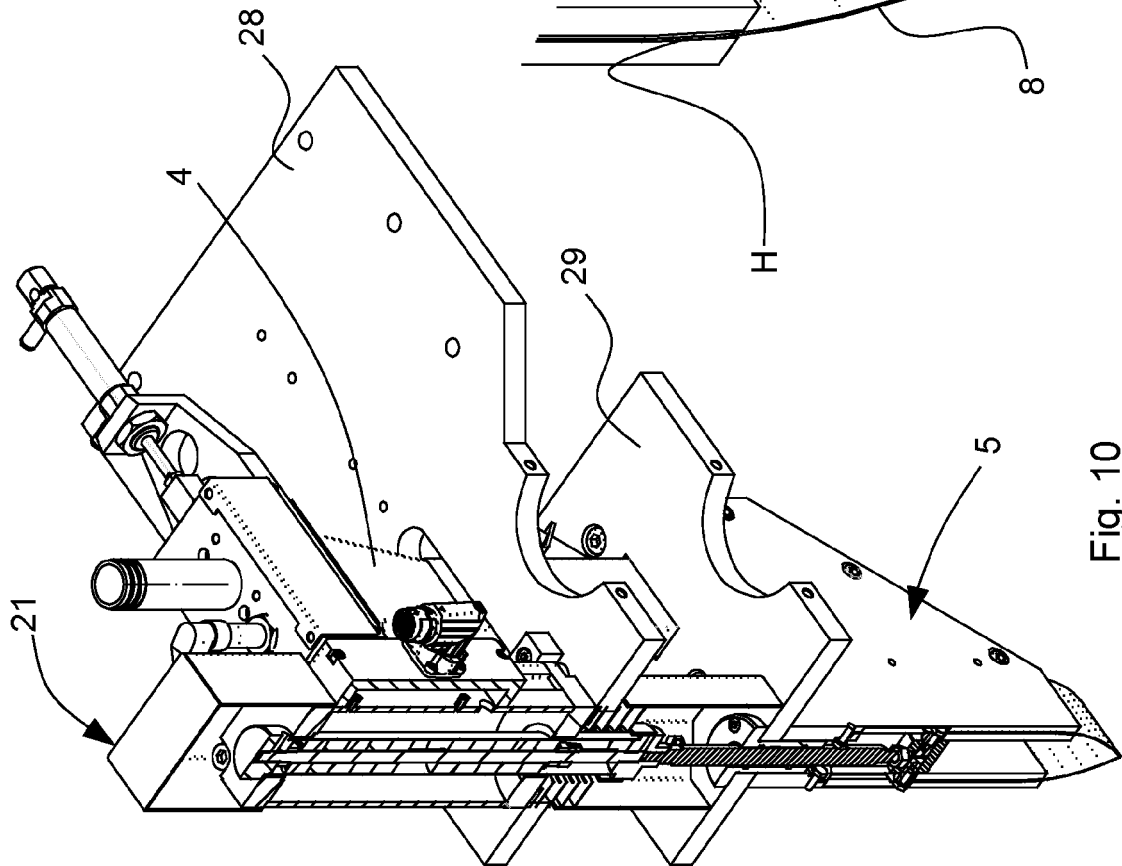


Fig. 10



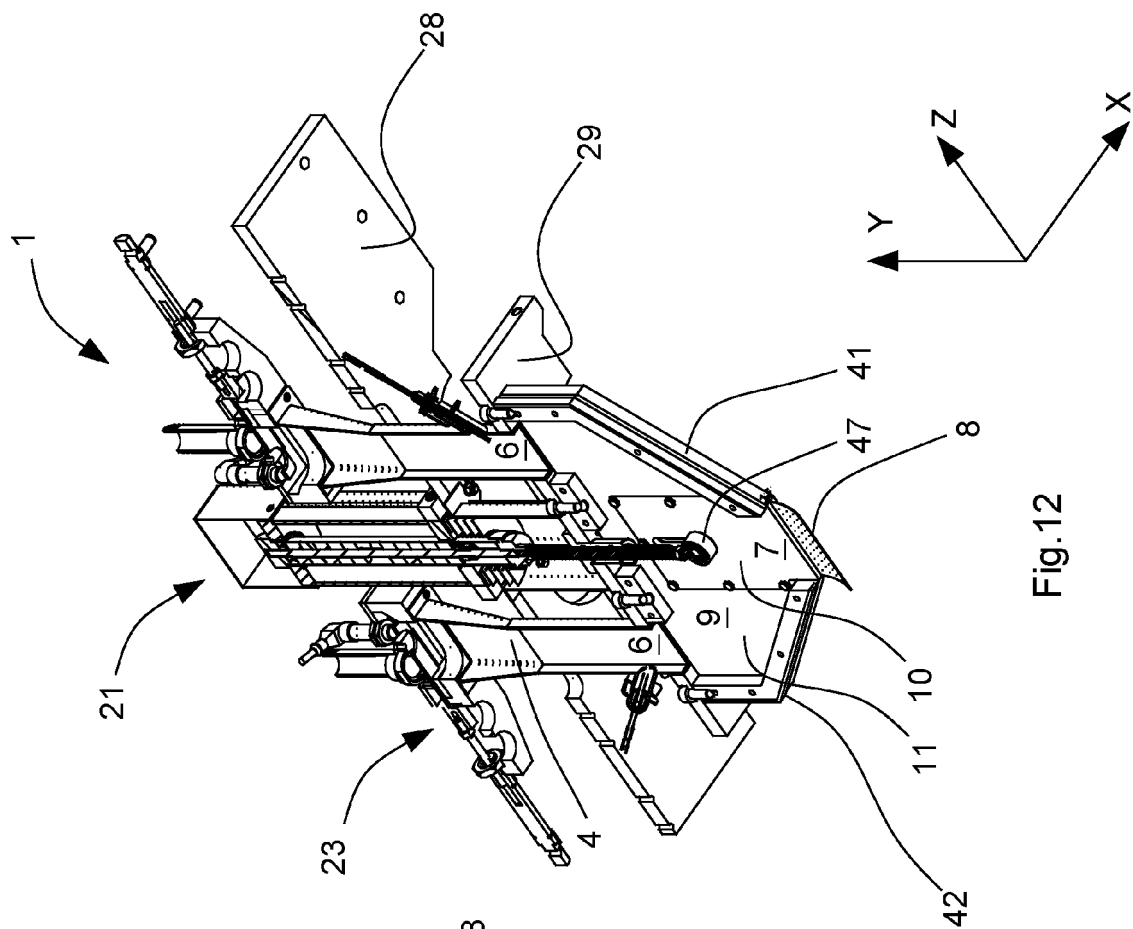


Fig. 12

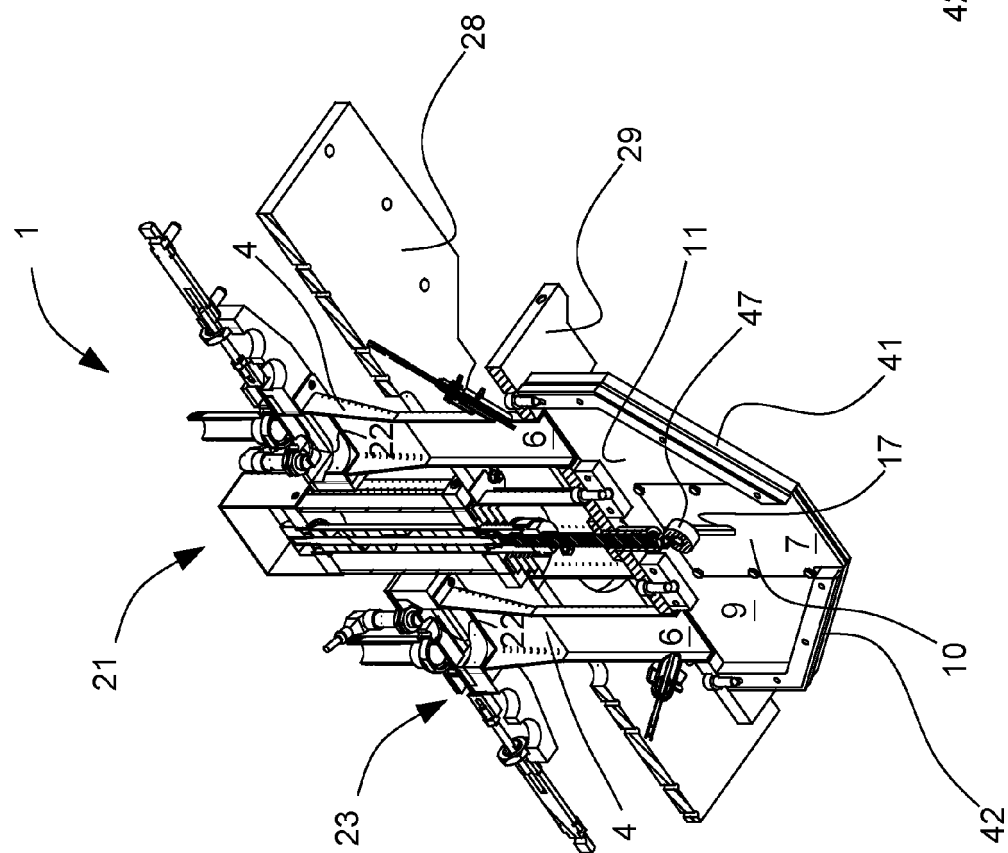


Fig. 11

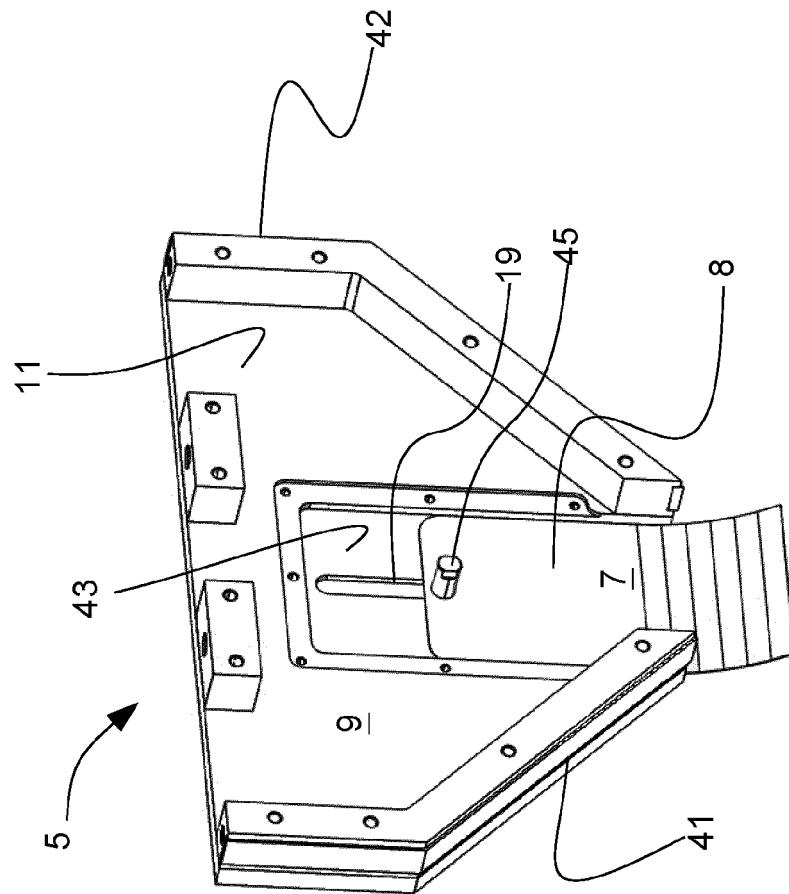


Fig. 14

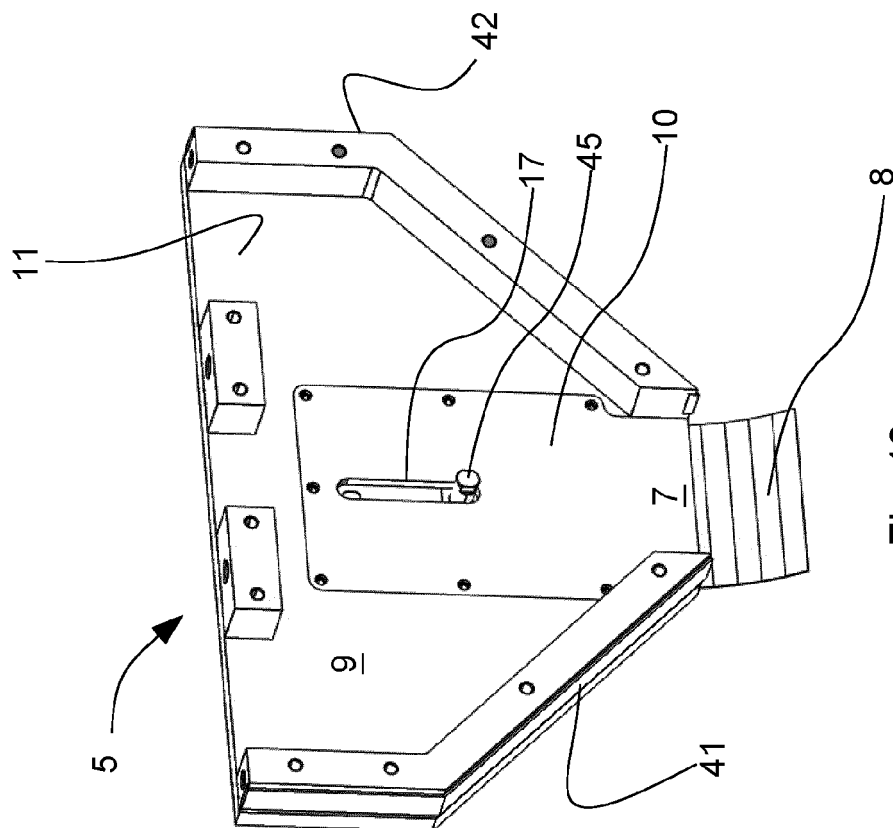


Fig. 13



EUROPEAN SEARCH REPORT

Application Number
EP 21 15 7163

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A	* paragraph [0017] - paragraph [0019]; figures 6-7 *	3-14,19, 21,22	B28B13/02
A	EP 0 605 930 A1 (MIRAGE CERAMICA SPA [IT]) 13 July 1994 (1994-07-13)	1-22	
	* page 5, line 1 - page 5, line 21; figures 1-7 *		
			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 2 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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 21 15 7163

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
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02-06-2021

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