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(54) **SYSTEM AND METHOD FOR TREATMENT OF GRAIN**

(57) The present disclosure relates to a grain treatment system comprising: a grain container (1) having a support structure (2), an external wall (18) and a top closure (3); an inlet (4) for grain at said top closure (3); an outlet (15) for feeding out grain (14) from said container (1); and means (6) for feeding an air flow through the processed grain (19); characterized in that said external wall (18) of the container (1) is provided with a number of openings (11) for allowing air originating from said air flow, and being forced to flow through a lower section (17) of the treated grain (19) to the outside of said container (1).

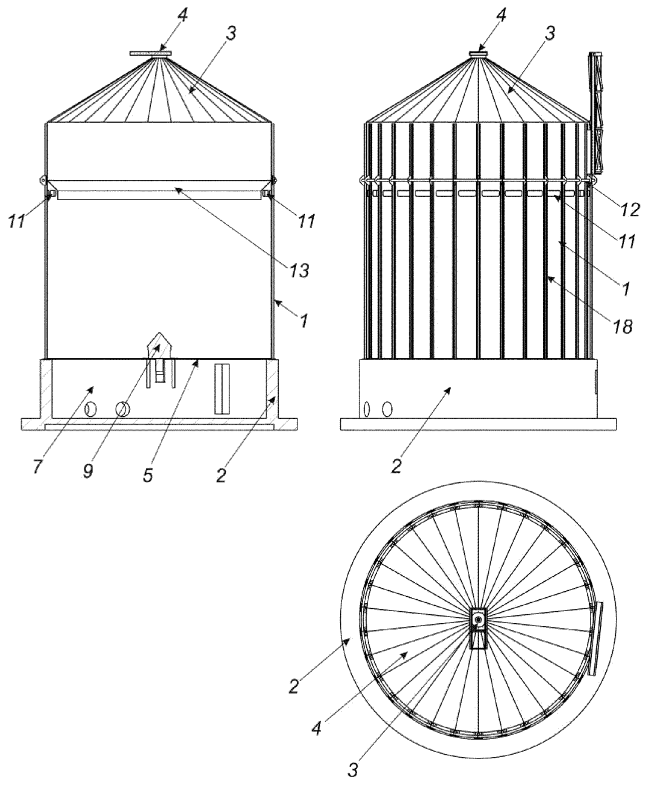

FIG. 2

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Description

FIELD OF THE INVENTION:

[0001] The present disclosure relates to a system of grain treatment, said system comprising: a grain container having a support structure, an external wall and a top closure; an inlet for grain at said top closure; an outlet for feeding out grain from said container; and means for feeding an air flow through the processed grain in a lower part of the container.

BACKGROUND OF THE INVENTION:

[0002] It is previously known that the treatment of grain comprises a drying process for grain which is used for consumption by humans or animals, such as for example wheat, oats, soybeans, barley, rice and many other types of grain.

[0003] With regard to arrangements and methods for cooling grain and similar agricultural products, it is well-known that it is necessary to keep the grain dry and at a specified temperature. More precisely, it is known that certain processes for drying and cooling grain are necessary in order to ensure the quality and durability of the grain in storage, and to keep the grain free from pest. For example, different types of grain have their own ideal storage temperature and moisture concentration.

[0004] The purpose of drying grain is generally to reduce its moisture content to an appropriate level in order to provide safe and efficient storage. Grains naturally contain moisture, and if not dried to the proper moisture level, they can be spoiled or may also attract pests such as insects and rodents.

[0005] For this reason, grain storage arrangements may involve different types of containers, silos, bins, or other structures for storage and treatment, which are provided with arrangements for drying, ventilating, temperature control, and pest control measures.

[0006] One specific process which is common is to dry collected grain so as to remove the moisture in the grain before it it stored. Such a drying operation can be performed by means of dryers which are operating continuously in a manner in which the grain is introduced through an upper portion of the dryer and removed through a bottom portion.

[0007] By drying the grain to a correct level, it can be stored for longer periods of time without spoilage, while also reducing the risk of mold or insect infestation. After the grain has been dried, it may be necessary to cool the grain to prevent reabsorption of moisture and to keep the grain at a temperature which is safe for storage.

[0008] Cooling is typically done by passing air over the grain, either naturally through ventilation or through the use of forced air cooling systems, until the grain has reached the desired temperature.

[0009] In summary, the process of drying and cooling grain is crucial for ensuring the quality of the stored grain.

[0010] The patent document EP 3971506 teaches a method and an apparatus to process grain which is received from a dryer. The method relies on a step of providing a transition zone in a volume of grain, said transition zone being moved between a first position at a location of a first temperature sensor and a second position at a location of a second temperature sensor. Ventilation air is stopped at the first position, and extraction of cooled grain is stopped at the second position.

[0011] Even though EP 3971506 discloses a useful arrangemeng for processing grain, there is a need for further improvements within this field of technology, in particular in the form of effective and reliable arrangements and methods for storing and processing grain which can be implemented at a low cost and without any complex detection and control systems.

SUMMARY OF THE INVENTION

[0012] In accordance with the disclosure, there is provided an improved grain treatment after drying of said grain, having a purpose of solving one or more of the drawbacks of known devices within this field.

[0013] For this reason, and in accordance with the disclosure, there is provided a grain treatment system comprising: a grain container having a support structure, an external wall and a top closure; an inlet for grain at said top closure; an outlet for feeding out grain from said container; and means for feeding an air flow through the processed grain. Furthermore, said external wall of the container is provided with a number of openings for allowing air originating from said air flow, and being forced to flow through a lower section of the treated grain to the outside of said container.

[0014] Certain advantages are achieved by means of the arrangement according to the disclosure. In particular, an important advantage is that the present disclosure relates to a system of grain treatment after a drying process (also called a "post-drying system") to ensure the safe storage of the processed grain in a grain container.

[0015] Furthermore, the arrangement is constituted by a grain process system which consists of a post-drying grain device in two stages that aims to separate, in a simple and efficient way, a lower cooling area from an upper resting/sweating area of the container.

[0016] By means of the arrangement according to the disclosure, there is no need for complex mechanical systems or temperature detection and regulation arrangements, or any other complex control systems which may be expensive and difficult to maintain in function.

[0017] According to an embodiment, the openings are generally evenly distributed along the periphery of the external wall of the container.

[0018] According to an embodiment, the container is provided with an internal separation ring which is attached to the inside of the wall of the container and which extends in a radial direction from the inside of the external wall, said separation ring being configured for allowing

an outflow of air while preventing an outflow of stored grain out of the container.

[0019] According to an embodiment, the container is provided with said air outlet openings defined in the wall of the container, around the perimeter of the wall of the container, distributed peripherally at approximately the same height as the separation ring, however without exceeding it.

[0020] According to an embodiment, the position of the separation ring within said container is configured so as to define two vertically oriented zones in the form of an upper resting zone and a lower cooling zone for the stored grain.

[0021] According to an embodiment, the separation ring is shaped as a truncated cone having an upper end portion and a lower end portion, wherein the upper end portion has a greater diameter than the lower end portion.

[0022] According to an embodiument, the separation ring is positioned at a height which is approximately 60% of the total height of a cylindrical part for storage and treatment within the container.

[0023] According to an embodiment, a false bottom is arranged in the lower part of the container and is configured so that the grain may rest upon said false bottom.

[0024] According to an embodiment, the air flow is generated by means of a fan arrangement which is arranged to blow said air flow from under the false bottom.

[0025] According to an embodiment, the arrangement is configured for receiving grain from an external drying device and into said inlet.

[0026] The disclosure also relates to a method for treating grain in a grain treatment system which comprises a grain container with a support structure, an external wall and a top closure. The method of treatment comprises certain steps: feeding grain through an inlet at said top closure; feeding grain through an outlet from said container; and feeding an air flow through the stored grain. In particular, the method for treating grain comprises a step of allowing air originating from said air flow and being forced to flow through a lower section of the treated grain to the outside of said container through a number of openings in said external wall.

[0027] Further advantages and advantageous features of the embodiments contemplated herein are disclosed in the following description and in the dependent claims.

BRIEF DESCRIPTION OF THE FIGURES

[0028] The disclosure will be described in greater detail below with reference to the figures shown in the appended drawings.

Figure 1 shows a perspective view of a grain process arrangement according to an embodiment;

Figure 2 shows three views of the grain process arrangement according to Figure 1; more precisely a cross-sectional view, a side view and a top view of the arrangement;

Figure 3 shows a detailed side view of a separation ring which is used in the process arrangement;

Figure 4 shows a detailed view of a number of air outlet openings in the process arrangement;

Figure 5 shows a cross-sectional view of the grain process system, showing in particular the processing of grain which is stored within a grain storage arrangement;

Figure 6 shows a cross-sectional view of the grain process system, without indicating the actual grain which is stored in the process system; and

Figure 7 shows a further detailed view of the grain process system, in particular the separation ring.

DETAILED DESCRIPTION OF PARTICULAR EMBODIMENTS

[0029] Different aspects of the present disclosure will be described more fully hereinafter with reference to the enclosed drawings. The disclosure can be realized in many different forms and should not be construed as being limited to the embodiments below.

[0030] In the context of this disclosure, the term "grain storage arrangement" (or "grain storage container", "grain container" etc.) is used broadly to describe any type of container, bin, silo or other type of building structure which is configured for storing or processing grain, such as for example wheat, corn, barley, rice, oatmeal or generally any other type of grain suitable for consumption by humans or animals.

[0031] With initial reference to Figure 1 and Figure 5, there is shown a first aspect of this disclosure in which there is provided a grain process in a storage arrangement which consists of a grain post-drying device in two stages that aims to separate, in a simple and efficient way, a lower cooling area (or zone) 17 and an upper resting/sweating area (or zone) 16 of a grain storage container 1, without the need for complex mechanical systems or temperature regulations. In order to achieve this purpose, the arrangement 1 basically comprises the following elements:

- a ring 13 (see in particular Figures 2, 3, 5 and 6) separating the cooling and quiescent (resting) sections, configured for self-adjustment of the grain feed rate as a function of the flow rate; and
- in addition, on the external side walls 18 of the grain

storage container 1, a plurality of air outlet openings 11 (in the form of slots, holes or similar openings), located under the separation ring 13.

[0032] With reference to Fig. 1, the grain storage arrangement according to the disclosure comprises a reinforced and thermally insulated grain container 1, located on a support structure 2 and topped at the top by a top closure 3, preferably with a truncated cone structure, and with at least one inlet opening 4 for grain arranged in the top closure 3.

[0033] With further reference to Figure 5 and Figure 6, for example, it is noted that the separation ring 13 defines an arrangement which helps keeping the grain 19 inside the container 1 while grain 19 is fed through the inlet opening 4. In this regard, it should be noted the grain is fed through the opening 4 and is then allowed to be fed into the grain container 1 generally uninformly by gravity.

[0034] It should also be noted that the grain 19 is suitably heated, in a previous drying process and by means of an external heating arrangement (not shown in the drawings) before it reaches the inlet opening 4. In this point where the grain is fed into the inlet opening 4, the grain has a temperature of about 55°C, or in any case not lower than 45°C.

[0035] The separation ring 13 completes a horizontally arranged cylindrical lower section, preferably located in the upper half of the container 1 and internally joined to its walls 18, defining in said container 1 the upper zone 16 for resting and draining of the grain, and the lower zone 17 for cooling of the grain.

[0036] Furthermore, a plurality of air outlet openings 11 are defined in the walls of the container 1 (suitably around generally the entire perimeter of the outside wall 18 of the container 1). The openings 11 are distributed peripherally at approximately the same height as the separation ring 13, but without exceeding said height, so that the openings 11 thereby remain in the upper part of the lower cooling zone 17. Generally, the more openings 11 the better, since it will allow a high flow of output air through the openings 11.

[0037] According to an embodiment, the grain storage container 1 is provided with a reinforcement ring 12 (see Figure 1) which is configured for reinforcing the structure of the container 1, if such reinforcement is considered to be necessary.

[0038] The separation ring 13 is preferably formed as a truncated cone and so that the grain 19 inside the grain container 1 is kept from being forced out of the openings 11 when the grain 19 is fed through the inlet 4.

[0039] Furthermore, as shown in particular in Figures 1, 5 and 6, the grain storage container 1 comprise a floor 5, suitably a so-called "false bottom", in particular in the form of a perforated sheet metal false bottom 5, which is horizontally arranged and located internally in the lower part of the container 1. The false bottom 5 defines an air chamber 7 underneath the false bottom 5 - and consequently underneath the storage of grain 19 - and is associated with a fan 6 for forced air intake from the outside of the storage container 1.

[0040] The grain container 1 also comprises means for extracting the dried grain 14 (see Figure 5) from the top of the perforated plate false bottom 5 through an outlet duct 15 which extends to the outside of the container 1. In order to achieve this, the container 1 comprises a screw conveyor 10 which forces grain 19 towards an outlet 9 and further towards the outlet duct 15.

[0041] According to an embodiment, the outlet duct 15 is located in the bottom portion of the grain container 1, suitably associated with the support structure 2.

[0042] The fan 6 is configured for generating a forced flow of air from underneath the stored grain 19, i.e. in an upwards direction as seen in the drawings (see in particular Figure 3). The flow of air will act so as to cool the stored grain 19 and ventilate moisture away from the grain. The air will flow through the grains which together form the stack of processed grain 19 (see in particular Figure 5, which shows grain which is stored and treated) and will then flow out through the openings 11.

[0043] According to an embodiment, a suitable air flow is between 40 - 60 $m^3/h/m^3$ (volume of grain). For the total volume it becomes 60 - 90 $m^3/h/m^3$ (volume of grain) for the cooling section, using the separation ring 13.

[0044] Due to the separation ring 13, it is ensured that hot grain which is fed into the grain container 1 through the inlet 4 will not exit through the openings 11.

[0045] It should be noted that, due to the arrangement with the upper zone 16 and the lower zone 17, the grain 19 which is at the highest level of the stack in the storage area, i.e. in the upper zone 16, will be "resting" so that the moisture within the kernels of the grains will have some time to reach the outside of the kernel, i.e. the external layer of the grain. After a certain time period, the grain which have rested in this manner will be moving towards the lower zone 17 by force of gravity, and also through the fact that grain 19 in the lower zone 17 is gradually fed out of the container 1 by means of the extraction system involving the screw conveyor and the outlet 15.

[0046] When the moisture within the grain has moved out of the kernel and to the outside of the grain, it can be expected that it has reached the lower zone 17 in which the flow of air from the fan 6 will force the moisture (which is now not longer trapped within the kernels of the grain) out of the grain container 1, i.e. through the openings 11. In this manner, the stored grain 19 in the lower zone 17 will be cooled.

[0047] In summary, it should be noted that an important feature of this disclosure is the insight that the grain 19 has to rest for a certain time period (in the upper zone 16) in order to have time for the moisture to go out from the kernel and to the outside of the grain. After this "resting time", the grain 19 is expected to have reached the lower zone 17 in which the moisture will be vented away by means of the airflow from the fan 6. In this manner, there is formed a two-stage process, involving an upper

resting zone 16 and a lower venting and cooling zone 17, wherein these two zones 16, 17 are divided by means of the separation ring 13 and the air outlet openings 11.

[0048] According to an embodiment, the separation ring 13 is placed, as regarded in the inside of the wall 1, at a height which is approximately 60% of the total height from the floor 5 of the container 1 and up to the top of the cylindrical part of the container 1, as seen for example in Figure 5. In other words, the separation ring 13 is positioned at a height which is approximately 60% of the total height of a cylindrical part for storage and treatment of grain within the container 1. The height of the separation ring 13 is chosen so that the process of treating the grain as described above is optimized. This means that, according to said embodiment, the height of the section of the cylindrical part which is above the separation ring 13 is approximately 40% of said total height.

[0049] Accordingly, according to an embodiment, the separation ring 13 is placed in a position that ensures a height of the cooling section of approximately 60% (of the total height of the cylindrical section) and consequently approximately 40 % for the remaining resting section.

[0050] When new grain is fed into the inlet 4, the amount of stored grain 19 within the grain container 1 will obviously increase. For this reason, the container arrangement is configured so that the level of grain in the upper zone 16 will be detected by a level sensor (not shown in the drawings) in a manner so that, when it has reached a certain maximum level, the conveyor screw 10 will be activated so as to feed grain out of the grain container 1 through the outlet 15.

[0051] The truncated cone-shaped separation ring 13 separates the upper zone 16 for resting and the lower zone 17 for cooling (and for venting out moisture), so that the grain feed is regulated by gravity, depending on the emptying flow carried out by the means for extracting the dried grain 14, i.e. the screw conveyor 10, from the upper part of the perforated sheet false bottom 5.

[0052] The air outlet openings 11 allow the air coming from the air chamber 7 to exit through the perforated plate false bottom 5, driven from the outside by the fan 6 and circulating through the stack of stored grain 19 in the lower cooling zone 17. The grain will eventually be out of the container 1 via the outlet 15, at a temperature as close a possible to the ambient temperature.

[0053] Consequently, the forced intake of outside air is used for a drying and cooling process. This is accomplished through the use of the fan 6 as described above and in the drawings. As alternatives, or additional equipment, other components such as blowers or other mechanical systems can be used in order to circulate air through the grain 19.

[0054] This invention has the following advantages over the prior art:

Firstly, it constitutes an arrangement with an outlet of air to the outside for automatic regulation of the cooling process, as opposed to the existing traditional equipment that uses a thermal control of the electrical process, by means of differential thermostats. This contributes to expensive and complex control systems.

[0055] Also, the openings 11 allow the air to exit and the inner cone-shaped ring 13 retains the grain, leaving a large section for the saturated cooling air to exit and leaving the upper part 16 without any air flow for the maintenance of the resting and resoaking area.

[0056] Furthermore, the arrangement according to the disclosure which involves air evacuation and zone separation is an inexpensive solution with a significant reduction of stress on the wall 18 of the grain container.

[0057] Furthermore, the arrangement preferably comprises an air outlet with an enlarged cross-section compared to conventional equipment, which is also located in the middle or upper part of the grain container, avoiding the overpressure required in the ventilation system to evacuate the air used in the upper part of the container roof. This has the additional consequence of reducing the electrical power required in the ventilation equipment per quantity of grain treated, and the electrical consumption, with the consequent economic savings in its operation.

[0058] The process regulation with the arrangement according to this disclosure is safer and more automatic, the physical separation of the air flow, together with the reduction of moving parts or electrical sensors, has a more reliable operation than a temperature comparison system that depends on the regulation of parameters chosen by the user, as is the case with conventional equipment.

[0059] Also, this arrangement provides a significant reduction in manufacturing costs, thanks to its simplification, compared to the existing and well-known models on the market with internal ducts and a central chimney outlet.

[0060] Furthermore, the absence of electrical probes or sensors required for process automation in existing devices on the market also reduces electrical installation and maintenance costs and avoids the need for these fragile elements that must be inserted into the bulk grain flow and are frequent sources of breakdowns.

[0061] The grain feed rate between the upper resting and resoaking zone 16 and the lower cooling zone 17 is regulated by gravity, automatically according to the emptying flow made by means of the means for extracting the dried grain from the upper part of the perforated sheet false bottom 5.

[0062] The arrangement according to the disclosure is suitable for use in the completion of drying and conditioning of all types of cereal grains, especially maize.

[0063] In summary, the present disclosure relates to a system of grain treatment, suitably after a drying process and configured to ensure the safe storage of grain in a grain container, said system comprising: a grain container 1 with a support structure 2, an external wall 18 and a top closure 3. The container comprises an inlet 4 for grain at said top closure 3, an outlet 14 for feeding out grain 15 from said container 1; and means 6 for feeding

an air flow through the grain 19. Furthermore, the external wall 18 is provided with a number of openings 11 for allowing air originating from said air flow and being forced to flow through the grain 19 to escape to the outside of said container 1.

[0064] In this manner, two separated zones 16, 17 can be defined, wherein an upper zone 16 is intended for resting grain, i.e. in which moisture trapped within each grain will be transported from each kernel, towards the outer layer of the grain and out of the grain. Furthermore, the purpose of the lower zone 17 is to ventilate the stored and processed grain 19 and evacuate air out of the openings 11. As the air moves through the grain 19, moisture evaporates from the grain into the passing air.

[0065] According to various embodiments of the arrangement according to the disclosure, certain advantages can be obtained.

[0066] For example, the openings 11 are suitably evenly distributed around the periphery of the external wall 18 of the container 1. The openings 11 are positioned slightly lower than the position of the separation ring 13. Also, according to an embodiment as shown in Figure 5, a deflector 20 may suitably be positioned abve each opening 11, in order to deflect rain and prevent water from entering the openings 11 and reach the stored grain 19. In this manner, the separation ring 13 is configured for allowing an outflow of air while preventing an outflow of stored grain 19 out of the container 1.

[0067] Furthermore, the internal separation ring 13 is attached to the inside of the wall 18 and extends in a radial direction from the inside of the external wall 18 and towards the centre of the grain container 1. As indicated for example in Figures 5 and 6, the separation ring 13 is suitably configured for allowing an outflow of air through the openings 11 while preventing an outflow of stored grain out of the container via the openings 11.

[0068] With reference to Figure 7, which shows a section of the grain container 1 with the separation ring and openings (see also Figure 3), it should be noted that the dimensions and design of the ring 13 can be defined by at least the following three parameters:

1. a slope of descent, which according to an embodiment can be approximately 45°, to ensure the grain flowing down;
2. a suitable dimension (between the lower edge of the ring and the position of the air outlets) for grain containing to ensure that grain will not reach the level of the air outlets 11; and
3. a natural slope of the grain; i.e. a natural descent of grain inside the container 1, which can be approximately 30°.

[0069] The separation ring 13 is shaped as a truncated cone having an upper end portion and a lower end portion, wherein the upper end portion generally has a greater diameter than the lower end portion. The position of the separation ring 13 within the container 1 is configured so as to define two vertically oriented zones in the form of an upper resting zone and a lower cooling zone for the stored grain 19.

[0070] Furthermore, the stored grain 19 rests upon a false bottom 5 which is arranged in the lower part of the container 1. Also, the air flow as mentioned above is generated by means of a fan arrangement 6 which is arranged to blow said air flow from under the false bottom 5 and generally vertically upwards, through the stored grain 19.

[0071] By using the forced intake of outside air which passes over the grain, and by dividing the grain container 1 into two sections, or zones 16, 17, the temperature and moisture content of the grain can be controlled precisely, which helps improving the quality of the stored grain.

[0072] The principles of an arrangement according to the disclosure have now been described. It should be noted that the disclosure also relates to a method for treating grain which is stored in the above-mentioned grain container 1 with a support structure 2, an external wall 18 and a top closure 3;. In a general sense, this method comprises the following steps:

a) feeding grain through an inlet 4 at said top closure 3;
b) feeding grain through an outlet 15 from said container 1; and
c) feeding an air flow through the stored grain 19; and in particular
d) allowing air originating from said air flow and being forced to flow through the treated grain 19 to flow to the outside of said container 1, via a number of openings 11 in said external wall 18. Suitably, the air flows through a lower section of the treated grain 19.

[0073] The invention is not limited to the embodiments described above but can be varied within the scope of the appended claims.

Claims

1. A grain treatment system comprising:

a grain container (1) having a support structure (2), an external wall (18) and a top closure (3);
an inlet (4) for grain at said top closure (3);
an outlet (15) for feeding out grain (14) from said container (1); and
means (6) for feeding an air flow through the processed grain (19);

characterized in that

said external wall (18) of the container (1) is provided with a number of openings (11) for allowing air originating from said air flow, and being forced to flow through a lower section (17) of the treated grain (19) to the outside of said container (1).

2. A grain storage arrangement according to claim 1, wherein the openings (11) are generally evenly distributed along the periphery of the external wall (18) of the container (1).

3. A grain treatment system according to claim 1 or 2, wherein the container (1) is provided with an internal separation ring (13) which is attached to the inside of the wall (18) of the container (1) and which extends in a radial direction from the inside of the external wall (18), said separation ring (13) being configured for allowing an outflow of air while preventing an outflow of stored grain (19) out of the container (1).

4. A grain treatment system according to any one of the preceding claims, wherein the container (1) is provided with said air outlet openings (11) defined in the wall (18) of the container (1), around the perimeter of the wall (18) of the container (1), distributed peripherally at approximately the same height as the separation ring (13), however without exceeding it.

5. A grain treatment system according to claim 3, wherein the position of the separation ring (13) within said container (1) is configured so as to define two vertically oriented zones in the form of an upper resting zone (16) and a lower cooling zone (17) for the stored grain (19).

6. A grain treatment system according to any one of claim 3 or 5, wherein said separation ring (13) is shaped as a truncated cone having an upper end portion and a lower end portion, wherein the upper end portion has a greater diameter than the lower end portion.

7. A grain treatment system according to any one of claim 3, 5 or 6, wherein said separation ring is positioned at a height which is approximately 60% of the total height of a cylindrical part for storage and treatment within the container (1).

8. A grain treatment system according to any one of the preceding claims, wherein a false bottom (5) is arranged in the lower part of the container (1) and is configured so that the grain (19) may rest upon said false bottom (5).

9. A grain treatment system according to claim 8, wherein the air flow is generated by means of a fan arrangement (6) which is arranged to blow said air flow from under the false bottom (5).

10. A grain treatment system according to any one of the preceding claims, wherein said arrangement is configured for receiving grain from an external drying device and into said inlet (4).

11. A method for treating grain in a grain treatment system which comprises a grain container (1) with a support structure (2), an external wall (18) and a top closure (3);

feeding grain through an inlet (4) at said top closure (3);
feeding grain through an outlet (15) from said container (1); and
feeding an air flow through the stored grain (19);

characterized in that the method for treating grain further comprises:
allowing air originating from said air flow and being forced to flow through a lower section (17) of the treated grain (19) to the outside of said container (1) through a number of openings in said external wall (18).

12. A method according to claim 11, wherein the method further comprises:
forcing said air flow through said openings (11) generally evenly along the periphery of the external wall (18) of the container (1).

13. A method according to claim 12, wherein the method further comprises:
forcing said airflow out of said openings (11) while preventing an outflow of stored and processed grain out of the openings (11) of said container (1) by means of an internal separation ring (13) which is attached to the inside of the wall (18) of the container (1) and which extends in a radial direction from the inside of the external wall (18).

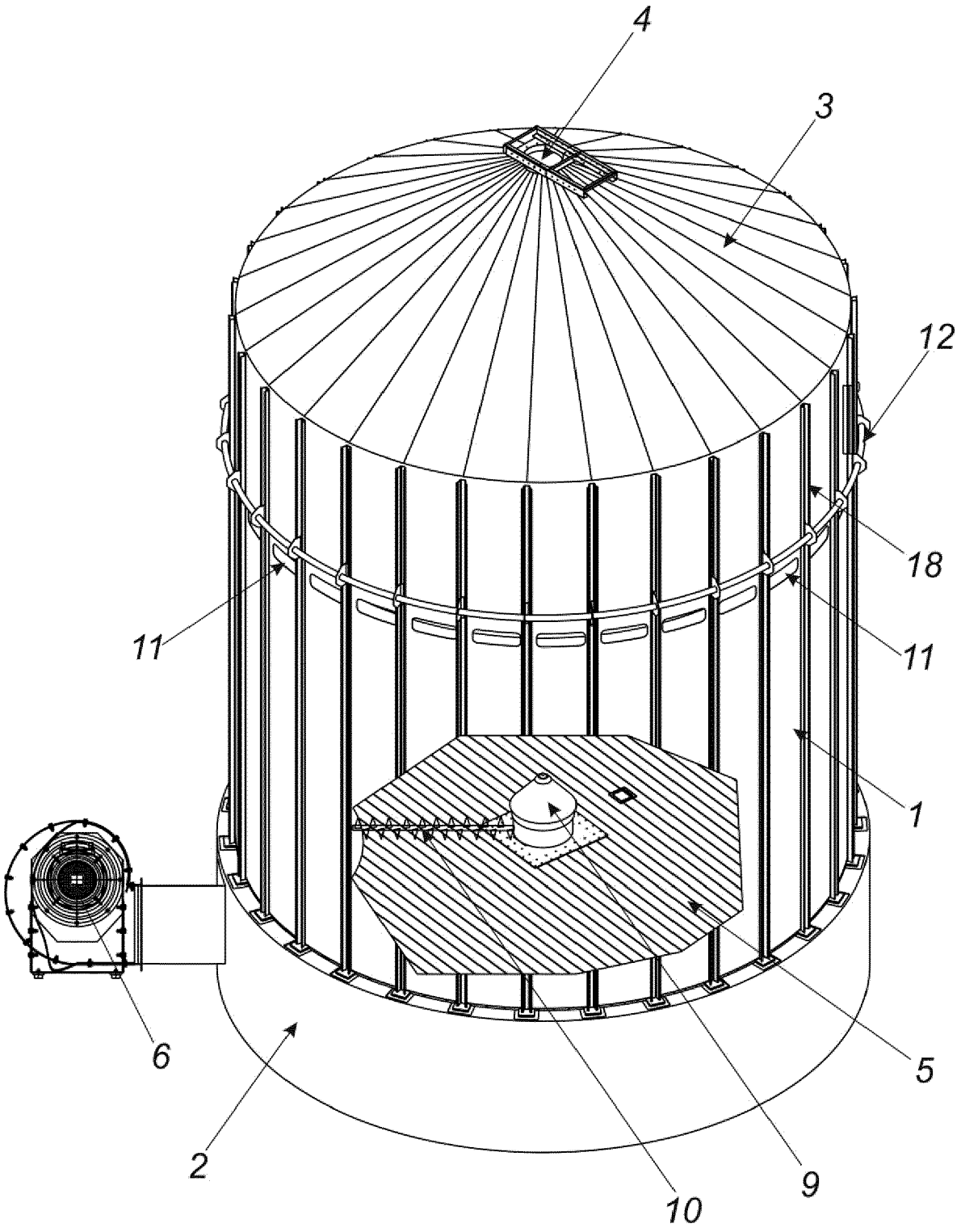


FIG. 1

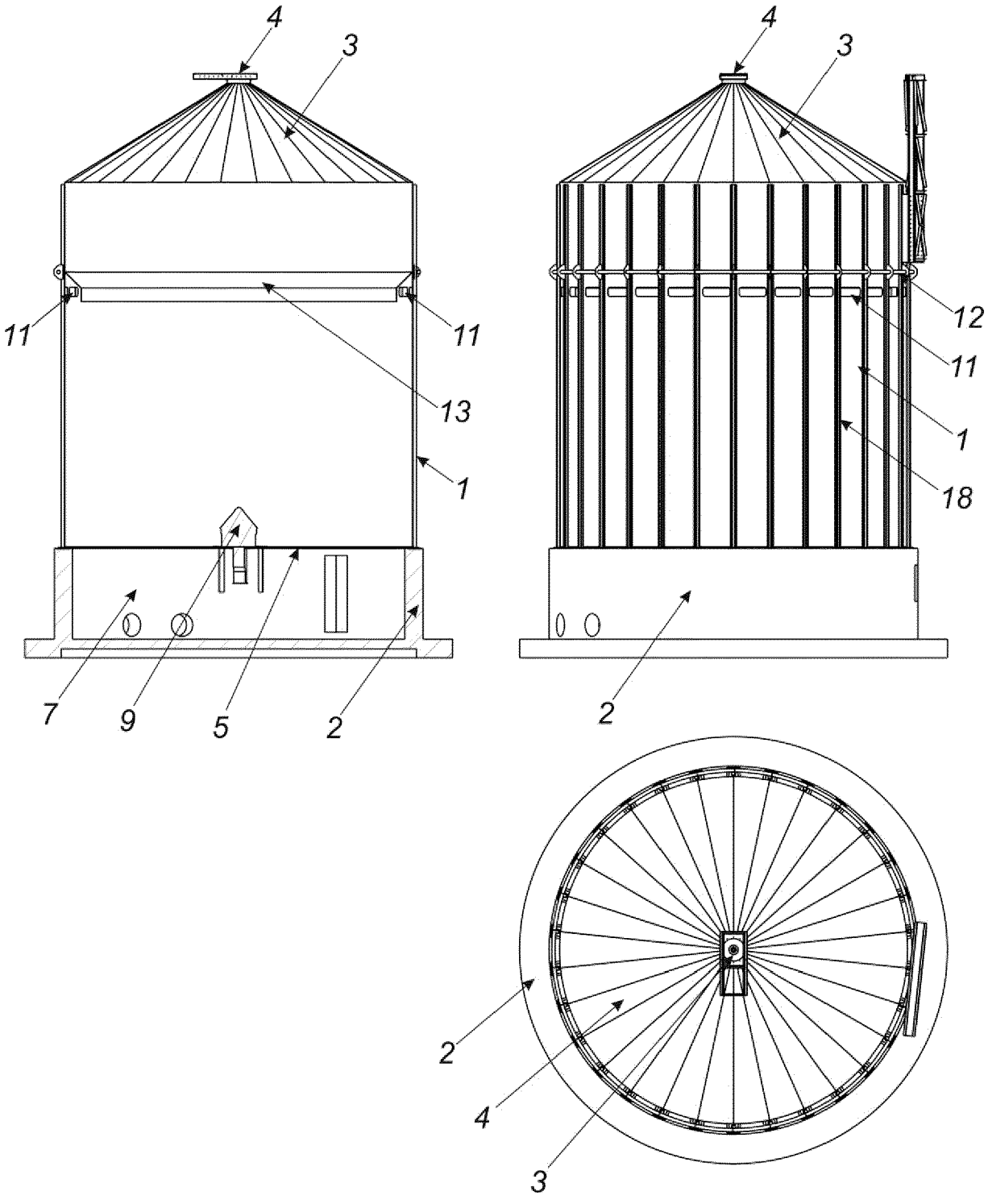


FIG. 2

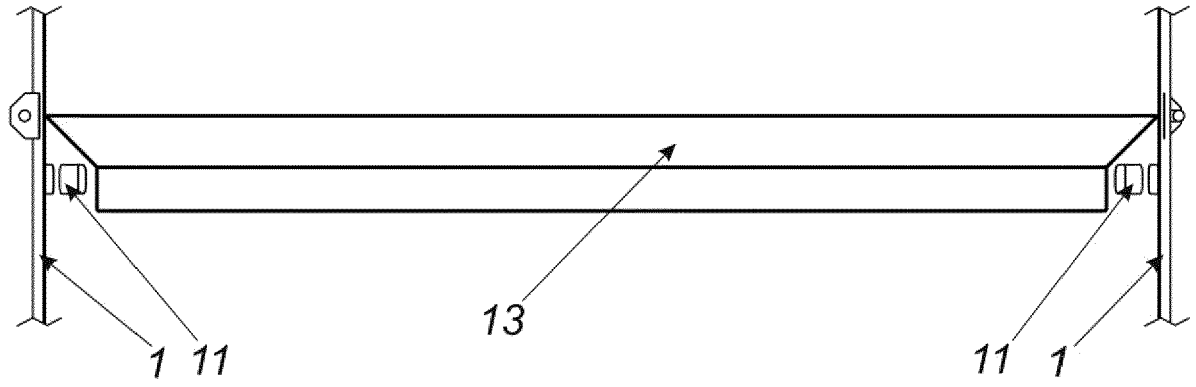


FIG. 3

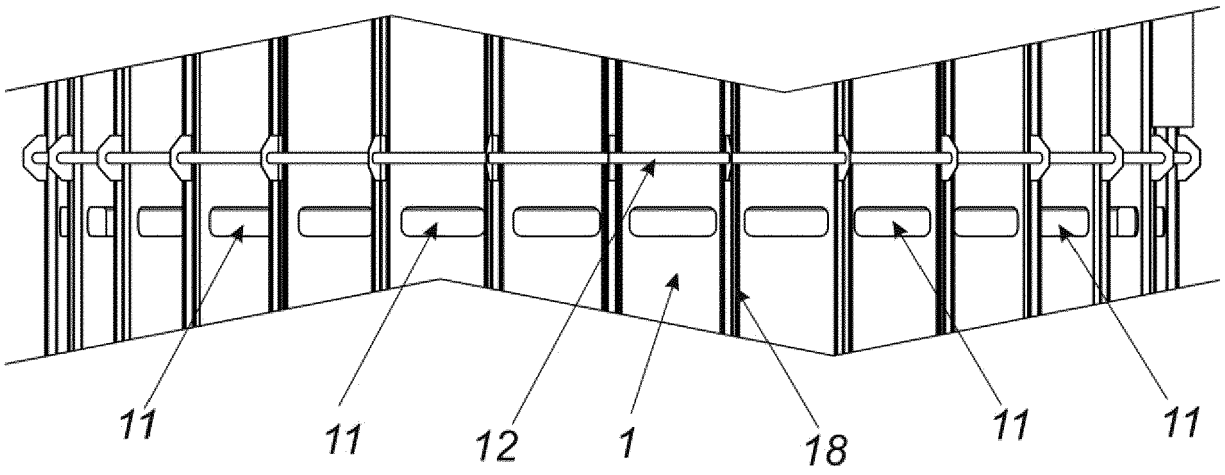


FIG. 4

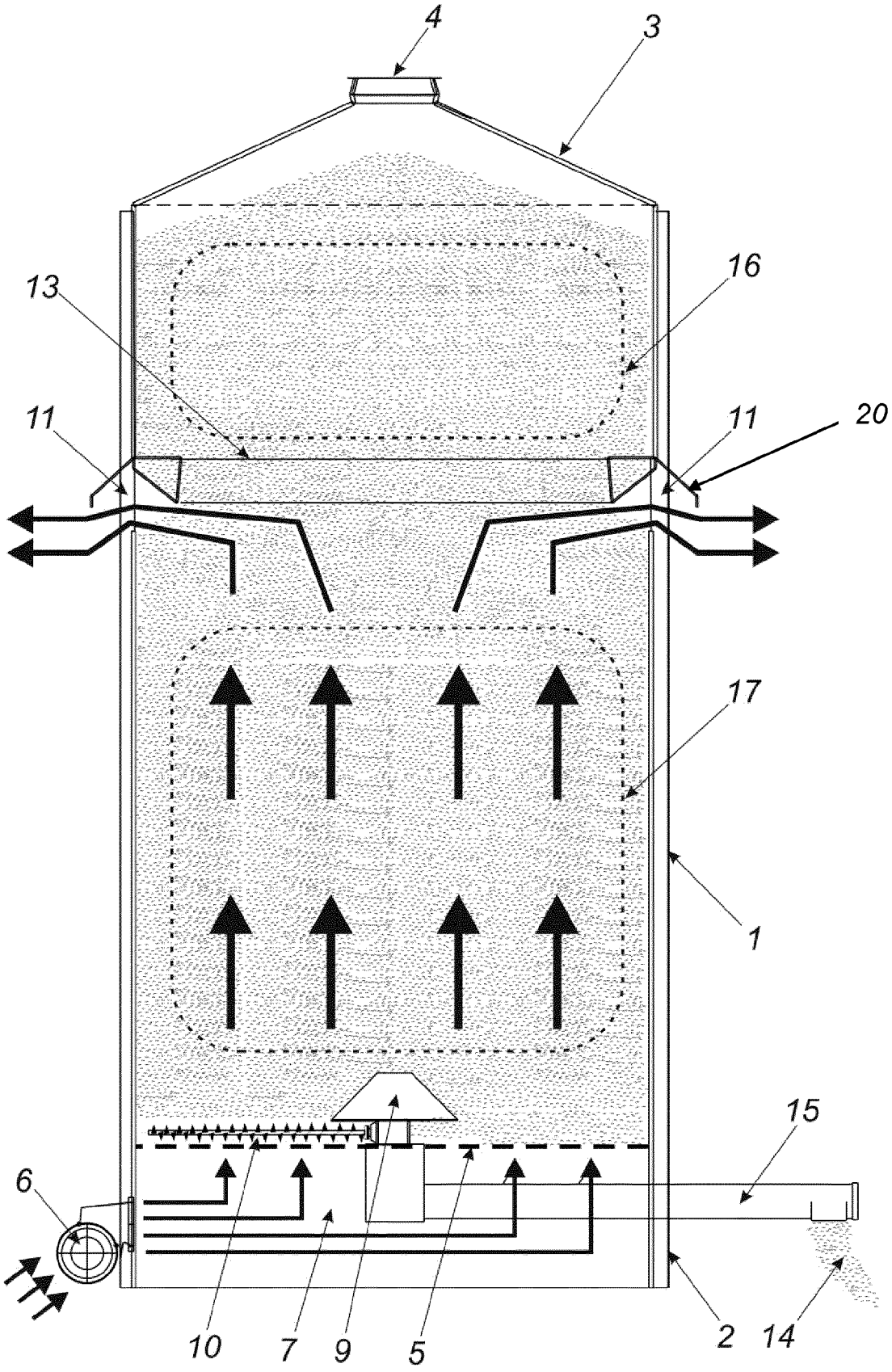


FIG. 5

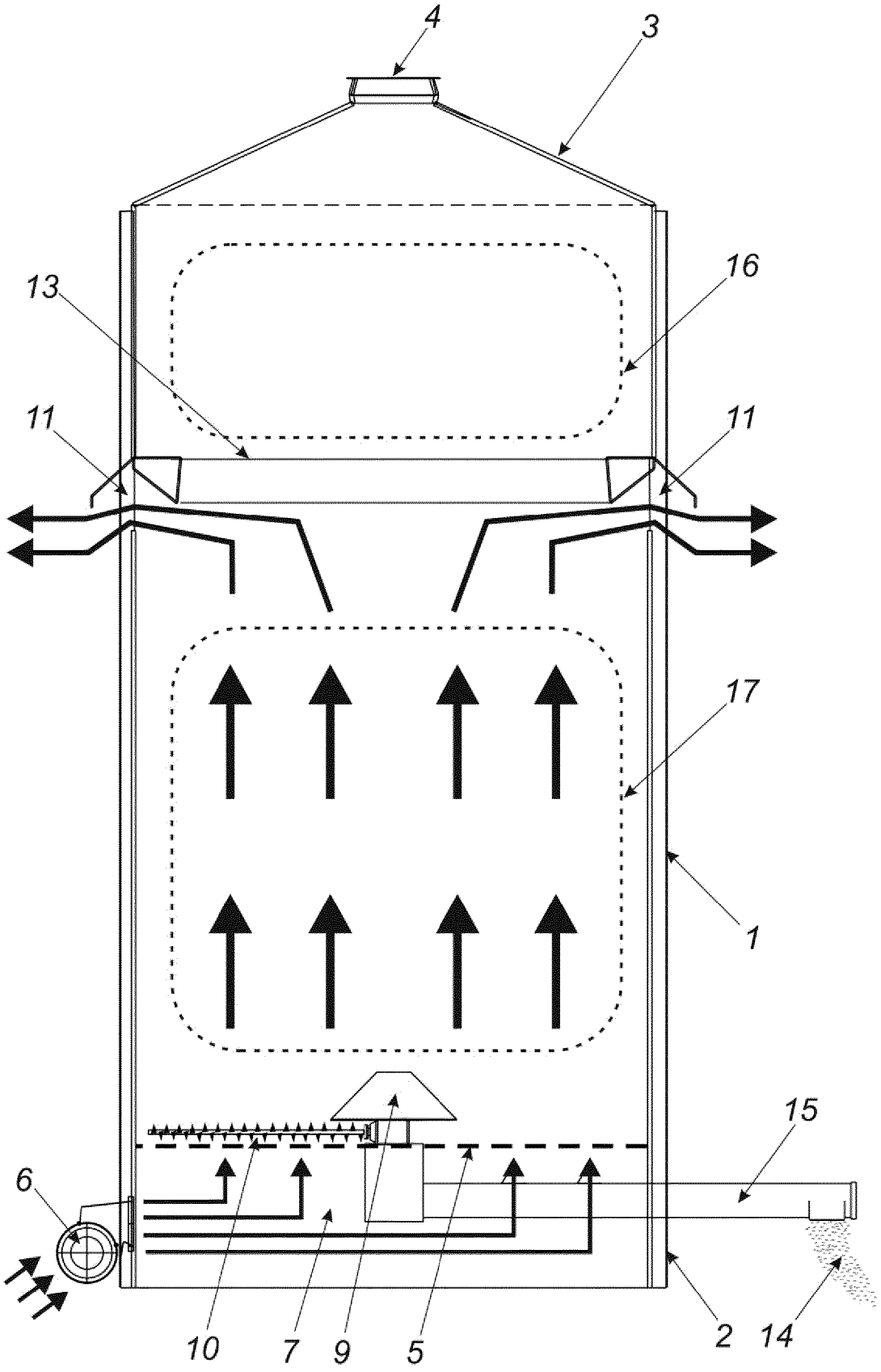
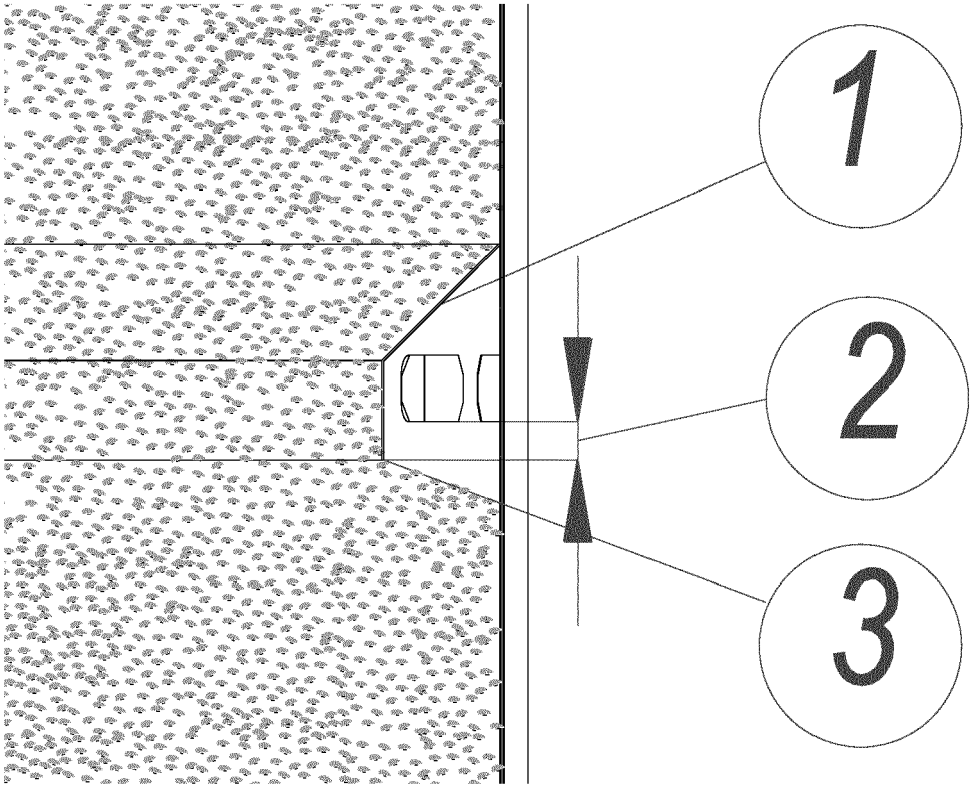


FIG. 6



1 SLOPE OF RING

2 DIMENSION FOR GRAIN CONTAINING

3 NATURAL SLOPE OF GRAIN

FIG 7

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EUROPEAN SEARCH REPORT

Application Number
EP 23 15 7045

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

Place of search	Date of completion of the search	Examiner
The Hague	31 July 2023	Makúch, Milan

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