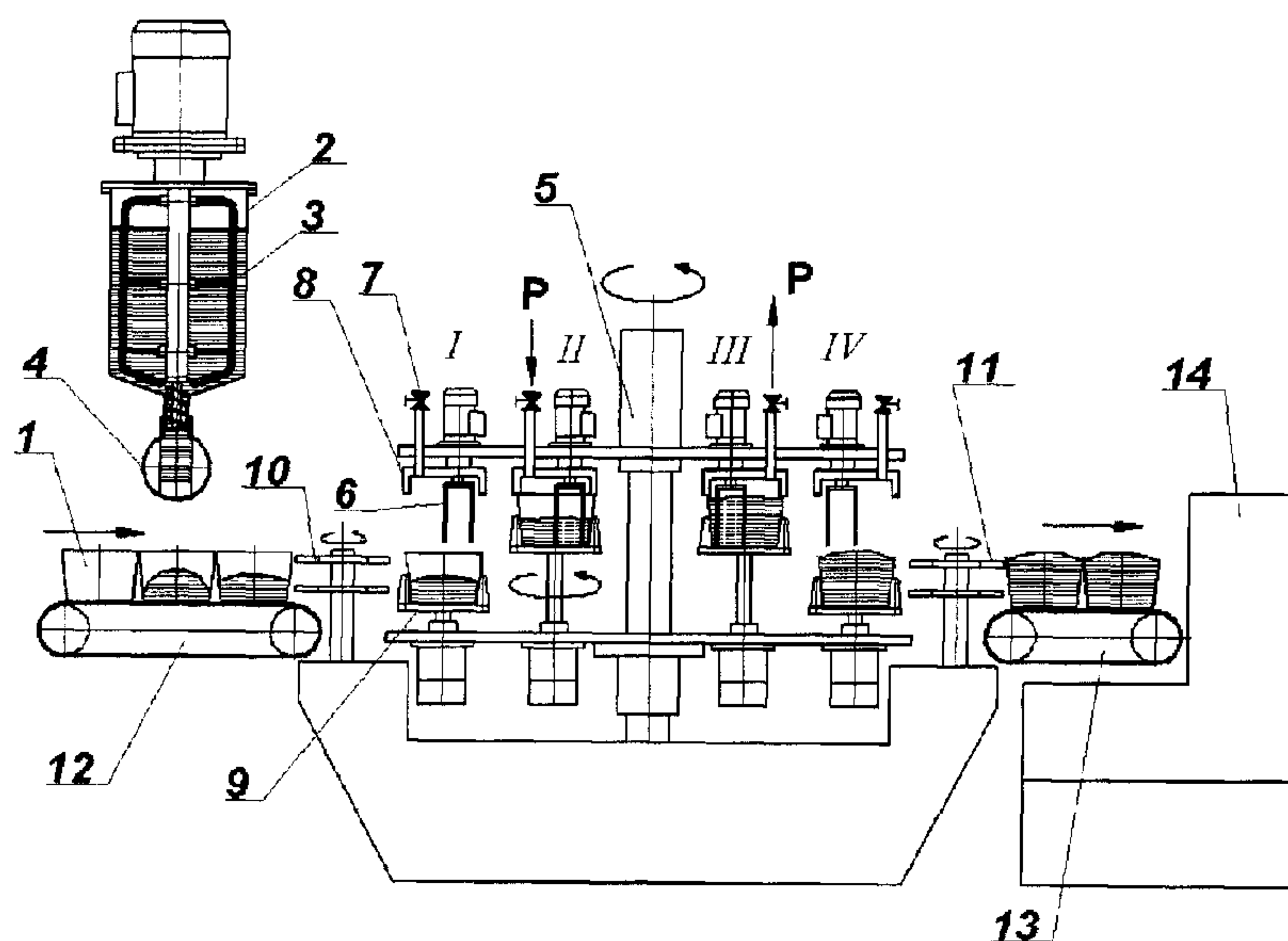




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(54) Title: METHOD FOR PRODUCTION OF BREAD FROM FOAMED DOUGH



(57) Abrégé/Abstract:

The components of the dough recipe are mixed in a dough mixing apparatus (2). The resulting dough is divided into portions, each of which is foamed and produces foamed dough. Mixing and foaming are performed by separate devices. Foaming is performed at a pressure no less than 0.3 MPa and is then reduced to atmospheric at a controlled rate of 0.02-0.2 MPa/s. The lowering of pressure to atmospheric occurs either before or after the removal of the foaming device (6) from the dough. The foaming process is performed in baking molds (1), or in intermediate vessels (16), and subsequently transferred to the molds (1). Transfer occurs either in molds (1) under atmospheric pressure, after lowering the pressure in the intermediate vessels (16) to atmospheric, or in molds (1) under increased pressure, where the pressure is decreased to atmospheric after the transfer is completed. The claimed invention simplifies and increases the accuracy of dividing the dough into portions of a specified weight, enhances the quality of the foamed dough, reduces energy consumption and increases production efficiency.



ABSTRACT

The components of the dough recipe are mixed in a dough mixing apparatus (2). The resulting dough is divided into portions, each of which is foamed and produces foamed dough. Mixing and foaming are performed by separate devices. Foaming is performed at a pressure no less than 0.3 MPa and is then reduced to atmospheric at a controlled rate of 0.02-0.2 MPa/s. The lowering of pressure to atmospheric occurs either before or after the removal of the foaming device (6) from the dough. The foaming process is performed in baking molds (1), or in intermediate vessels (16), and subsequently transferred to the molds (1). Transfer occurs either in molds (1) under atmospheric pressure, after lowering the pressure in the intermediate vessels (16) to atmospheric, or in molds (1) under increased pressure, where the pressure is decreased to atmospheric after the transfer is completed. The claimed invention simplifies and increases the accuracy of dividing the dough into portions of a specified weight, enhances the quality of the foamed dough, reduces energy consumption and increases production efficiency.

METHOD FOR PRODUCTION OF BREAD FROM FOAMED DOUGH

The invention relates to the bakery production, and may be used for bread production using foamed, including unleavened, dough.

A known method of producing foamed baked goods (MPK A21D 13/00, RU J 2320174 P 1, 17.06.2006, Bul No 9, 27.03.2008, authors: Magomedov G.O., Ponomareva E.I., Shelest T. N., Krutsky S. N., Peshekhonovo A.B., (analog), where the mixing of the starting dough ingredients occurs within 1 minute and the rotation of the mixing device is 5 c^{-1} , followed by the dough foaming process which occurs at a pressure of 0.35MPa using the same device, for 3-5 minutes at a rotation speed of 13.3 c^{-1} , then the dough is divided into portions of 150-170g and baked.

Disadvantages of this method are decreased precision and more complicated technical implementation when dividing the foamed dough into portions of a specified mass, since the baking industry divides dough into portions of a specified weight on a volume basis, dividing portions from the dough mass of equal volumes, whereas after completion of the foaming process the foamed dough is a foamed foam-like mass, whose characteristics, including density, are as dependent on the parameters of the foaming process as they are on the ratio of ingredients in the dough and their properties, meaning that using a volume-based division process for foamed dough after completion of the foaming process does not provide an acceptable level of accuracy. In the proposed method, the process of dough division is performed after completion of the mixing process, so that the dough is a homogenous mass, before it is foamed and forms a foamed foam-like structure, which provides increased accuracy when dividing the dough into specified weights and simplifies technical implementation of the division process, for example using a high-performance industrial dough divider.

Another drawback of the existing method is a decreased quality of finished foamed dough, consisting of a foamed foam-like mass, due to partial destruction of the foam occurring during the foamed dough division process. Foam destruction is caused initially by sharp unregulated drops of pressure in the zone where the dough exits from the dough mixing apparatus, being under increased pressure equal to 0.35 Mpa, into the atmosphere, which ruptures the shell of air bubbles during the drop in foam pressure,

while in the proposed method the pressure is dropped around each portion of the foamed dough with a controlled speed between 0.02-0.2 MPa/s, providing minimum foam destruction and maximum dough rise. Additional foam destruction occurs because the output of foam from the device happens as a result of pressure in the apparatus which forces it through the channels of the shutoff and discharge device, where partial destruction of the foam also occurs, and therefore decreases the quality of the foamed dough.

Additional drawbacks to the existing method are decreased quality of foamed dough, increased energy consumption, and decreased manufacturing productivity due to the use of the same devices for the mixing and foaming processes, specifically the foaming process is conducted within and by the same mixing device, which was used for conducting the mixing process. However the processes of mixing and foaming have different objectives - the mixing process combines dry and liquid ingredients, resulting in a homogenous dough mass, whereas the foaming process saturates that homogenous dough mass with air. Therefore, in order to mix the basic ingredients use a dough mixer apparatus with strong rigid mixing elements designed for heavy loads, having minimal surface contact with the dough, and for the foaming process use foaming devices similar to the "beater", having a large amount of relatively thin, elastic wire-knives, which are designed to create in the homogenous dough mass upon rotation as many cuts as possible, so air can pass into them and be evenly distributed inside the dough. The foaming device requires less power. The use of mixing devices in analogs for performing the foaming process decreases the quality of the foamed dough, increases energy requirements, and lowers production efficiency.

A known invention even closer to the technical nature is a method for producing foamed unleavened bread from whole grain wheat (MPK A21D 13/02, RU J 2364087 P 1, 26.02.2008, Bul No 23, 20.08.2000, authors: Magomedov G.O., Ponomareva E.I., Aleynik I.A., (prototype), where within the first 5-15 minutes the process of mixing the starting ingredients for dough at a mixing device rotation speed of 15 c^{-1} occurs, followed by the dough foaming process at a pressure of 0.4 MPa using the same mixing device, for a period of 6-12 minutes at a rotation speed of 20 c^{-1} , after which the dough dividing process makes 0.25kg portions and is consequently baked.

Disadvantages of this method are decreased precision and more complicated technical implementation when dividing the foamed dough into portions of a specified mass, since the baking industry divides dough into portions of a specified weight on a volume basis, dividing portions from the dough mass of equal volumes, whereas after completion of the foaming process the foamed dough is a foamed foam-like mass, whose characteristics, including density, are as dependent on the parameters of the foaming process as they are on the ratio of ingredients in the dough and their properties, meaning that using a volume-based division process for foamed dough after completion of the foaming process does not provide an acceptable level of accuracy. In the proposed method, the process of dough division is performed after completion of the mixing process, so that the dough is a homogenous mass, before it is foamed and forms a foamed foam-like structure, which provides increased accuracy when dividing the dough into specified weights and simplifies technical implementation of the division process, for example using a high-performance industrial dough divider.

Another drawback of the existing method is a decreased quality of finished foamed dough, consisting of a foamed foam-like mass, due to partial destruction of the foam occurring during the foamed dough division process. Foam destruction is caused initially by sharp unregulated drops of pressure in the zone where the dough exits from the dough mixing apparatus, being under increased pressure equal to 0.4 Mpa, into the atmosphere, which ruptures the shell of air bubbles during the drop in foam pressure, while in the proposed method the pressure is dropped around each portion of the foamed dough at a controlled rate between 0.02-0.2 MPa/s, providing minimum foam destruction and maximum dough rise. Additional foam destruction occurs because the output of foam from the device happens as a result of pressure in the apparatus which forces it through the channels of the shutoff and discharge device, where partial destruction of the foam also occurs, and therefore decreases the quality of the foamed dough.

Additional drawbacks to the existing method are decreased quality of foamed dough, increased energy consumption, and decreased manufacturing productivity due to the use of the same devices for the mixing and foaming processes, specifically the foaming process is conducted within and by the same mixing device, which was used for conducting the mixing process. However the processes of mixing and foaming have

different objectives - the mixing process combines dry and liquid ingredients, resulting in a homogenous dough mass, whereas the foaming process saturates that homogenous dough mass with air. Therefore, in order to mix the basic ingredients use a dough mixer apparatus with strong rigid mixing elements designed for heavy loads, having minimal surface contact with the dough, and for the foaming process use foaming devices similar to the "beater", having a large amount of relatively thin, elastic wire-knives, which are designed to create in the homogenous dough mass upon rotation as many cuts as possible, so air can pass into them and be evenly distributed inside the dough. The foaming device requires less power. The use of mixing devices in analogs for performing the foaming process decreases the quality of the foamed dough, increases energy requirements, and lowers production efficiency.

Technical results of the claimed invention are simplification and improved precision of the process of dividing the dough into portions of specified weight, improved quality of the foaming dough, improved energy efficiency, and increased production efficiency.

Technical results are achieved by the bread production method using foamed, including unleavened, dough, comprised of processes of mixing dough, foaming of the dough, division of dough into portions of a predetermined weight and bread baking, where the process of division is performed after conclusion of the mixing process, before the foaming process, then the foaming process is performed by the foaming device separately for each portion of dough, after which the bread baking with the foamed dough is conducted under the corresponding baking conditions. The processes of mixing and foaming the dough are performed with separate devices, preferably suited to performing mixing and foaming processes, respectively. The process of foaming a portion of dough is performed in baking molds, or in intermediate vessels, followed by transfer of the dough into the baking mold. Transfer of the foamed dough from the intermediate vessels is performed either in baking molds under atmospheric pressure after lowering the pressure in the intermediate vessels to atmospheric, or in baking molds under the same increased pressure as the intermediate vessels, where the pressure is decreased to atmospheric after the transfer is completed.

Simplification and improved accuracy of the process of dividing dough into

portions of a specific weight is achieved by carrying out the process of dividing the dough after completing the mixing process, when the dough is a homogenous mass, before it is foamed and forms the dough's foamed foam-like structure. This removes the need to divide the foam-like mass, whose characteristics, including density, are dependent on the parameters of the foaming process as well as the ratio of ingredients in the dough and their properties. Division of thoroughly mixed dough with a homogenous structure ensures increased precision when dividing the dough into specified weights and simplifies technical implementation of the division process, for example using a high-performance industrial dough divider.

Improved foamed dough quality is achieved by eliminating partial foam destruction, occurring during the process of dividing the foamed masses of dough, and replacing sharp pressure drops in the expansion zone of the foamed dough with decreases in pressure after foaming at controlled rates between 0.02-0.2 MPa/s, producing minimal destruction of the resulting foam-like structure and maximum rise in the dough before baking. Improved quality is also achieved because the dough mixing and foaming processes are performed using different devices, preferably suited to performing mixing and foaming processes, respectively, since the mixing and foaming processes have different objectives – the mixing process combines dry ingredients with liquid ones, resulting in a homogenous mass of dough, and the foaming process saturates the homogenous mass with air. Therefore, in order to mix the basic ingredients use a dough mixer apparatus with strong rigid mixing elements designed for heavy loads, having minimal surface contact with the dough, and for the foaming process use foaming devices similar to the “beater”, having a large amount of relatively thin, elastic wire-knives, which are designed to create in the homogenous dough mass upon rotation as many cuts as possible, so air can pass into them and be evenly distributed inside the dough. The resulting dough, prepared in accordance with this proposed method, is lighter, with a more stable foam, and the bread made from this foamed dough bakes more thoroughly and has more porous crumbs.

Increased production is achieved firstly due to the division of the dough into portions of a specific weight in the proposed method is conducted after completing the process of mixing the dough ingredients into a homogenous mass, i.e. until the foam-like

structure is formed, which allows it to be used in the dough division process of high-performance industrial dough dividers. Increases in productivity are also achieved as a result of using equipment designed specifically for mixing and foaming in the mixing and foaming processes, which reduced foaming time by a factor of three.

Reducing energy consumption is also due to the use of separate devices for mixing and foaming the dough, preferably suited to performing mixing and foaming processes, respectively. Thus, the use of foaming devices in the foaming process instead of mixing devices allows a power reduction of the actuator by a factor of two per each individual mass of processed dough.

On Fig. 1, a line for production of foamed, unleavened dough is displayed.

Fig. 2 shows six stages of the process of foaming dough on a dough carousel. In contrast to Fig. 1, the foaming device is removed from the dough before starting to decrease pressure.

Fig. 3 shows an installation for production of foamed, unleavened bread, on which the foaming process is performed in intermediate vessels and followed by transfer of the foamed dough into the baking mold. The transfer of dough occurs after the pressure is decreased in the intermediate vessels.

Fig. 4-9 show six stages of the dough foaming process in the foaming chamber in periodic operation, where the dough foaming process is conducted in intermediate vessels with subsequent transfer of the foamed dough into baking molds attached to the carriages under the intermediate vessels. Unlike Fig.3, the transfer of the dough occurs from intermediate vessels into baking molds having the same increased pressure as the intermediate vessels in the process of foaming dough, and the process of decreasing pressure in the foaming chamber only begins after the transfer.

Fig. 4 shows a stage where the dough that has been mixed in the mixer is divided into portions of a specified weight and moved to intermediate vessels, placed on the carriage, which has baking molds attached under the intermediate vessels. Shown here, the process of introducing the carriages with intermediate vessels and baking molds into a hermetically sealed foaming chamber.

Fig. 5 shows a stage where the specified increased pressure is created in the foaming chamber, the foaming devices are introduced to the intermediate vessels with

portions or dough and the dough is foamed simultaneously in all the intermediate vessels by the foaming devices.

Fig. 6 shows a stage of the foaming devices being removed from the intermediate vessels.

Fig. 7 shows a stage of transferring the foamed dough from the intermediate vessels into the baking molds.

Fig. 8 shows stage of controlled decrease of pressure in the foaming chamber, accompanied by the rising of dough in the baking molds and forming of the foam-like structures.

Fig. 9 shows a stage of carriage introduction with intermediate vessels and baking molds with foamed dough from the foaming chamber.

Static

A method for production of bread using foamed dough is implemented by the following devices.

Fig. 1 shows a line for the production of foamed unleavened bread, with dough foaming occurring directly in the baking molds 1, comprised of dough mixing apparatus 2 with mixing device 3, fitted with a dough divider 4, foaming carousel 5, having several positions for foaming dough, each of which is supplied with a foaming device 6, a device 7 for supplying and regulating pressure, a sealing cover 8, and lift table 9. The line contains the input and output star wheels 10, 11, supply and output transporters 12, 13, and baking oven 14. The rotation speed of the foaming carousel and the amount of foaming positions are determined by the capacity of the production line and dough foaming time. Roman numerals I-IV indicate the stages of the process.

Fig. 2 shows the six stages of the foaming process on the foaming carousel 5, equipped with additional mechanisms 15 for lifting and lowering the foaming device 6. Roman numerals I-IV indicate the stage of the process.

Fig. 3 shows the foamed unleavened dough production line, where the dough is foamed in intermediate vessels 16, consisting of the dough mixing apparatus 2 with mixing device 3, equipped with a dough divider 4, foaming carousel 5, having several positions for foaming dough, each of which includes the intermediate glass 16, with hermetically sealed bottom 17 and sealing cover 8, lifting and lowering mechanism 18 for

sealing cover, with foaming device 6 and device 7 for supplying and regulating pressure drop installed on it. The line also contains the supply transporter 12, feeding empty baking molds 1 to the position where foamed dough from the intermediate vessels 16 is transferred onto them, the supply star wheel 10, which synchronizes the baking mold 1 and intermediate glass positions in the foamed dough transfer zone. Roman numerals I-V indicate the stage in the process.

Fig. 4-9 show the installation for foamed unleavened bread production, comprising a dough mixing apparatus 2 with mixing device 3, equipped with a dough divider 4, foaming chamber 19 with periodic operation, equipped with device 7 for supply and adjustable decrease of pressure, having several positions for foaming dough, each of which is fitted with additional mechanisms 15 for lifting and lowering the foaming device 6. The installation also includes carriage 20 fitted with intermediate vessels 16, and nests 21 for placing and affixing baking molds 1 under the intermediate vessels 16. The quantity and position of the intermediate vessels on the carriage 20 correspond to the quantity and position of the foaming devices 6 and foaming chamber 19.

Method illustrated by the following examples:

Example 1 (Fig. 1).

The previously prepared components of the dough recipe are mixed for 5-15 minutes in the dough mixing apparatus 2 under atmospheric pressure by the mixing device 3 at a rotation of 15 c^{-1} . The mixed dough is divided by the dough divider 4 into portions of specified weight, which are placed in the baking molds 1, that are constantly supplied to the dough divider zone by the transporter 12. The dough division process can be performed either by using the dough divider 4, mounted directly on the dough mixing apparatus 2, or using a commercial dough divider, which transfer the mixed dough from the dough mixing apparatus 2 after completion of the mixing process. Baking molds 1 are loaded with dough portions of specified weight and supplied by the same transporter 12 to the constantly rotating (at a set speed) foaming carousel 5, and using the input star wheel 10 are placed in foaming position, where the baking molds 1 are fixed to a lift table 9 (stage I). Each foaming position is equipped with a foaming device 6, device 7 to supply and regulate decreases in pressure, and a seal cover 8. The quantity of foaming positions and rotation speed of the foaming carousel 5 are determined by the production

line and dough foaming time. In the process of foaming carousel 5 rotation, each baking mold 1 loaded with a portion of dough is lifted by the lifting table 9 and sealed to the seal cover 8. Inside the baking mold, device 7 creates the specified pressure, for example 0.4 MPa and the portion of dough is foamed by the foaming device 6 (stage II) at a rotation speed of 16 c^{-1} for a duration of 40-60 seconds, resulting in dough saturated with air via mechanical distribution throughout the dough mass, also due to the additional dissolved air in the soluble components of the dough, a result of foaming under increased pressure. The dough mixing and foaming processes are performed using different devices, preferably suited to performing mixing and foaming processes, respectively, since the mixing and foaming processes have different objectives – the mixing process combines dry ingredients with liquid ones, resulting in a homogenous mass of dough, and the foaming process saturates the homogenous mass with air. Therefore, in order to mix the basic ingredients use a dough mixer apparatus 2 with strong rigid mixing elements 3 designed for heavy loads, having minimal surface contact with the dough, and for the foaming process use foaming devices 6 similar to the “beater”, having a large amount of relatively thin, elastic wire-knives, which are designed to create in the homogenous dough mass upon rotation as many cuts as possible, so air can pass into them and be evenly distributed inside the dough. This increases the effectiveness of performing each of the aforementioned processes, lowers their power consumption and increases productivity of the processes, as well as increases the quality of the foamed dough produced. After completing the dough foaming process, a device 7 reduces the pressure inside the mold to atmospheric, with the pressure decrease performed at a controlled rate, between 0.02-0.2 MPa/s, ensuring minimal foam destruction and maximum dough rise. Then the lift table 9 is lowered, the foaming device 6 is removed from the dough and molds 1 with foamed dough portions are constantly moved away by the outgoing star wheel 11 from the foaming carousel to the outgoing transporter 13 and directed to the bread-baking oven 14, where the foamed dough is baked under the corresponding baking settings. In experiments conducted at those same dough foaming parameters as the prototype, the total operating power of the foaming devices at that same production level decreased more than 2 times for each individual mass of processed dough.

Accuracy of volume-based division of mixed dough into portions of a specified weight, at a portion weight of 0.25-0.5kg, was within 2-3%, while the prototype used volume-based foam division and the weight of a portion of specified volume depended on the content of the ingredient, foaming modes, dough moisture, amount of foamed dough left in the dough mixing apparatus and so forth. Foaming time in the experiments was 40-60 seconds, while the prototype was between 6-12 minutes, so it was decreased by at least 6 times. The dough, prepared in accordance with this proposed method, is lighter, with a more stable foam, and the bread made from this foamed dough bakes more thoroughly and has more porous crumbs.

Example 2 (Fig. 2).

After mixing and dividing the dough the baking molds 1, loaded with dough portions of specified weight, are installed in the foaming position, where they are fixed to lift tables 9 (stage I). During the process of rotating the foaming carousel 5 every baking mold 1 loaded with dough portions is lifted by the lift table 9 and sealed with the seal cover 8, forming a hermetically sealed chamber, within which a device 7 creates the specified pressure increase, for example 0.3 MPa (stage II). The foaming device 6 is inserted and performs the dough foaming at a rotation speed of 12c^{-1} for a duration of 50-70 seconds (stage III). After completing the foaming process, the foaming device 6 is removed from the dough (stage IV), then inside the sealed chamber the device 7 lowers pressure to atmospheric (stage V), with the pressure decrease performed at a controlled rate between 0.02-0.2 MPa/s. Next the lift tables 9 are lowered (stage VI), and the baking molds 1 with foamed dough are constantly removed from the foaming carousel 5 and directed to the baking oven, where bread is baked from foamed dough at the corresponding baking settings. The given example, in contrast to example No 1, the foaming device is removed from the dough (stage IV) before starting to decrease the pressure in the foaming zone (stage V), i.e. before the start of the expansion process of the foamed dough mass and formation of a foam-like structure in the baking mold. The resulting foamed dough is of a higher quality due to eliminating foam destruction caused by the foaming device, but construction of the installation for foaming dough in this example's embodiment of the method is somewhat more complicated.

Example 3 (Fig. 3)

The previously prepared components of the dough recipe are mixed thoroughly in the dough mixing apparatus 2 at atmospheric pressure by the mixing device 3. The mixed dough is divided by the dough divider 4 into portions of a specified weight, which are moved to the intermediate vessels 16 with hermetically sealed bottom 17, installed on the foaming carousel 5. During rotation of the foaming carousel 5 each intermediate glass 16 is placed under a sealing cover 8, equipped with foaming device 6 and a device 7 for supplying and adjusting the pressure drop (stage I). Then the intermediate glass 16 is hermetically sealed by the seal cover 8 using the mechanism 18 for raising and lowering the cover 8, the interior of the intermediate glass 16 reaches the specified increased pressure, for example 0.5 MPa and performs the process of foaming dough portions using foaming device 6 at a rotation speed of 13.5c^{-1} for a duration of 40 seconds (stage II). After completing the foaming process, the pressure inside the intermediate glass 16 is dropped to atmospheric by the device 7 (stage III). At the point of transfer the bottoms 17 are shifted and the foamed dough from the intermediate vessels 16 is loaded in the baking mold 1 (stage IV), constantly fed to the loading zone by the supply transporter 12. The positions of baking molds 1 and intermediate vessels 16 in the foamed dough loading zone are synchronized using a star sprocket 10. Further, baking molds 1 with foamed dough are directed by the same transporter 12 to the baking oven, where foamed dough baking is performed under the corresponding baking settings. In the given example, in contrast with examples 1 and 2, the dough foaming process is performed not in the baking molds 1, but rather in the intermediate vessels 16. Foaming of dough in the baking molds imposes some limitations on implementing the baking mold. Firstly, all baking molds must have a non-stick coating prior to foaming, since coating a mold before performing the foaming process leads to mixing of the lubricant with dough during its foaming process in the baking mold, which is unacceptable. Secondly, foaming in molds always necessitates using molds of a certain configuration, to which all the foaming devices must be compatible, limiting the range of producible baked goods. It is simpler and cheaper to produce a small amount of intermediate vessels with frictionless coating than hundreds of baking molds with non-stick coatings, which lowers the cost of bread production on the installation, implemented

as in example 3 compared to examples 1 and 2. The given embodiment of the proposed method is more technically difficult, but is also more universal and can be implemented on any bread factory.

Example 4 (Fig. 4-9).

The previously prepared components of the dough recipe are thoroughly mixed in the dough mixing apparatus 2 under atmospheric pressure by the mixing device 3 (Fig. 4). The mixed dough is divided by the dough divider 4 into portions of a specified weight, which are placed in intermediate vessels 16, mounted on a carriage 20, on which under intermediate glass 16 an empty baking mold 1 is attached in nests 21 for fixation. After filling all of the intermediate vessels with dough portions of a specified weight, the carriage 20 is placed in a hermetically sealed foaming chamber 19 with periodic operation. The foaming chamber 19 is equipped with a device 7 to supply and regulate pressure decreases, and has several dough foaming positions, each of which is fitted with foaming devices 6. The quantity of foaming devices 6 and their placement in the foaming chamber 19 correspond to the amount of intermediate vessels 16 and their placement on the carriage 20. Inside the foaming chamber 19, a device 7 creates the specified increase in pressure, for example 0.6 MPa, after which the dough foaming process is performed by the foaming device 6 simultaneously in all of the intermediate vessels 16 (Fig. 5). After completing the foaming process, the foaming device is removed from the dough (Fig. 6) and the foamed dough is loaded into intermediate vessels 16 and baking molds 1, positioned under the vessels on the carriage 20 (Fig. 7). After this, the pressure in the foaming chamber 19 is decreased to atmospheric by the device 7, while the dough rises in the baking molds 1 and forms the foam-like structures of the foamed dough (Fig. 8). The time it takes to lower pressure from 0.6 MPa to atmospheric, depending on the type of dough and the size of the dough pieces, takes between 20-60 seconds. After lowering the pressure in the foaming chamber 19 to atmospheric, the carriage 20 is withdrawn from the foaming chamber 19 (Fig. 9). Intermediate vessels 16 are once again filled with lines of dough portion, and the baking molds 1 with foamed dough are removed from the carriage 20 and directed to the bread baking oven, where the bread baking is performed using foamed dough at the corresponding baking settings. In this example, in contrast to example 3, the loading of the dough from the intermediate

vessels happens in the baking molds under the same increased pressure as the intermediate vessels during the foaming process, with the pressure decreased back to atmospheric after completing loading of the foamed dough, that is why expansion of the foamed mass of foamed dough and formation of the foam-like structure happens directly in the baking mold, increasing the quality of the foamed dough. This embodiment of the method is like productive and technically more complex, than the variant in example 3, but it allows you to produce a higher quality bread.

Technical and economic indicators.

Simplification and increased precision of the process of dividing dough into portions of a specific weight are due to performing the dough division process prior to the foaming, i.e. before formation of the foamed foam-like dough structure. Accuracy of volume-based division of mixed dough into portions of a specified weight, and at a portion weight of 0.25-0.5kg, was within 2-3%, while the prototype used volume-based foam division and the weight of a portion of specified volume depended on the content of the ingredient, foaming modes, dough moisture, amount of foamed dough left in the dough mixing apparatus and so forth. Dividing the mixed dough with a homogenous structure permits using the process on a high-performance commercial dough divider, having increased precision when dividing dough into specified weights.

Improved foamed dough quality is achieved by eliminating partial foam destruction, occurring during the process of dividing the foamed masses of dough, and replacing sharp pressure drops in the expansion zone of the foamed dough with decreases in pressure after foaming at controlled rates between 0.02-0.2 MPa/s, producing minimal destruction of the resulting foam-like structure and maximum rise in the dough before baking. Improved quality is also achieved because the dough mixing and foaming processes are performed using different devices, preferably suited to performing mixing and foaming processes, respectively. The resulting dough, prepared in accordance with the proposed method, is lighter, with a more stable foam, and the bread made from this foamed dough bakes more thoroughly and has more porous crumbs.

Increases in energy efficiency are achieved as a result of using equipment designed specifically for mixing and foaming in the mixing and foaming processes. Therefore when using foaming devices similar to a "beater" during the foaming process

the total operating power of the foaming devices at that same production level decreased more than 2 times for each individual mass of processed dough.

Increases in productivity of production of more than 3 times are due to performing the dough division process on a high-performance commercial dough divider and performing the mixing and foaming processes with devices that are designed especially for performing mixing and foaming processes, respectively.

CLAIMS:

1. A method for producing a bread using a foamed dough, comprising: mixing a dough, dividing the dough into portions of specified weight, foaming each portion of the dough separately and baking of the bread, wherein the division step is performed after completion of the mixing step, before the foaming step, after which the foamed dough is baked into the bread;
 - wherein the foaming is performed by a plurality of mechanical devices;
 - wherein each of the portions of the dough is foamed by one of the plurality of mechanical devices;
 - wherein each mechanical device comprises a plurality of elastic wire-knives,
 - wherein the foaming step is carried out under a pressure greater than atmospheric pressure;
 - wherein the pressure is decreased to atmospheric either before or after removal of said elastic wire knives;
 - wherein decreasing the pressure to atmospheric is performed at a controlled rate.
2. The method according to claim 1, wherein conducting the mixing and foaming of the dough is performed by the plurality of mechanical devices each of which is designed specifically for mixing and foaming steps, respectively.
3. The method according to claim 1, wherein performing said foaming step is carried out under a pressure of no less than 0.3 MPa followed by decreasing pressure to atmospheric.
4. The method according to claim 3, wherein decreasing pressure to atmospheric is performed at a controlled rate, between 0.02-0.2 MPa/s.
5. The method according to claim 3, wherein decreasing pressure to atmospheric is performed prior to the removal of the foaming device from the dough.
6. The method according to claim 3, wherein decreasing pressure to atmospheric is performed after the removal of the foaming device from the dough.

7. The method according to claim 1, wherein the foaming step is performed in intermediate vessels inside of which the dough is temporarily transferred for foaming with a subsequent loading of the dough in baking molds.

8. The method according to claim 7, wherein the loading of said foamed dough from the intermediate vessels into the baking molds is performed under atmospheric pressure and the loading is performed after decreasing the pressure in the intermediate vessels to atmospheric.

9. The method according to claim 7, wherein the loading of the foamed dough from the intermediate vessels into the baking molds is performed at the same increased pressure that the intermediate vessels are under during the foaming step, and decreasing of the pressure to atmospheric occurs after loading the dough into the baking molds.

10. The method according to claim 1, wherein the foaming step as well as plurality of the steps comprising claim 1 are performed in the same baking molds;

wherein the baking molds are capable of withstanding the foaming pressure and shaped to fit the elastic wire knives.

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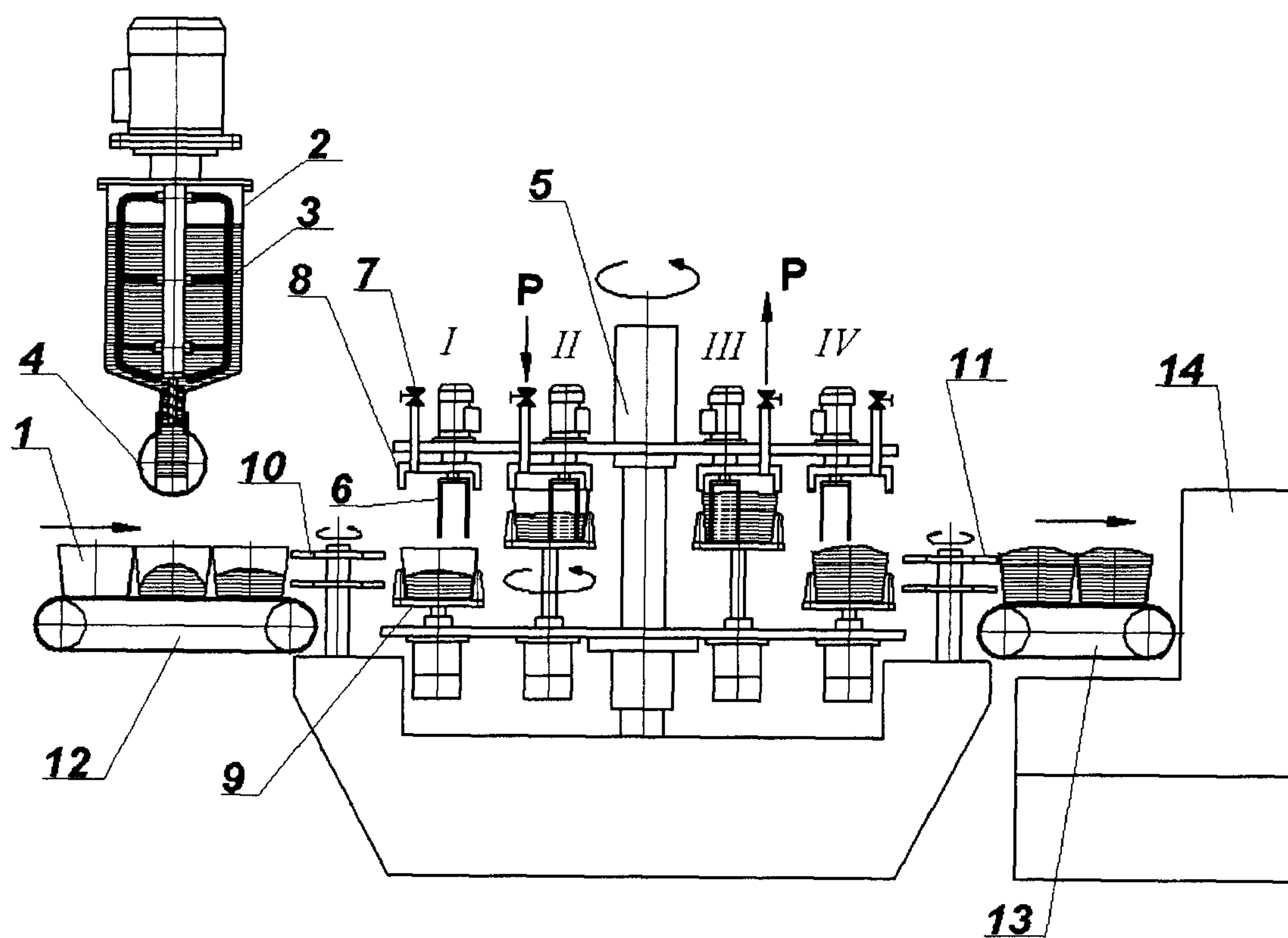


Fig. 1

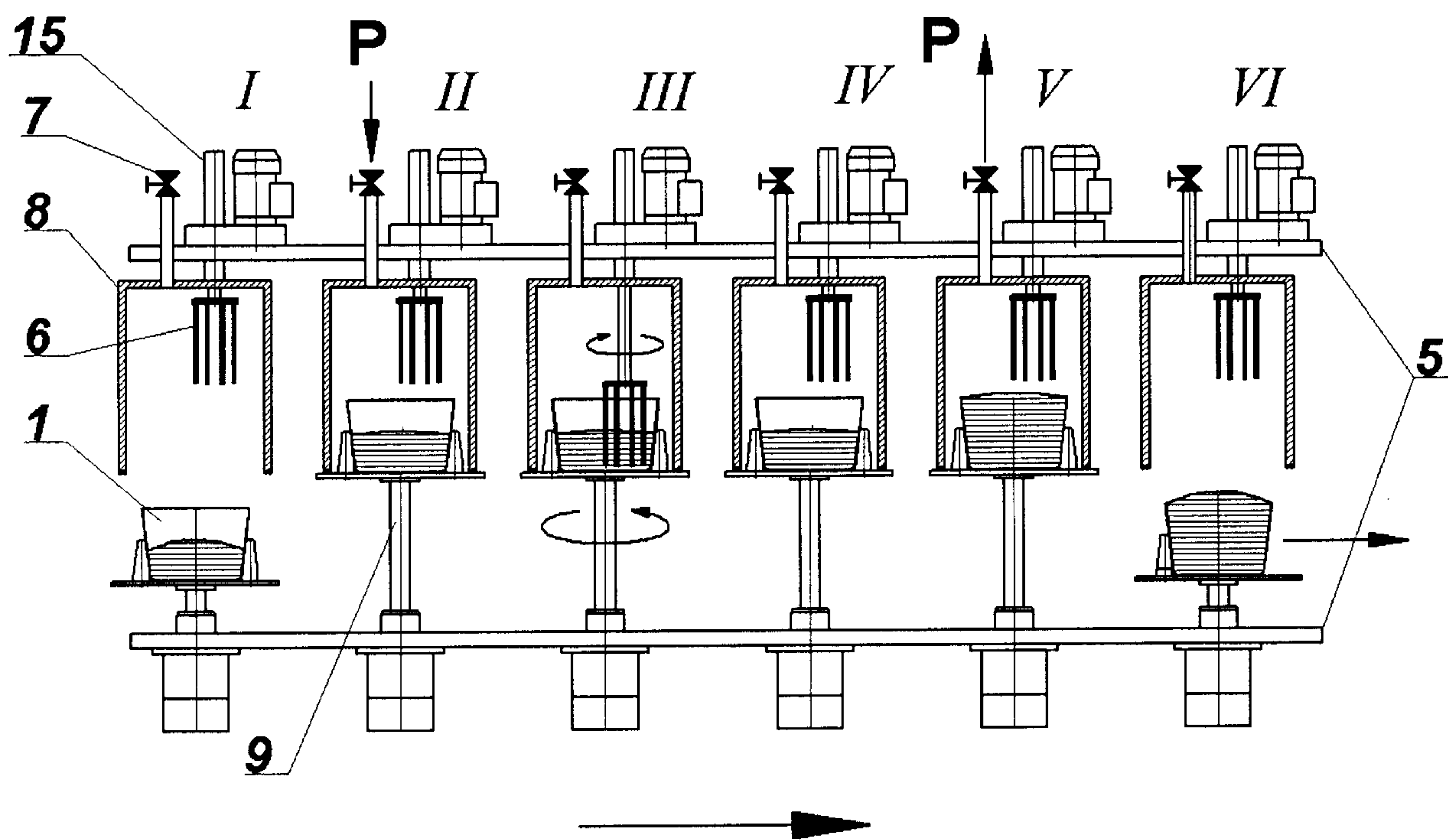


Fig. 2

3/6

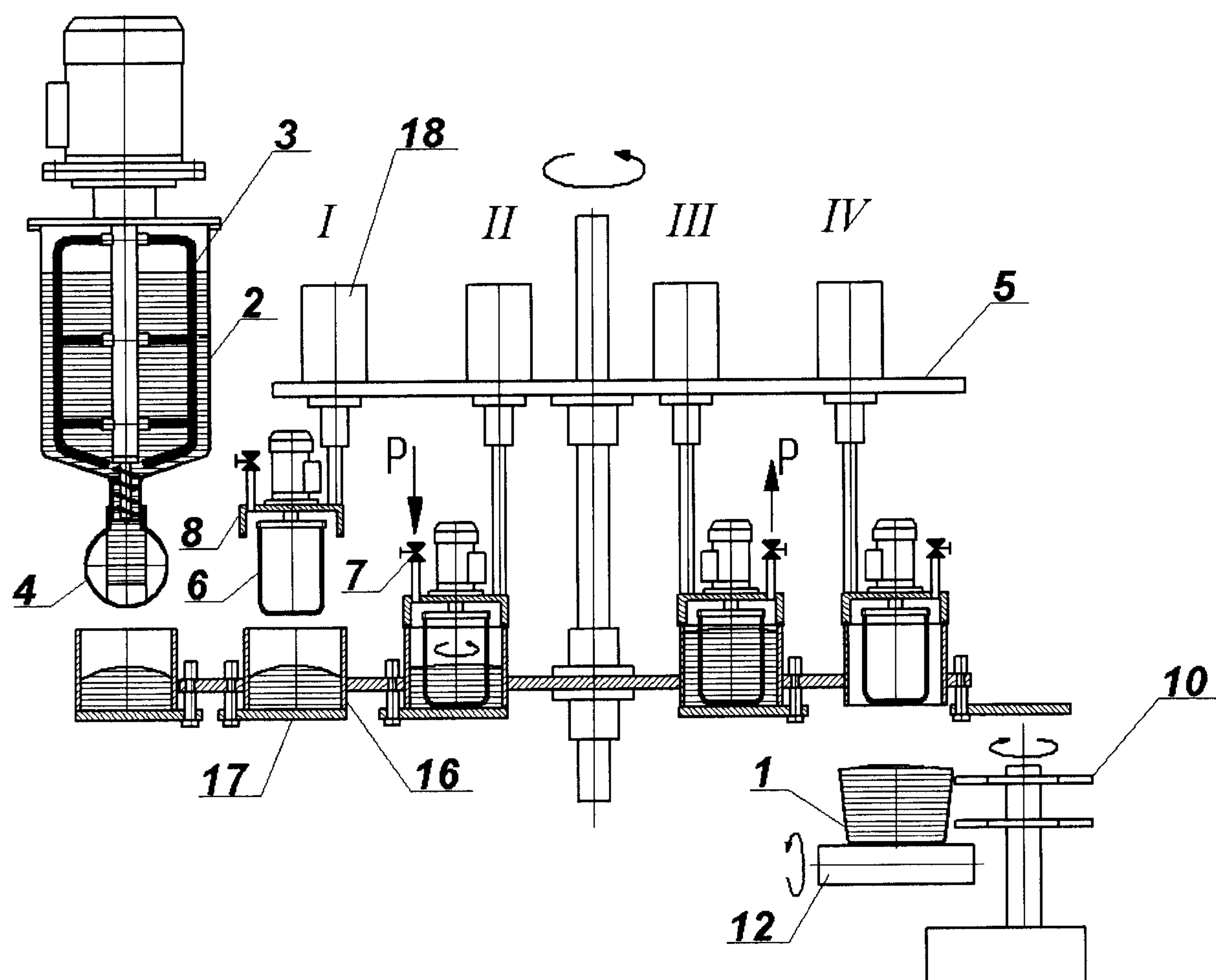


Fig. 3

4/6

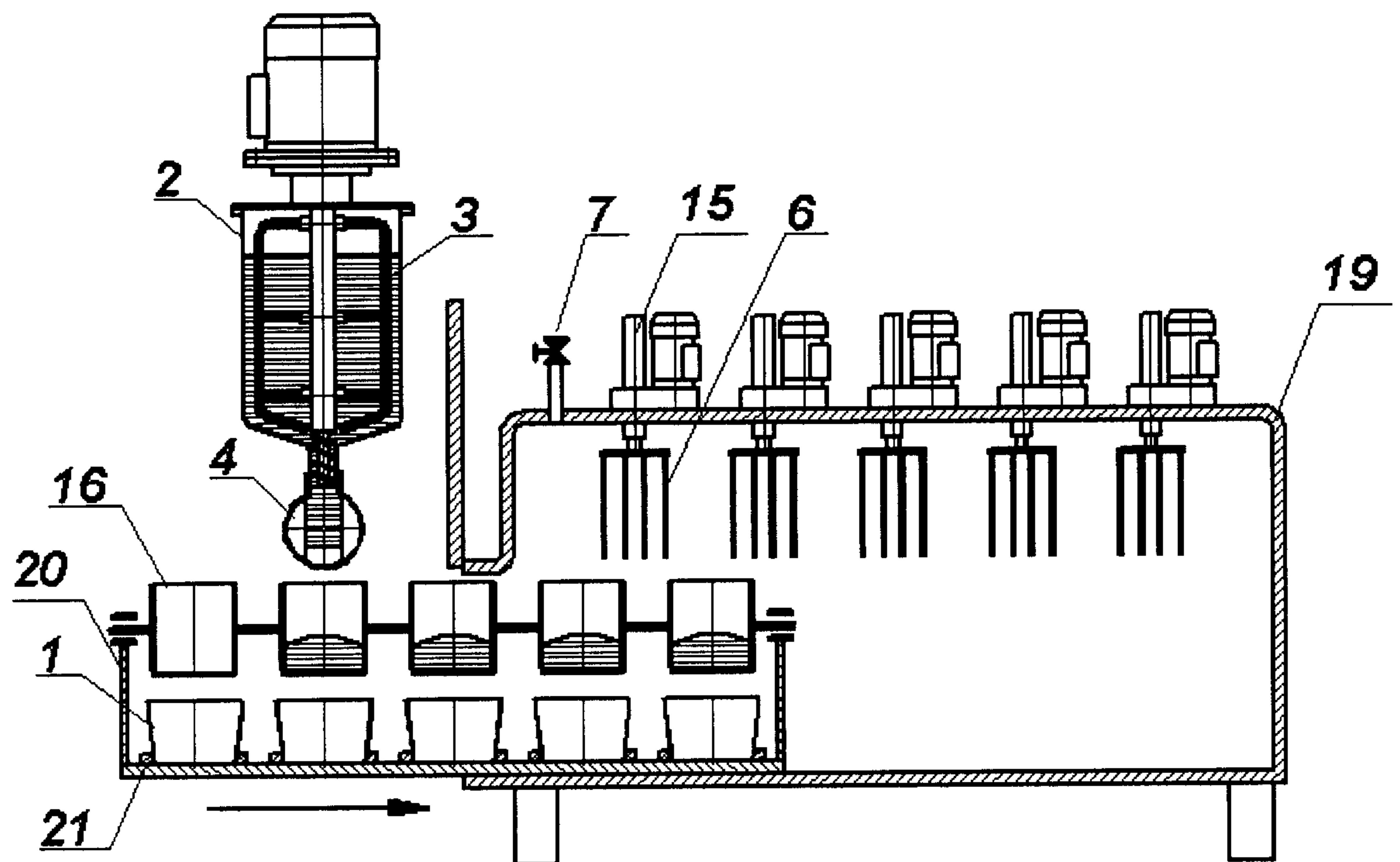


Fig. 4

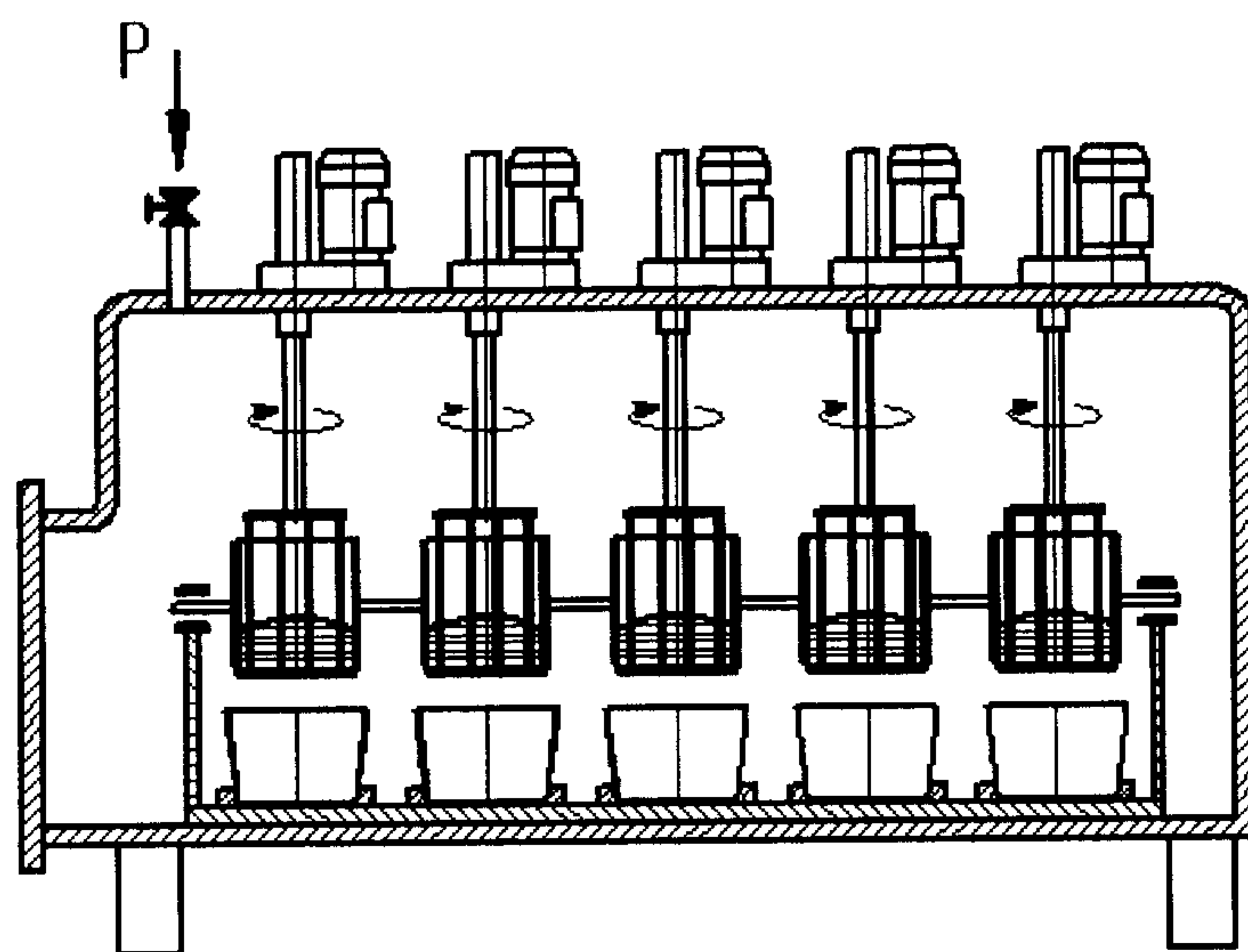


Fig. 5

5/6

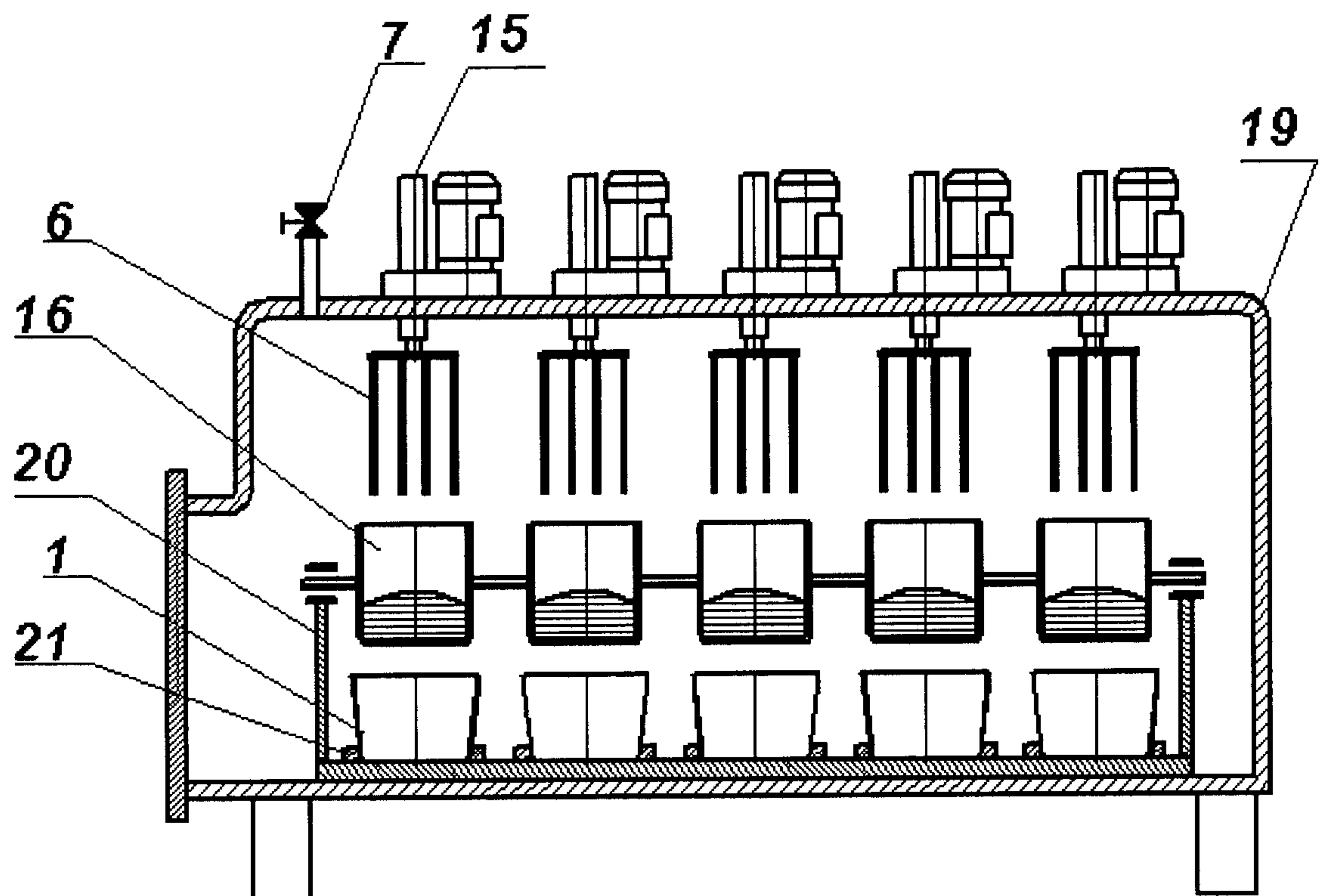


Fig. 6

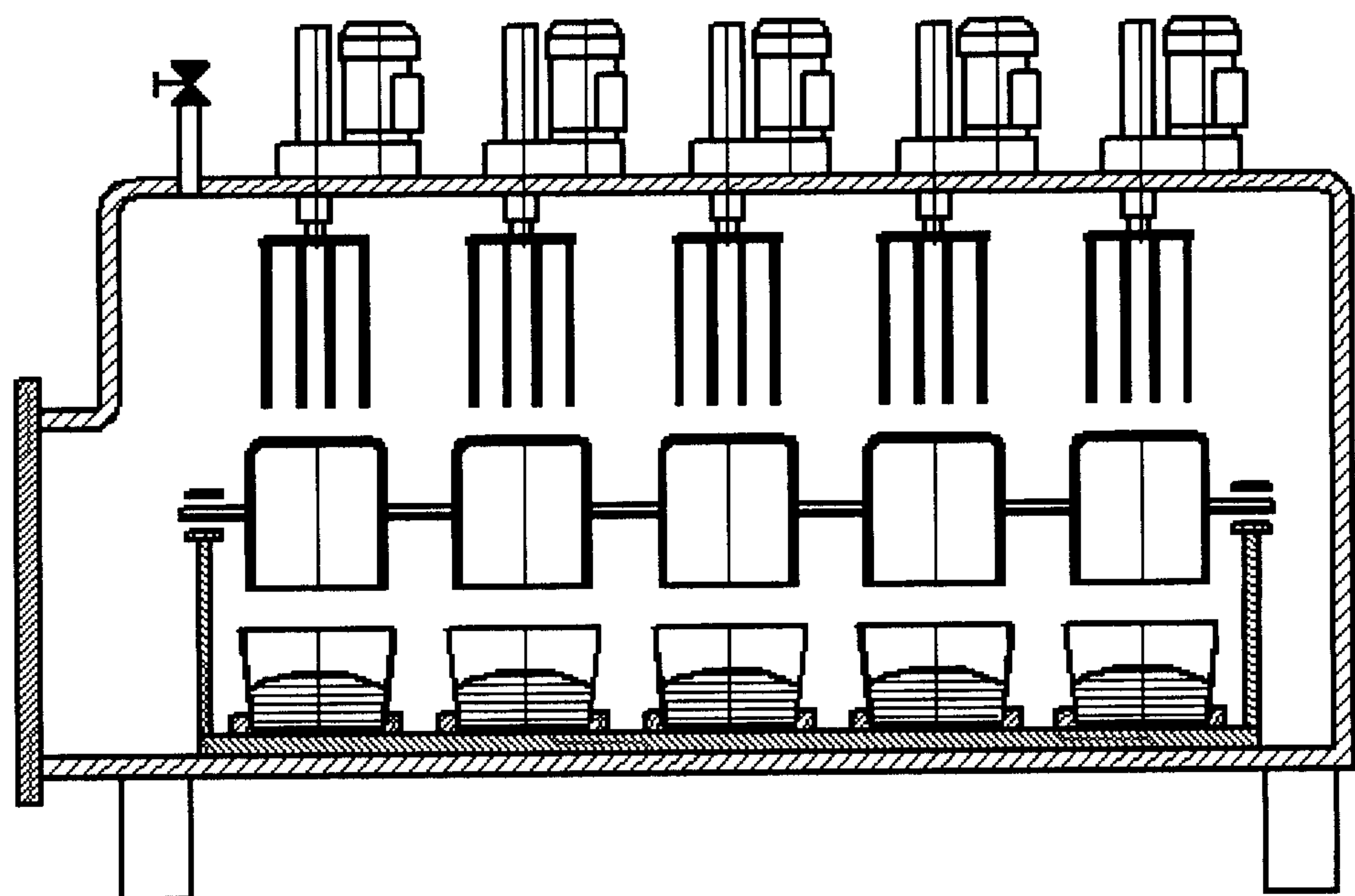


Fig. 7

6/6

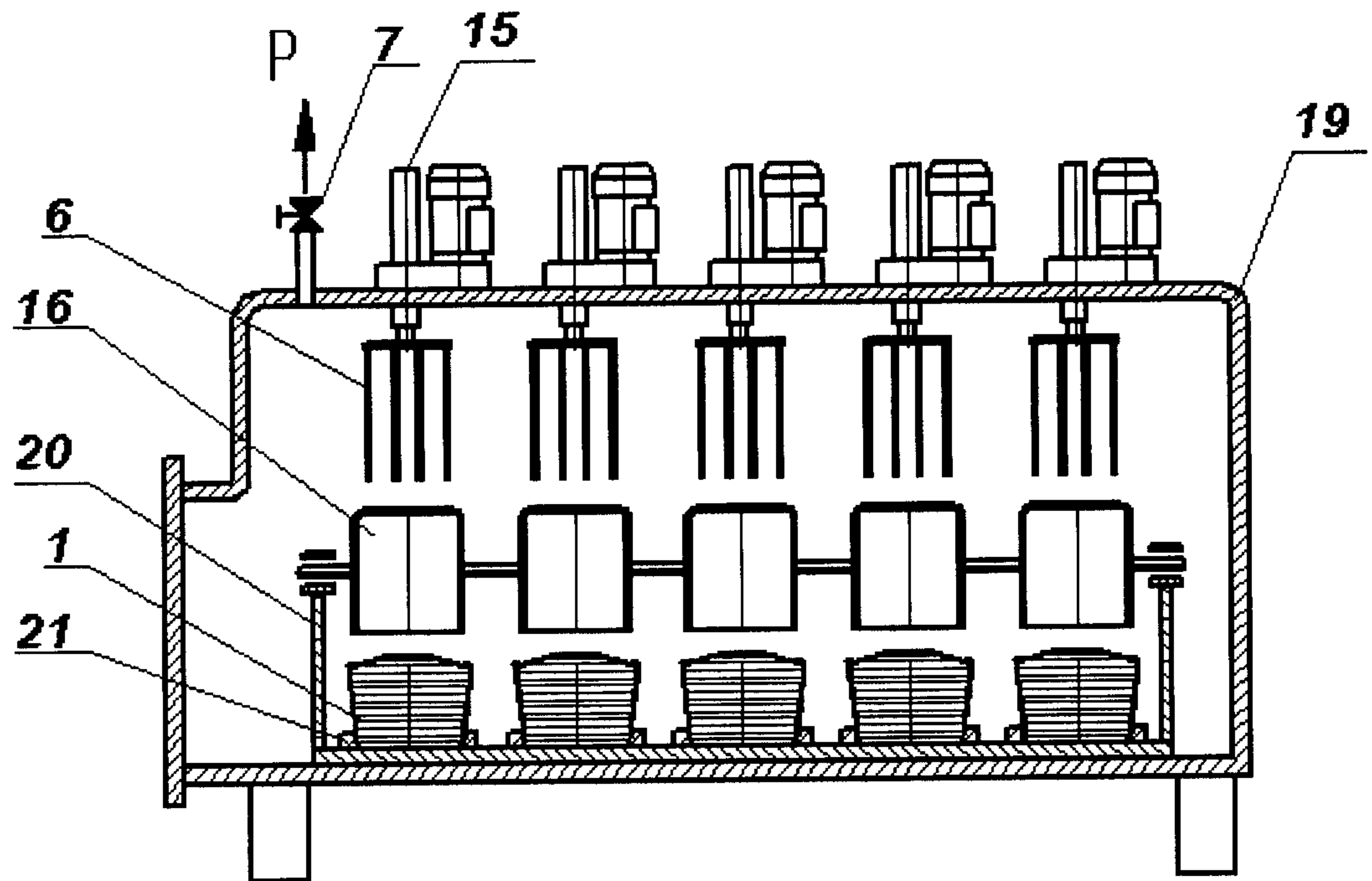


Fig. 8

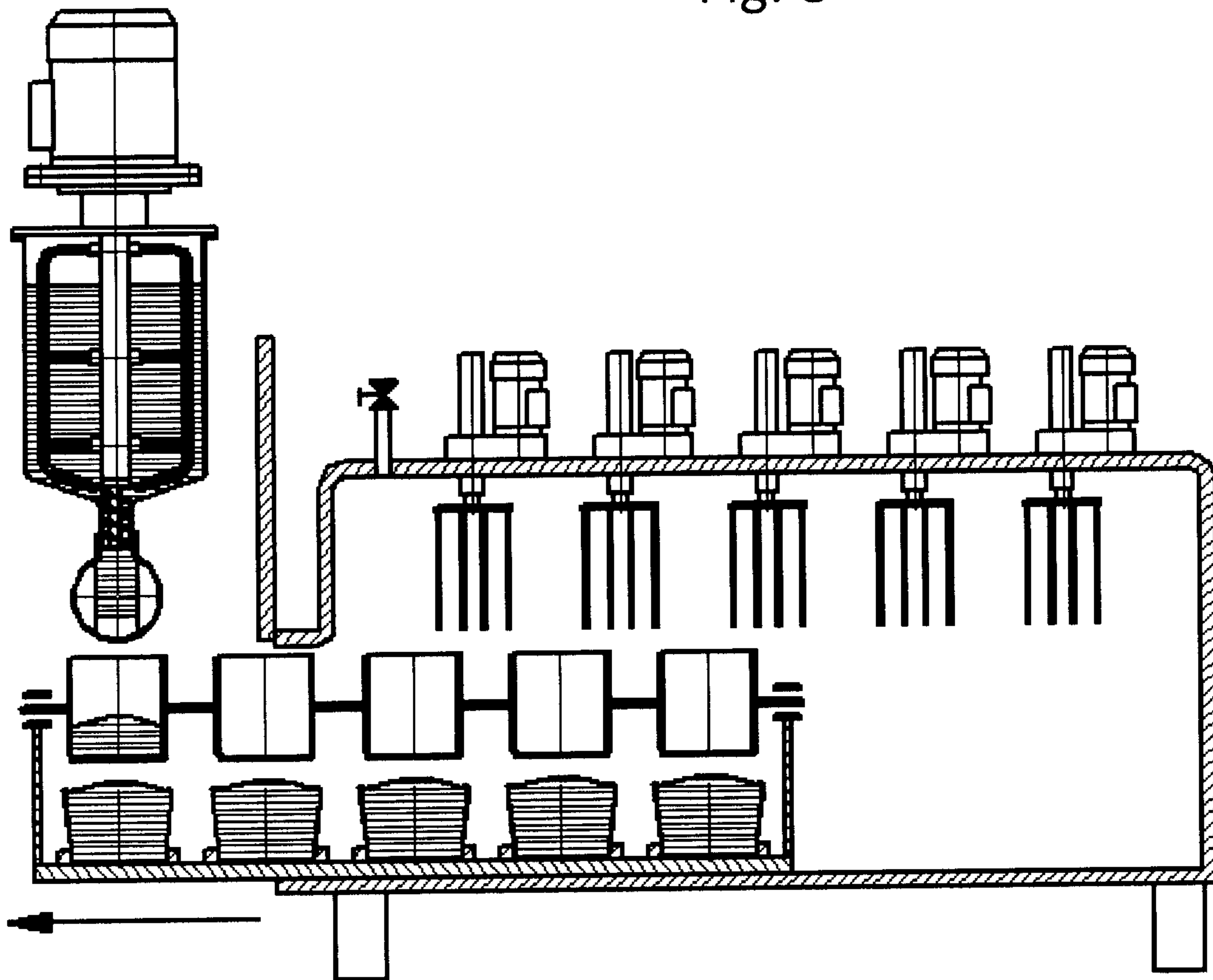


Fig. 9

