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(54) **MACHINE AND METHOD FOR PACKAGING POWDER PRODUCTS INSIDE A CONTAINER MADE OF DEFORMABLE MATERIAL**

(57) A machine (1) for packaging products in powder, for example coffee powder, inside a container made of deformable material, comprising a compacting unit (2) and a filling unit (6). The compacting unit (2) comprises a compacting chamber (13) configured to receive a dose of product in powder (3), at a first loading station (4). A presser element (17) is configured to compact the dose of product in powder (3) inside the compacting chamber (13) and subsequently transfers the compacted dose of

product in powder (5) into a container (9) arranged inside a filling chamber (21) of the filling unit (6). The compacted dose of product in powder (5) can be further compacted inside the filling chamber (21). The container (9) filled with the compacted dose of product in powder (5) and defining a package being processed (8), is inserted into a vacuum chamber (10) where sealing means (11) close and seal the package being processed (8) during a step of activating vacuum in the vacuum chamber (10).

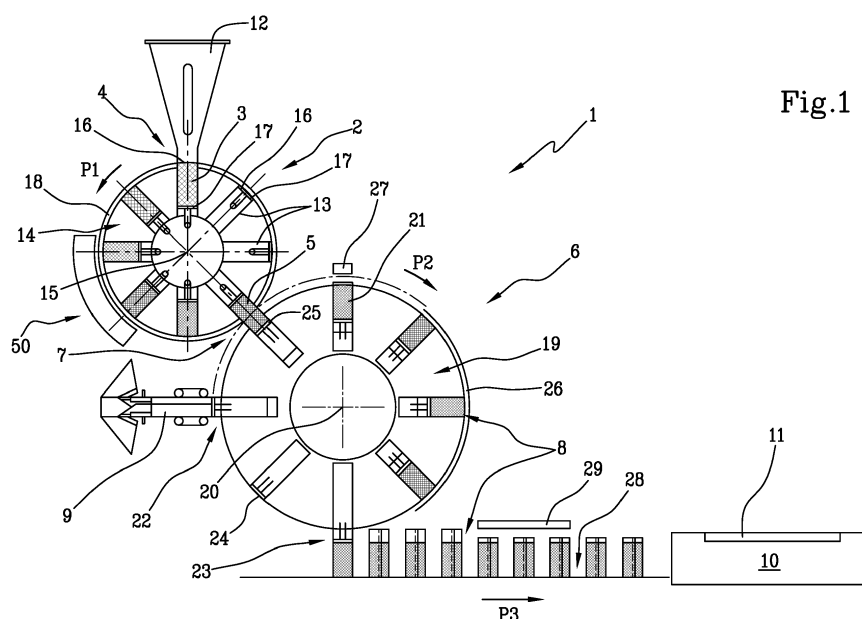


Fig.1

Description

[0001] The present invention concerns a machine and a method for packaging products in powder inside a container made of deformable material (in order to create so-called "brick" packaging).

[0002] More particularly the present invention refers to the field of packaging for food products in powder, for example products intended for infusion and/or extraction like coffee or similar, or soluble products.

[0003] Throughout the present description and in the enclosed claims, the term brick package is intended to refer to a container, generally made of a plastic, aluminium, or multilayer material, inside of which a food product is held and which has a generally parallelepiped shape which is kept by means of the vacuum to which it has been subjected before being closed.

[0004] In what follows reference is made to the packaging of coffee, but not at the exclusion of any other particular details.

[0005] For the packaging of coffee in containers in order to create a brick package it is known to take loose coffee in powder form and put a certain amount in a container. The container is then placed inside a vacuum chamber (autoclave) where it is given a brick shape, subjected to a vacuum and sealed.

[0006] It should be observed that in the apparatuses of the prior art there is, generally speaking, a plurality of product release stations, in an attempt to optimise the distribution of the product inside the container. Moreover in these apparatuses of the prior art there are, generally speaking, vibrating elements to optimise the homogenisation of the product inside the container and consequently to obtain a homogeneous distribution of product density which will benefit the aesthetic aspect of the finished package.

[0007] In practice, after the dose-adding step, the product that has fallen into the container is subjected to vibrations to allow for the subsequent dose to be added, and so on until the preset quantity has been reached.

[0008] The Applicant has noted that the prior art presents some drawbacks, both from a structural and from a functional point of view.

[0009] In the first place, in fact, the need for a plurality of stations to release the product, as well as the need for vibrating elements, adds a certain complexity to the construction.

[0010] It should furthermore be observed that, generally speaking, in the apparatuses of the prior art further compacting elements are present inside the vacuum chamber, needed to obtain the characteristic brick shape of the container.

[0011] Secondly, the vacuum chamber must guarantee a closed, perfectly sealed atmosphere, which makes it particularly complex to include and operate the devices that complete the packaging by compacting the loose powder and folding, sealing and closing the container. In fact, precisely because of the presence of loose powder

inside the container, the vacuum chamber must have opportune and suitable seats for the containers and the containers must be kept in position while the loose powder is compacted and the container is closed and sealed.

[0012] Eventually, following the aspiration generated inside the vacuum chamber, some particles of loose powder could reach the sealing area, thus preventing the correct sealing of the brick and causing the unexpected loss of the vacuum seal and as a result the loss of the characteristic brick shape. The powder could even escape from the container altogether when the latter is not yet folded and sealed, and be deposited inside the vacuum chamber itself and on the devices contained therein.

[0013] In order to overcome these drawbacks, the obtainment of the vacuum required (typically $0,7 \div -0,9$ bar) in the vacuum chamber occurs over an 8-10 second time span. In some cases, in order to speed up the packaging, packaging machines have been arranged with two or more vacuum chambers, which causes, as a collateral effect, an incremental complexity in the machine and its operation.

[0014] In the present day, therefore, some exigencies are particularly felt, among which are how to accelerate packaging time without increasing the complexity of the machine itself, how to limit the structural and functional complexity of the vacuum chamber, and how to optimise the volume of the powder inside the container while avoiding the dispersion of particles inside the vacuum chamber.

[0015] The aim of the present invention is therefore that of providing a machine and a method for packaging suitable for the packaging of products in powder inside a container in a particularly simple and quick manner while guaranteeing that the end result is of the highest quality.

[0016] More particularly one aim of the present invention is to provide a machine for the packaging of products in powder inside a container that is simple and reliable.

[0017] A further aim of the present invention is that of providing a packaging method for products in powder inside a container in order to create a brick package, which is fast but which also guarantees that the end product is of the highest quality.

[0018] The technical characteristics of the invention in accordance with the above-mentioned aims, are clearly present in the claims provided hereunder, and the advantages of the same will become even clearer in the detailed description that follows, in which reference is made to the enclosed figures which illustrate a purely explanatory and non-limiting embodiment, wherein:

- figure 1 illustrates a schematic front view of a machine for packaging products in powder inside a container according to a possible embodiment of the invention;
- figure 2 and figure 3 illustrate respective enlargements of details from figure 1;
- figure 4 illustrates a graph representing the density

of the product in powder as a function of the sub-steps of the application of the load.

[0019] In accordance with the enclosed drawings, the number 1 indicates a machine for packaging products in powder inside a container made of deformable material, preferably food products in powder form, and even more preferably ground coffee.

[0020] According to the invention the machine 1 for packaging comprises a compacting unit 2 configured to receive a dose of product in powder 3 at a first loading station 4, and compact it in order to obtain a compacted dose of product in powder 5.

[0021] Furthermore the machine 1 comprises a filling unit 6 configured to receive, at a first transfer station 7, the compacted dose of product in powder 5 coming from the compacting unit 2 and to provide a package being processed 8 defined by a container 9 made of deformable material filled with the compacted dose of product in powder 5.

[0022] The term deformable material should be interpreted as any material that is able to be formed in the shape of a compact brick that is in close contact with a dose of product in powder after the air is extracted from its interior. As a non-limiting example, the composite PE / ALU / PET presents the characteristics needed to be a deformable material.

[0023] According to the invention the machine 1 for packaging further comprises a vacuum chamber 10 designed to receive the package being processed coming from the filling unit 6 and to extract air from the package being processed 8, in such a way as to make the deformable material of the container 9 adhere to the compacted dose of product in powder 5 placed inside the package being processed 8; and sealing means 11 positioned in the vacuum chamber and configured to close and seal the package being processed 8 during a step of activating a vacuum in the vacuum chamber and to obtain closed and sealed packages.

[0024] In the course of this description and the enclosed claims, the term "container" is intended to mean a container not yet closed and sealed, in which only some of the sides have been joined, folded and sealed, therefore. Furthermore the term "package being processed" is intended to indicate the container 9 together with the compacted dose of product in powder 5 which has been inserted into it. This definition applies from the moment of insertion of the compacted dose of product in powder 5 into the container 9, up to the complete closing, sealing and application of the vacuum to the container, which is designed to result in a brick package.

[0025] According to a possible embodiment, the first loading station 4 is defined at a loading hopper 12 designed to receive the product in powder and direct it towards the compacting unit 2 where it is divided into doses. Preferably the dividing into doses occurs by means of a volumetric dosage system, not illustrated.

[0026] It should be observed that, in a more general

sense, the first loading station 4 can comprise any kind of feeding device (e.g. volumetric dosage system, auger, etc.).

[0027] The following will describe the compacting unit 2 which comprises at least one compacting chamber 13 designed to receive the dose of product in powder 3 at the first loading station 4, in particular to receive the dose of product in powder 3 from the loading hopper 12.

[0028] Preferably the compacting unit 2 comprises a drum 14, rotating about an axis of rotation 15 (in a counterclockwise direction in figure 1), which defines a first transporting element.

[0029] Preferably the first transporting element, and in particular the drum 14, has a plurality of compacting chambers 13.

[0030] The transporting element, and in particular the drum 14, is configured to successively advance the compacting chambers 13 of the first loading station 4 to the first transfer station 7, and vice versa, along a first feed path "P1".

[0031] According to a possible embodiment, the compacting chambers 13 are regularly spaced along the first transporting element and along the first feed path "P1". In this case the first transporting element is preferably operable in step with the compacting chambers 13. In other words the transporting element advances the compacting chambers 13 in an intermittent fashion, proceeding at a stepped sequence whose steps correspond to the steps at which the compacting chambers 13 are distributed.

[0032] According to a possible embodiment, of which the enclosed drawings illustrate a non-limiting example, each compacting chamber 13 of the drum 14 extends radially between an access opening 16 radially outside and a bottom that is radially inside and preferably made by means of a presser element 17, or piston.

[0033] In practice, the compacting chamber 13 consists of a spindle with opposite openings with the presser element 17 sliding inside it.

[0034] The shape of the compacting chamber 13 substantially reproduces the form that the final brick package will have.

[0035] The presser element 17 is movable inside the compacting chamber 13 in a radial direction (in a centrifugal or centripetal direction).

[0036] In particular, it is observed that in the position in which the compacting chamber 13 is found at the first loading station 4, the presser element 17 is first arranged in a position that is radially outside (not illustrated) and subsequently, during the loading of the product, it is moved in a radial centripetal direction in such a manner as to (gradually) increase the volume of the compacting chamber 13 (and incorporate a greater quantity of product).

[0037] In this manner, advantageously, seeing as how the compacting chamber 13 is always filled with product, the creation of areas filled with air during the loading of the product inside the compacting chamber 13 is avoided.

ed.

[0038] It should be observed, therefore, that in this manner the compacting is extremely effective and the density of the powder in chamber 13 is homogeneous.

[0039] With a radial centrifugal motion the presser element 17 reaches a compacting position that is radially intermediate, corresponding for example to the position in which the compacted dose of product in powder 5 is received, in other words just before the first transfer station 7 (for example the position diametrically opposite the loading hopper 12, with reference to the embodiment of figure 1). Proceeding in a radial centrifugal motion, the presser element 17 reaches a radially external position for the expulsion of the compacted dose of product in powder 5 from the compacting chamber 13, at the first transfer station 7.

[0040] Figure 1 illustrates a block of coffee at the first transfer station 7 which has not yet been completely expelled from the compacting chamber 13.

[0041] After the expulsion of the compacted dose of product in powder 5, the presser element 17 remains in this radial position up to the loading station 4 (where it receives new product and will be moved in a radial centripetal direction during the loading).

[0042] In general terms, therefore, the compacting unit 2 comprises at least a compacting chamber 13 and at least a presser element 17 configured for compacting the dose of product in powder 3 inside the compacting chamber 13. In the case of a plurality of chambers, preferably a presser element 17 configured for compacting the dose of product in powder is associated with each compacting chamber 13.

[0043] Control elements, not illustrated, are operationally associated with the presser element 17 to activate the compacting step in which the product in powder inside the compacting chamber 13 is compacted. The control elements can comprise mechanical elements such as cams, elastic, pneumatic or hydraulic elements, and/or electronic or electromechanical systems.

[0044] The control elements can be configured to activate the compacting step with a continuous mode and such as to generate a progressively increasing load value exercised by the presser element 17. Alternatively, and according to a preferred embodiment, the control elements are configured to activate an intermittent mode for the compacting step, between a maximum load value and a minimum load value exercised by the presser element. The maximum and minimum load values preferably increase as the compacting step progresses. In other words, the presser element 17 is made to advance from the position that is radially inside, to a first compacting position that is radially intermediate and that corresponds to a first maximum load value for the load exercised on the product in powder. Subsequently the presser element is made to move back so as to apply a first minimum load value. The advancement and retreat of the presser element constitutes a sub-step of the compacting step. Subsequently this sub-step is repeated several

times, each time increasing the maximum and minimum load values applied.

[0045] An example of continuous and intermittent compacting steps is illustrated in the graph of figure 4, in which the continuous line represents a compacting step with application of a gradual load, whereas the jagged line represents the sequence of sub-steps of advancement and retreat of the presser element. The X-axis of figure 4 marks the sub-steps of application of the load and the Y-axis represents the corresponding values for the density of the product in powder, expressed in g/dm³.

[0046] In accordance with a possible embodiment, the compacting unit 2 comprises closing means that act on the compacting chamber(s) 13 during the compacting step performed by the presser element 17. Preferably the closing means are disabled, i.e. they allow access to the compacting chamber 13, at the first loading station 4 to allow the dose of product in powder 3 to be loaded into the compacting chamber, and at the transfer station 7 to allow the compacted dose of product in powder 5 to be transferred from the compacting chamber 13 to the filling unit 6.

[0047] According to a possible embodiment, of which the enclosed drawings illustrate a non-limiting example, the closing means of the compacting unit 2 comprise a fixed wall 18 that extends at least for a section between the first loading station 4 and the transfer station 7 along a direction of the path of the first transporting element. The fixed wall 18 is arranged so that it closes the compacting chamber 13 during its advancement between the first loading station 4 and the first transfer station 7. Preferably the presser element 17 is configured for compacting the dose of product in powder 3 against the fixed wall 18.

[0048] It should be observed that, preferably, on the fixed wall 18 there are pushing elements 50 that act by exerting a direct push that counterbalances the push of the presser element 17. In this manner, advantageously, deformation of the wall itself as a result of the pushing action of the presser element 17 is prevented.

[0049] With reference to the enclosed figures, but not at the exclusion of any other particular details, the wall 18 can be made by means of a cylindrical sleeve that envelops the drum 14 and that has at least two openings arranged at the first loading station 4 and at the first transfer station 7. The compacting chambers 13 are made to advance by the drum 14 inside the fixed wall 18 that keeps them closed in contrast to the radial push exerted by the presser element 17 during the compacting step.

[0050] At the areas where the push of the presser element 17 and of the counterbalancing pushing elements occurs, the fixed wall 18 is advantageously made flat.

[0051] In the following the filling unit 6 is described, which comprises a second transporting element, preferably of the rotary type, and even more preferably made by means of a drum 19, rotating about an axis of rotation 20 (in a clockwise direction in figure 1).

[0052] The drum 14 of the compacting unit 2 and the

drum 19 of the filling unit 6 are arranged with their respective axes of rotation parallel, preferably horizontally. Moreover the drum 14 of the compacting unit 2 and the drum 19 of the filling unit 6 are tangential, defining the first transfer station 7 in the area of the respective tangent points. The second transporting element has a filling chamber 21, preferably a plurality of filling chambers 21, designed to be coupled with a container 9 at a second loading station 22.

[0053] Preferably, in at least a zone of the respective path of movement (at the first transfer station 7) each compacting chamber 13 of the compacting unit 2 will be facing and aligned with a filling chamber 21 of the filling unit 6 (so that the transfer of the product from the compacting chamber 13 to the filling 21 can take place, as illustrated in figure 1).

[0054] The second transporting element is configured to advance the filling chamber 21 along a second feed path "P2". In particular the second transporting element is configured to advance the filling chamber 21 of the second loading station 22 to the first transfer station 7, to receive the compacted dose of product in powder 5. Furthermore the second transporting element is configured to advance the filling chamber 21 from the first transfer station 7 to a second transfer station 23 to make available the package being processed 8, defined by the container 9 filled with compacted dose of product in powder 5.

[0055] The second transporting element, and in particular the drum 19, is configured to successively advance the filling chambers 21 along the second feed path "P2".

[0056] According to a possible embodiment, the filling chambers 21 are regularly spaced along the second transporting element and along the second feed path "P2". In this case the second transporting element is preferably operable in step with the filling chambers 21, analogous with the previous description with reference to the first transporting element.

[0057] In particular the drum 14 of the compacting unit 2 and the drum 19 of the filling unit 6 are operated in step in such a manner that in the first transfer station 7 a compacting chamber 13 and a filling chamber 21 become aligned, with their respective access openings facing one another.

[0058] According to a possible embodiment, of which the enclosed drawings illustrate a non-limiting example, each filling chamber 21 of the drum 19 extends radially between a radially external access opening 24 and a bottom that is radially internal, preferably made by means of a further presser element 25, or piston, which can be structurally and functionally analogous to the presser element 17 of the compacting chamber 13.

[0059] The further presser element 25 is movable inside the filling chamber 21 in a radial direction, with a centrifugal or centripetal directional movement.

[0060] In practice, the filling chamber 21 consists of a spindle with opposite openings with the further presser element 25 sliding inside it.

[0061] The shape of the filling chamber 21 substantially reproduces the form that the final brick package will have.

[0062] In practice the shape of the filling chamber is substantially the same as that of the compacting chamber 13.

[0063] The container 9 of deformable material is in the form of a sleeve that is open at its opposite extremities and arranged to envelop from the outside the spindle which represents the filling chamber 21.

[0064] It is observed that when the further presser element 25 is at the first transfer station 7, it is initially arranged in a position that is radially external, after which it is then moved radially in a centripetal direction during the transfer of the product from the compacting chamber 13 to the filling chamber 21.

[0065] Figure 1 illustrates, at the first transfer station 7, a block of product which has been partially transferred from the compacting chamber 13 to the filling chamber 21: evidently, the presser element 17 is moved radially in a centrifugal direction as the further presser element 25 is moved radially in a centripetal direction, so as to produce the shifting, that is to say transfer, of the compact block of product from the compacting chamber 13 to the filling chamber 21.

[0066] Subsequently, according to one embodiment, following a radial centrifugal motion, the further presser element 25 reaches a compacting position that is radially intermediate, for example just before the second transfer station 23. Proceeding with the radial centrifugal motion, the further presser element 25 reaches a radially external position for the expulsion of the package being processed 8 from the filling chamber 21, for example at the second transfer station 23.

[0067] After the expulsion, the further presser element 25 remains in a radially external position up to the first transfer station 7 (where it receives a new block of product).

[0068] In general terms, therefore, the filling unit 6 can comprise at least one filling chamber 21 and at least one further presser element 25 configured for further compacting the dose of product in powder 5 inside the filling chamber 21 and the container 9. Control elements, not illustrated, are operationally associated with the further presser element 25 to activate the step in which the compacted dose of product in powder 5 inside the filling chamber 21 is compacted further. Also in this case, as with the presser elements 17, the control elements can comprise mechanical elements such as cams, elastic, pneumatic or hydraulic elements, and/or electronic or electro-mechanical systems. Furthermore the control elements can be configured to activate a continuous mode or an intermittent mode for the compacting step, as described above with reference to the presser element 17.

[0069] According to a possible embodiment, the filling unit 6 comprises closing means that act on the filling chamber(s) 21 during the further compacting step. The closing means are disabled, i.e. they allow access to the filling chamber 21, at least at the second loading station

22 to allow the filling chamber 21 to be loaded, at the first transfer station 7 to allow the compacted dose of product in powder 5 to be transferred into the filling chamber 21, and at the second transfer station 23 to allow the expulsion of the package being processed 8.

[0070] According to the illustrated embodiment, intermediate sealing means 27 are provided along the second feed path "P2" which can be activated to operate on a part of the container 9, for example a bottom of the container 9.

[0071] Preferably the intermediate sealing means 27 are arranged downstream from the first transfer station 7 and configured for folding and sealing the flaps of the bottom of the container 9 arranged at the access opening 24 of the filling chamber 21.

[0072] In concrete terms the container 9, at the intermediate sealing means 27, is made to slide radially on the filling chamber 21 towards the exterior, until a part of the open container 9 is outside of the filling chamber 21, in order to effect the folding and sealing of the bottom.

[0073] According to an embodiment, of which the enclosed drawings illustrate a non-limiting example, downstream (in the direction of advancement P2) from the intermediate sealing means 27, closing means for the filling unit 6 are arranged, which comprise a fixed wall 26 that extends at least for a section between the first transfer station 7 and the second transfer station 23 along a direction of the path of the first transporting element. The fixed wall 26 is arranged so that it counteracts the bottom of the container 9 as it advances between the first transfer station 7 and the second transfer station 23, so as to consolidate the closed bottom of the container 9. Preferably the further presser element 25 is configured for further compacting the compacted dose of product in powder against the fixed wall 26.

[0074] With reference to the enclosed figures, but not at the exclusion of any other particular details, the fixed wall 26 can be made by means of an angular portion of a cylindrical sleeve that partially envelops the drum 19.

[0075] It should be observed that, in an embodiment that is not illustrated here, on the fixed wall 26 there are pushing elements (not illustrated) that act by exerting a direct push that counterbalances the push of the further presser element 25. In this manner, advantageously, deformation of the wall itself as a result of the pushing action of the further presser element 25 is prevented.

[0076] Furthermore, the pushing elements allow the bottom of the container 9 which has just been closed, to be consolidated.

[0077] At the areas where the push of the further presser element 21 and of the counterbalancing pushing elements occurs, the fixed wall 26 is advantageously made flat.

[0078] According to a possible embodiment, the machine 1 can comprise a transport line 28 that extends at least between the second transfer station 23 and the vacuum chamber 10 to transport the packages being processed 8 along a third feed path "P3". Preferably the ma-

chine 1 comprises folding and pre-sealing means 29, arranged along the third feed path "P3" and configured for the folding and pre-sealing of the extremities of the packages being processed 8 that are still open, before inserting them into the vacuum chamber 10. The term pre-sealing is intended to mean a partial sealing of the flaps of the packages being processed 8. These folding and pre-sealing elements 29 are arranged upstream from the vacuum chamber 10.

[0079] In use, the machine 1 for packaging is able to implement a packaging method for products in powder inside a container, for example ground coffee, according to the present invention.

[0080] According to a possible embodiment, this method involves loading a dose of product in powder 3 inside a compacting chamber 13 and compacting this dose of product in powder inside the compacting chamber in order to obtain a compacted dose of product in powder 5.

[0081] These steps can be implemented by the compacting unit 2 described previously.

[0082] Subsequently the compacted dose of product in powder 5 is transferred inside a container 9 to provide a package being processed 8, defined as a container 9 filled with the compacted dose of product in powder 5. These steps can be implemented by the filling unit 6 described previously.

[0083] The package being processed 8 is then transferred to a vacuum chamber in which it is closed and sealed during a vacuum activation step inside that vacuum chamber.

[0084] With reference to a possible implementation in the machine 1 previously described, the method according to the present invention involves loading the compacting chamber 13 by means of the loading hopper 12, then proceeds with a volumetric dosing of the product in powder to obtain the dose of product in powder 3. The drum 14 is made to rotate around axis 15 (counterclockwise in figure 1) so as to advance the compacting chamber 13 from the first loading station 4 to the first transfer station 7 and vice versa, preferably in a stepped, intermittent advancing motion with the compacting chambers 13 made in the drum 14.

[0085] To close the compacting chamber 13 during the compacting step it is advantageously arranged that during the rotation of the drum 14, the compacting chamber 13 encounters the fixed wall 18 which closes its access opening 16. The presser element 17 is then moved (in a centrifugal direction) against the fixed wall 18 (centrifugal movement) thereby creating the compacting step of the dose of product in powder contained in the compacting chamber 13.

[0086] This compacting step can be carried out in a continuous mode, gradually increasing the pressure exercised by the presser element 17, or in an intermittent mode, as described previously.

[0087] The presser element 17 is then moved against the fixed wall 18 with the compacting chamber 13 stationary (in other words, when the compacting unit 2 is

not in rotation).

[0088] Alternatively the compacting can take place in a continuous fashion.

[0089] In other words, the compacting step occurs inside the compacting chamber as the latter is made to advance towards the first transfer station 7.

[0090] The drum 19 of the filling unit 6 rotates (in a clockwise direction, with reference to figure 1), and in step with the drum 14 of the compacting unit 2.

[0091] Upstream from the first transfer station 7, the container 9 is arranged onto the filling chamber 21 at the second loading station 22. More particularly, in this step the container 9 consists of a sleeve with open opposite ends.

[0092] This container 9 in the shape of a sleeve envelops the filling chamber 21, adhering to the external surface of the latter.

[0093] When, after the rotation of the drum 19, the filling chamber 21 (with the container wrapped around its exterior) reaches the first transfer station 7, the compacted dose of product in powder 5 is transferred inside the filling chamber 21 and then inside the container 9 arranged to envelop the filling chamber.

[0094] Then a step can advantageously be arranged in which the compacted dose of product in powder 5 is compacted further inside the filling chamber 21. Also this step of further compacting is carried out in an intermittent mode as previously described, or alternatively in a continuous mode.

[0095] According to the illustrated embodiment, there is an intermediate closing step of the container 9, preferably carried out before the further compacting step, if included. For example, after having left the first transfer station 7, the filling chamber 21 reaches the intermediate sealing means 27 which act on a part of the bottom end of the container 9 in the shape of a sleeve, to fold and close it. As described previously, the sleeve is made to slide radially outwards along the filling chamber 21 in advance in order to make the part of the bottom end available for the folding and sealing that is to follow.

[0096] Subsequently the filling chamber 21 encounters the fixed wall 26 which counteracts the bottom of the container which finds itself at the access opening 24.

[0097] The further presser element 25 is then moved against the fixed wall (centrifugal movement), thus effecting the step of further compacting the compacted dose of product in powder 5 contained in the filling chamber 21. The further compacting step occurs in the filling chamber 21 as the latter is made to advance towards the second transfer station 23 where the package being processed 8 is transferred to the transport line 28. In the second transfer station 23 the package being processed 8 is removed from the filling chamber 21 (by means of the push of the further presser element 25 against the compacted product in powder 5) in such a manner that the compacted product in powder 5 comes into direct contact with the inside of the package being processed 8.

[0098] Preferably, before reaching the vacuum cham-

ber 10, the packages being processed 8 encounter the folding and pre-sealing means 29 which fold and pre-seal a part of the package 8 before inserting it into the vacuum chamber 10. In particular the folding and pre-sealing means 29 fold the end of the sleeve that is still open and that will then be sealed in the vacuum chamber, during a vacuum activation step inside that vacuum chamber.

[0099] Said pre-sealing means are configured for partially closing the packages being processed 8, leaving open at least a channel, i.e. an area of access to the interior of the container.

[0100] In practice, the folding and pre-sealing means 29 apply the folding and partial sealing of the upper flaps of the container 8, thereby creating a kind of fin at the top of the container.

[0101] In this case, in the vacuum chamber 10, the sealing means 11 then permanently close the containers by sealing them, in other words apply the closure of the channel, i.e. the area of access (after the air has been extracted).

[0102] It should be observed that, according to the present invention, the time each brick package has to stay inside the vacuum chamber in order to be processed, is significantly reduced with respect to the prior art, with a correspondingly increased speed of the machine as a result.

[0103] According to another aspect, the force of compression preferably exercised by the presser element 17 or by the further presser element 25 is between 10.000 and 50.000 N, and even more preferably between 20.000 and 30.000 N.

[0104] According to yet another aspect, the pressure inside the vacuum chamber 10 is preferably between -0.9 and -0.7 bar (the pressure has a negative value, as the chamber is under vacuum).

[0105] An advantage of the present invention is that the packaging machine 1 of the invention is able to package products in powder inside a container in a fashion that is particularly simple, quick, and able to ensure an end result of the highest quality.

[0106] A further advantage of the present invention is that the machine 1 of the invention is simple and reliable and that the packaging method of the invention is quick but still ensures that the end product is of the highest quality.

[0107] A further advantage according to the present invention is that in the machine 1 of the invention the density of the product inside the container is homogeneous.

[0108] A further advantage according to the present invention is that in the machine 1 of the invention the amount of air inside the brick package is extremely reduced, thus making it possible to have a particularly high degree of compaction of the product.

[0109] A further advantage according to the present invention is that the machine 1 of the invention has extremely reduced operating times (in particular with regard to the step of closing and sealing the packages being

processed 8 inside the vacuum chamber, where the operating times are four times lower compared to the systems of the prior art).

[0110] A further advantage according to the present invention is that in the machine 1 of the invention it is substantially avoided that the product in powder becomes dispersed during the steps of arranging the packages being processed 8 inside the vacuum chamber.

[0111] In the machine and the method according to the invention the vacuum chamber is not a critical point, thanks to the fact that, different from the prior art, it is advantageously arranged that the doses of product in powder are compacted before being inserted into the container.

[0112] This also makes it possible to improve the quality of the end product, by performing the compacting steps in a manner that is most suitable for the type of material in powdered form.

[0113] Furthermore it is possible to introduce further compacting steps, which contributes to improving the quality of the end product and eliminates the concerns that the vacuum chamber presents.

Claims

1. A machine (1) for packaging products in powder, for example coffee powder, inside a container made of deformable material, **characterised in that** it comprises:

- a compacting unit (2) comprising a compacting chamber (13) configured to receive a dose of product in powder (3), at a first loading station (4),
- a presser element (17) configured to compact the dose of product in powder (3) inside the compacting chamber (13) in such a way as to obtain a compacted dose of product in powder (5),
- a filling unit (6) comprising at least a filling chamber (21) configured to receive, at a first transfer station (7), the compacted dose of product in powder (5) coming from the compacting unit (2) and to provide a package being processed (8) defined by a container (9) made of deformable material filled with the compacted dose of product in powder (5),
- a vacuum chamber (10) designed to receive the package being processed (8) coming from the filling unit (6) and to extract air from the package being processed (8), in such a way as to make the deformable material of the container (9) adhere to the compacted dose of product in powder (5),
- sealing means (11) positioned in the vacuum chamber (10) and configured to close and seal the package being processed (8) during a step of activating vacuum in the vacuum chamber

(10).

2. The packaging machine according to the preceding claim, wherein the compacting unit (2) comprises a first transporting element, preferably of the rotary type, having the compacting chamber (13), the first transporting element being configured to feed the compacting chamber (13) from the first loading station (4) to the first transfer station (7) and vice versa along a first feed path (P1).
3. The packaging machine according to claim 1 or 2, wherein the compacting unit (2) comprises closing means acting on the compacting chamber (13) during the compaction step actuated by the presser element (17) and deactivated at the first loading station (4) and the first transfer station (7) to allow the loading the dose of product in powder (3) in the compacting chamber (13) and to allow the transfer of the compacted dose of product in powder (5) from the compacting chamber (13) to the filling unit (6).
4. The packaging machine according to claim 2 or 3, wherein the closing means comprise a fixed wall (18) extending at least for a stretch between the first loading station (4) and the first transfer station (7) according to a direction of travel of the first transporting element, the fixed wall (18) being positioned for closing the compacting chamber (13) during its movement between the first loading station (4) and the first transfer station (7), the presser element (17) being configured to compact the dose of product in powder (3) against the fixed wall (18).
5. The packaging machine according to any one of claims 2 to 4, wherein the first transporting element is a drum (14), rotating about an axis of rotation (15), and wherein each compacting chamber (13) extends radially between an access opening (16) radially outside and the presser element (17), movable inside the compacting chamber (13) in a radial direction between a loading position, wherein the presser element (7) moves in the centripetal direction to allow the insertion of the dose of product in powder in the compacting chamber (7), a compacting position, wherein the presser element (7) acts in a centrifugal direction against the dose of product in powder loaded in the compacting chamber (13), and a position of expulsion, wherein the presser element (7) moving in the centrifugal direction reaches the radially external position, thus expelling the compacted dose of product in powder (5) from the compacting chamber (13).
6. The packaging machine according to any one of the preceding claims, wherein the filling chamber (21) is configured to be wrapped around by the container made of deformable material (9) at a second loading

- station (22), the filling unit (6) being configured to feed the filling chamber (21) from the second loading station (22) to the first transfer station (7), to receive the compacted dose of product in powder (5) inside the filling chamber (21), and from the first transfer station (7) to a second transfer station (23) to provide a package being processed (8) defined by the container (9) filled with the compacted dose of product in powder (5), along a second feed path (P2).
7. The packaging machine according to the preceding claim, comprising intermediate sealing means (27) positioned along the second feed path (P2) and which can be activated on a portion of the container (9).
 8. The packaging machine according to any one of the preceding claims, comprising a further presser element (25) configured for further compacting inside the filling chamber (21) the compacted dose of product in powder (5).
 9. The packaging machine according to the preceding claim, wherein the filling unit (6) comprises closing means acting on the filling chamber (21) during the further compacting step actuated by the further presser element (25) and deactivated at least at the first transfer station (7) and the second transfer station (23).
 10. The packaging machine according to the preceding claim, wherein the closing means comprise a fixed wall (26) extending at least for a stretch between the first transfer station (7) and the second transfer station (23) according to a direction of travel of the filling unit (6), the fixed wall (26) being positioned to close the filling chamber (21) during its movement between the first transfer station (7) and the second transfer station (23).
 11. The packaging machine according to any one of claims 8 or 10, wherein the filling unit (6) comprises a drum (19), rotating about an axis of rotation (20), and wherein each filling chamber (21) extends radially between an access opening (24) radially external and the further presser element (25), movable inside the filling chamber in a radial direction between a loading position, wherein the further presser element (25) moves in the centripetal direction to allow the insertion of the compacted dose of product in powder (5) in the filling chamber (21), a further compacting position, wherein the further presser element (25) acts in a centrifugal direction against the compacted dose of product in powder (5) loaded in the filling chamber (21), and a position of expulsion, wherein the further presser element (25) moving in the centrifugal direction reaches the radially external position, thus expelling the compacted dose of product in powder (5) and the container (9) for making the package being processed (8) with inside the dose of product in powder (5) further compacted.
 12. A method for packaging products in powder, for example coffee powder, inside a container, **characterised in that** it comprises the following steps:
 - loading a dose of product in powder (3) inside a compacting chamber (13),
 - compacting the dose of product in powder (3) inside the compacting chamber (13) to obtain a compacted dose of product in powder (5),
 - set up/arrange a container made of deformable material
 - transferring the compacted dose of product in powder (5) inside a container (9) made of deformable material in order to provide a package being processed (8) defined by a container (9) filled with the compacted dose of product in powder (5),
 - transferring the package being processed (8) to a vacuum chamber (10),
 - closing and sealing the package being processed (8), inside the vacuum chamber (10) during a step for activating the vacuum in the vacuum chamber (10), the activation of the vacuum being realized in such a way as to extract the air from the package being process (8) up to allow the deformable material of the container (9) to adhere to the compacted dose of product in powder (5) positioned inside the package being process (8),
 13. The packaging method according to the preceding claim, comprising the step of feeding the compacting chamber (13) from a first loading station (4) to a first transfer station (7) and vice versa along a first feed path (P1), preferably using an intermittent feed motion.
 14. The packaging method according to claim 12 or 13, wherein the compacted dose of product in powder (5) is transferred inside a filling chamber (21) on which the container (9) made of deformable material is wrapped, the filling chamber (21) being fed along a second feed path (P2) preferably using an intermittent feed motion.
 15. The packaging method according to the preceding claim, comprising the step of further compacting the compacted dose of product in powder (5) inside the filling chamber (21), preferably after having closed the filling chamber.
 16. The packaging method according to any one of claims 12 to 15, comprising, before the step of transferring the package being processed (8) to a vacuum

chamber (10), the step of pre-sealing edges of the package being processed (8), so as to leave channels for extracting air facing and open towards the inside of the package being processed (8).

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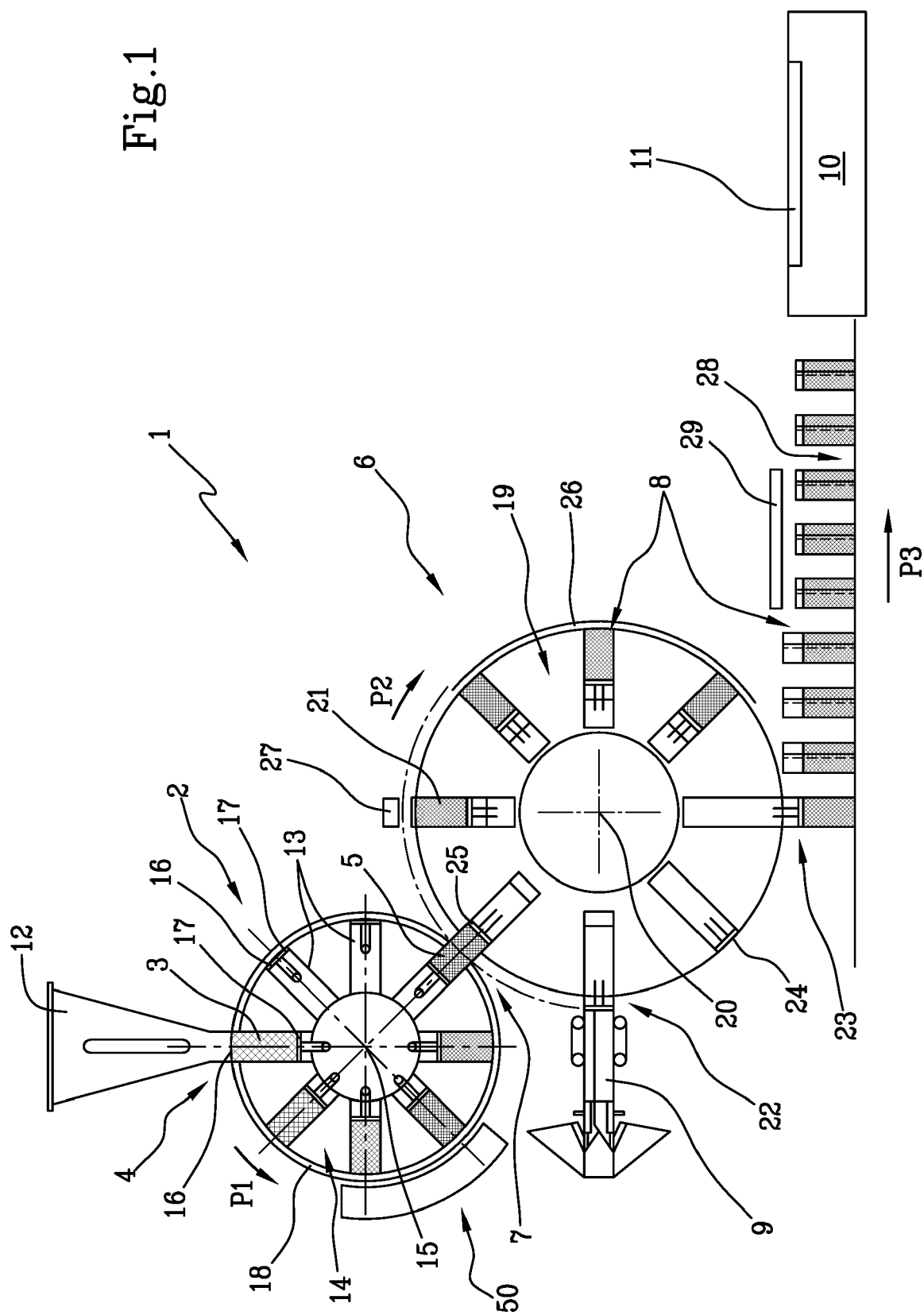
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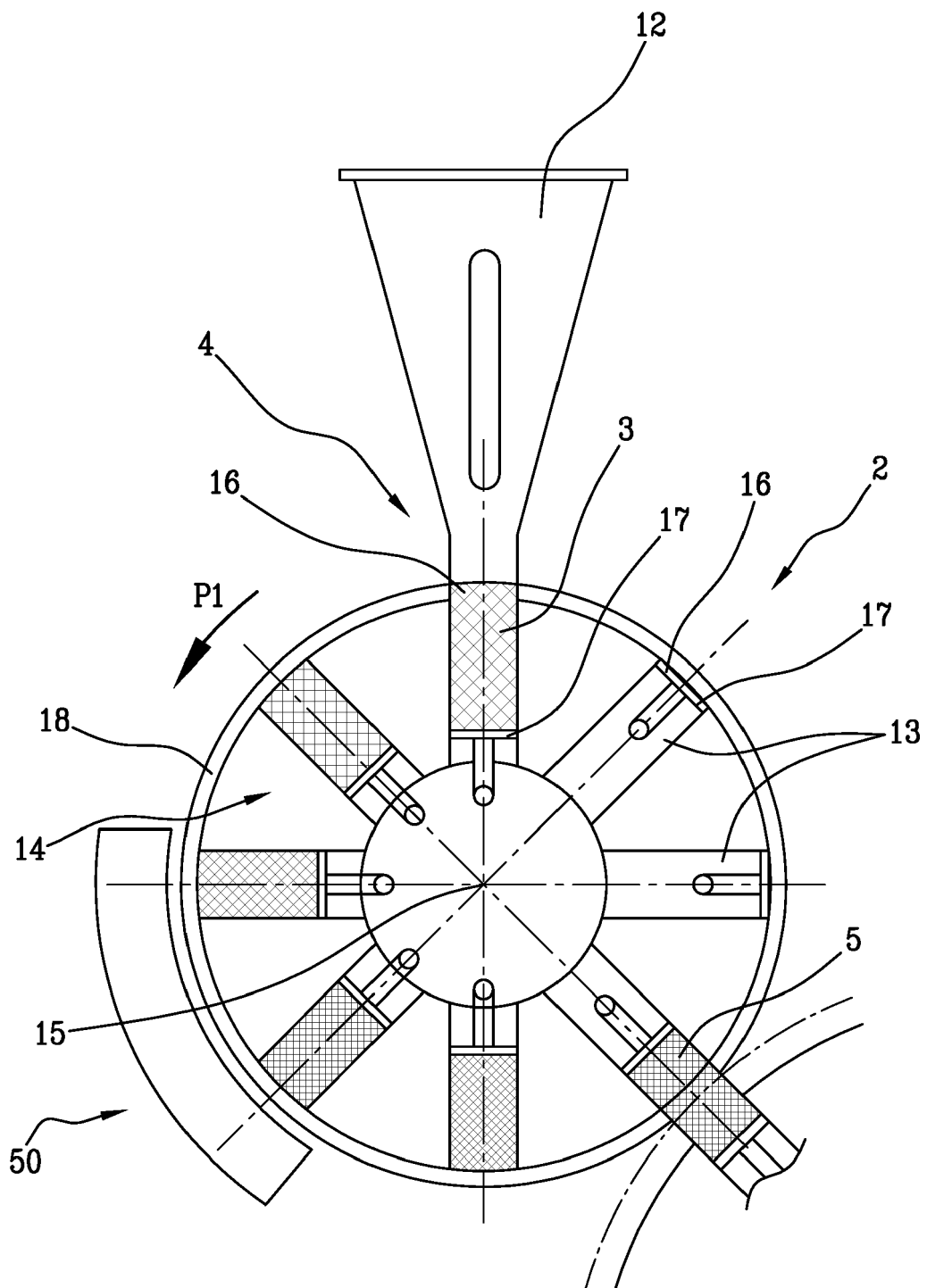
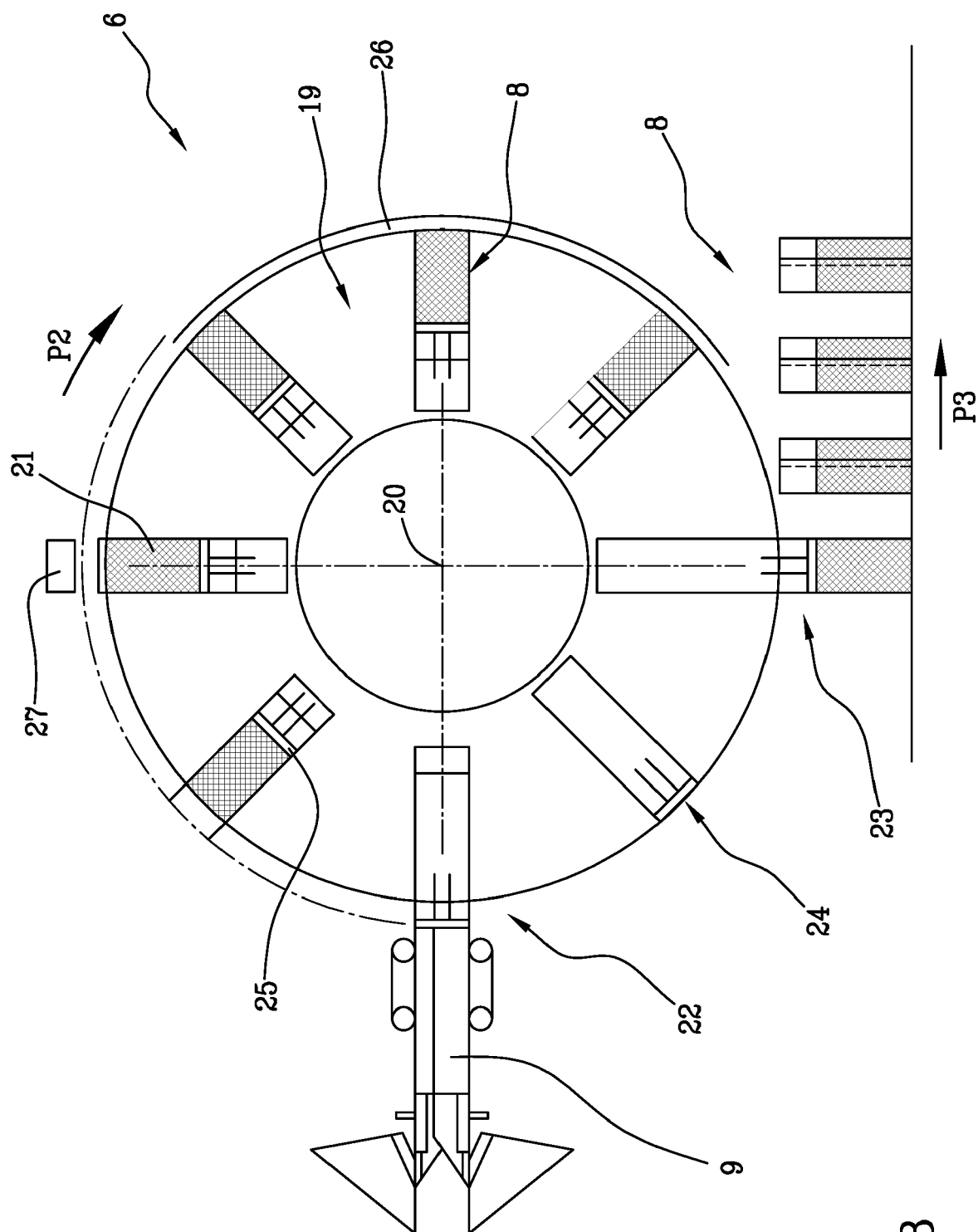
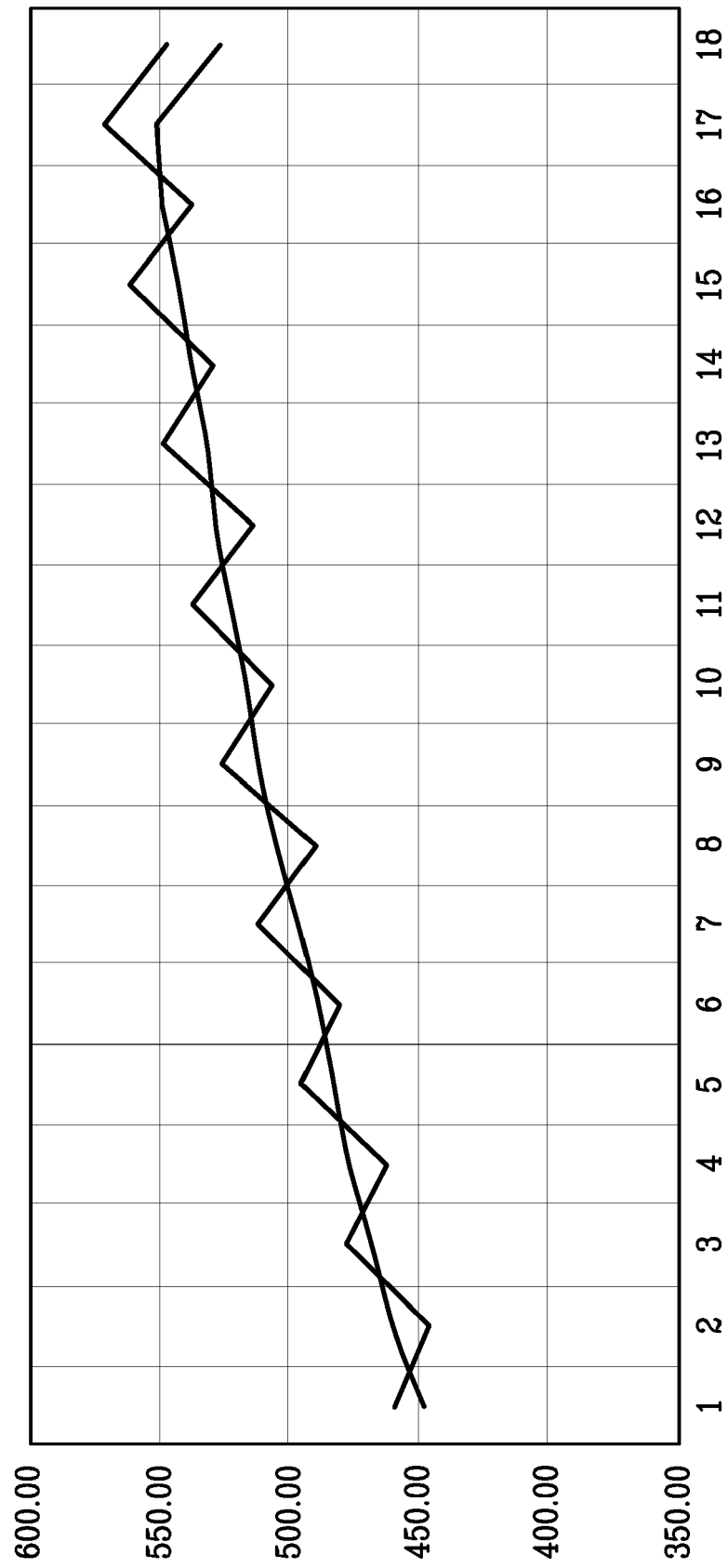


Fig.2



Fi. 3.

Fig.4





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