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(54) METHOD AND PLANT FOR MANUFACTURING CERAMIC PRODUCTS

(57) A method for manufacturing ceramic products (T) is described, sequentially comprising the steps of: feeding a mixture of ceramic powders, micro metering the ceramic powders by means of a metering device (14), dispensing and depositing the powders on a transport device (18), accumulating and compacting the powders by means of an accumulation and compaction device (20), pressing the compacted ceramic powders (CL). The feeding step comprises a sub-step of feeding the ceramic powders along inclined feeding directions (A1, A2, A3), so as to relieve the vertical load of the powder weight on the metering device (14). The micro metering step comprises a sub-step of removal of any powders not meeting quality criteria. The dispensing and depositing step comprises a sub-step of separating the ceramic powders along a plurality of longitudinal channels, parallel to the feeding direction (B) of the transport device (18), to avoid dispersion by falling of the ceramic powders. This separation sub-step is implemented by a transport device (18) in the form of a conveyor belt whose surface comprises longitudinal protrusions (44) interspersed by longitudinal grooves (46). The accumulation and compaction step comprises a sub-step of dynamic variation of the accumulation and compaction direction (C) with respect to a substantially vertical plane, so as to control the formation of chromatic effects in the thickness of the compacted ceramic powders. A plant (10) for manufacturing ceramic products (T) by implementing the aforementioned method is also claimed.

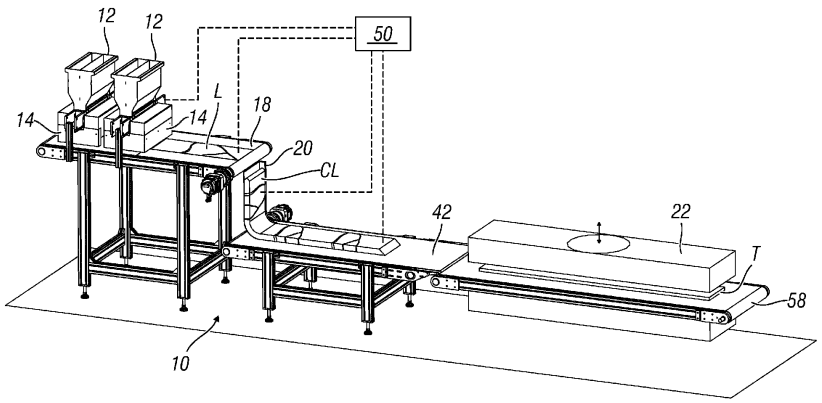

Fig. 1

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Description

[0001] The present invention generally relates to a method and a plant for manufacturing ceramic products and, in particular, a method and a plant for preparing and distributing, according to a plurality of predefined layouts, ceramic powders for the production of slabs and/or tiles.

[0002] Plants for manufacturing ceramic slabs and/or tiles that faithfully reproduce the appearance, or layout, of natural stones, such as marble and/or granite, are known from the prior art. Natural stones are in fact provided with internal striations or veining, distributed randomly within their thickness, which are highly appreciated by customers, especially when these natural stones are used as a covering material for floors, walls, worktops, etc.

[0003] The aforesaid plants typically comprise devices for feeding and metering atomized and coloured ceramic powders. These feeding and metering devices usually operate by gravity. The ceramic powders are then deposited, in a controlled and programmable way through a proper electronic control system, on a conveyor belt so that a continuous strip of ceramic powder with a predefined layout is formed. The continuous strip of ceramic powder is then sent to an accumulation and compaction device where, again by gravity, the ceramic material which is still in powder "stratifies" in a controlled manner. In this way the compacted ceramic powder can take on the final appearance of the slab and/or tile, which will be effectively and definitively formed after further operations of pressing on the ceramic material still in the powder form, cutting the ceramic material to size and final cooking.

[0004] A plant for manufacturing ceramic products of a known type is disclosed, for example, in document WO 2020/058891 A1, which also describes a method for manufacturing ceramic products according to the preamble of claim 1. Another plant for manufacturing ceramic products according to the prior art is disclosed in document US 5056998 A. Document CN 109927161 A, on the other hand, discloses a method for manufacturing slabs and/or tiles starting from ceramic powders.

[0005] A first drawback of the known plants for manufacturing ceramic products can even occur in the respective ceramic powders feeding and metering device. As this feeding and metering device operates by gravity and is designed for the inlet of a large amount of powders in a limited time unit, it can be subject to clogging.

[0006] Another drawback of the known plants for manufacturing ceramic products is then due to the fact that the ceramic material to be processed, being initially formed by more or less compacted ceramic powder, can undergo deformations and/or alterations within the various devices of the system, so as to compromise the final aesthetic appearance of the finished slabs and/or tiles.

[0007] The object of the present invention is therefore to provide a method and a plant for manufacturing ceramic products, in particular a method and a plant for preparing and distributing, according to a plurality of predefined layouts, ceramic powders for producing slabs and/or tiles, which are capable of solving the aforementioned drawbacks of the prior art in an extremely simple, economical and particularly functional way.

[0008] In detail, it is an object of the present invention to provide a method and a plant for manufacturing ceramic products that are capable of improving the appearance of the slabs and/or tiles as much as possible.

[0009] Another object of the present invention is to provide a method and a plant for manufacturing ceramic products that are capable of avoiding clogging and/or other possible malfunctions of the plant due to an uncontrolled management of the powders used for manufacturing slabs and/or tiles.

[0010] These objects according to the present invention are achieved by providing a method and a plant for manufacturing ceramic products as set forth in the independent claims. Further features of the invention are highlighted by the dependent claims, which are an integral part of this description.

[0011] The features and advantages of a method and a plant for manufacturing ceramic products according to the present invention will be clearer from the following, exemplifying and non-limiting description, referring to the attached drawings, wherein:

Figure 1 is a perspective view of a preferred embodiment of a plant for manufacturing ceramic products according to the present invention;

Figure 2 is a sectional view showing a component of the plant of Figure 1, designed to carry out a step of feeding the powders in the method for manufacturing ceramic products according to the present invention;

Figures 3A, 3B and 3C are sectional views showing respective embodiments of another component of the plant of Figure 1, designed to carry out a step of micro metering the powders in the method for manufacturing ceramic products according to the present invention;

Figure 4 is a sectional view showing a further component of the plant of Figure 1, designed to carry out a step of conveying the powders in the method for manufacturing ceramic products according to the present invention;

Figure 5 is a perspective view showing a further component of the plant of Figure 1, designed to carry out a step of controlled depositing the powders in the method for manufacturing ceramic products according to the present invention;

Figure 6 is a sectional view showing further components of the plant of Figure 1, designed to carry out a step of controlled accumulating powders in the method for manufacturing ceramic products according to the present invention;

Figure 7 is a perspective view showing a further component of the plant of Figure 1, designed to carry out

a step of controlling the constant maintenance of the level of powders in the method for manufacturing ceramic products according to the present invention; and

Figure 8 is a sectional view showing a further component of the plant of Figure 1, designed to carry out a step of checking the thickness of the final layer of powders that will form the ceramic products upon completion of the method for manufacturing ceramic products according to the present invention.

[0012] With reference to Figure 1, a preferred embodiment of a plant for manufacturing ceramic products according to the present invention is shown. The plant is indicated as a whole with the reference number 10. The plant 10 is designed to provide a method for manufacturing ceramic products T which sequentially comprises a plurality of operative steps.

[0013] A first operative step consists in gravity feeding a mixture of one or more ceramic powders having features and/or colours different from one another, by means of at least one feeding device 12 and along at least one substantially vertical feeding direction A (Figure 2). As shown in the sectional view of Figure 2, each feeding device 12 comprises at least one hopper 28 which is internally provided with a plurality of separator baffles 30, 32, 34, 36, 38 which, as will be better specified below, are configured to discharge the weight of the mixture of ceramic powders leaving the feeding device 12, so as to avoid clogging thereof.

[0014] Further to the feeding step, a micro metering step is provided for micro metering said ceramic powders fed by the hopper 28, by means of at least one metering device 14 controlled by at least one central processing unit 50, so as to divide said ceramic powders on the basis of predefined quality criteria. These predefined quality criteria can consist, for example, of the particle size of the ceramic powders, humidity, flowability, flow rate, etc.

[0015] Each metering device 14 is conveniently provided with a plurality of nozzles 40 whose predefined passage section is as small as possible, but is in any case suitable for gravity dropping the ceramic powders along the substantially vertical feeding direction A. The sectional views of Figures 3A, 3B and 3C show three possible embodiments of the metering device 14 and the respective nozzles 40, which are manufactured according to known technologies and are operated independently by the central processing unit 50 of the plant. 10.

[0016] According to the invention, as shown in Figures 3A, 3B and 3C, the step of micro metering the ceramic powders comprises at least one sub-step of removing those ceramic powders which do not satisfy one or more of the abovementioned predefined quality criteria. For this purpose, each metering device 14 can be preferably provided with one or more powder removal apparatuses 48, 60 arranged to remove at least part of the ceramic powders, such as too fine powders, from the main flow of ceramic powders passing through each nozzle 40. For example, as shown in Figure 3B, the powder removal apparatus 48, 60 of the metering device 14 can comprise one or more micro-filters 48, operatively associated with a respective nozzle 40 through which the main flow of ceramic powders passes, and one or more suction pumps 60, designed to suck the too fine powders through each micro-filter 48.

[0017] Each metering device 14 can also be preferably provided with one or more shut-off valves 64, such as pinch valves. Each of these shut-off valves 64 can be installed along a respective nozzle 40 (Figure 3A), to intercept the main flow of the ceramic powders, and/or at one or more ducts 66 (Figure 3B) arranged for extracting the too fine powders from this main flow of ceramic powders.

[0018] Further to the ceramic powders micro metering step, a dispensing and depositing step is provided, by means of at least one dispensing device 16 (Figure 4), for dispensing and depositing said ceramic powders on a first transport device 18 which is substantially flat and movable along a substantially horizontal feeding direction B, so as to obtain a first layer L of ceramic powders having surface chromatic effects.

[0019] Preferably, as shown in Figure 4, said step of dispensing and depositing the ceramic powders comprises at least one sub-step of conveying, by means of at least one conveying element 24 of said dispensing device 16, said ceramic powders along a single dispensing direction F starting from a plurality of separate and distinct dispensing directions D, E. In this way, the ceramic powders can be dispensed on the first transport device 18 along the single dispensing direction F, in order to better control the flow rate of these ceramic powders by the central processing unit 50 of the plant 10, as well as to increase the characterization of the surface chromatic effects that can be seen on the first layer L of the ceramic powders.

[0020] The first transport device 18 transfers the first layer L of powdered ceramic material towards the subsequent operative accumulation and compaction step. In this operative step, the first layer L of powdered ceramic material is accumulated and compacted by means of at least one accumulation and compaction device 20 controlled by the central processing unit 50, along an accumulation and compaction direction C, which, preferably and as shown in Figure 6, is substantially vertical. In this way a second layer CL of compacted ceramic powders is obtained, which has both surface chromatic effects and chromatic effects in the thickness.

[0021] Further to the accumulation and compaction step, the second layer CL of ceramic powders compacted by the accumulation and compaction device 20 is transferred, preferably by means of a second transport device 42 which is substantially flat and movable along the same substantially horizontal feeding direction B as the first transport device 18, towards the subsequent operative pressing step. This pressing step is obtained by means of at least one pressing device 22 which compresses the

second layer CL of compacted ceramic powders, so as to reduce its thickness and obtain the ceramic products T in the form of one or more slabs and/or tiles.

[0022] According to the invention, the step of feeding the mixture of ceramic powders comprises at least one sub-step of feeding this mixture of ceramic powders along one or more feeding directions A1, A2, A3 which are inclined according to respective predefined angles with respect to the substantially vertical feeding direction A, so as to relieve the vertical load of this mixture of ceramic powders which weighs on the nozzles 40 of the metering device 14, which is located below the feeding device 12.

[0023] The mixture of ceramic powders is diverted along one or more feed directions A1, A2, A3 which are inclined with respect to the substantially vertical feeding direction A: this diversion is due to the particular and innovative internal conformation of the hopper 28. In addition to one or more substantially vertical separator baffles 30, 32, this hopper 28 is in fact internally also provided with further separator baffles 34, 36, 38, which are operatively associated with the substantially vertical separator baffles 30, 32 and/or with the walls of the hopper 28 and which, as shown in Figure 2, are oriented along respective directions A1, A2, A3 which are inclined according to respective predefined angles with respect to the substantially vertical feed direction A.

[0024] Again according to the invention, the step of dispensing and depositing the ceramic powders on the first transport device 18 comprises at least one sub-step of separating these ceramic powders along a plurality of channels longitudinal and parallel to the feeding direction B of the first transport device 18. In this way the dispersion by falling of the ceramic powders is avoided, while maintaining the characterization of the surface chromatic effects on the first layer L of the ceramic powders and set through the central processing unit 50 of plant 10.

[0025] The ceramic powders are separated due to the fact that the first transport device 18 consists of a closed loop conveyor belt, the transport surface of which comprises (see Figure 5) a plurality of longitudinal protrusions 44, i.e., oriented along the feeding direction B, interspersed by a corresponding plurality of longitudinal grooves 46, also oriented along the feeding direction B. Preferably, both the longitudinal protrusions 44, and the corresponding longitudinal grooves 46 have a cross-sectional triangular or pyramidal shape, i.e. a section perpendicular to the feeding direction B. The particular conformation of the transport surface of the first transport device 18, with alternating longitudinal protrusions 44 and longitudinal grooves 46, helps to contain the ceramic powders leaving the nozzles 40 of the metering device 14 and the conveying element 24 of the dispensing device 16, avoiding its dispersion by falling and thus maintaining a good characterization of the layout of the slab and/or tile T in the process of formation. It should also be noted that the first layer L of the powdered ceramic material deposited on the first transport device 18 has a very reduced thickness, so as to obtain a greater characterization of the layout even in the subsequent accumulation and compaction step, adapted to form the second layer CL of compacted ceramic powders.

[0026] The step of accumulating and compacting the first layer L of powdered ceramic material comprises at least one sub-step of dynamic variation of the accumulation and compaction direction C with respect to a substantially vertical plane, so as to control the formation of both the surface chromatic effects, and the chromatic effects in the thickness of the second layer CL of compacted ceramic powders. For this purpose, the accumulation and compaction device 20 consists of at least one hopper (or "drawer") with a substantially vertical development, sized to allow therein an adequate flow of the powders which form the first layer L of ceramic material during the respective stratification step leaving the first transport device 18.

[0027] As shown in Figure 6, an important aspect is linked to the fall height of the ceramic powders which form the first layer L of ceramic material inside the hopper 20. This determines the success of the layout of the slab and/or tile T in the process of formation, especially when this layout reproduces the typical veining of marble throughout the thickness of this slab and/or tile T. The lower the fall height of the ceramic powders, the higher the resolution of the layout, as it avoids a mixing of the ceramic powders due to a possible excessively high drop height.

[0028] To obtain the dynamic variation of the accumulation and compaction direction C of the powdered ceramic material, the hopper 20 is conveniently provided with at least one pivoting mechanism 52 configured to rotate this accumulation and compaction device 20 about a horizontal axis which is substantially perpendicular with respect to said feeding direction B. In this way, not only is the dynamic variation of the accumulation and compaction direction C of the powdered ceramic material with respect to a substantially vertical plane, but also a variation of the angle α (Figure 8) between the substantially horizontal plane on which said first transport device 18 lies and the plane passing through said accumulation and compaction device 20 at the respective upper loading opening 54 are obtained. An angle α less than 90°, in fact, helps to improve control of the formation of both the surface chromatic effects, and the chromatic effects in the thickness of the second layer CL of compacted ceramic powders.

[0029] The step of accumulation and compaction of the first layer L of powdered ceramic material can also comprise at least one sub-step of controlling, by means of at least one control sensor 26 for controlling the hopper 20, the quantity of powdered ceramic material contained inside this hopper 20. The control sensor 26 is preferably positioned at the upper loading opening 54 of the hopper 20.

[0030] Preferably, the hopper 20 can be provided with at least one arch shaped lower unloading opening 56,

placed at the second transport device 42 (Figure 8). The radius of curvature of this arch shaped lower unloading opening 56 is preferably equal to 2.5 times the average thickness S of the passage section for the passage of the ceramic powders inside the hopper 20, for the purpose of a correct positioning of the second layer CL of compacted ceramic powders on the second transport device 42.

[0031] Again preferably, as shown in Figure 8, the hopper 20 can also be provided with at least one gate 62 designed to selectively close the respective arch shaped lower unloading opening 56 under certain operating conditions of the plant 10. This gate 62, for example, can be kept closed during the step of the first filling of the hopper 20 with the powders coming from the first layer L of ceramic material transported by the first transport device 18. Once a predefined quantity of powdered ceramic material has been reached inside the hopper 20, in which this predefined quantity can be indicated for example by the control sensor 26, the gate 62 can be opened to allow the formation of the second layer CL of compacted ceramic powders on the second transport device 42.

[0032] Outgoing from the second transport device 42, the second layer CL of compacted ceramic powders, provided with chromatic effects on the surface and/or the thickness thereof, pre-set by the central processing unit 50 of the plant 10, undergoes the pressing step for the formation of ceramic products T in the form of one or more slabs and/or tiles. This pressing step can take place at a third transport device 58, yet oriented along the same substantially horizontal feeding direction B of the first two transport devices 18 and 42. In a per se known manner, this pressing step can be followed by at least one subsequent cooking step, in proper furnaces (not shown), of the ceramic products T in the form of one or more slabs and/or tiles, as well as a possible cut to size of the ceramic products T.

[0033] It has thus been seen that the method and the plant for manufacturing ceramic products according to the present invention achieve the previously highlighted objects.

[0034] The method and the plant for manufacturing ceramic products of the present invention thus conceived are however susceptible of numerous modifications and variations, all of which falling within the scope of the same inventive concept; furthermore, all the details can be replaced by technically equivalent elements. In practice, the materials used, as well as the shapes and dimensions, may be any according to the technical requirements. The scope of protection of the invention is therefore defined by the attached claims.

Claims

1. A method for manufacturing ceramic products (T) comprising in sequence the steps of:

   - gravity feeding a mixture of one or more ceramic powders having different features and/or colours from one another, by means of at least one feeding device (12) and along at least one substantially vertical feeding direction (A);
   - micro metering said ceramic powders, by means of at least one metering device (14) controlled by at least one central processing unit (50), so as to divide said ceramic powders on the basis of predefined quality criteria;
   - dispensing and depositing, by means of at least one dispensing device (16) positioned downstream of said at least one metering device (14), said ceramic powders on a first transport device (18) which is substantially flat and movable along a substantially horizontal feeding direction (B), so as to obtain a first layer (L) of ceramic powders having surface chromatic effects;
   - accumulating and compacting said first layer (L) of powdered ceramic material along an accumulation and compaction direction (C), by means of at least one accumulation and compaction device (20) controlled by said central processing unit (50), so as to obtain a second layer (CL) of compacted ceramic powders having both surface chromatic effects, and chromatic effects in the thickness; and
   - pressing said second layer (CL) of compacted ceramic powders, by means of at least one pressing device (22), so as to obtain said ceramic products (T) in the form of one or more slabs and/or tiles,

   wherein said dispensing and depositing step comprises at least one sub-step of separating said ceramic powders along a plurality of channels which are longitudinal and parallel to said feeding direction (B), so as to avoid dispersion by falling of said ceramic powders and to maintain the characterization of said surface chromatic effects, the method being **characterized in that:**

   - said feeding step comprises at least one sub-step of feeding said ceramic powders along one or more feeding directions (A1, A2, A3) which are inclined according to respective predefined angles with respect to said substantially vertical feeding direction (A), so as to relieve the vertical load of said ceramic powders which weighs on said metering device (14);
   - said accumulation and compaction step comprises at least one sub-step of dynamic variation of said accumulation and compaction direction (C) with respect to a substantially vertical plane, so as to control the formation of both said surface chromatic effects, and said chromatic effects in the thickness of said second layer (CL) of compacted ceramic powders; and

- said step of micro metering the ceramic powders comprises at least one sub-step of removing those ceramic powders which do not satisfy one or more of said predefined quality criteria.

2. The method according to claim 1, wherein said step of dispensing and depositing the ceramic powders comprises at least one sub-step of conveying, by means of at least one conveying element (24) of said dispensing device (16), said ceramic powders along a single dispensing direction (F) starting from a plurality of separate and distinct dispensing directions (D, E), so that said ceramic powders are dispensed on said first transport device (18) along said single dispensing direction (F).

3. The method according to claim 1 or 2, wherein said accumulation and compaction step comprises at least one sub-step of variation of the angle (a) between the substantially horizontal plane on which said first transport device (18) lies and the plane passing through said accumulation and compaction device (20) at the respective upper loading opening (54), wherein an angle (α) less than 90° helps to improve control of the formation of both said surface chromatic effects and said chromatic effects in the thickness of said second layer (CL) of compacted ceramic powders.

4. The method according to any claims 1 to 3, wherein said accumulation and compaction step comprises at least one sub-step of controlling, by means of at least one control sensor (26) for controlling said accumulation and compaction device (20), the quantity of powdered ceramic material contained inside said accumulation and compaction device (20).

5. The method according to any claims 1 to 4, further comprising, after said pressing step, at least one step of cooking said ceramic products (T) in the form of one or more slabs and/or tiles.

6. A plant (10) for manufacturing ceramic products (T) by implementing the method according to any claims 1 to 5, the plant (10) comprising:

- at least one central processing unit (50);
- at least one feeding device (12), which is arranged for gravity feeding said ceramic powders and comprises at least one hopper (28);
- at least one metering device (14), which is designed for carrying out the micro metering of said ceramic powders and is provided with a plurality of nozzles (40) having a predefined passage section suitable for gravity dropping said ceramic powders along a substantially vertical feeding direction (A);
- a first transport device (18), which is substantially flat and movable along a substantially horizontal feeding direction (B) and which consists of a closed loop conveyor belt;
- at least one accumulation and compaction device (20), which is arranged for carrying out accumulation and compaction of said ceramic powders along an accumulation and compaction direction (C);
- a second transport device (42), which is substantially flat and movable along said substantially horizontal feeding direction (B) and on which said second layer (CL) of compacted ceramic powders coming out of said accumulation and compaction device (20) is transferred; and
- at least one pressing device (22), which is designed to press said second layer (CL) of compacted ceramic powders, so as to obtain said ceramic products (T) in the form of one or more slabs and/or tiles,

the plant (10) being **characterized in that** it comprises at least one dispensing device (16) for dispensing said ceramic powders, which is positioned downstream of said at least one metering device (14), which is designed for carrying out the dispensing and deposition of said ceramic powders on said first transport device (18) and which is provided with at least one element (24) for conveying said ceramic powders along a single feeding direction (F) starting from a plurality of separated and distinct feeding directions (D, E),

- wherein said hopper (28) is internally provided with both one or more substantially vertical separator baffles (30, 32), and further separator baffles (34, 36, 38) which are operatively associated with said one or more substantially vertical separator baffles (30, 32) and/or with the walls of said hopper (28), and wherein said further separator baffles (34, 36, 38) are oriented along respective directions (A1, A2, A3) which are inclined according to respective predefined angles with respect to said substantially vertical feeding direction (A);
- wherein the transport surface of said closed loop conveyor belt comprises a plurality of longitudinal protrusions (44), i.e., oriented along said feeding direction (B), interspersed by a corresponding plurality of longitudinal grooves (46), also oriented along said feeding direction (B); and
- wherein said accumulation and compaction device (20) is provided with at least one pivoting mechanism (52) configured to rotate said accumulation and compaction device (20) about a horizontal axis which is substantially perpendicular with respect to said feeding direction (B).

7. The plant (10) according to claim 6, wherein said metering device (14) is provided with one or more powder removal apparatuses (48, 60) arranged to remove at least part of the ceramic powders from the main flow of ceramic powders passing through each nozzle (40).

8. The plant (10) according to claim 6 or 7, wherein both said longitudinal protrusions (44), and the corresponding longitudinal grooves (46) have a triangular or pyramidal shape in cross-section, i.e., a section perpendicular to said feeding direction (B).

9. The plant (10) according to any claims 6 to 8, wherein said accumulation and compaction device (20) consists of a hopper equipped with at least one control sensor (26) for controlling the quantity of ceramic powders contained inside said hopper (20), said at least one control sensor (26) being preferably positioned at the upper loading (54) of said hopper (20).

10. The plant (10) according to claim 9, wherein said hopper (10) is provided with at least one arch shaped lower unloading opening (56), located at said second transport device (42), wherein the radius of curvature of said arch shaped lower unloading opening (56) is equal to 2.5 times the average thickness (S) of the passage section for the passage of the ceramic powders inside said hopper (20).

11. The plat (10) according to claim 10, wherein said hopper (10) is provided with at least one gate (62) designed to selectively close said arch shaped lower unloading opening (56) under certain operating conditions of the plant (10).

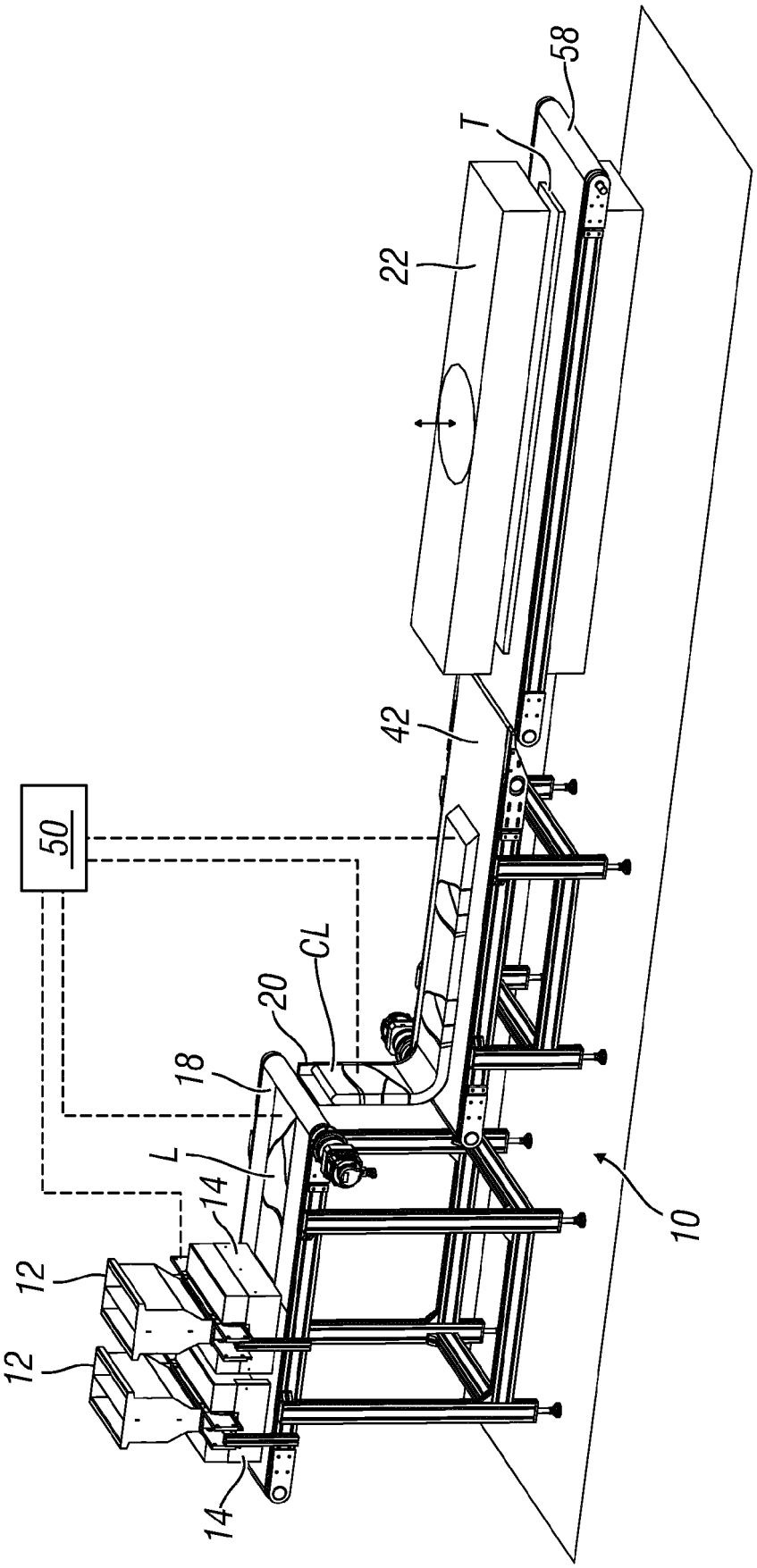

Fig. 1

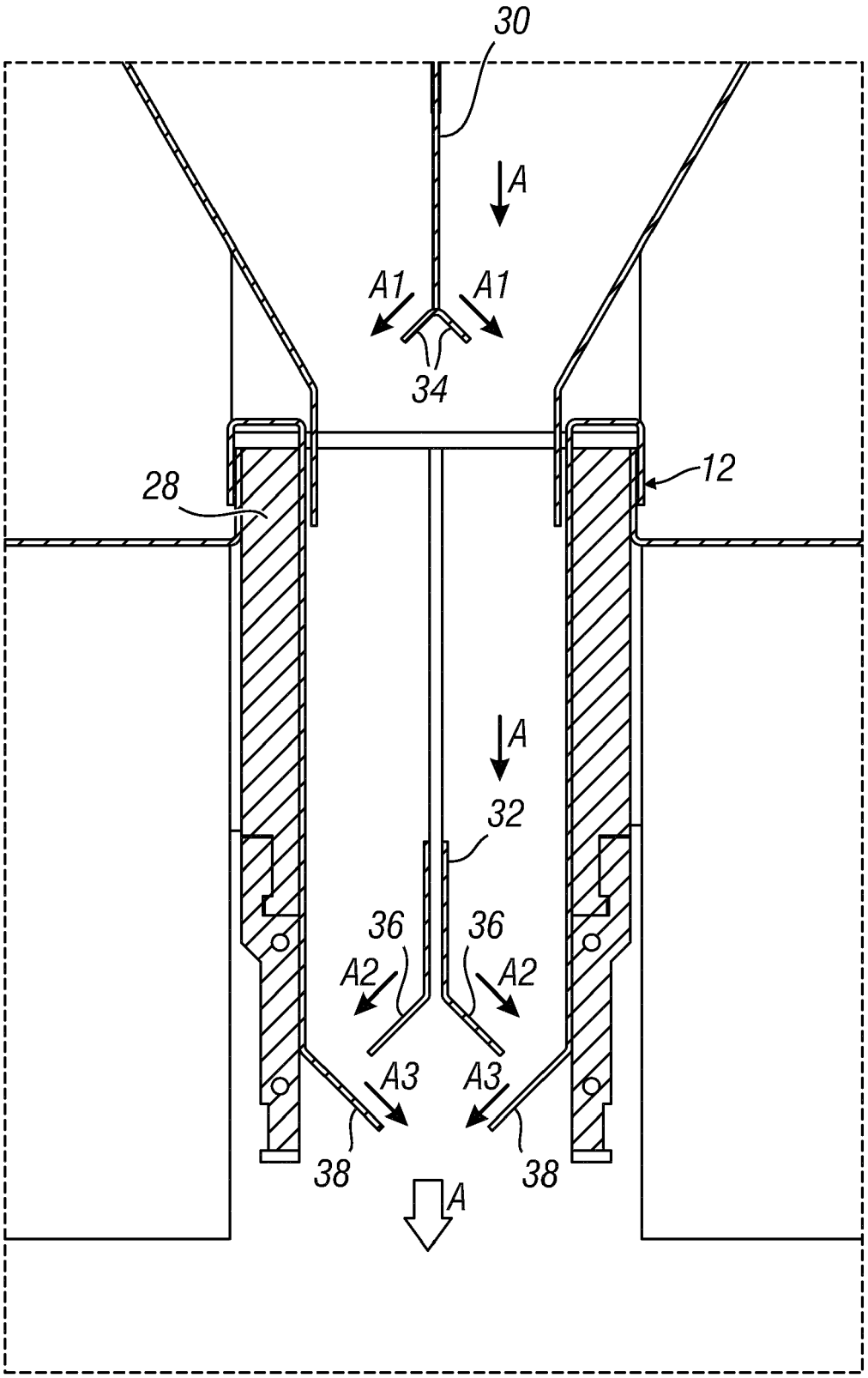

Fig. 2

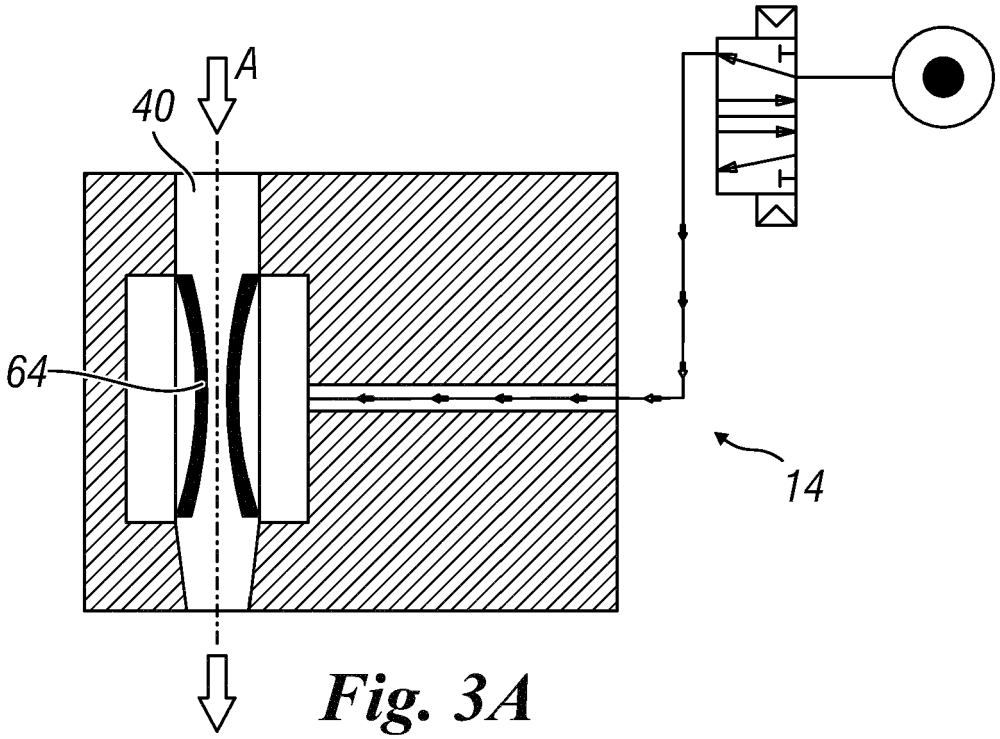

Fig. 3A

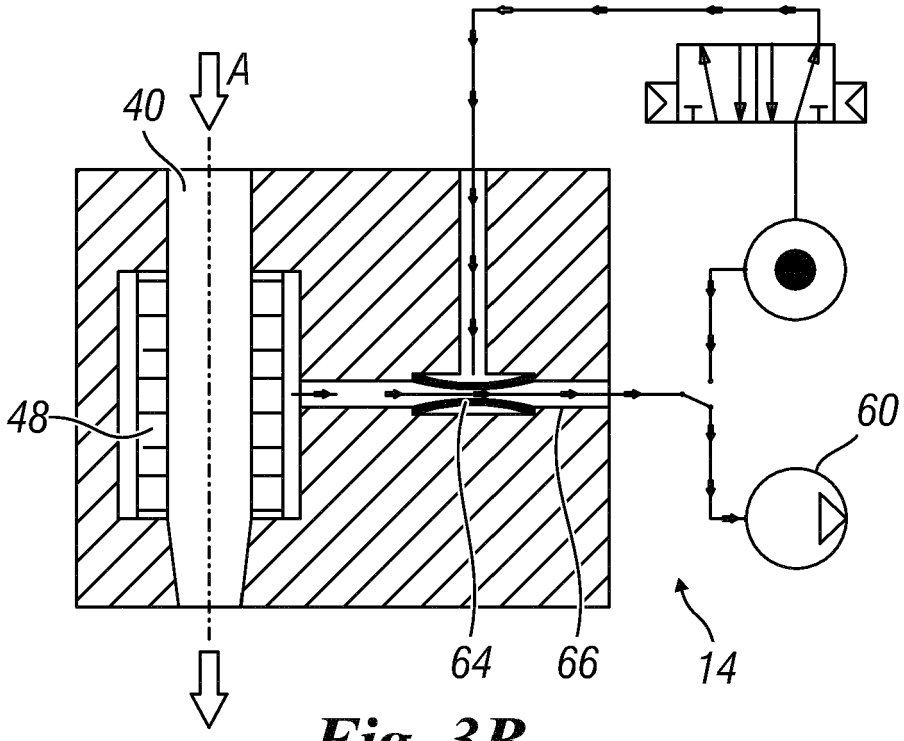

Fig. 3B

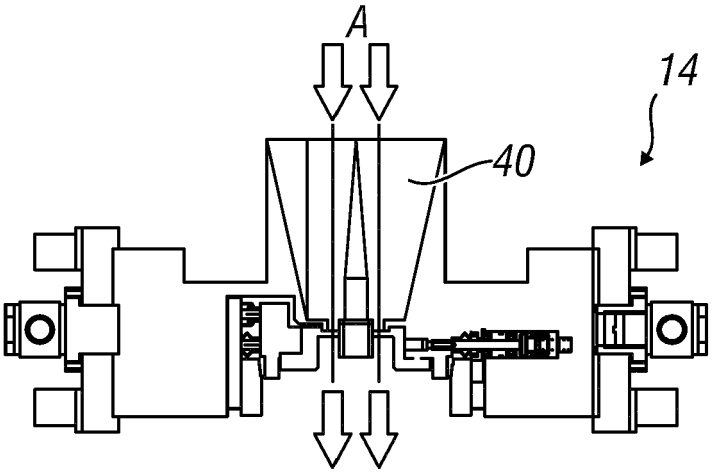

Fig. 3C

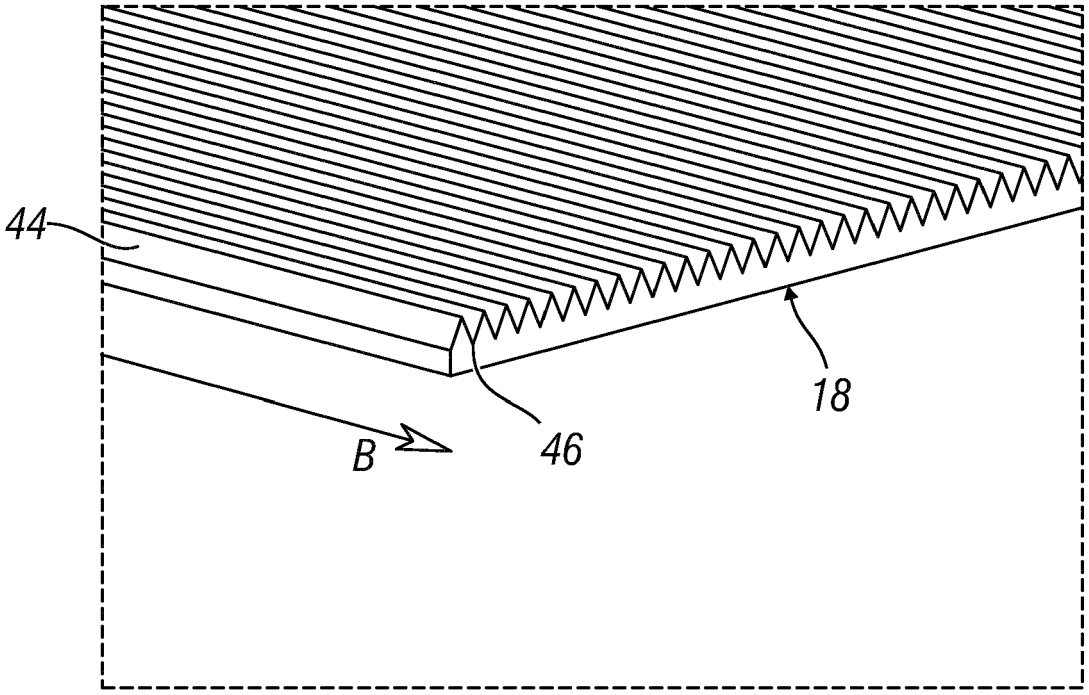

Fig. 5

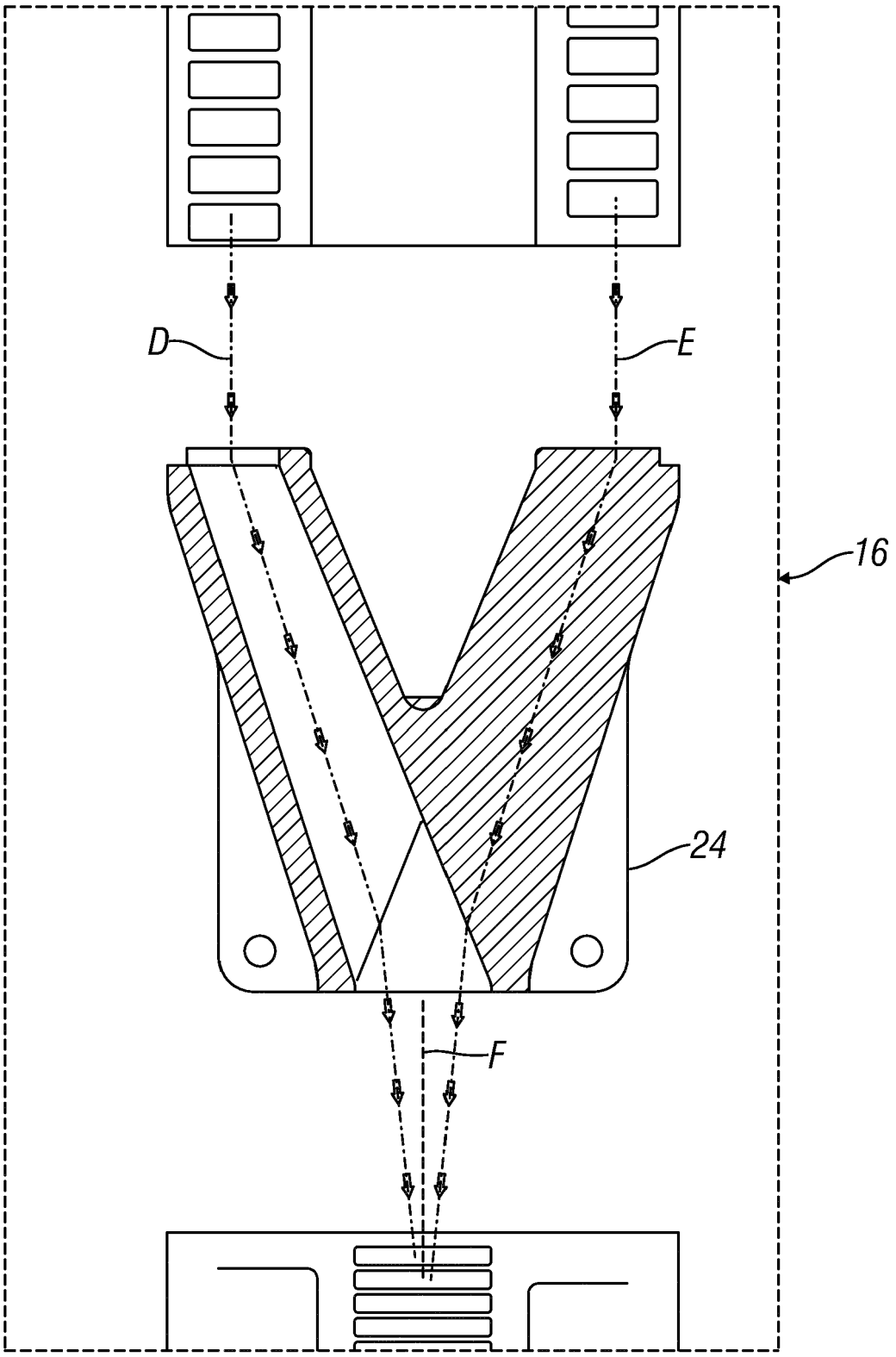

Fig. 4

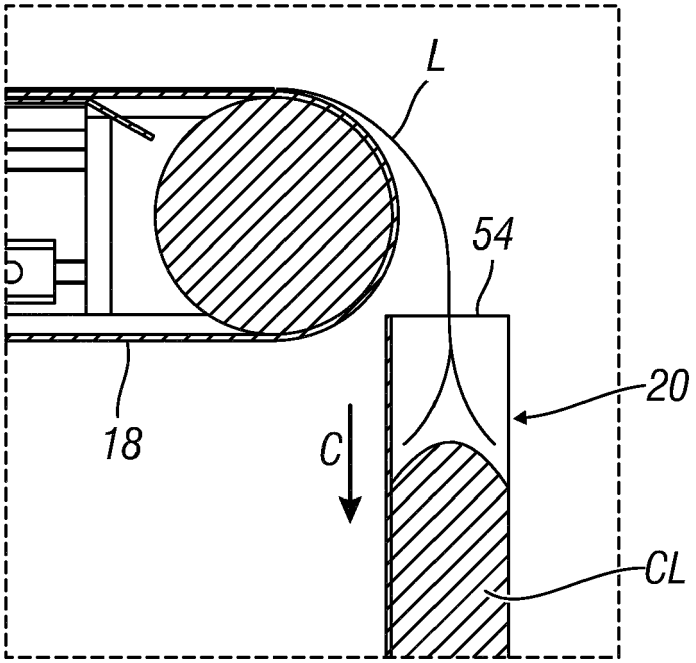

Fig. 6

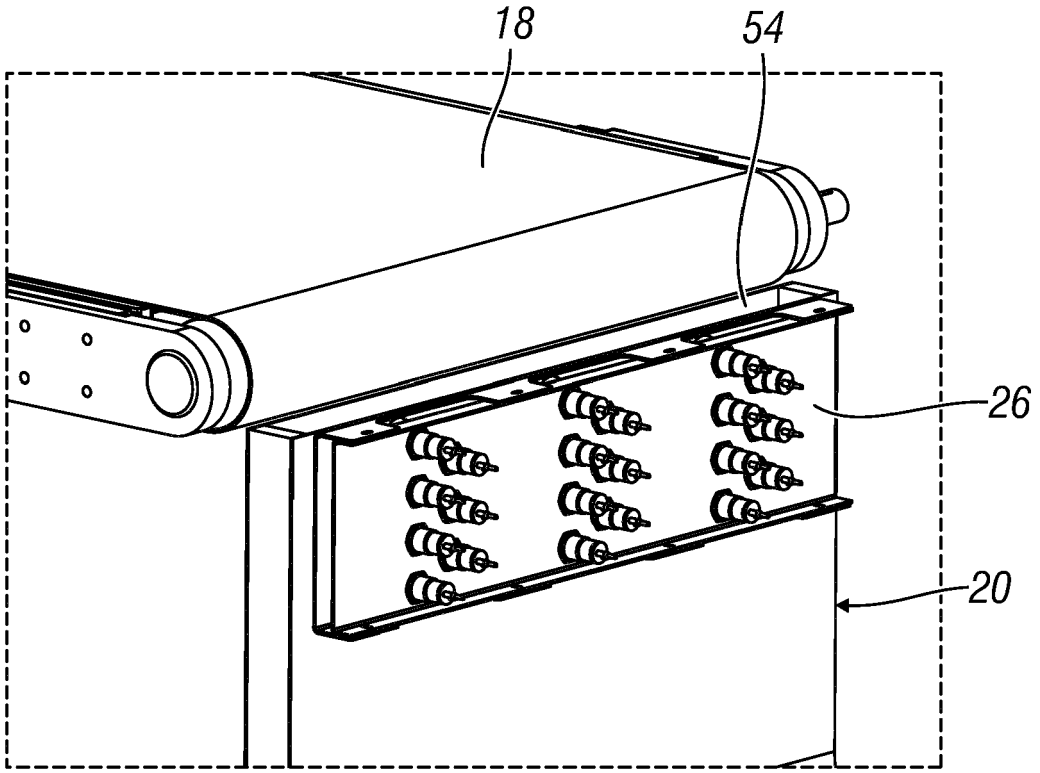

Fig. 7

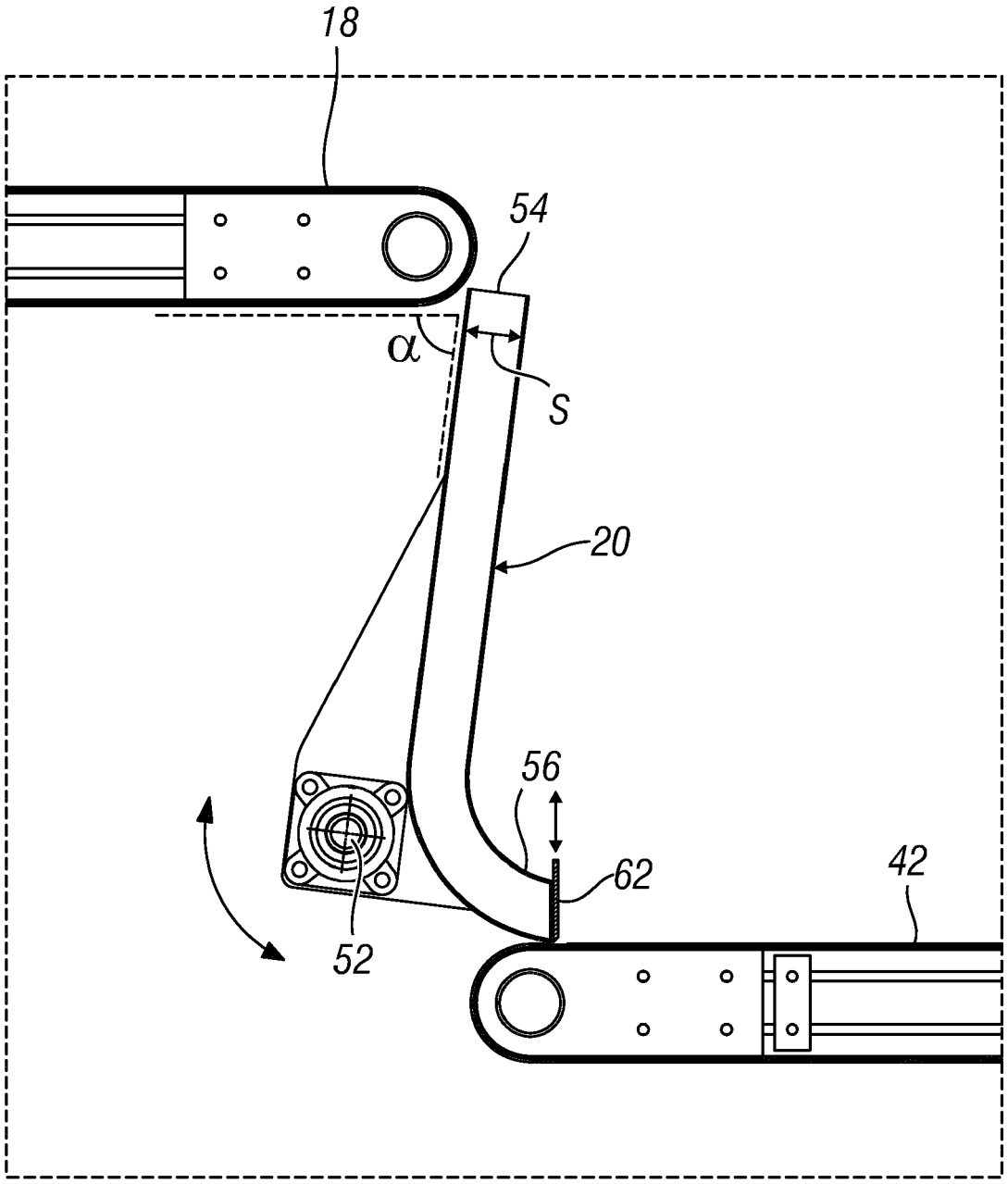

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 6124

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 October 2022	Papakostas, Ioannis

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
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EUROPEAN SEARCH REPORT

Application Number
EP 22 17 6124

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 October 2022	Papakostas, Ioannis

CATEGORY OF CITED DOCUMENTS

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-11

Method and plant for manufacturing ceramic products

1.1. claims: 1-5

Method for manufacturing ceramic products, wherein the step of micro metering the ceramic powders comprises a sub-step of removing those ceramic powders which do not satisfy certain predefined quality criteria.

1.2. claims: 6-11

Plant for manufacturing ceramic products, wherein a dispensing device, positioned downstream of a metering device, is provided with an element for conveying the ceramic powders along a single feeding direction starting from a plurality of separated and distinct feeding directions.

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 17 6124

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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24-10-2022

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

REFERENCES CITED IN THE DESCRIPTION

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- WO 2020058891 A1 **[0004]**
- US 5056998 A **[0004]**
- CN 109927161 A **[0004]**