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(54) Title: DEVICE FOR DISCHARGING POWDERY MATERIAL

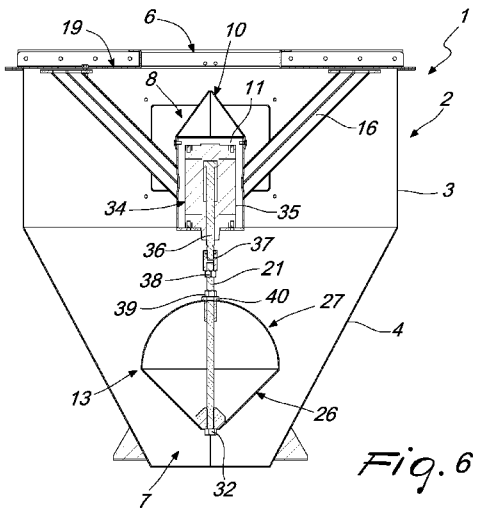


Fig. 6

(57) Abstract: A device for discharging powdery material, constituted by a hopper (2) provided with an upper loading opening (6) and with a lower discharge opening (7) and provided internally with a valve (13) for temporary closure or throttling of the discharge opening (7). Inside the hopper (2), which is fixed, there are means (12) adapted to allow and control the manual or automatic vertical movement of the valve (13) and a radial element (8) for dispersion which is arranged below the upper loading opening (6) and accommodates or does not accommodate the means (12).

DEVICE FOR DISCHARGING POWDERY MATERIAL

The present invention relates to a device for discharging powdery material which is of particular use in the loading of powdery materials and granules on all means of transport or in systems for movement, such as for example tank trucks.

One of the problems that such type of use has to deal with is substantially that of operating without emissions of dust.

Nowadays EP1699713B1 is known in which an apparatus is disclosed for discharging powdery material; such solution claims an apparatus for discharging material which is adapted to control the discharge of flowable material which is transported through a conical hopper, the hopper being configured and arranged, in use, to be useable at a height above a discharge heap, the apparatus including the hopper having an inlet opening adjacent to the top of the hopper and an open discharge outlet at the base of the hopper, the hopper being adapted to be suspended below a support frame by way of hopper support members, the discharge outlet being exposed to the surrounding environment such that, in use, flowable material is discharged through the open discharge outlet, and a valve means being configured and arranged in the hopper, the valve means being adapted to be suspended below the support frame and including a bulbous lower end portion with an inverted conical shape such that the bulbous lower end portion tapers toward a central point, the bulbous lower end portion being positionable adjacent to the discharge outlet forming a gap between the internal wall of the hopper and the bulbous lower end portion, for material that, in use, flows by gravity through and out from the open discharge outlet, the valve means and/or the hopper being adapted to move relative to each other, in use, in order to control the rate of continual discharge through the gap in order to form a solid column of material passing through, in order to reduce the quantity of dust that is dispersed in the surrounding environment.

Such known solution however suffers the drawback of not permitting

an optimal reduction of the formation of dust which is thus still discharged outside the hopper through the discharge outlet.

Furthermore, the presence of the support frame, below which the apparatus is suspended, requires the use of support members for the hopper which are constituted by springs: when the product to be inserted in the hopper is changed, it is also necessary to calibrate it, which necessitates a plant shutdown and time to find the optimal solution for the product handled (for example wheat instead of sunflower seeds).

Furthermore the bulbous portion has a lower end which has an inverted conical shape: such shape does not make it possible to achieve an optimal closure of the discharge outlet, which thus remains slightly open even in the condition in which it should block the outflow of material.

Finally the valve means has, above the bulbous portion, a triangular superstructure: this shape structure causes problems because, once the hopper is filled until it reaches a certain weight, the outer lateral surface of the triangular superstructure generates a downward force that tends to make the discharge outlet open.

The aim of the present invention is therefore to resolve the above mentioned technical problems, eliminating the drawbacks in the cited known art and therefore providing a device that makes it possible to achieve the discharge of powdery material through a hopper while at the same time preventing the outflow, together with the discharged material, of dust as well.

Within this aim, an object of the invention is to provide a device that makes it possible to achieve the discharge of powdery material through a hopper while preserving the integrity of the discharge outlet and preventing its accidental opening owing to the weight of the material contained in the hopper.

Another object of the invention is to provide a device that is structurally simple, is low cost, and can be made with the usual

conventional systems.

This aim and these and other objects which will become better apparent hereinafter are achieved by a device for discharging powdery material, constituted by a hopper provided with an upper loading opening and with a lower discharge opening and provided internally with a valve for temporary closure or throttling of said discharge opening, characterized in that inside said hopper, which is fixed, there are means adapted to allow and control the manual or automatic vertical movement of said valve and at least one element for radial dispersion of the powdery material which is arranged below said upper loading opening and accommodates or does not accommodate said means.

Further characteristics and advantages of the invention will become better apparent from the detailed description of a particular, but not exclusive, embodiment, which is illustrated by way of non-limiting example in the accompanying drawings wherein:

Figure 1 is a first perspective view of a device according to the invention;

Figure 2 is a view from above of the device;

Figure 3 is a cross-sectional view taken along the line III-III in Figure 2;

Figure 4 is a partially cutaway perspective view of the device;

Figure 5 is a view from above of the device in the previous figure;

Figure 6 is a cross-sectional view taken along the line VI-VI in Figure 5;

Figure 7 is a view of a detail of the device;

Figure 8 is a further partially cutaway perspective view of the device;

Figures 9 to 14 show in three views, of which one is a view from above, one a side view and one a cross-sectional view taken along the line XIV-XIV in Figure 12, of a different embodiment of the device for discharging powdery material according to the invention.

In the embodiments illustrated, individual characteristics shown in relation to specific examples may in reality be interchanged with other, different characteristics, existing in other exemplary embodiments.

With reference to the figures, the reference numeral 1 generally designates a device for discharging powdery material which is constituted by a hopper 2, which is fixed and constituted by a cylindrical first enclosure 3 overlying a frustum-shaped second enclosure 4 with the vertex 5 directed downwardly.

At and axially with respect to the first enclosure 3, there is an upper loading opening 6 which is polygonal, preferably square, in plan view.

At the second enclosure 4 there is, at the vertex 5, a lower discharge opening 7 for discharging the powdery material, which in plan view is preferably circular.

Inside the fixed hopper 2 there is, at the first enclosure 3 and below the upper opening 6, a dispersion element 8 of the powdery material.

The dispersion element 8 is arranged in axial alignment with the upper loading opening 6 and is ogive-shaped so as to define a cylindrical body 8a with a flat base 9 and a tip 8b the vertex 10 of which is directed toward the upper loading opening 6.

The dispersion element 8 interacts with means 12 adapted to allow the manual or automatic vertical movement of a valve 13 for closure or throttling.

The outer lateral surface 14 of the dispersion element 8 is coupled to the inner lateral surface 18 of the upper wall 19 of the first enclosure 3 by way of adapted supports 16, which are advantageously arranged inclined.

Advantageously the diameter of the base 9 is smaller than the projection thereon of the upper opening 6.

The valve 13 is shaped substantially like an upside-down ogive so as to define a tip 26, with the vertex radiused and directed toward the lower discharge opening 7 for discharging the powdery material, and a body 27,

which is substantially hemispherical and directed toward the upper loading opening 6.

The means 12 adapted to allow the manual vertical movement of the closure or throttling valve 13 are constituted by a threaded first screw 21 of which a first end 28, directed toward the upper loading opening 6, is associated within a complementarily-threaded seat provided on the flat base 9 of the dispersion element 8.

A first complementarily-threaded nut 30 locks the first screw 21 at the base 9 of the dispersion element 8.

Alternatively, the first end 28 of the first screw 21 is welded to the base 9.

The second end 31 of the first screw 21 protrudes freely beyond the tip 26 and is associated therewith, in a preset position, by way of the use of an adapted second complementarily-threaded nut 32 which abuts against the outer lateral surface of the tip 26.

The first screw 21 further passes freely at an adapted hole provided axially with respect to the body 27 of the valve 13, and is associated therewith by way of an adapted first bush 33 for guiding which is provided with an adapted dustproof gasket.

The adjustment of the positioning of the second nut 32 and of the first bush 33 makes it possible to define the desired positioning of the valve 13 inside the second enclosure 4.

The position that the valve 13 is made to assume depends on the material being handled and no external controls are required in order to indicate its position.

The means 12 adapted to allow the automatic vertical movement of the closure or throttling valve 9 are constituted by a pneumatic cylinder 34 arranged inside the receptacle 11 provided inside the dispersion element 8, which in this case is therefore internally hollow.

The pneumatic cylinder 34 is constituted by a body 35 within which a

stem 36 is slideably associated and can extend and retract in the direction of the lower opening 7.

The end tip of the stem 36 is interconnected, by way of a second bush 37, with the first screw 21, while a third complementarily-threaded nut 38 locks the mutual position thereof.

The first screw 21 still passes through the body 27 of the valve 13 and is locked, at its second end 31, by the second nut 32.

The second nut 32 and a fourth nut 39, which is arranged adjacent to the first end 28 of the first screw 21 with the interposition of a T-shaped sleeve 40, clamp the valve 13 in the manner of a vise.

There is further a sensor 41 arranged on the outer lateral surface of the first enclosure 3 in a region proximate to the interconnection with the second enclosure 4: the sensor 41 checks, inside the hopper 2, the fill level thereof and causes, by way of an adapted centralized logic, the travel of the stem 36 so as to optimize the discharge of powdery material.

Such travel of the stem 36 is delimited by adapted magnetic stroke limiters 42a, 42b which are associated with the pneumatic cylinder 34.

The magnetic stroke limiters 42a, 42b make it possible to control the vertical movement of the valve 13. A preset level of product is always kept inside the hopper 2. The sensor 41 is paired with a timer that controls the movement of the stem 36 on the basis of preset data for the product being processed; depending in fact on whether it is maize, or sunflower seeds or soya beans etc. that is being processed, a time can be set for the product to fall inside the hopper 2.

In the automatic vertical movement of the closure or throttling valve 9, the level sensor 41 advantageously works with the timer; when the powdery product triggers the sensor 41 because it has reached a determined level, the timer starts and after a set time it makes the stem 36 of the pneumatic cylinder 34 move.

In the embodiment shown in Figures 9 to 14, the reference numeral 1

generally designates a device for discharging powdery material in which the dispersion element 8 is, in the particular embodiment shown, substantially conical and its base 9 lies substantially at the plane of division between the first enclosure and the second enclosure 3, 4.

The dispersion element 8 in turn has a vertex 10 directed in the direction of the overlying upper loading opening 6, the height of the cone that constitutes the dispersion element 8 coinciding substantially with the central axis of the upper loading opening 6.

The dispersion element 8 is internally hollow so as to define a receptacle 11 for means 12 adapted to allow the vertical movement of the closure or throttling valve 13.

At the outer lateral surface 14 of the dispersion element 8 there is a plurality of wings 15 which, starting from the vertex 10, extend according to a helical pattern in the direction of the base 9.

Advantageously the dispersion element 8 is also supported by way of adapted supports or brackets or bars 16 which connect the perimetric edge 17 of the base 9 to the overlying inner lateral surface 18 of the upper wall 19 of the first enclosure 3.

Advantageously the diameter of the base 9 is, at least partially, slightly greater than the projection thereon of the upper opening 6.

The means 12 adapted to allow the vertical movement of the closure or throttling valve 13 are constituted by a gearmotor 20 which is adapted to move an adapted first screw 21 which has an axis that coincides substantially with the height of the dispersion element 8.

The gearmotor 20 is actuated by way of an adapted shaft 22 which is arranged along an axis that is perpendicular to that of the first screw 21 and protrudes outside the hopper 2 through an adapted opening 23 provided on the outer lateral surface of the first enclosure 3.

The shaft 22 is connected to an adapted motor 24 which is supported, by way of an adapted bracket 25, on the outer lateral surface of the first

enclosure 3.

The end of the first screw 21 which is directed in the direction of the discharge opening 7 is associated with the closure or throttling valve 13, which has the shape of a solid, preferably a sphere with a diameter that is greater than the diameter of the lower discharge opening 7.

Thus it has been found that the invention fully achieves the intended aim and objects, in that a device has been obtained which makes it possible to achieve the discharge of powdery material which, thanks also to the presence of the dispersion element, is forced to flow with radial dispersion inside the hopper proper so as to achieve the optimal distribution of the material inside it, while preventing the formation and outflow, together with the discharged material, of dust.

Use of the means 12 makes it possible to adjust, manually or automatically, the vertical movement of the closure or throttling valve 13 which makes it possible to optimally adjust, slow or close the flow of the product as a function of the flow-rate and/or of its specific weight and/or of its type, all in a very rapid and simple manner.

Furthermore the invention, by providing for the use of a hopper that is fixed, and therefore without springs, can be used for loading bins and tanks for trucks or goods wagons of trains or holds of ships, or it can be applied to discharge pipes.

Last but not least, the invention is structurally simple and low cost.

Obviously, the invention is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

Obviously the materials used as well as the dimensions of the individual components of the invention may be more relevant according to specific requirements. The characteristics indicated above as advantageous, convenient or the like, may also be missing or be substituted by equivalent characteristics.

The content of Italian utility model application no. MI2015U000035

(202015902330244), the priority of which is claimed in the present application, is incorporated as a reference.

Where the technical features mentioned in any claim are followed by reference numerals and/or signs, those reference numerals and/or signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference numerals and/or signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference numerals and/or signs.

CLAIMS

1. A device (1) for discharging powdery material, constituted by a hopper (2) provided with an upper loading opening (6) and with a lower discharge opening (7) and provided internally with a valve (13) for temporary closure or throttling of said discharge opening (7), characterized in that inside said hopper (2), which is fixed, there are means (12) adapted to allow and control the manual or automatic vertical movement of said valve (13) and at least one element (8) for radial dispersion of the powdery material which is arranged below said upper loading opening (6) and accommodates or does not accommodate said means (12).

2. The device according to claim 1, characterized in that said hopper (2) is constituted by a first cylindrical enclosure (3) which lies above a second enclosure (4) which is frustum-shaped with the vertex (5) directed downwardly, inside said fixed hopper (2) there being, at said first enclosure (3) and below said upper opening (6), an element (8) for dispersion of the powdery material which is arranged axially with respect to said upper loading opening (6) and is ogive-shaped so as to define a cylindrical body (8a) with a flat base (9) and a tip (8b) the vertex (10) of which is directed toward said upper loading opening (6), the outer lateral surface (14) of said element (8) being coupled to the inner surface (18) of the upper wall (19) of said first enclosure (3) by way of adapted supports or brackets or bars (16), which are advantageously arranged inclined, the diameter of said base (9) being smaller than the projection thereon of said upper opening (6).

3. The device according to claims 1 and 2, characterized in that said valve (13) is shaped substantially like an upside-down ogive so as to define a tip (26), with the vertex radiused and directed toward said lower discharge opening (7) for discharging the powdery material, and a body (27), which is substantially hemispherical and directed toward said upper loading opening (6).

4. The device according to one or more of the preceding claims,

characterized in that said dispersion element (8) interacts with means (12) which are adapted to allow the manual vertical movement of said closure or throttling valve (13), said means (12) being constituted by a threaded first screw (21) of which a first end (28), directed toward said upper loading opening (6), is associated within a complementarily-threaded seat provided on said flat base (9) of said dispersion element (8), a first complementarily-threaded nut (30) locking said first screw (21) at said base (9) of said dispersion element (8).

5. The device according to one or more of the preceding claims, characterized in that said first end (28) of said first screw (21) is welded to said base (9).

6. The device according to one or more of the preceding claims, characterized in that the second end (31) of said first screw (21) protrudes freely beyond said tip (26) and is associated therewith, in a preset position, by way of the use of an adapted second complementarily-threaded nut (32) which abuts against the outer lateral surface of said tip (26), said first screw (21) passing freely at an adapted hole which is provided axially with respect to said body (27) of said valve (13), and being associated therewith by way of an adapted first bush (33) for guiding which is provided with an adapted dustproof gasket.

7. The device according to one or more of the preceding claims, characterized in that said dispersion element (8) interacts with means (12) which are adapted to allow the automatic vertical movement of said closure or throttling valve (13), said means (12) being constituted by a pneumatic cylinder (34) arranged inside the receptacle (11) provided inside said dispersion element (8), said pneumatic cylinder (34) being constituted by a body (35) within which a stem (36) is slideably associated and can extend and retract in the direction of said lower opening (7), the end tip of said stem (36) being interconnected, by way of a second bush (37), with said first screw (21), while a third complementarily-threaded nut (38) locks the

nutual position thereof, said first screw (21) passing through said body (27) and being locked, at its second end (31), by said second nut (32) which, together with a fourth nut (39), which is arranged adjacent to the first end (28) of said first screw (21) with the interposition of a T-shaped sleeve (40), clamp said valve (13) in the manner of a vise.

8. The device according to one or more of the preceding claims, characterized in that it comprises a sensor (41) arranged on the outer lateral surface of said first enclosure (3) in a region proximate to the interconnection with said second enclosure (4), said sensor (41) checking, inside said hopper (2), the fill level thereof and causing, by way of a centralized logic, the travel of said stem (36) so as to optimize the discharge of powdery material, said travel of said stem (36) being delimited by adapted magnetic stroke limiters (42a, 42b) which are associated with said pneumatic cylinder (34).

9. The device according to one or more of the preceding claims, characterized in that said sensor (41) is paired with a timer that controls the movement of said stem (36) on the basis of preset data for the product being processed.

10. The device according to one or more of the preceding claims, characterized in that said closure valve (13) is arranged in a region below said radial dispersion element (8) and above said discharge opening (7), said closure or throttling valve (13) being spherical and being vertically moveable with respect to said hopper (2) by way of a shaft (22) driven by a motor (24) arranged radially and externally with respect to said hopper (2).

11. The device according to one or more of the preceding claims, characterized in that said at least one element (8) for radial dispersion of the powdery material is substantially conical and its base (9) lies substantially at the plane of division between said first enclosure and said second enclosure (3, 4), said dispersion element (8) having a vertex (10) directed in the direction of said, overlying, upper loading opening (6), the height of the

cone that constitutes said dispersion element (8) coinciding substantially with the central axis of said upper loading opening (6).

12. The device according to one or more of the preceding claims, characterized in that at the outer lateral surface (14) of said dispersion element (8) there is a plurality of wings (15) which, starting from said vertex (10), extend according to a helical pattern in the direction of said base (9), said dispersion element (8) being supported by way of brackets or bars (16) which connect the perimetric edge (17) of said base (9) to the overlying inner lateral surface (18) of the upper wall (19) of said first enclosure (3).

13. The device according to one or more of the preceding claims, characterized in that said dispersion element (8) is hollow internally so as to define a receptacle (11) for said means (12) which are adapted to allow the vertical movement of said closure or throttling valve (13), said means (12) being constituted by a gearmotor (20) adapted to move a first screw (21) which has an axis that coincides substantially with the height of said dispersion element (8), said gearmotor (20) being actuated by way of an adapted shaft (22) which is arranged along an axis that is perpendicular to the axis of said first screw (21) and protrudes outside said hopper (2) through an adapted opening (23) provided on the outer lateral surface of said first enclosure (3).

14. The device according to one or more of the preceding claims, characterized in that said shaft (22) is connected to a motor (24) which is supported, by way of an adapted bracket (25), on the outer lateral surface of said first enclosure (3).

15. The device according to one or more of the preceding claims, characterized in that the end of said first screw (21) which is directed in the direction of said discharge opening (7) is associated with said closure or throttling valve (13), which has the shape of a solid such as a sphere with a diameter that is greater than the diameter of said lower discharge opening

(7).

16. The device according to one or more of the preceding claims, characterized in that the diameter of said base (9) is, at least partially, slightly greater than the projection on the base of said upper opening (6).

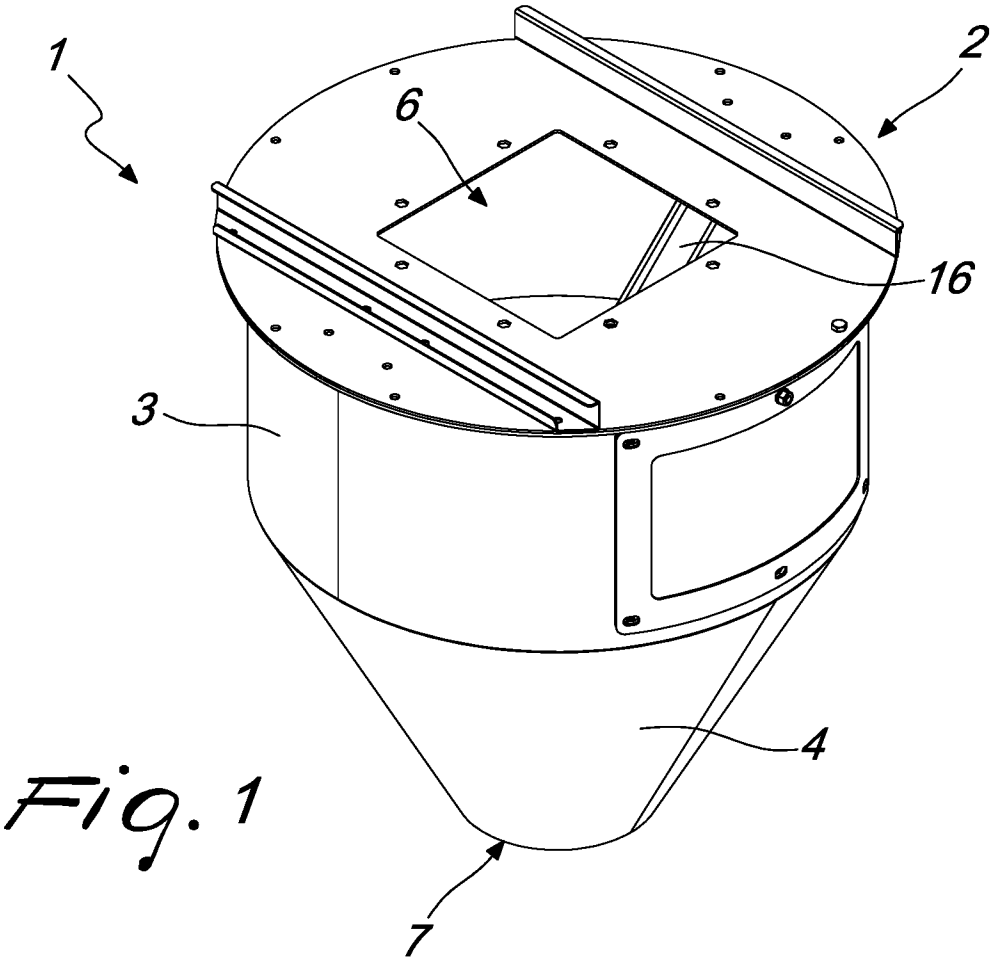


Fig. 1

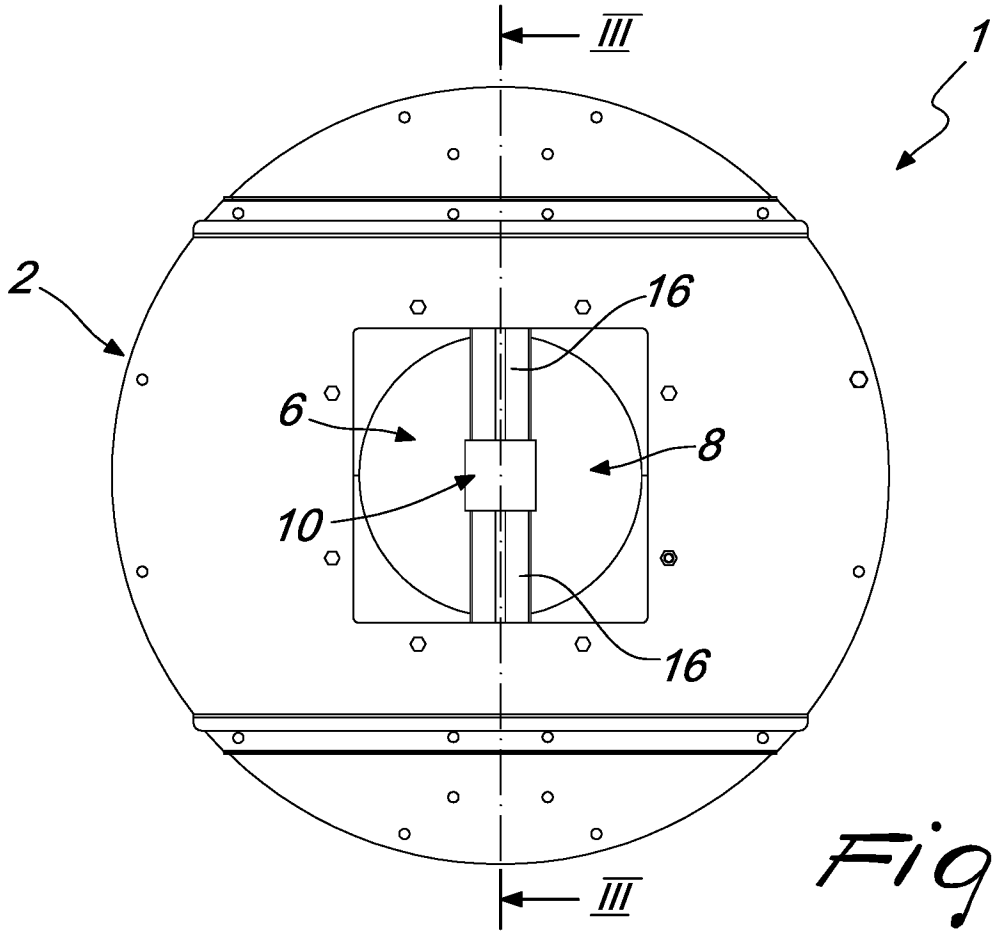


Fig. 2

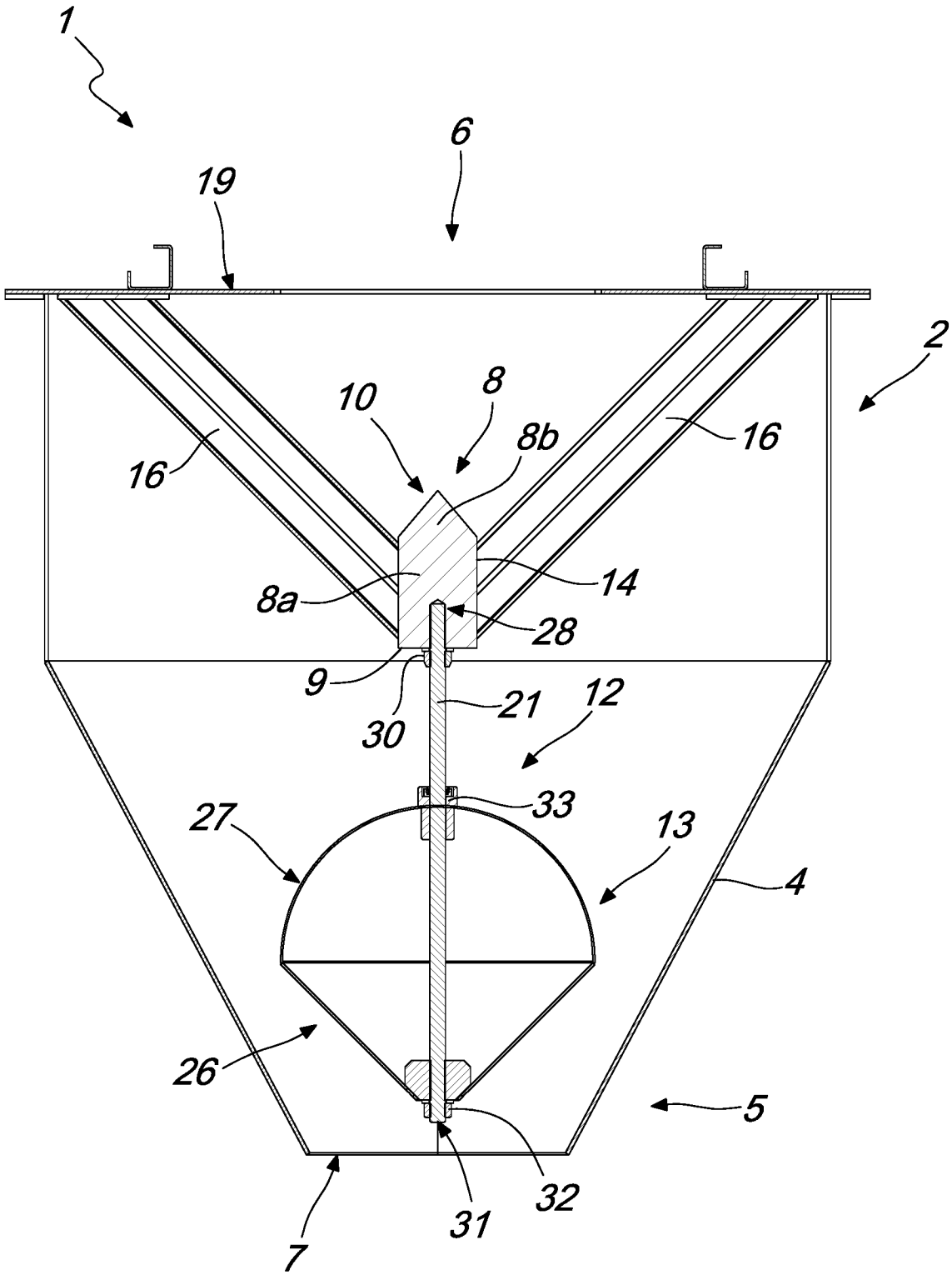


Fig. 3

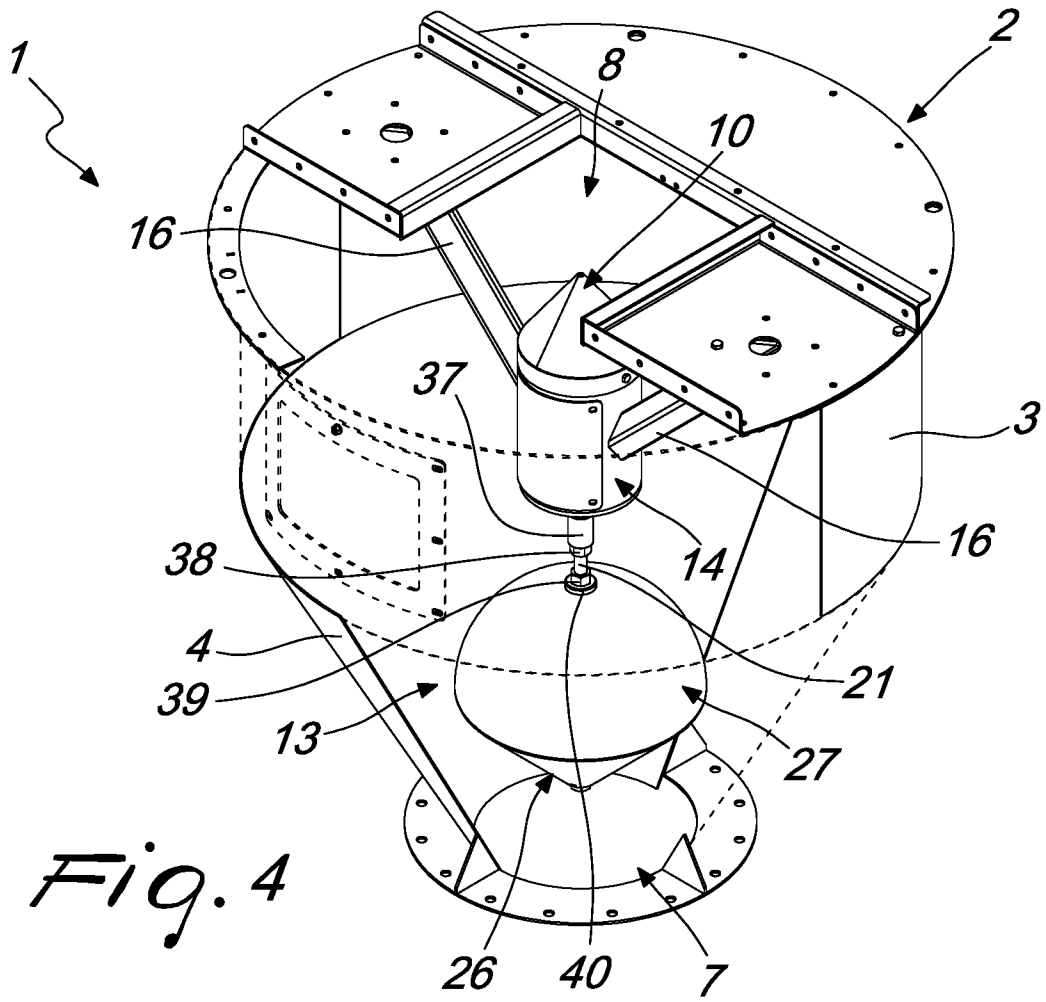


Fig. 4

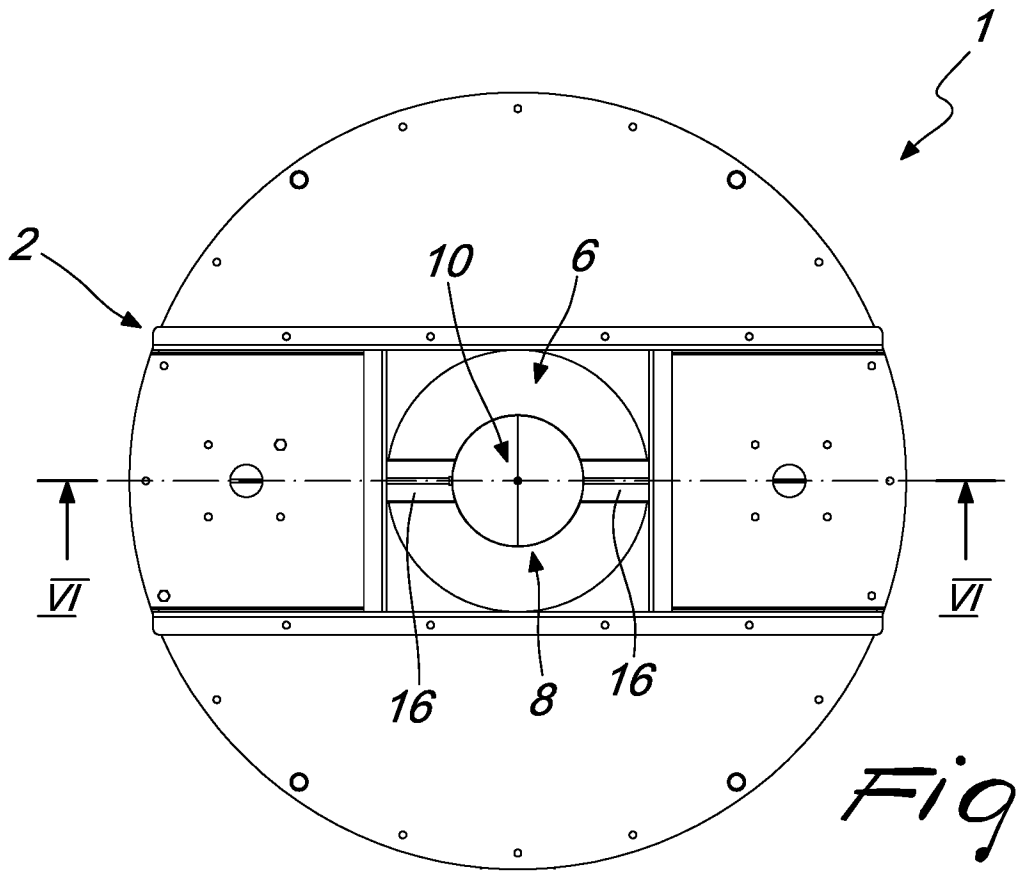


Fig. 5

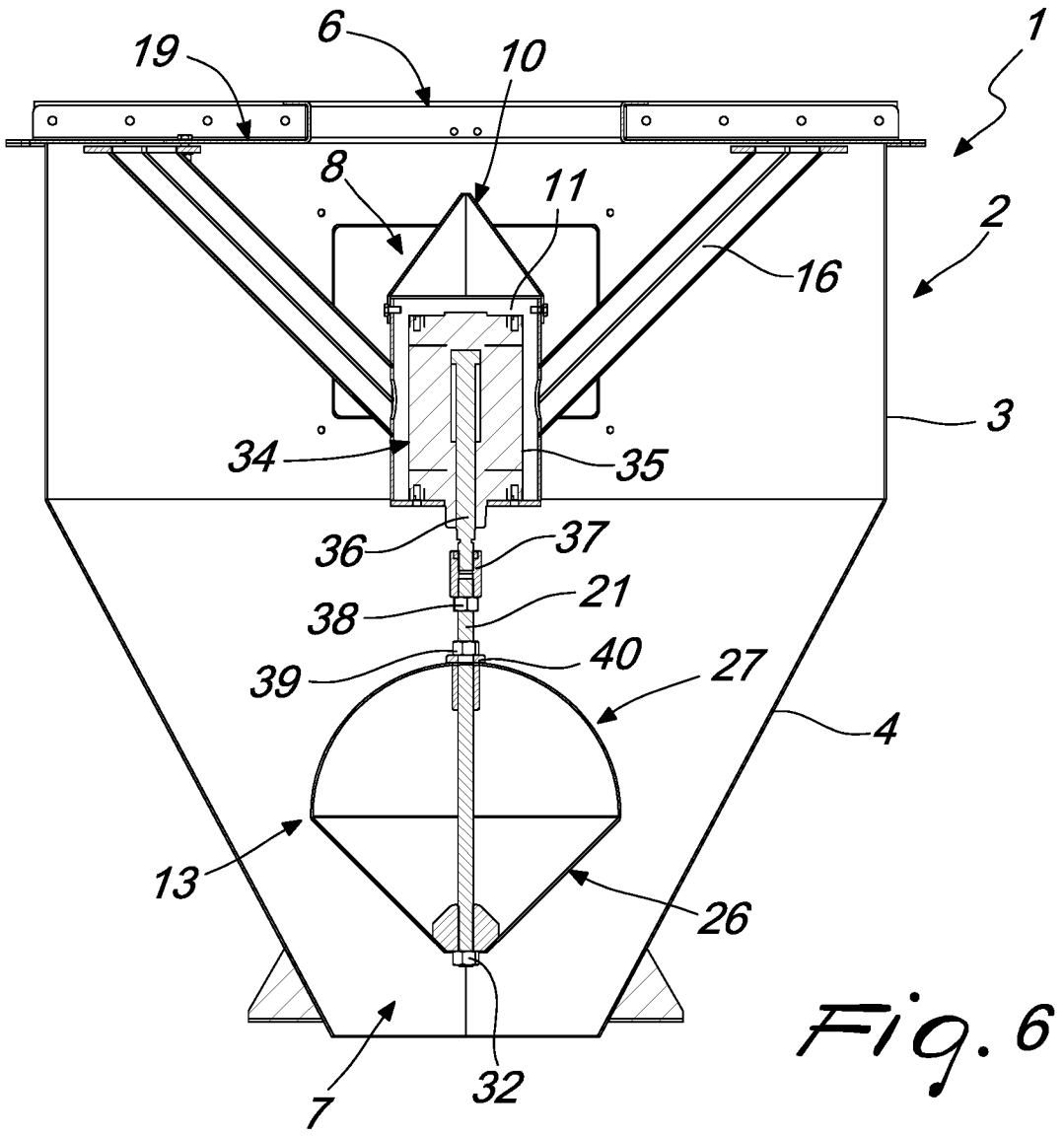

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Fig. 6

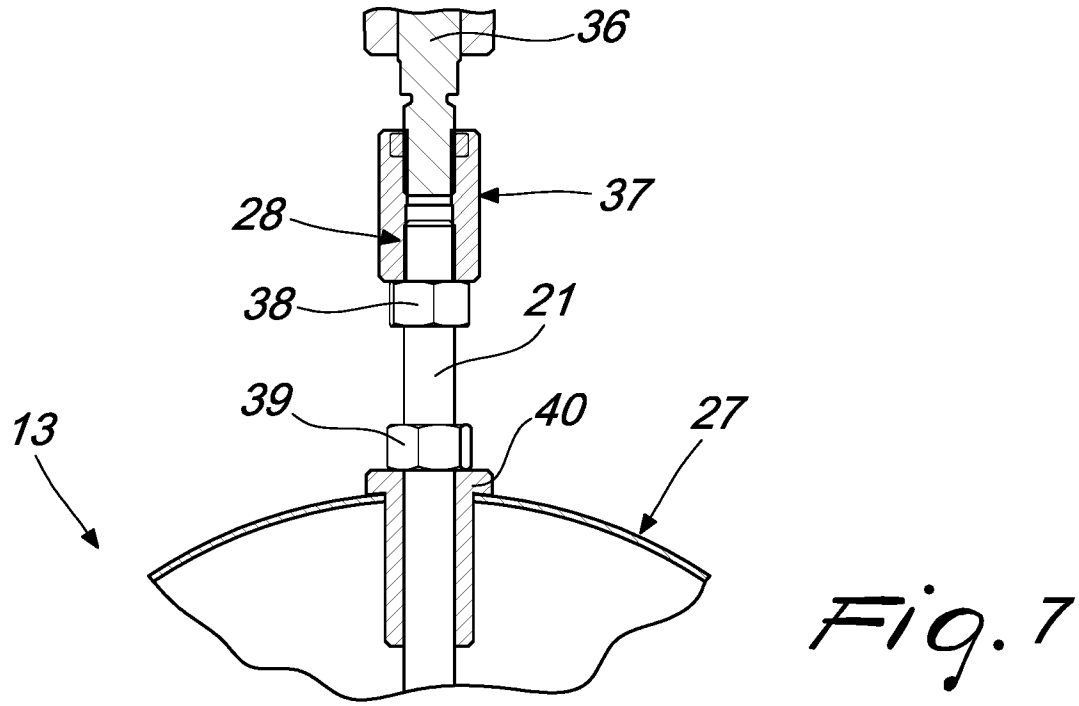

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Fig. 7

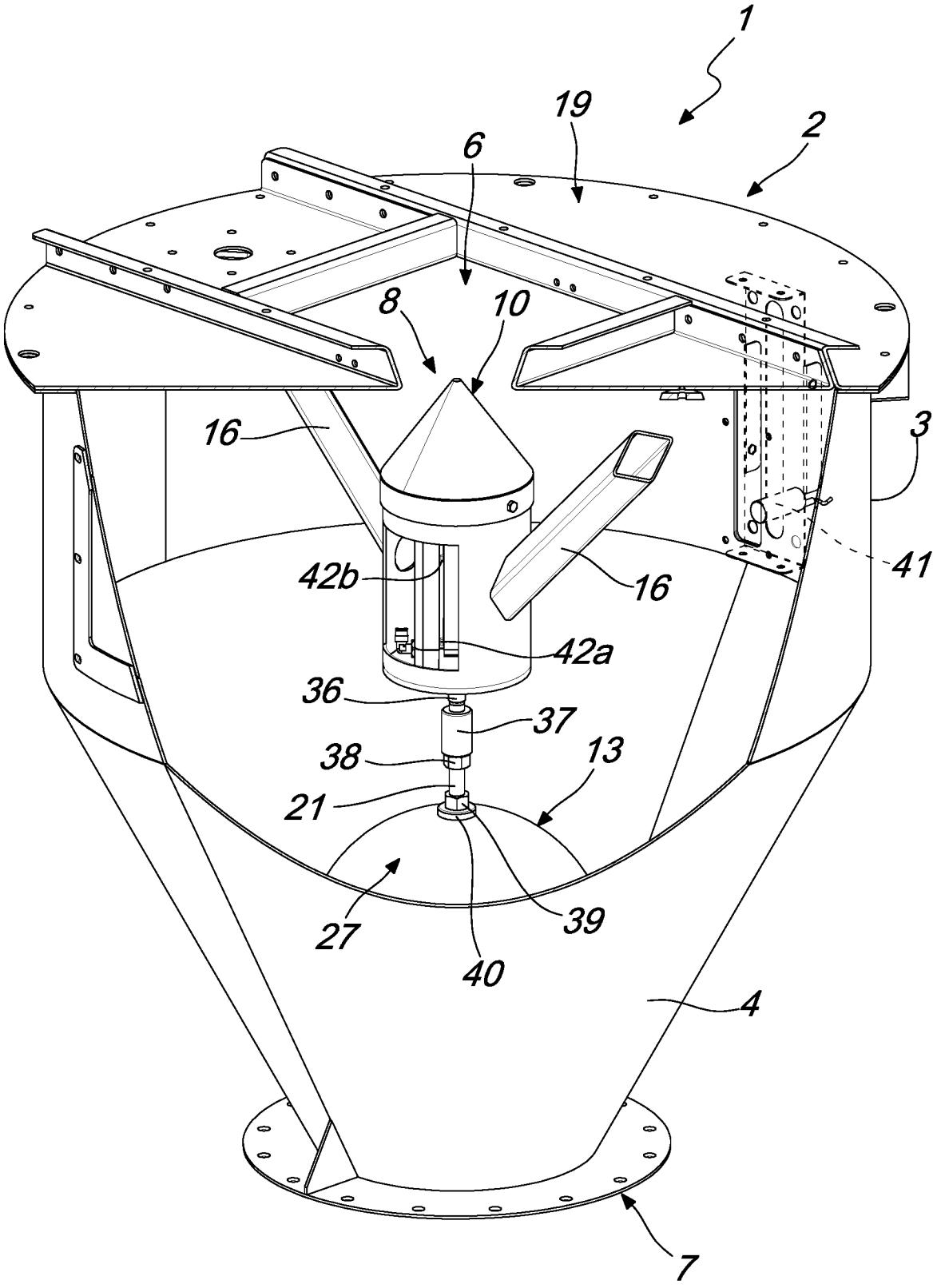


Fig. 8

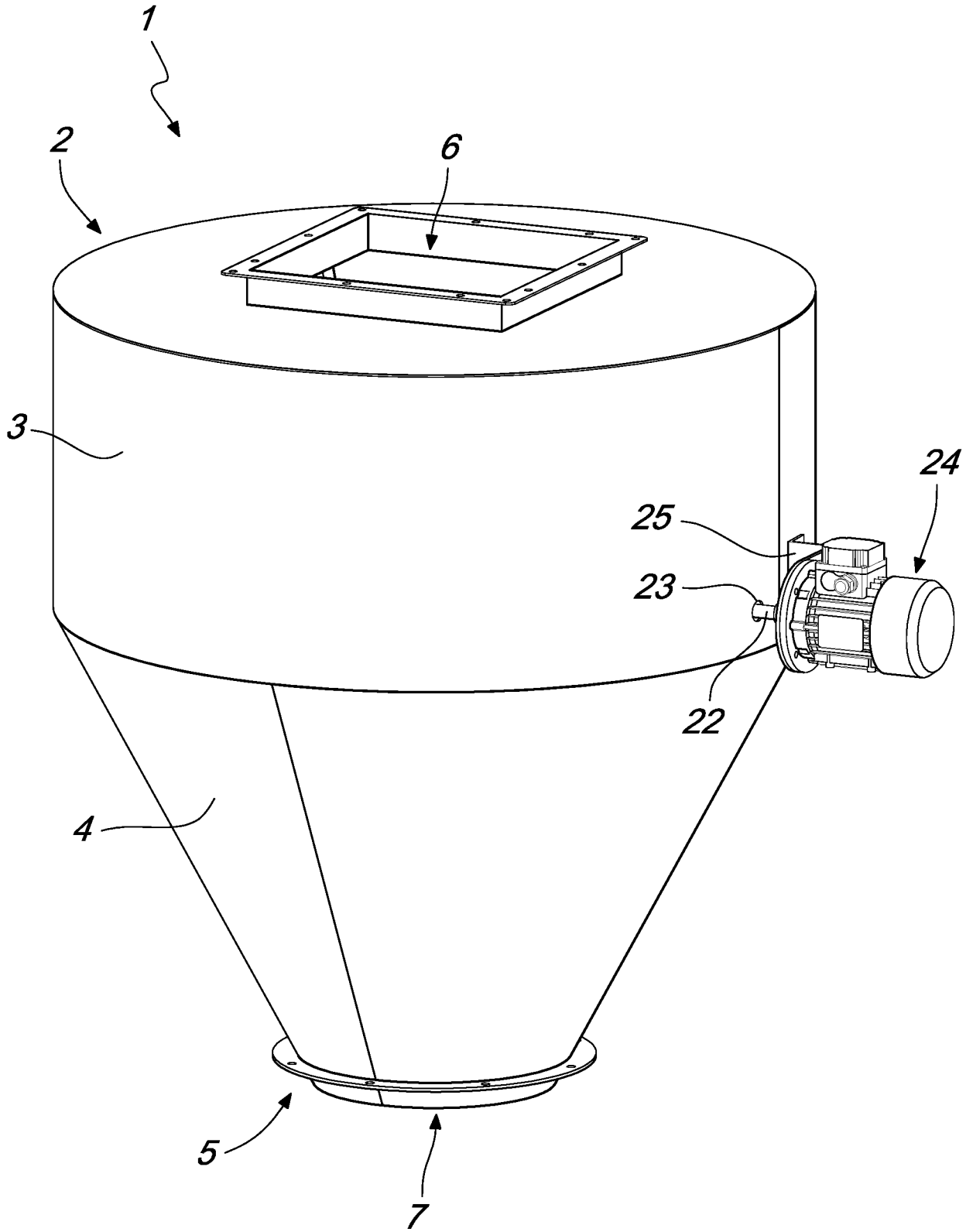


Fig. 9

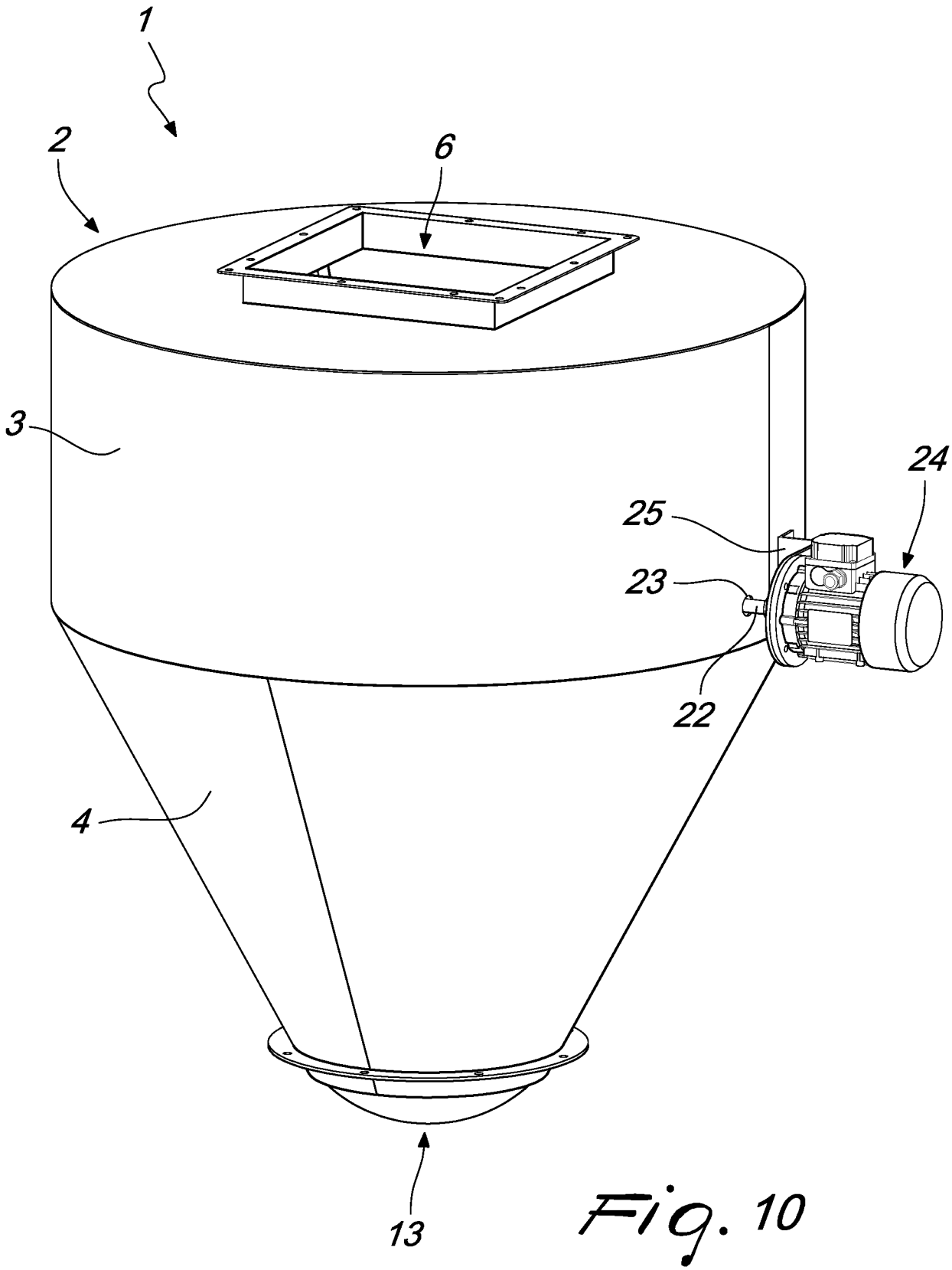


Fig. 10

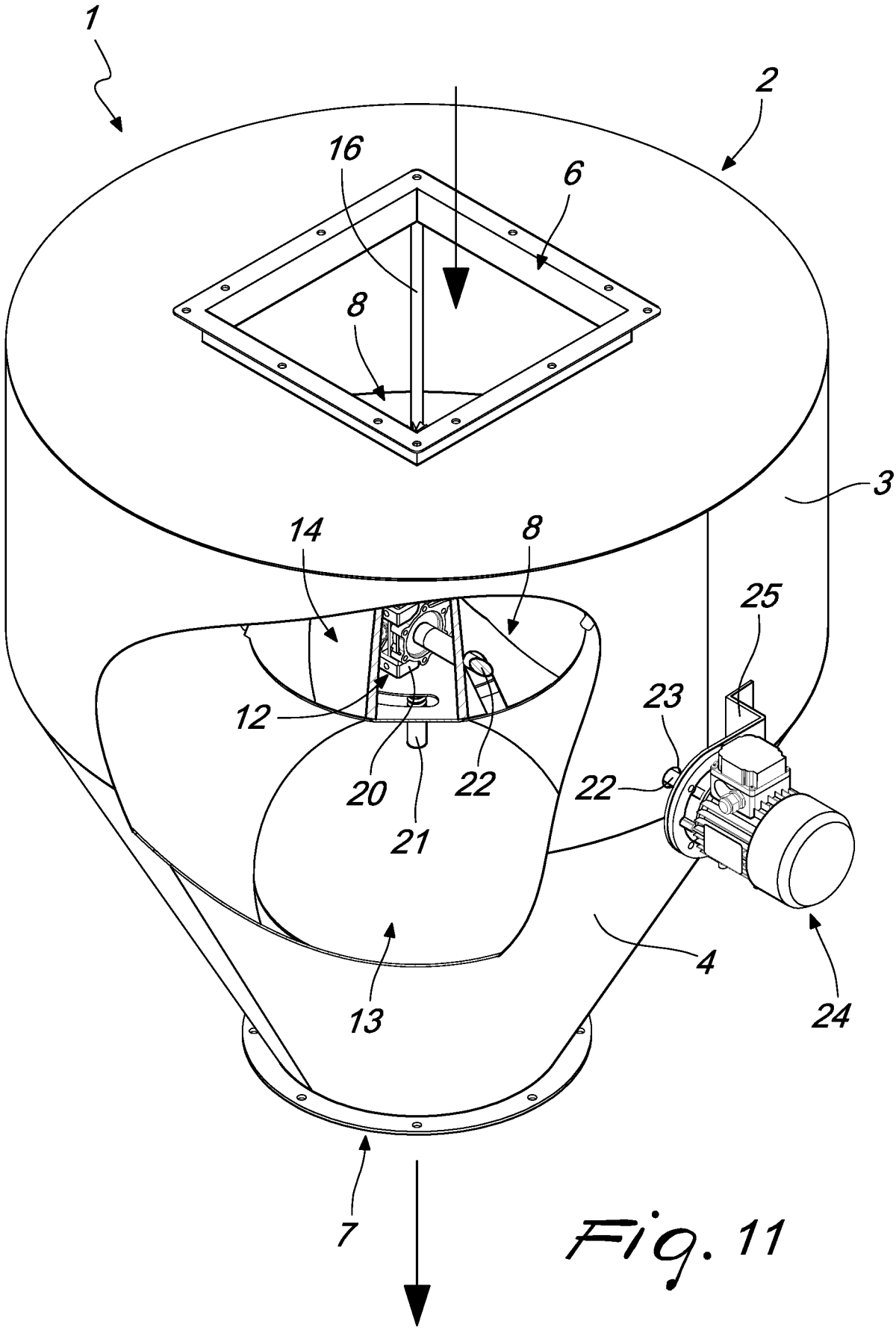


Fig. 11

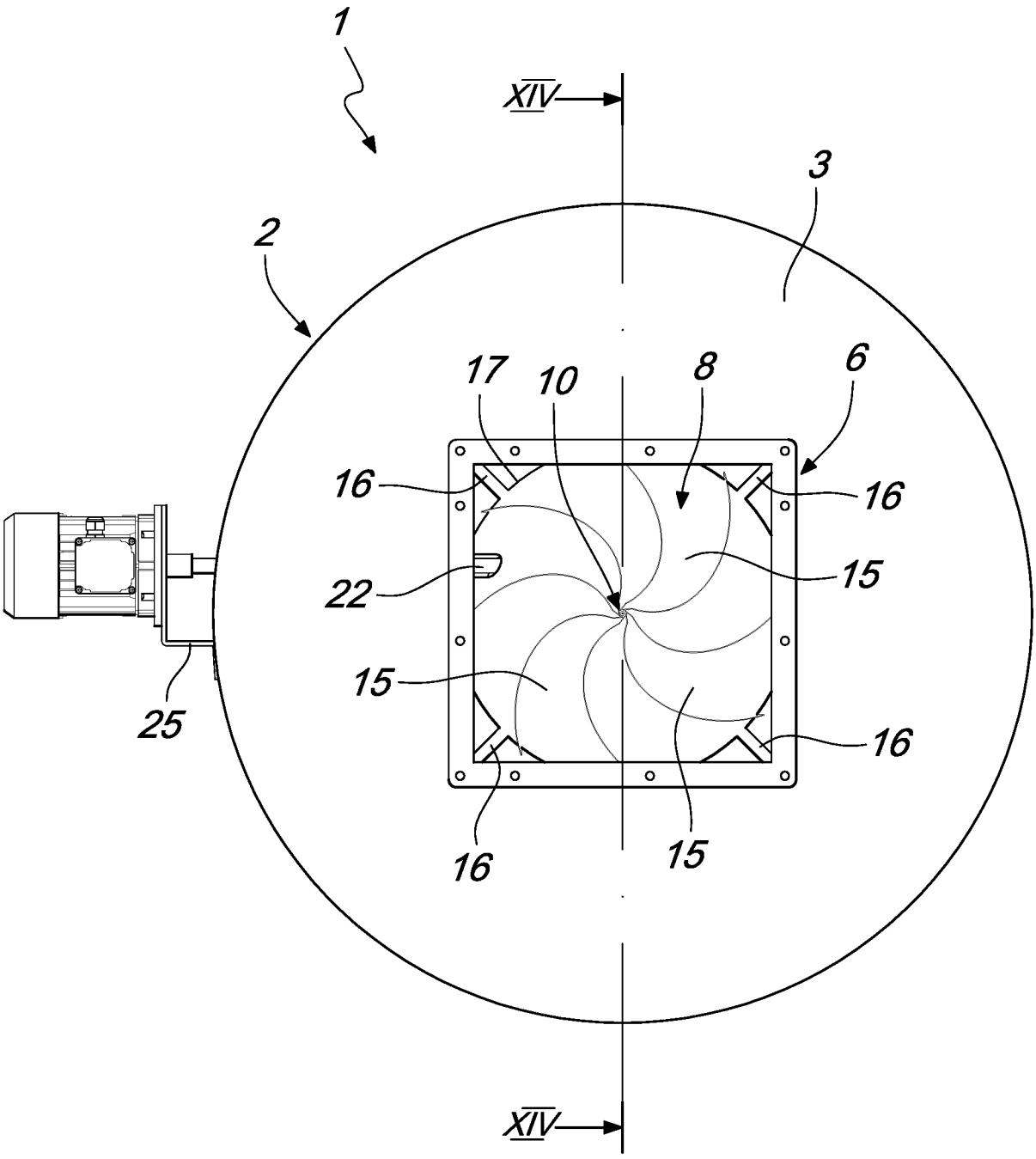


Fig. 12

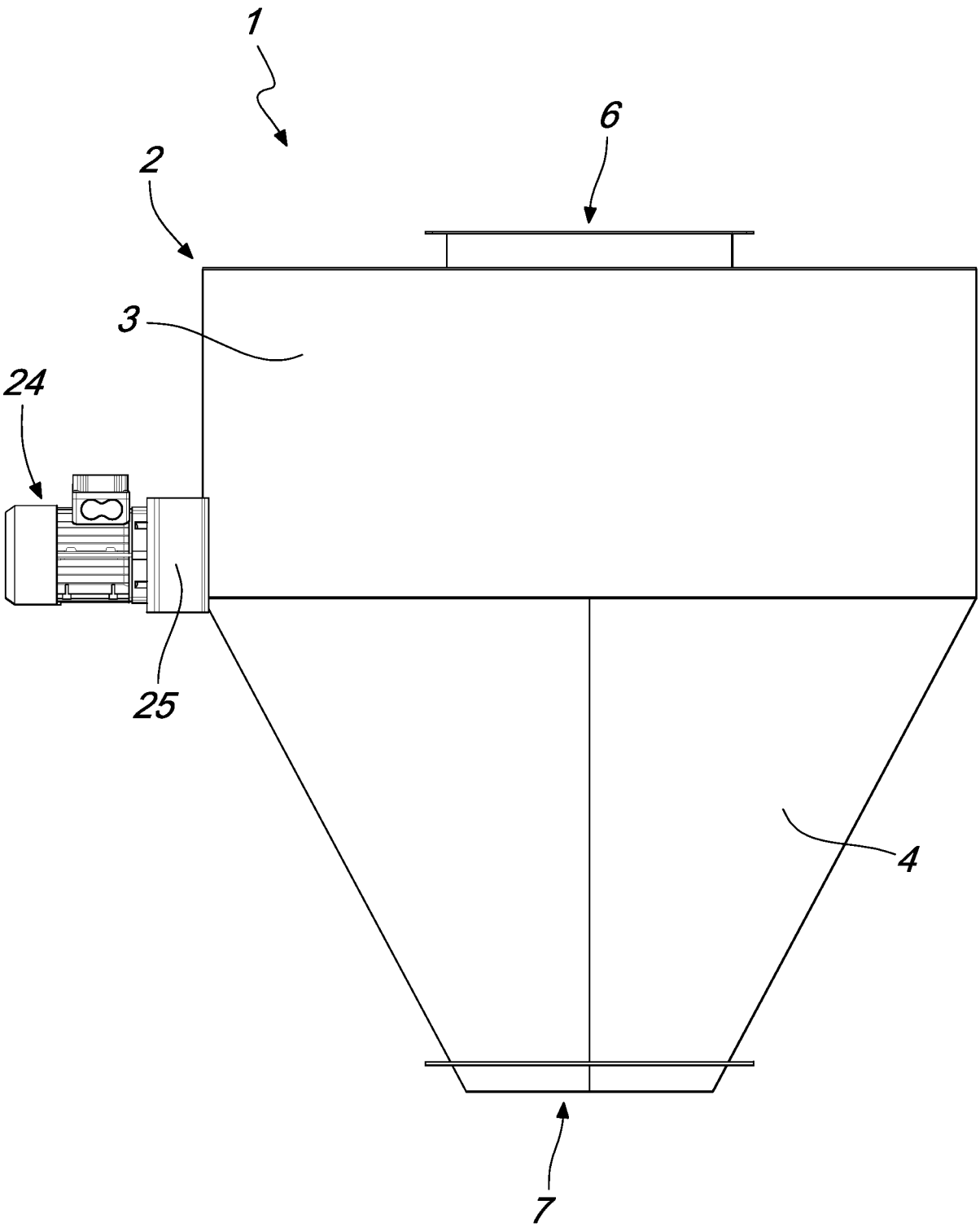


Fig. 13

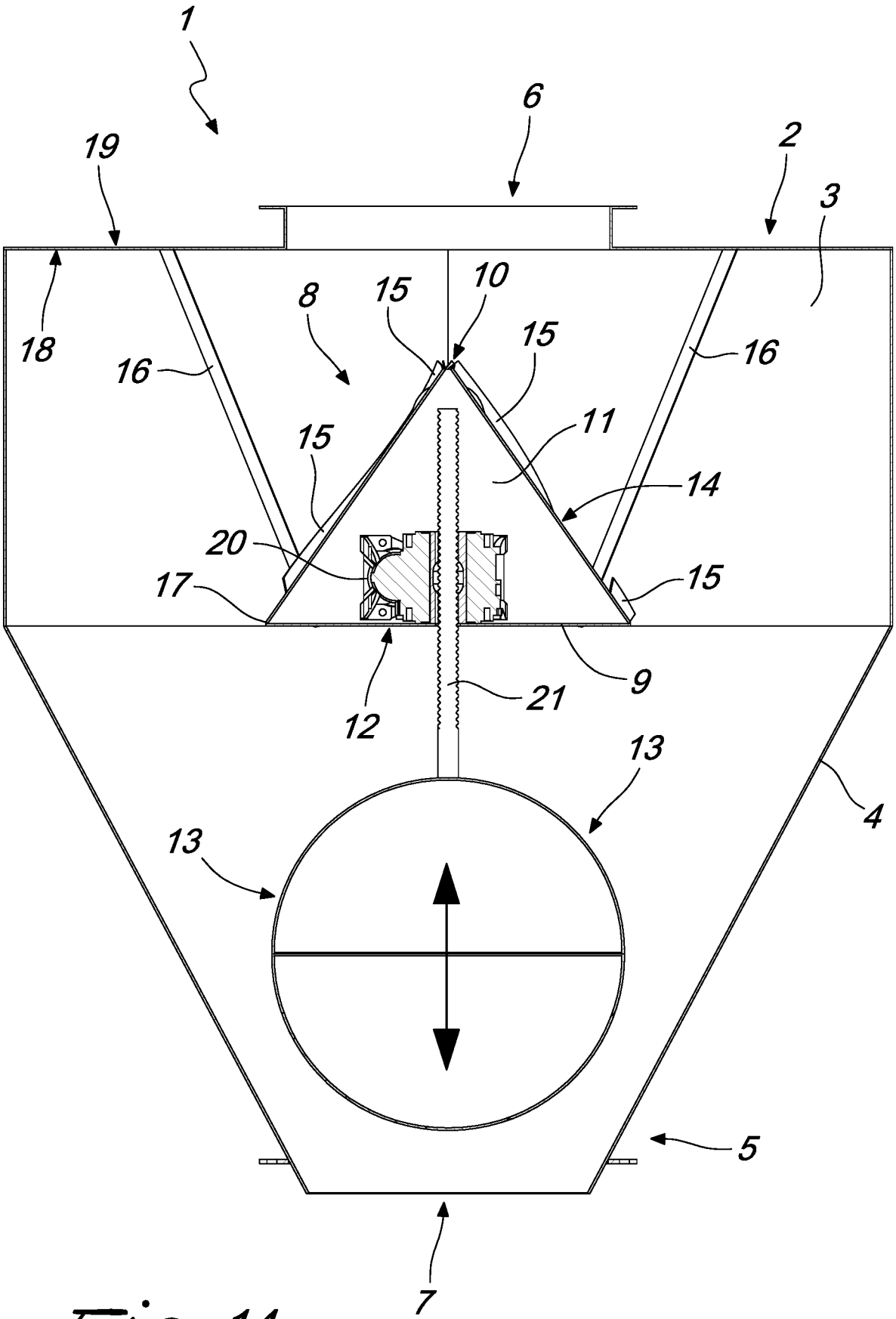


Fig. 14

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/059127

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65G47/19 B65G69/18 B65D90/62 B65G65/40
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65G B65D A01K F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 91 037 B (LUTHERWERKE LUTHER & JORDAN) 13 October 1960 (1960-10-13)	1,2,11
Y	claim 1 figure 1 column 1, line 38 - column 3, line 4	10, 12-14,16
X	US 3 716 172 A (CRIPPEN H) 13 February 1973 (1973-02-13)	1,2,4-6, 15
Y	claim 1 figures 1-5 column 1, line 38 - line 41 column 2, line 61 - column 5, line 51	3,7-9, 13,14

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
10 March 2016	17/03/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Thibaut, Charles

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2015/059127

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 427 280 A1 (BOZEL ELECTROMETALLURGIE [FR]) 28 December 1979 (1979-12-28) claim 1 figure 1 page 1, line 1 - line 4 page 2, line 29 - page 4, line 6	1,13,14
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Y	claim 1 figures 1, 4, 5, 6, 7d,8a, 8b paragraph [0001] paragraph [0012] paragraph [0014] paragraph [0043] - paragraph [0052]	3,12,16
Y	US 5 992 689 A (JOHANSON JERRY R [US]) 30 November 1999 (1999-11-30) claim 1 figures 10-15 column 1, line 6 - line 10 column 2, line 21 - line 31 column 3, line 7 - line 43 column 4, line 60 - column 8, line 17	7-9
Y	CN 203 840 918 U (MUYUAN FOOD CO LTD) 24 September 2014 (2014-09-24) claim 1 figures 1-2 paragraph [0002] paragraph [0021]	10

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2015/059127

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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