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(54) **Press for processing agricultural products, particularly grapes and fruits in general**

(57) A press for pressing agricultural products, particularly grapes and fruits in general, comprises a cylindrical rotating tank (2) having a substantially horizontal axis, which is constituted by a perforated metal plate and by partitions that form at least one annular pressing chamber that is comprised between a tubular membrane (10), arranged coaxially to the tank (2), the walls and the inner surface of the tank, the press including members for supporting the membrane, which are arranged coaxially inside the membrane, which is elastic. The press can be constituted by modular components, which form a plurality of pressing chambers separated by movable partitions.

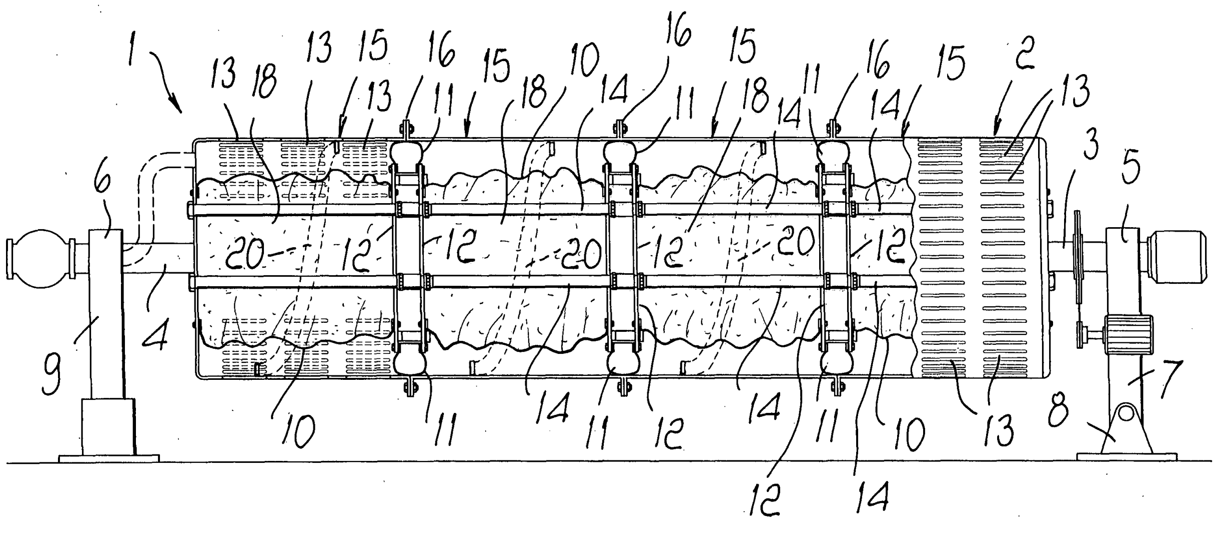

Fig. 1

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Description

[0001] The present invention relates to a press for pressing agricultural products, particularly grapes and fruits in general.

[0002] So-called tank presses, for example of the pneumatic or water type, are known for pressing grapes.

[0003] In particular, a cylindrical press is known which has a horizontal axis and a tubular membrane and in which, after loading the container, the tubular membrane is pressurized without turning the container, because the rotation would damage the loose membrane.

[0004] This means that the material to be pressed settles by gravity on the bottom of the tank and therefore the product is not distributed uniformly over the entire surface of the tank, compromising the outflow of the juice.

[0005] Another drawback of this type of press is that it is not possible to perform rotations while the membrane is loose, i.e., unpressurized, in order to drain the juice of the product without damaging the membrane.

[0006] Last but not least, during the breakup of the product the loose membrane is damaged by being entrained by the product during the rotation of the tank.

[0007] Those drawbacks have been contained by limiting the volume of the container, and therefore the production of those type of press has been limited to models having a small capacity and a limited length. This is why the concept of the press with elastic tubular membrane has been abandoned in favor of the use of non-elastic flat membranes that are fixed on a diametrical plane of the tank; however, those presses have the drawback that the juice is drained through only half of the tank, while the other half is used as a support for the membrane during retraction and acts as a chamber for pressurizing the membrane. There is also the drawback that the product, during breakup, settles by gravity in the lower part of the container, in a draining region that is reduced further with respect to the half-circumference of the container, and the pressure is applied to the stacked product instead of on a material that is distributed uniformly on the entire circumference, so that pressing occurs over long periods and by using high pressures.

[0008] In any case, pressing large quantities of product with tanks that have a non-elastic diametrical membrane in a discontinuous manner requires large tanks having a large diameter, which are expensive and bulky and most of all have a low draining yield and accordingly have long pressing times and consequent unavoidable leaching and oxygenation phenomena that reduce the quality of the product.

[0009] The product to be pressed in fact has a considerable and uneven thickness, and therefore the times for draining and discharging the liquid are long and uneven.

[0010] An aim of this invention is to provide a press that is capable of eliminating the drawbacks of the cited known art.

[0011] An object of this invention is to provide a press that is capable of eliminating the drawbacks due to damage of the tubular membrane and of allowing its use also on tanks that have a large diameter and a considerable length, allowing rotation in all steps: loading, draining without pressure, actual pressing, breakup and discharge of the used product.

[0012] Another object of the invention is to provide a press that is capable of pressing both discontinuously and in a semicontinuous-intermittent manner.

[0013] This aim and these and other objects that will become better apparent hereinafter are achieved by a press for pressing agricultural products, particularly grapes and fruits in general, as claimed in the appended claims.

[0014] Further characteristics and advantages will become better apparent from the description of preferred but not exclusive embodiments of the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a longitudinally sectional side elevation view of a press according to the invention;
Figure 2 is a schematic cutout perspective view of the press of Figure 1;
Figure 3 is a partial enlarged-scale cutout perspective view of the press of the preceding figures;
Figure 4 is a schematic exploded perspective view of the system for connection between the disks and the tension members;
Figure 5 is a sectional side elevation view, illustrating an enlarged-scale detail of the diaphragm in the extended position;
Figure 6 is a view, similar to Figure 5, of the diaphragm in the retracted position;
Figure 7 is a longitudinally sectional side elevation view of a press according to another aspect of the invention, with a single chamber;
Figure 8 is a transverse sectional view of the tank during loading, with the membrane in vacuum;
Figure 9 is a view that is similar to Figure 8 but illustrates a pressing step;
Figure 10 is a view that is similar to Figure 9 but illustrates a discharge step;
Figure 11 is a sectional side elevation view, which illustrates schematically and partially the support of the membrane;
Figure 12 is a transversely sectional front view of the support of Figure 11;
Figure 13 is a schematic and partial sectional side elevation view of the support of the membrane, according to another embodiment, which has a monolithic structure;
Figure 14 is a transversely sectional front view of the support of Figure 13.

[0015] With reference to the cited figures, the press, generally designated by the reference numeral 1, comprises a cylindrical tank 2 made of perforated sheet metal, with a substantially horizontal axis, which is supported so that it can rotate at its ends by hubs 3 and 4, which are in turn supported by opposite supports 5 and 6.

[0016] The support 5 is anchored to a fixed supporting frame 7, which is pivoted to a base 8, while the support 6 is anchored to a jack 9, which is suitable to lift the end of the tank in order to tilt it so as to facilitate the transfer of the pressed material from the inlet chamber toward the subsequent chambers, as described in greater detail hereinafter.

[0017] The tank 2 has, in a per se known manner, at least one door for unloading the pressed material.

[0018] The outflow (draining) of the pressed juice occurs through slotted holes 13 of the tank, and the juice collects in underlying trays, not shown in the figures.

[0019] At the end of the hub 3, a coupling, that can rotate in a per se known manner and is not shown in the drawings, feeds the pressing fluid at low and high pressure for inflating and respectively deflating a membrane 10 and diaphragms 11 made of fabric-reinforced rubber, each of which is associated with a pair of disks 12, which are arranged at right angles to the longitudinal axis of the tank 2 and are supported by tension members 14.

[0020] The tank 2 is actually constituted by a series of modules, designated by the reference numeral 15, which are constituted by an outer side wall that is provided with slotted holes 13 and with end flanges 16 for fixing to the adjacent modules.

[0021] The circular disks 12 are comprised within the side wall, and the elastic membranes 11 are coupled by means of a flange to the sides of the disks, thus forming a plurality of chambers 18.

[0022] The diameter of the disks 12 is smaller than the inside diameter of the tank, in order to allow the transfer of the product from one chamber to the other.

[0023] At the circular disks 12 there are diaphragms 11 which, when retracted (in vacuum), allow the transfer of the product from one chamber to another and when pressurized instead seal the pressing chambers, which can accordingly be pressurized.

[0024] The diaphragms 11 are preferably made of fabric-reinforced rubber and, when pressurized by a fluid, close the annular passage between the circular disks 12 and the side wall of the tank.

[0025] These components can be all pressurized simultaneously or separately, forming separate and independent pressing chambers, in which pressing can be performed individually or simultaneously at different pressures in each chamber. If the diaphragms 11 remain open, pressing can be performed in all the chambers with a pressing program as if it were a single-chamber tank with discontinuous operation.

[0026] The diaphragms 11 preferably have an internal pressure that is several times higher (5-6 bar) than the pressure of the membrane (1.6 bar), because the diaphragms 11, in addition to having the function of separating and closing the chambers, are also adapted to contain the lateral thrusts caused by the difference in pressure between the membranes of one chamber and the other.

[0027] The pressure fluid is conveyed through a rotary coupling to the various membranes 10 through holes 20 formed in the tension members 14, which for this purpose are hollow, as shown in Figure 4.

[0028] The high-pressure fluid is conveyed by a rotary coupling and pipes, not shown in the figures, which are connected to a hole 21 that is provided in the disk 12 in order to feed each diaphragm 11.

[0029] The diaphragms 11 can also be associated with the outer side wall, in annular chambers, and in this case the pressure fluid would be supplied by a pipe located outside the tank.

[0030] The circular disks 12, which constitute the partitions that delimit two adjacent pressing chambers 18, have outer sides to which the membranes 10 are fixed by means of flanges 19.

[0031] The diaphragms 11, in the vacuum condition, are retracted, as shown in Figure 6, in order to allow to convey the product from one chamber to another, while in the pressing step they are pressurized, as shown more clearly in Figure 5, sealing the chamber and making it capable of performing pressing, and containing, in cooperation with the disks 12, the lateral thrusts applied by the pressing pressure.

[0032] As mentioned, the diaphragms can be retracted, in the vacuum step, also into a receptacle that is external to the tank and can act, during the pressure step, by inflating hermetically at and against the peripheral wall of two circular disks. As mentioned, in this case, the fluid would be fed by means of a pipe arranged externally to the tank.

[0033] The figures illustrate the embodiment of the diaphragms that is deemed most advantageous, in which each diaphragm 11, retracted in vacuum, is accommodated inside the two disks 12, expanding toward the outside of the tank, i.e., against the inner wall of the side wall, in the active step, thus providing a hermetic seal capable of withstanding the pressing pressures in the chamber involved.

[0034] In this case, air is fed to the diaphragms 11 from the inside of the tank, by feeding the hermetic chamber constituted by the pair of disks 12.

[0035] The pairs of annular disks 12 are assembled hermetically with modular tension members 14 in order to allow to assemble the disks and the membranes 10, one after the other, starting from one end of the tank 2 and advancing so as to lock each one of the modules.

[0036] Finally, the two ends are connected, by means of the tension members, forming a single tank so as to contain all the axial thrusts of the tank.

[0037] Figure 1 schematically illustrates conveyance devices 20, which are preferably glued to the inner surface of the tank 2 and are suitable to convey the marc during the rotation of the tank.

[0038] Figures 7 to 14 illustrate a single-chamber press, generally designated by the reference numeral 101, which includes a cylindrical tank 102 made of perforated sheet metal, with a horizontal axis that is supported so that it can rotate at its ends by the two hubs 103 and 104 by supports 105 and by a supporting frame 107. The tank 102 has, in a per se know manner, at least one door 112 for loading and unloading the material.

[0039] The pressed juice is discharged through the holes of the perforated sheet metal 113 of the cylinder and is collected by an underlying tray, which is not shown in the figures.

[0040] At one end of a hub, in the specific case the hub 104 on the left in Figure 7, the pressing fluid is fed in a per se known manner at low and high pressure in order to inflate and deflate the membrane 110 of the press.

[0041] The fluid is conveyed by a rotary coupling, which is per se known and is not shown in the figure, through the hole of the shaft 104 into the membrane 110, pressurizing it.

[0042] The elastic tubular membrane 110 is fixed, by means of flanges 119, to the ends 120 of the tank.

[0043] Supporting members 114 are provided inside the membrane 110 and coaxially thereto and are adapted to support, during the rotation of the tank, the membrane and the weight of the material.

[0044] The supporting members, constituted by tubes or solid rods 114, can be of the load-bearing type and be monolithic with the hubs 103 and 104 and the flanges 119, as in the example shown in Figures 11 and 12.

[0045] The tubes 114 can be mutually rigidly coupled by welded metal plates, increasing the strength of the supporting frame. However, this entails that the ends and the cylindrical central part of the tank can be disassembled and provided with flanges in order to allow the assembly and disassembly of the membrane. This solution is required for low-capacity tanks, where it is not possible to install the membrane from the inside of the tank.

[0046] In a more preferable embodiment, shown in Figures 13 and 14, the supporting members 114 of the membrane can be constituted by one or more tension members that can be extracted from the outside of the tank, inserted in the membrane 110 and locked with nuts 121 to the outside of the ends 120.

[0047] This is preferable for tanks in which it is possible to install the membrane from the inside: in this case, the tank is welded monolithically and is not bolted together as in the embodiment shown in Figures 11 and 12.

[0048] The operation of the single-chamber press, shown in Figures 7 to 14, is particularly evident from what has been described above: loading occurs through the opening of the door 112 in a vertical position, as shown in Figure 8, or through the hollow shaft 103, in a continuous manner, during the rotation of the tank.

[0049] Draining occurs by gravity through the perforated sheet metal of the container 102. The supporting members 114 allow to rotate the tank in order to facilitate a more thorough static draining without damaging the membrane, which is still loose.

[0050] During the pressing step, the tank is rotated and the combined action of rotation and inflation of the membrane facilitates the distribution of the product in a uniform manner over the entire annular region between the membrane and the perforated draining plate.

[0051] The membrane in the loose state is supported by the supporting tension members 114, and as it pressurizes it acquires a considerable surface rigidity that allows it to make the material flow during rotation.

[0052] During deflation, the membrane is retracted, even in vacuum, adhering perfectly to itself and to the supporting members, thus being able to rotate without being damaged.

[0053] During rotation, the previously pressed product is broken up and is ready for a subsequent pressing action.

[0054] The mixing and pressing cycles are alternated and repeated until the required depletion is achieved.

[0055] If the press has a plurality of chambers, such as the one shown in Figures 1 to 6, the operation in a single chamber is identical to the preceding one for a single-chamber press, with the only difference that in this case there are different possibilities to develop the pressing to its best, by adapting the pressing cycle according to production requirements.

[0056] By way of non-limitative example, the following possibilities of operation are described.

[0057] Discontinuous operation is possible by keeping the diaphragms open as if the various chambers constituted a single tank.

[0058] In this case, the pressing process is discontinuous and occurs while the chambers are open, as in a single-chamber tank.

[0059] This process is advantageous in discontinuous treatments, for example in order to press all of the content of a tank where what matters is the capacity rather than the hourly output of a continuous treatment.

[0060] Semi-continuous operation, with partial pressing cycles in each chamber and in succession in a number "n" of chambers, is also possible.

[0061] Another type of possible operation is semi-continuous operation with cycles of partial pressing in each chamber and simultaneously in n chambers.

[0062] In practice it has been found that the invention achieves the intended aim and objects, a press having been provided in which the elastic tubular membrane allows uniform distribution of the product to be pressed over the entire peripheral surface of the draining tank, reducing the pressing times and the values of the pressures without damaging the pressing membrane in any cycle.

[0063] The press with elastic tubular membrane, in the version with a plurality of modular chambers, in addition to achieving the same aim and objects as the single-chamber press, allows to cover various operating requirements by increasing both the capacity of the tanks, by increasing the number of modules of limited commercial length, and hourly production, by distributing the entire pressing cycle into partial cycles that are performed simultaneously in each chamber.

[0064] Preferably, the membrane can be made to adhere perfectly in vacuum conditions to the supporting frame, rigidly coupling it to the supporting structure. In these conditions, the container of the press can rotate in all of the operating steps, i.e., loading, pressing, discharge, without suffering any damage regardless of the diameter of the membrane and of its length.

[0065] During the inflation step, the membrane acquires, due to internal pressure and to an adequate thickness, a considerable rigidity, which allows the product to move into the empty spaces as the membrane inflates and the container rotates, distributing the product in a practically uniform and annular fashion over the entire cylindrical draining surface of the tank.

[0066] Another advantage of the present invention is that it uses the single-chamber tank with elastic tubular membrane for small capacities and develops the same principle for medium and large capacities, forming a tank that has a reduced diameter and extending the capacity lengthwise by means of independent chambers, which can press both discontinuously, i.e., as a single tank with a complete pressing cycle, and semicontinuously-intermittently, wherein a partial pressing cycle is performed in each chamber simultaneously with other partial cycles in other chambers.

[0067] The process becomes more continuous as the number of chambers increases.

[0068] Hourly production is of course proportional to the number of chambers.

[0069] The press according to the invention is susceptible of numerous modifications and variations, within the scope of the claims. All the details may be replaced with other technically equivalent elements.

[0070] The materials used, as well as the dimensions, may of course be any according to requirements and to the state of the art.

Claims

1. A press for pressing agricultural products, particularly grapes and fruit in general, comprising a substantially cylindrical rotating tank having a substantially horizontal axis, which is constituted by a perforated metal plate and by partitions that form at least one annular pressing chamber that is comprised between a tubular membrane, arranged coaxially to the tank, said walls and the inner surface of said tank, **characterized in that** it comprises members for supporting said membrane, said members being arranged coaxially inside said membrane, said membrane being elastic.

2. The press according to claim 1, **characterized in that** said membrane can rotate and inflate simultaneously, arranging the material so that it is uniformly distributed in the annular region between the membrane and the draining plate of the tank.

3. The press according to claim 1 or 2, **characterized in that** said elastic membrane can be retracted in vacuum, making it adhere to itself and to the supporting members in the steps of the loading cycle, in order to avoid reducing the useful filling volume.

4. The press according to one or more of the preceding claims, **characterized in that** said elastic membrane is supported internally by supporting members along its entire length.

5. The press according to one or more of the preceding claims, **characterized in that** for small-capacity tanks the membrane supporting members are fixed and constitute a single frame, together with the hub and the coupling flanges of the membrane, which supports the entire tank; said membrane being preassembled to the frame by means of complementary flanges and the two ends and the cylindrical perforated plate of the tank being assembled subsequently.

6. The press according to one or more of the preceding claims, **characterized in that** for large-capacity tanks, said membrane is coupled hermetically to the ends from the inside of the tank and then the tension members that support the membrane are either inserted internally and coaxially to the membrane, inserting them from the outside of the tank and locking them with nuts against the outer wall of the ends.

7. The press according to one or more of the preceding claims, **characterized in that** it comprises three supporting members, which are arranged at the vertices of an equilateral triangle, whose center is approximately equal to the inside diameter of the membrane and of the membrane fixing flange: the perimeter of the triangle being smaller than the circumference of the membrane in order to allow to install the tension members inside the membrane.

8. The press according to one or more of the preceding claims, **characterized in that** it comprises a plurality of pressing chambers formed by modular components.

9. The press according to claim 8, **characterized in that** the modular pressing chambers are delimited by pairs of disks, which are coupled and keyed hermetically on said tension members and are suitable to contain the lateral thrusts of the membrane and the inflation pressure of the diaphragms.

10. The press according to claim 8 or 9, **characterized in that** it comprises annular diaphragms, which are arranged between each pair of disks and the side wall of the tank and have at least two positions: a retracted position, in which they allow the passage of the product from one chamber to the other, and an extended or pressurized position, in which they close the annular region formed between said disks and said side wall of the tank in order to constitute separate chamber in which pressing is performed.

11. The press according to one or more of the preceding claims, **characterized in that** the product is transferred by keeping the diaphragms open and adjusting the inclination of the tank toward the outlet of the product and under the thrust of conveyance members during rotation.

12. The press according to one or more of the preceding claims, **characterized in that** it is possible to work in independent modular chambers with partial pressing cycles on one or more chambers sequentially or simultaneously.

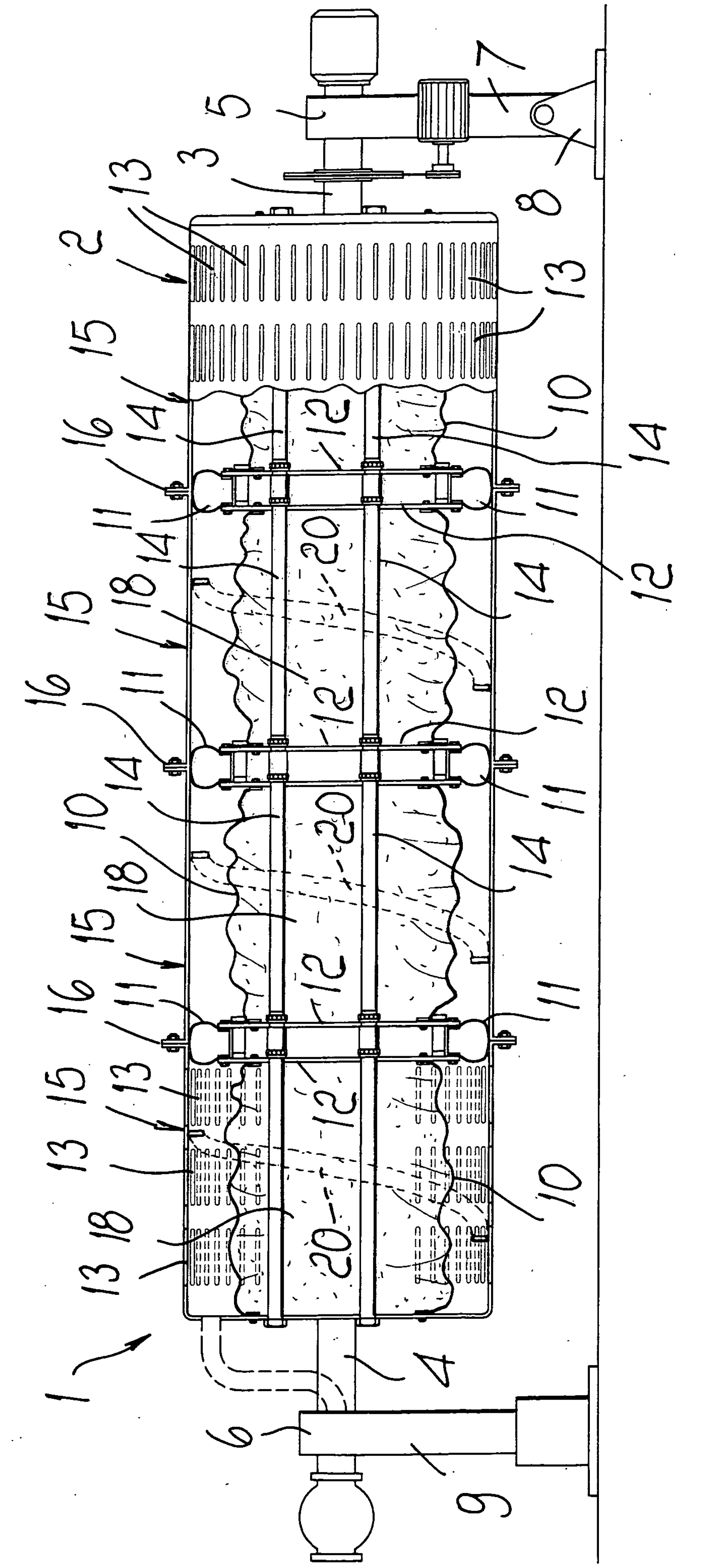

Fig. 1

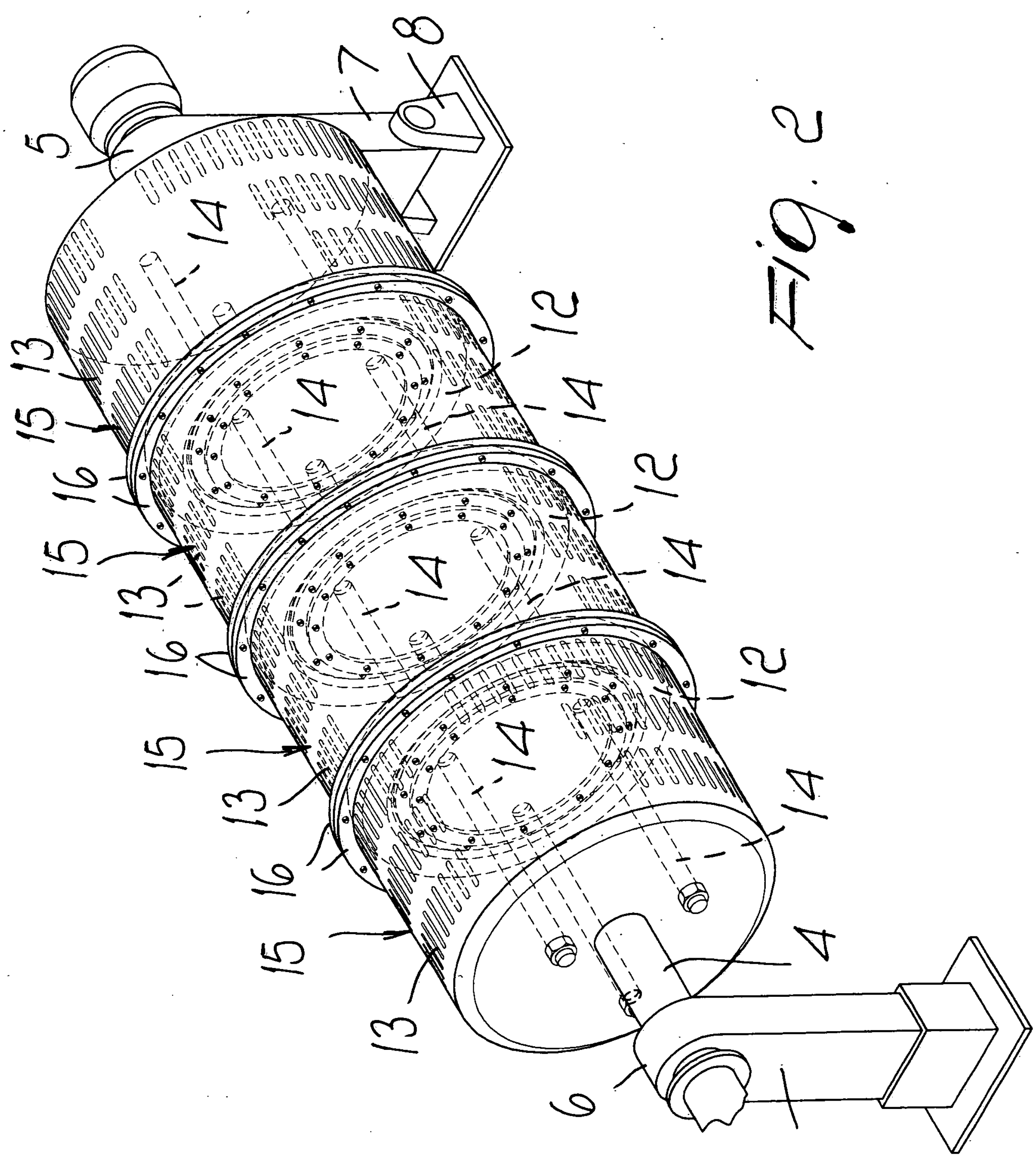

Fig. 2

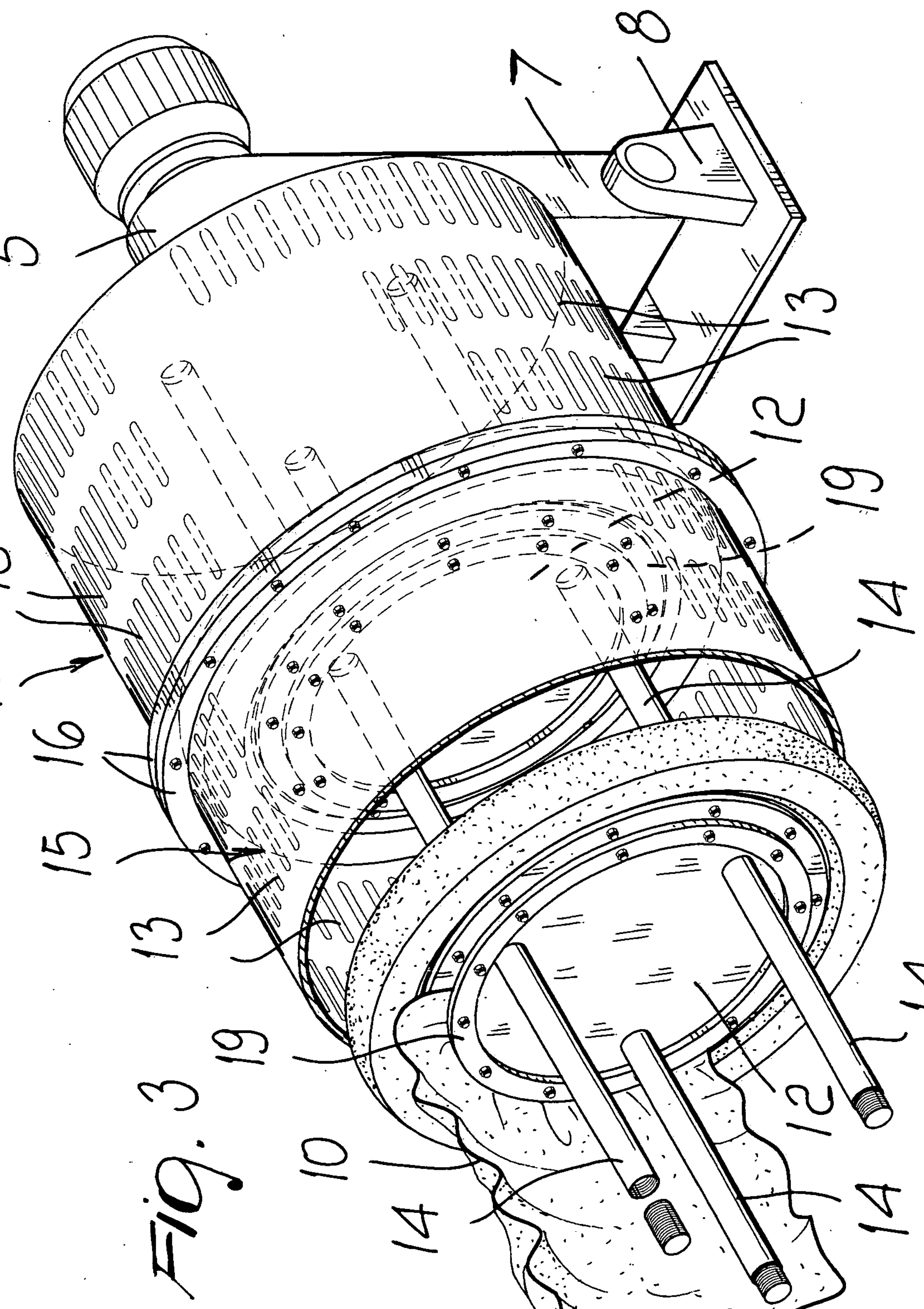

Fig. 3

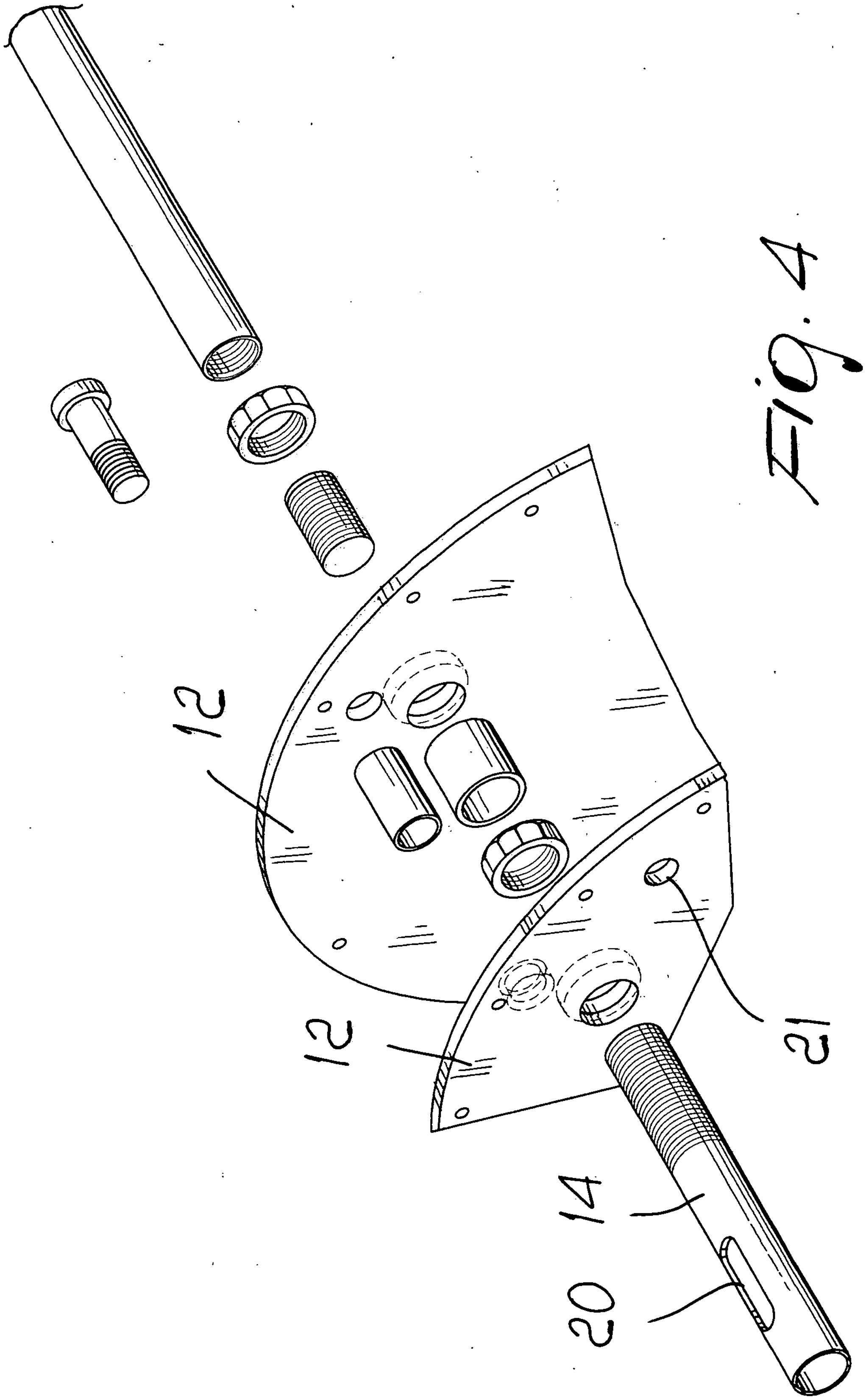

Fig. 4

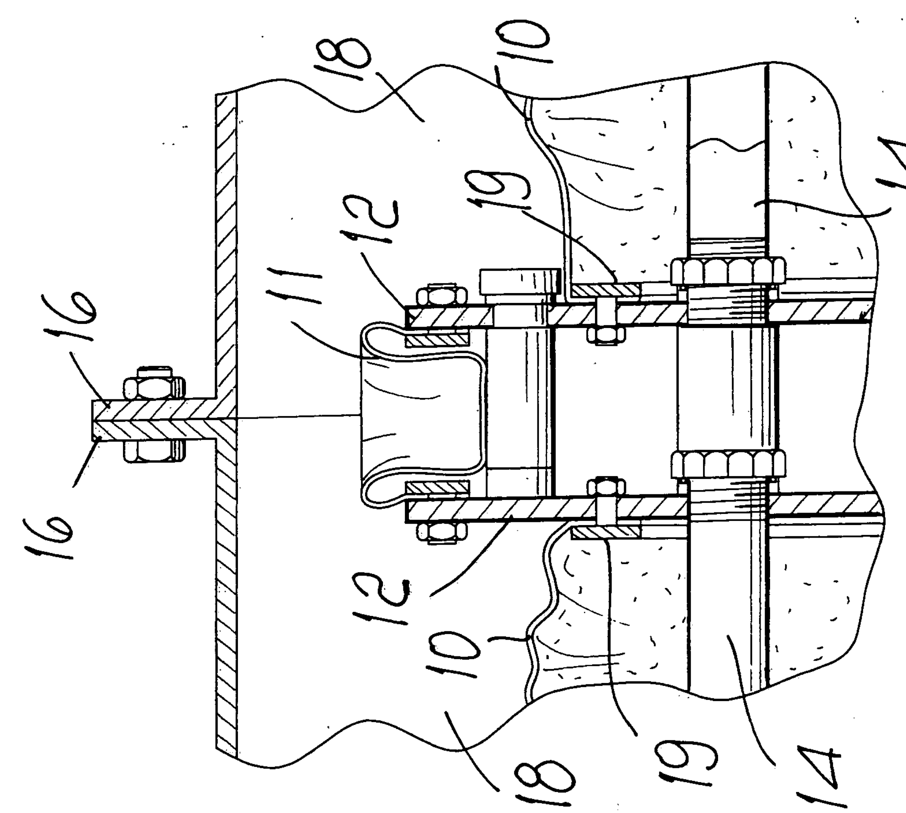
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Fig. 6

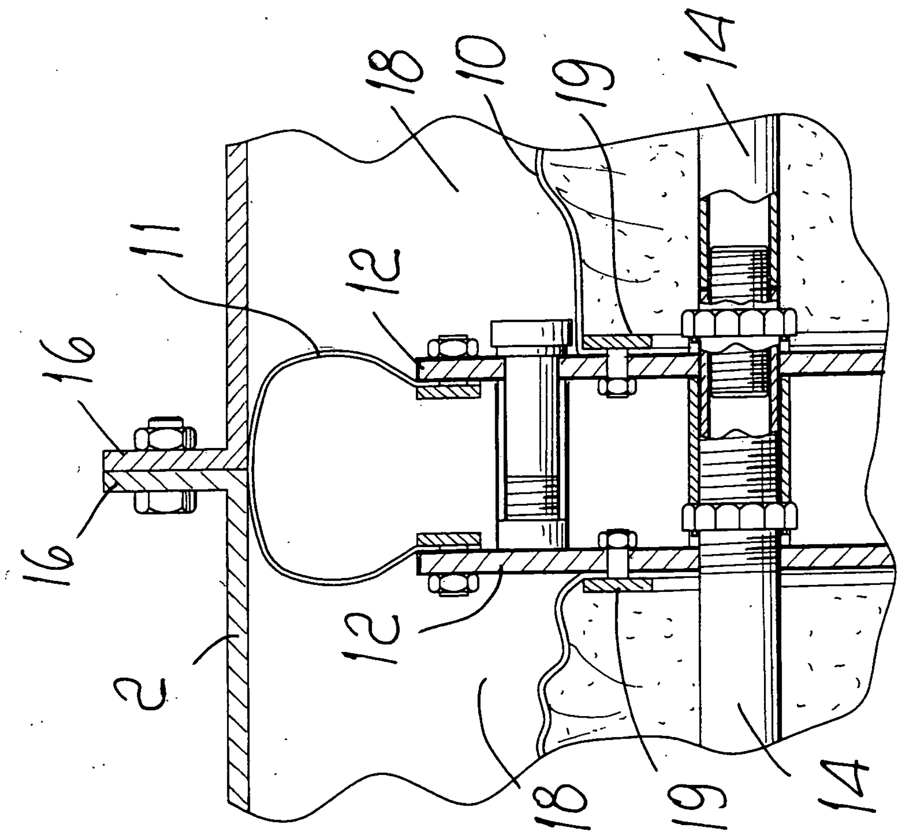
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Fig. 5

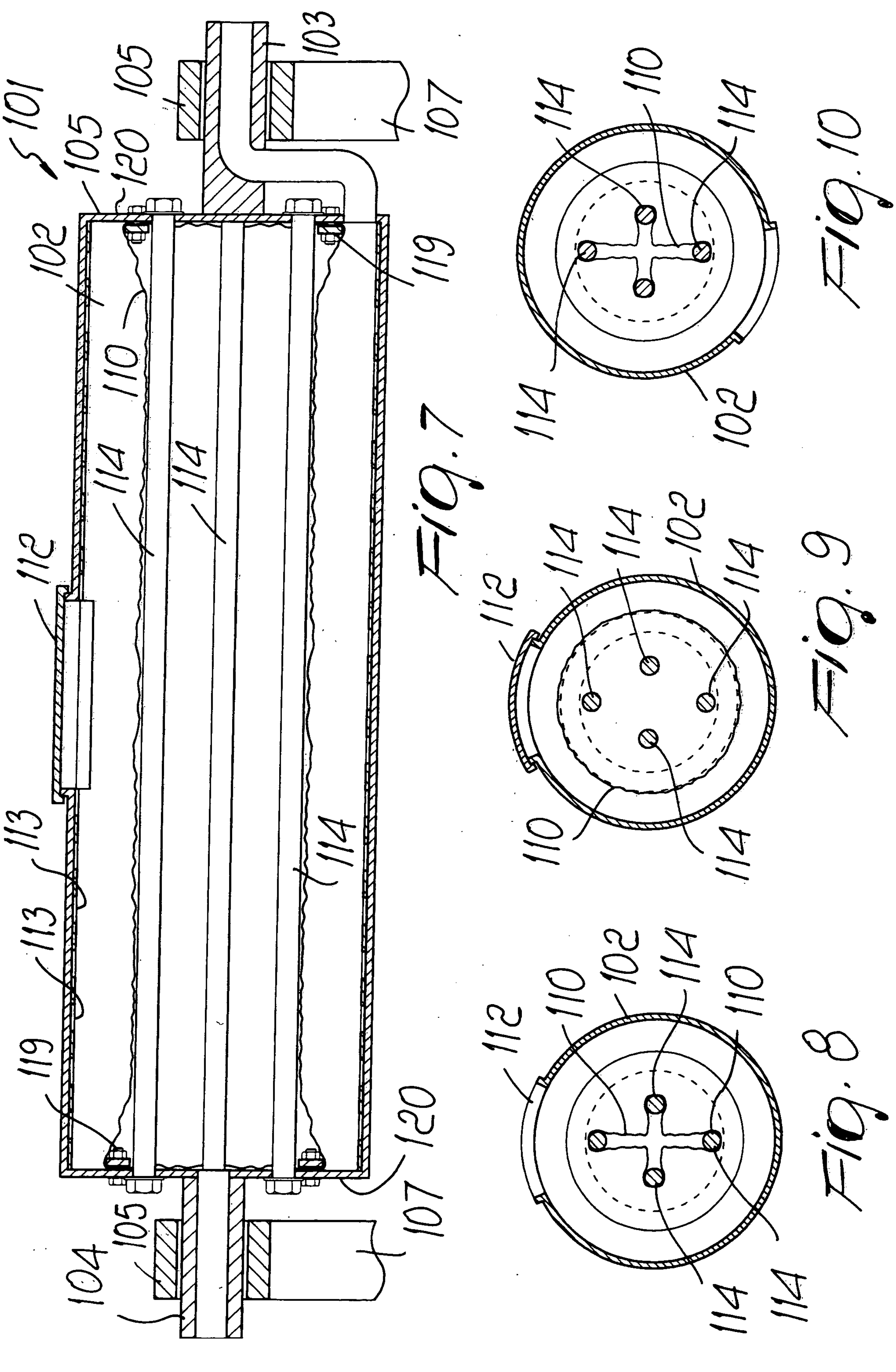
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Fig. 7
Fig. 8
Fig. 9
Fig. 10

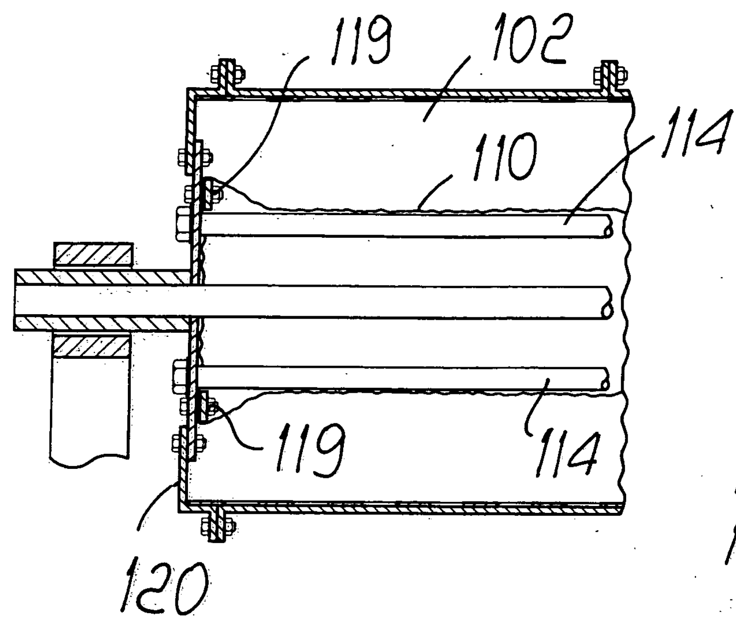

Fig.11

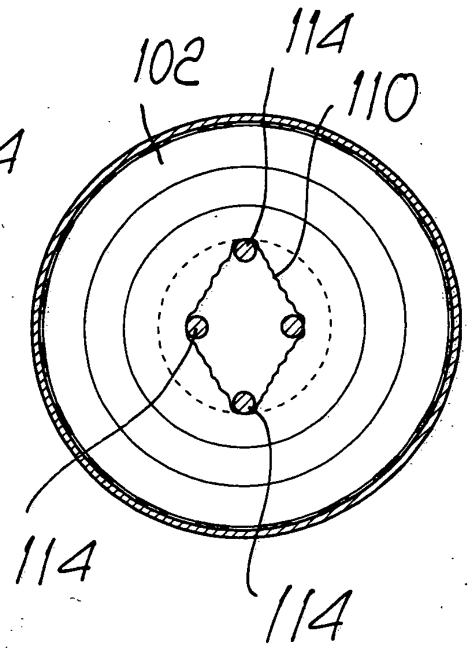

Fig. 12

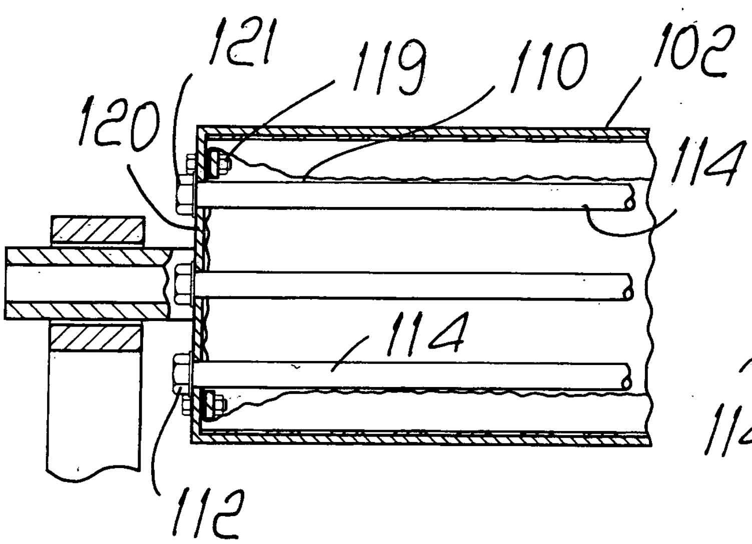

Fig.13

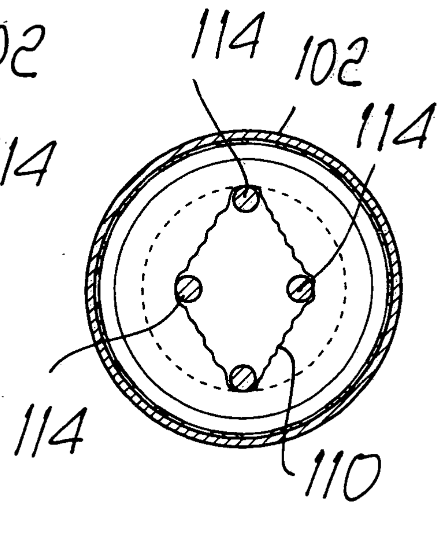

Fig.14