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(54) MACHINE FOR PRESSURE CASTING CERAMIC MATERIALS AND COMPOUNDS, WITH WEIGHT ZEROING APPARATUS

(57) Machine (100) for casting ceramic materials and compounds with weight zeroing apparatus adapted for reducing to a minimum the physical effort required by operators on site, said machine (100) being developed in height, allowing to increase production and saving space and energy. The machine (100) comprises a frame (10); a control panel (11); molds formed by a female part (19') and a male part (19); a lower movable cradle (15) with at least one female part (19'), mobilized towards the intermediate movable cradle (14), allowing the closure of the molds (19-19'); an upper movable cradle (13) with at least one male part (19), mobilized towards said intermediate movable cradle (14), allowing the closure of further molds (19-19'); an intermediate movable cradle (14) with corresponding male parts (19) and female parts (19'), positioned between said lower movable cradle (15) and said upper movable cradle (13); a weight zeroing trolley (12) which, when aligned with one of said movable cradles (13, 14, 15), allows the removal, without physical effort, of the molds (19-19') by an operator.

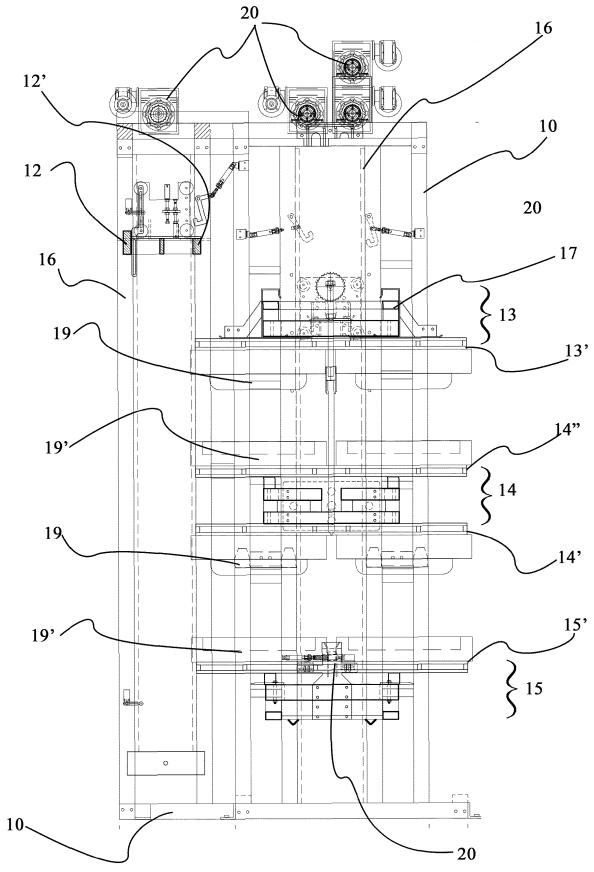

Fig. 2

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Description

Field of the invention

[0001] The present invention relates to the field of the production of casting machines, specifically machines for pressure casting ceramic materials or compounds in molds which minimize the effort required of the operators on site. Even more advantageously, the present invention relates to a machine which, by developing in height, allows increasing production, save space and energy.

Prior art

[0002] In the industry linked to the production of ceramic sanitary ware (such as bathtubs, toilets, bidets and the like), the most common production method is that in which a fluid mixture (called slip composed of a watery part and a clay part, kept in suspension), is poured into the appropriate casting molds, which are generally structures of porous material.

[0003] These porous molds consist of at least two halves (of the male-female type), which, when joined together or inserted into each other, give rise to an internal volume from which the molded product acquires its shape.

[0004] These two or more parts of the mold comprise special systems with a different design, corresponding to the type of product to be molded, and are assembled at least from the following components:

- a frame which supports the various parts of the mold;
- positioning means by which the parts of the mold can be at least moved towards or away from each other with the possibility of extracting the molded product from the mold;
- feed devices with which the mixture is fed.

[0005] Among the known properties of porous resin molds, however, is a relatively high mechanical strength, which allows the use of pressure methods, i.e. methods in which the slip is fed into the mold and cured to the required thickness under high pressure (usually between 3 and 15 bars).

[0006] At such high internal pressures, however, forces perpendicular to the casting surfaces formed by the parts of the mold arise, and deformations of the mold become potentially dangerous: consequently, these forces must be compensated for by suitable devices which guarantee the containment thereof.

[0007] The technical evolutions have often concerned the method of distribution of the mixture inside these molds, and at the same time the enhancement of the positioning means.

[0008] An example is provided by patent application MXPA03008860 (A). The patent claims a mold machine comprising a pallet and two planes associated with the pallet, each of which supports a respective half-mold; one of the two plates can be moved along the pallet in the longitudinal direction, while the other incorporates a tilting plate carrying the respective half-mold and can rotate around a horizontal axis extending perpendicularly to the longitudinal direction. In this way, accessibility to the half-molds and to the casting is improved, facilitating the operations of demolding the raw products and transferring them to subsequent processing step, as well as the mold change procedure.

[0009] Another example is provided by patent application EP1043132A2. The patent claims an apparatus for die-casting sanitary appliances, comprising an external frame; at least a block slidable within said frame comprising a male mold part and a female mold part; a fixed part at the end of said frame provided with the male part and a movable part of said frame being provided with the female mold part. The entire apparatus is also provided with means for pushing the movable part in the direction of the fixed part and systems for feeding the pressurized slip into the cavities which form when both parts of the mold are positioned against each other.

[0010] These are just a few examples, which have been improved in turn; above all the last mentioned patent has witnessed a longitudinal development of the same machines to produce several pieces in series at the same time to the detriment of the increasingly large occupation of the space reserved for the installation of the machinery.

[0011] One of the drawbacks that characterize all the machinery listed above is that relating to the great physical effort required of the operators working near the machinery. If on the one hand with the help of external trolleys it is possible to extract the finished product, on the other hand the handling of the parts of the molds, which can have a weight greater than 30 kg, up to now carried out by translation on an external trolley, requires considerable strength and an effort of the sensitive parts of the body, such as the back, causing many physical problems for the operator him/herself.

[0012] The object of the present patent application is to overcome the aforementioned drawbacks, proposing an innovative casting machine on one side developed in height, or by adopting three cradles for molds, allowing to obtain, in a small space, a high production and considerable energy savings, on the other comprising a weight zeroing movable surface, which reduces to a minimum the physical efforts made by the operators in handling the parts of the mold.

Description of the invention

[0013] According to the present invention, an innovative machine is provided for pressure casting ceramic materials or compounds in molds which minimize the effort required of the operators on site.

[0014] Even more advantageously, the invention develops in height with superimposed movable parts in which to engage the molds, which allow producing a

greater quantity of products in a limited space; moreover, such casting machine is of the modular type allowing installation, inside the premises of the companies, in series through special pins: this factor, together with the development in height previously mentioned, allows significantly increasing the production of the companies, while occupying the same space and energy.

[0015] The invention is advantageously compatible with any material distribution system, preferably ceramic and/or compounds. In particular it refers to materials such as:

- Techstone, i.e. materials of a very new conception, made up of a high percentage of natural minerals and a low percentage of polymers;
- Porcelain stoneware;
- Vitreous china, i.e. white vitrified paste ceramic with high hardness and mechanical resistance.

[0016] The sturdiness and stability of the invention is guaranteed by a frame, fixable to the installation surface present in the company premises by means of special pins. The frame is made up of a series of tubulars, fixed in such a way as to leave a free part included between two lateral and in which the movable cradles and the weight zeroing trolley are used. The frame, advantageously, with its structure protects and contains all the mechanical and electrical components. Furthermore, said lateral panels are internally provided with guides, which allow the movable cradles and the weight zeroing trolley to move up and down.

[0017] All the mechanical movements, carried out by a system of gears and chains, of the aforementioned components are guaranteed by a control panel; the same control panel advantageously allows switching on and off the casting machine according to the present patent application.

[0018] A plurality of molds are engageable to the above cradles, which are each formed by a female part and a male part, which, when joined together or inserted into each other, give rise to an internal volume from which the molded product acquires its shape.

[0019] The lower movable cradle is the component engaged between said lateral panels, precisely in the lower part of the invention, which allows the engagement of at least one said female part of the mold. The lower movable cradle is mobilized, during the casting step, towards the intermediate movable cradle, placed above it, so as to allow the closure of the female parts engaged with the respective male parts of the molds, the latter, precisely engaged on the intermediate movable cradle. Advantageously, the cradle can rotate, during the fixing step, in such a way as to bring the female parts engaged from 0° to 180° with respect to the support plane of the invention, allowing a homogeneous distribution of the ceramic or composite material used for the realization of the product.

[0020] The upper movable cradle is also similar to it, also engaged within said lateral panels and in the upper part of the invention, and allows the engagement of at least a male part of the mold: in the same way it is mobilized, during the casting towards the intermediate movable cradle allowing closure of the male part with the respective female part of the mold, the latter engaged on said intermediate movable cradle; in addition, like the lower movable cradle, the upper movable cradle also rotates, during the fixing step, bringing the engaged male parts from 0° to 180° with respect to the support plane of the invention, allowing a homogeneous distribution of the ceramic material or compound used for the realization of the product and/or its cleaning. Consequently, it follows that the aforementioned intermediate movable cradle is a component, also movable, positioned between the lower movable cradle and the upper one within the space of the two lateral panels. Advantageously, the intermediate movable cradle allows at the same time the engagement, on the lower surface, of several male parts corresponding to the female parts engaged on the lower movable cradle, and the engagement, on the upper surface, of female parts corresponding to the male parts engaged on the upper movable cradle. The intermediate movable cradle can be mobilized during the casting step, both towards the lower and the upper movable cradle, so as to allow the closure of the female parts and the corresponding male parts.

[0021] The invention is completed by a weight zeroing trolley, positioned between said lateral panels, in front of the previously described movable cradles, in such a way that its rear part is perfectly aligned with the front limit switches of the same cradles, avoiding any collisions between the components. Advantageously, the weight zeroing trolley is mobilized, through upward/downward movements along guides and allows, when it is aligned with at least one of the movable cradles, the removal, without physical effort, of the mold components by an operator: once these parts have been loaded on the weight zeroing trolley, it can be raised and/or lowered, according to the needs, so as to allow a mold change and/or cleaning operations.

[0022] Electricity is supplied by a supply system adapted for feeding all components of the machine. In one of the preferred embodiments, the invention may comprise a Raspberry Pi computer, engaged and electrically connected to the control panel, which allows connecting the present invention with local area networks, wireless networks, Bluetooth connections and/or external devices: in this way, it is also possible, via network, to connect the casting machine to a remotely positioned PLC, which can mobilize the previously described components, increasing the safety of the operators.

[0023] Furthermore, the machine for casting ceramic materials and compounds with weight zeroing apparatus can be implemented with mechanical arms, which, engaged on the surface of the frame and electrically connected to the control panel, can mimic the loading movement on the weight zeroing trolley of the female parts

and male parts usually carried out by operators. Even more advantageously, the mechanical arms can regulate and control the correct sealing of the parts of the mold during the casting step and carry out a correct and safe removal of the finished product.

[0024] In one of the preferred embodiments, the invention can comprise electric gates, engaged at the front and/or rear of the frame and mobilized, after the casting step, by the control panel and/or PLC, so as to give off heat towards the movable cradles, considerably improving the time necessary for drying the product. In addition, temperature sensors can be engaged on the surface of the frame, connected to the control panel, which monitor the temperature present in the installation area and the temperature generated by the already described electric gates, in such a way as to allow safe and effective monitoring for the realization of the product.

[0025] The advantages offered by the present invention are clear in the light of the above description and will be even clearer from the accompanying figures and the related detailed description.

Description of the figures

[0026] The invention will hereinafter be described in at least a preferred embodiment thereof by way of non-limiting example with the aid of the accompanying figures, in which:

- FIGURE 1 shows a front view of a machine 100 for casting ceramic materials and compounds with weight zeroing apparatus according to an embodiment of the present patent application;
- FIGURE 2 illustrates a side perspective view of a machine 100 for casting ceramic materials and compounds with weight zeroing apparatus according to an embodiment of the present patent application.

Detailed description of the invention

[0027] The present invention will now be described purely by way of non-limiting or binding example with the aid of the figures, which illustrate some embodiments relative to the present inventive concept.

[0028] With reference to FIGS. 1 and 2, the components of a machine 100 for casting ceramic materials and compounds with weight zeroing apparatus according to the present invention is shown, which, developing in height through the application of several overlapping movable cradles 13-14-15, considerably increases the production properties while occupying a small space; furthermore, the machine 100 for casting ceramic materials and compounds with weight zeroing apparatus, by virtue of the presence of a zeroing trolley 12, reduces to a minimum the physical effort required of the operators on site for mobilizing the parts 19-19' of the molds. In particular, FIG. 1 shows a front view of the components constituting the machine 100 according to the present invention; FIG. 2 shows, through a lateral elevation, clarifying for the positioning, all the components of the machine 100 for casting ceramic materials and compounds with weight zeroing apparatus.

[0029] The invention comprises a frame 10, formed by a plurality of tubular elements joined together in such a way as to make the invention stable and safe and has a free central part comprised within two lateral panels 21-21'; moreover, the frame 10 contains and protects all the mechanical and electrical components. The lateral panels 21-21' are provided with guides 16 which allow the movable cradles 13-14-15 to move upwards and/or downwards.

[0030] On the surface of the frame 10, in particular near the lateral panel, there is a control panel 11, which allows the invention to be switched on/off; moreover, this control panel allows all the mechanical movements of said movable cradles 13-14-15, through a system of gears and chains 20.

[0031] The invention requires a plurality of molds, which are each formed by a female part 19' and a male part 19, which, when joined together or inserted into each other, give rise to an internal volume from which the molded product acquires its shape. These parts 19'-19 are coupled engaged on said movable cradles 13-14-15. Specifically, the invention comprises a lower movable cradle 15, engaged between said lateral panels 21-21', which allows eight female parts 19' of the mold to engage in the upper surface 15'. The same lower movable cradle 15 is mobilized, during the casting step, towards the intermediate movable cradle 14 allowing the closure of the eight female parts 19' with the respective eight male parts 19 of the mold, engaged in the lower part 14" of the intermediate movable cradle 14. Furthermore, the lower movable cradle 15 can be mobilized in such a way as to rotate, during the fixing step, said female parts 19' of the mold from 0° to 180° with respect to the support plane of the invention, allowing a homogeneous distribution of the ceramic or composite material used for the realization of the product.

[0032] Likewise, an upper movable cradle 13, also engaged between said lateral panels 21-21', in turn allows the engagement, in the lower surface 13', of eight male parts 19 of the mold. Also the upper movable cradle 13 is mobilized, during the casting step, towards the intermediate movable cradle 14 allowing the closure of the eight male parts 19 with the respective eight female parts 19' of the mold, engaged in the upper part 14" of the intermediate movable cradle 14. Also the upper movable cradle can rotate, during the fixing step, the previously engaged male parts 19 of the mold, from 0° to 180° with respect to the support plane of the invention, allowing a homogeneous distribution of the ceramic or composite material used for the realization of the product. Finally, the upper movable cradle 13 is realized with movable brackets 17 present in a number of at least four for each installed male part 19 and mounted in the upper surface of said upper movable cradle 13: the movable brackets

17 not only improve the closing of said mold, but exert a balanced unloading, on four different points, when material is introduced inside the mold, avoiding the breakage thereof; the movable brackets 17 are adjustable according to the size of the molds and are reinforced by a diagonal reinforcing plate, so as to support heavy loads.

[0033] Said intermediate movable cradle 14 is engaged between said lateral panels 21-21' and in a median position between the lower movable cradle 15 and the upper movable cradle 13; also the intermediate movable cradle 14 is mobilized during the casting step, towards the lower movable cradle 15 and/or the upper movable cradle 13 so as to allow the closure of the female parts 19' and the corresponding male parts 19.

[0034] The invention is completed by a weight zeroing trolley 12, engaged between said lateral panels 21-21' and positioned in front of the movable cradles 13-14-15, so that its rear part 12' is perfectly aligned with the front limit switches of said movable cradles 13-14-15. The weight zeroing trolley 12, by moving up/down along the guides 16 controlled by the control panel 11, allows, when aligned with at least one of the movable cradles 13-14-15, the removal, without physical effort, of the female parts 19' and male parts 19 by an operator. Subsequently, the weight zeroing trolley 12 raises and/or lowers the parts 19'-19 of the mold previously loaded thereon, so as to allow a mold change and/or cleaning operations.

[0035] Finally, it is clear that modifications, additions or variants may be made to the invention described thus far which are apparent to those skilled in the art, without departing from the scope of protection that is provided by the appended claims.

Claims

1. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus adapted for reducing to a minimum the physical effort required to operators on site, the machine (100) extending vertically, allowing to increase production, and saving both space and energy, the machine (100) being **characterized in that** it comprises:

   - at least a frame (10), including a plurality of tubular elements assembled together in such a way as to ensure stability and safety of the invention, and presenting a central free space enclosed between two lateral panels (21-21'); wherein, said frame (10) is configured to contain and protect all electric and mechanical components; wherein, said lateral panels (21-21') are provided with guides (16) allowing an upward and/or downward movement of movable cradles (13-14-15); wherein said frame (10) is adapted for being fastened to an installation surface by means of corresponding pins;
   - at least a control panel (11), which is engaged on the surface of said frame (10) near at least one of said lateral panels (21-21'), for turning on or off the machine; wherein said control panel (11) is configured to permit the mechanical movements of said movable cradles (13-14-15) through a system of gears and chains (20);
   - a plurality of molds, each of which is formed by a female part (19') and a male part (19), which, when joined together or inserted into each other, give rise to an internal volume from which the molded product acquires its shape;
   - at least a lower movable cradle (15), engaged between said lateral panels (21-21'), adapted to receive on its upper surface (15') at least one of said female parts (19') of a mold; wherein said lower movable cradle (15) is configured to be moved during casting towards an intermediate movable cradle (14), so as to allow closing of said female part (19') with the respective male part (19) of the mold, the latter part being engaged on said intermediate movable cradle (14); wherein said lower movable cradle (15) is adapted for being actuated in order to rotate, in the fastening step, said female part (19') of the mold from 0° to 180° with respect to the rest plane of the machine, thereby allowing uniform distribution of the ceramic material or of the compound used for the realization of the product;
   - at least an upper movable cradle (13), engaged between said lateral panels (21-21'), adapted to receive in its lower surface (13') at least one of said male parts (19) of the mold; wherein said upper movable be or cradle (13) is configured to be moved during casting towards said intermediate movable cradle (14), so as to allow closing of said male part (19) with the corresponding female part (19') of the mold, the latter part being engaged on said intermediate movable cradle (14); wherein said upper movable cradle (13) is adapted for moving in order to rotate, in the fastening step, said male part (19) of the mold from 0° to 180° with respect to the rest plane of the invention, thereby allowing uniform distribution of the ceramic material or of the compound used for the realization of the product;
   - at least an intermediate movable cradle (14), engaged between said lateral panels (21-21') and arranged between said lower movable cradle (15) and said upper movable cradle (13); wherein said intermediate movable cradle (14) is adapted to receive in its lower surface (14') at least a male part (19) corresponding to said female part (19'), the latter being engaged on the lower movable cradle (15); wherein said intermediate movable cradle (14) is adapted to receive in its upper surface (14") at least a female part (19') corresponding to said male part (19), the latter being engaged on the upper movable

cradle (13); wherein said intermediate movable cradle (14) is adapted for being moved during the casting step towards said lower movable cradle (15) and/or said upper movable cradle (13), thus allowing to close said female parts (19') with the corresponding male parts (19);
- at least a weight zeroing trolley (12), engaged between said lateral panels (21-21') and arranged anteriorly to said movable cradles (13-14-15), in such a way that its rear part (12') is exactly aligned with the front ends of said movable cradles (13-14-15); wherein said weight zeroing trolley (12) can be actuated, using said control panel (11), to perform upward/downward movements along said guides (16); wherein said weight zeroing trolley (12) can be used, without physical effort by an operator, to remove said female parts (19') and said male parts (19), when it is aligned with at least one of said movable cradles (13-14-15); wherein, said weight zeroing trolley (12) is adapted for lifting and/or lowering said female parts (19') and said male parts (19) previously loaded thereon, in such a way as to permit a mold replacement and/or cleaning operations;
- a feeding system adapted for feeding all components of the machine.

2. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus, according to claim 1, **characterized in that** it comprises a Raspberry Pi computer, engaged and electrically connected with said control panel (11); wherein, said Raspberry Pi computer is adapted for allowing to connect the present invention to local networks, wireless networks, Bluetooth connections and/or external devices.

3. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus, according to claim 1 or 2, **characterized in that** it is connected through a network to a remotely positioned PLC (programmable logic controller), wherein said PLC is configured to move components in such a way as to increase the operators' safety.

4. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus, according to any one of the preceding claims, **characterized in that** it comprises mechanical arms engaged on said frame (10) and electrically connected with said control panel (11), which mimic the loading movements on said weight zeroing trolley (12) of said female parts (19') and said male parts (19), performed by the operators; wherein said mechanical arms are adapted for adjusting and controlling the correct seal of said female parts (19') and said male parts (19) during casting; wherein said mechanical arms are adapted for performing a proper and safe picking/removal of the finished product.

5. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus, according to any one of the preceding claims, **characterized in that** it is compatible with distribution plants of ceramic materials and compounds.

6. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus, according to any one of the preceding claims, **characterized in that** it is modular thanks to appropriate pins allowing to arrange side by side a set formed by several of said machines (100) for casting ceramic materials and compounds, including a weight zeroing apparatus.

7. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus, according to any one of the preceding claims, **characterized in that** it comprises electrically actuated gates mounted anteriorly and posteriorly on said frame (10), moved after said casting step by said control panel (11) and/or said PLC, and which are adapted to emit heat towards said movable cradles (13-14-15), so as to considerably reduce the time required for drying the product.

8. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus, according to any one of the preceding claims, **characterized in that** it comprises temperature sensors connected to said control panel (11) and installed on the surface of said frame (10), which monitor the temperature in the installation area and the temperature generated by said electrical gates, so as to ensure a safe and effective monitoring for the product realization.

9. A machine (100) for casting ceramic materials and compounds, including a weight zeroing apparatus, according to any one of the preceding claims, **characterized in that** said upper movable cradle (13) is realized with movable brackets (17) present in a number of at least four for each of said installed male parts (19) and mounted in the upper surface of said upper movable cradle (13); wherein said movable brackets (17) are adapted for improving the closing of said mold and for exerting a balanced stress relief at four different points when a material is introduced into said mold, thus avoiding breakage of the mold; wherein said movable brackets (17) are adjustable according to the size of said mold and are reinforced by a diagonal reinforcement plate or sheet metal, in such a way to withstand heavy loads.

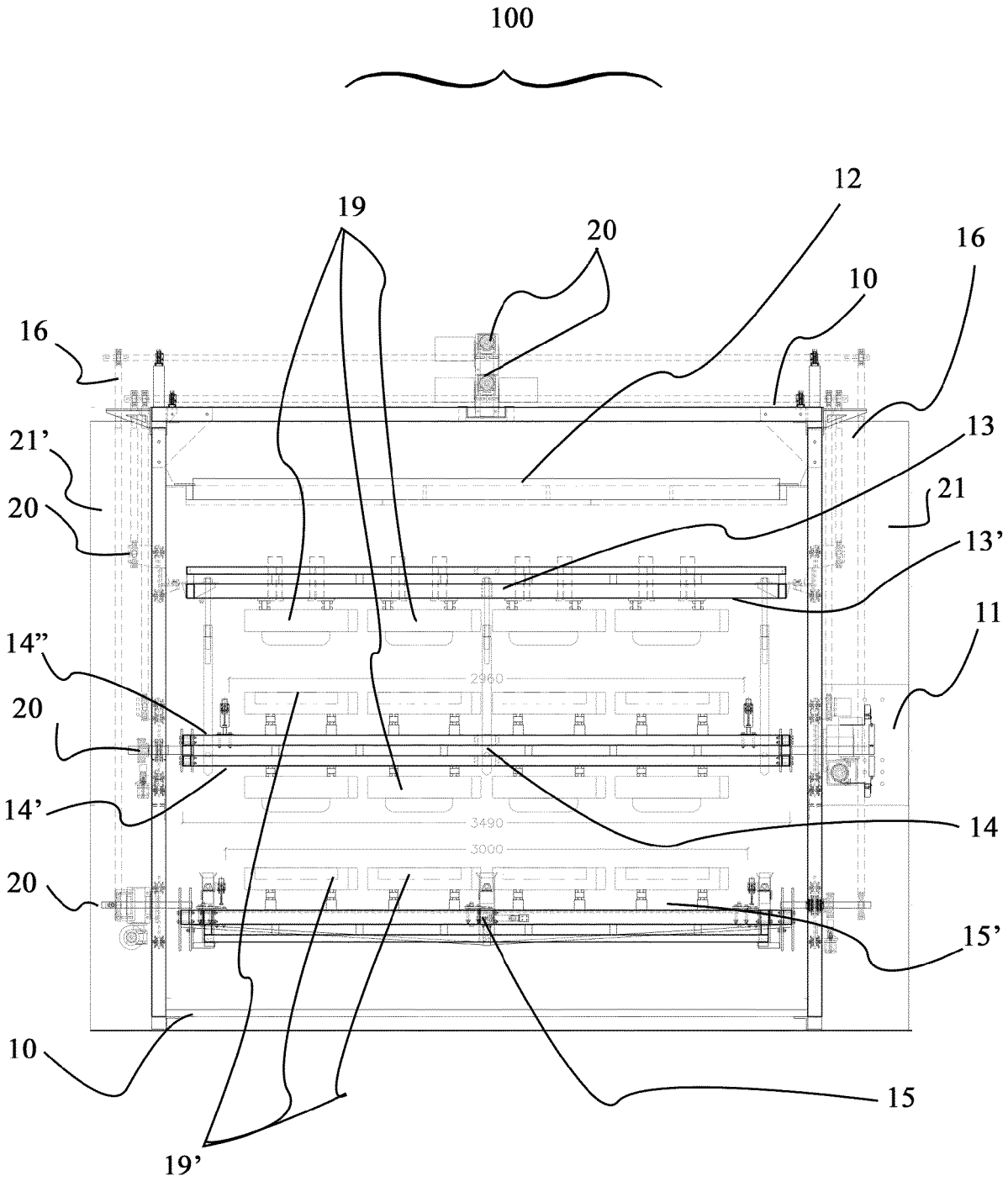
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Fig. 1

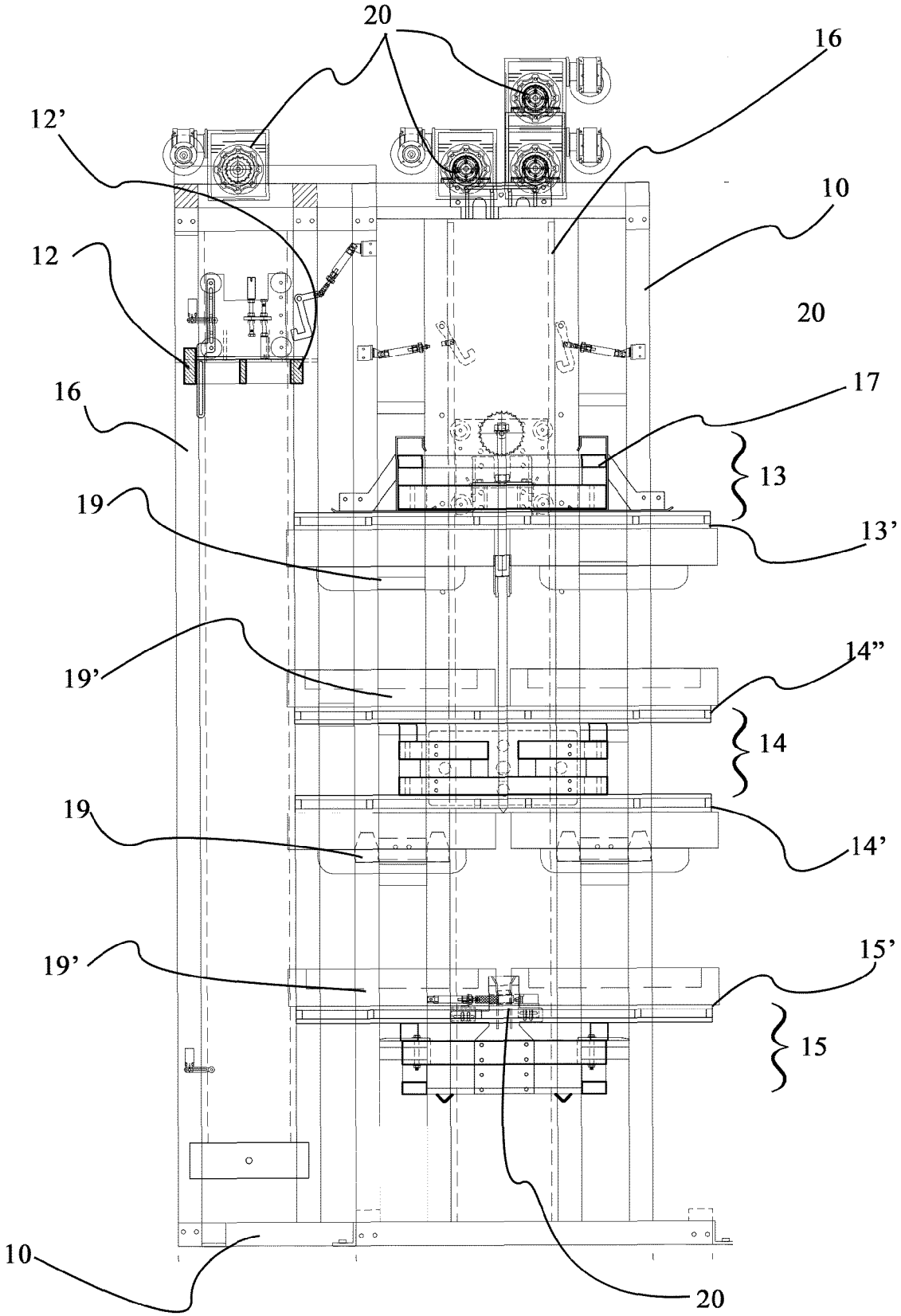

Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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