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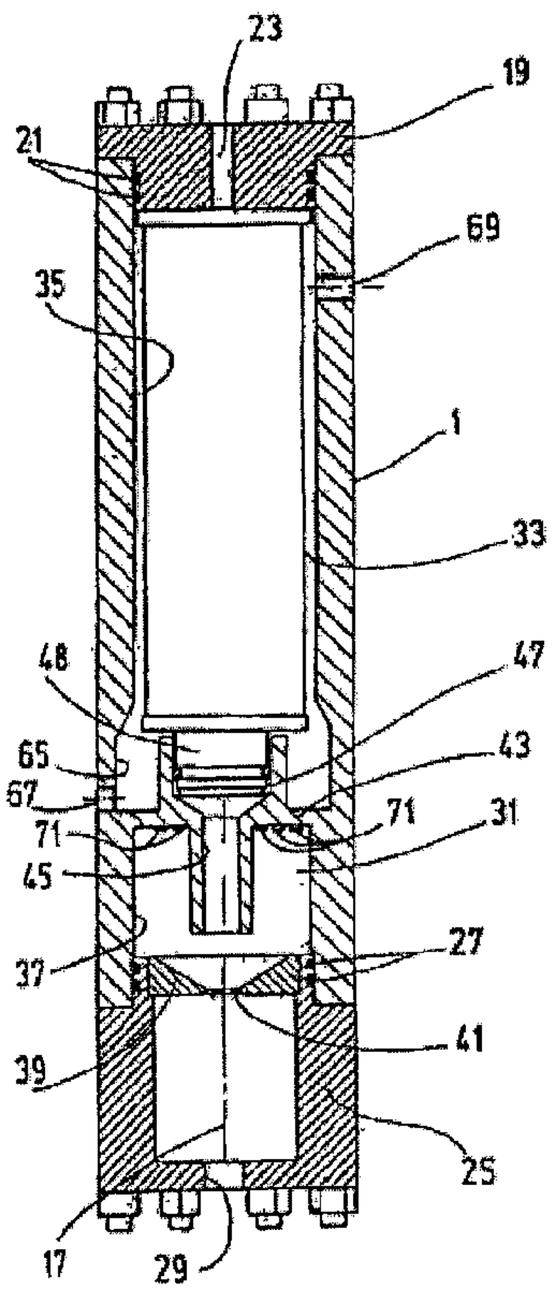


(57) Abrégé/Abstract:
In a system for gas cleaning which has at least one casing (1) with a first chamber (31) into which the gas to be cleaned can be flowed, and with a second chamber (33) from which the cleaned gas exits, wherein a filter device (35) which can be flowed through by the gas is arranged between the chambers mentioned and has filter media both for the separation of solid particles and for dehumidifying the gas by separating out coalesced liquid, the system has, upstream of the filter device (35), an arrangement (11, 37) for preliminary dehumidification of the gas.

ABSTRACT

In a system for gas cleaning which has at least one casing (1) with a first chamber (31) into which the gas to be cleaned can be flowed, and with a second chamber (33) from which the cleaned gas exits, wherein a filter device (35) which can be flowed through by the gas is arranged between the chambers mentioned and has filter media both for the separation of solid particles and for dehumidifying the gas by separating out coalesced liquid, the system has, upstream of the filter device (35), an arrangement (11, 37) for preliminary dehumidification of the gas.

SYSTEM FOR GAS CLEANING

This is a divisional application of Canadian Patent Application Serial No. 2,632,906 filed on September 9, 2006.

The invention concerns a system for gas cleaning, having at least one casing with a first chamber, into which the gas being cleaned can flow, and with a second chamber, from which the cleaned gas emerges, while a filter device is arranged between the aforesaid chambers, through which the gas can flow, having filter media both for separation of solid particles and for dehumidification of the gas by separating out coalesced liquid.

It should be understood that the expression "the invention" and the like encompasses the subject-matter of both the parent and the divisional applications.

Systems of this kind, which are required not only to remove contamination with solid pollution but also dehumidify certain gaseous media, are familiar and are also known as coalescers when there is a coalescence of liquid particles on the filter device located inside a casing. Such systems are often used in conjunction with exhaust producing processes, during which exhaust gas flows of relatively high temperature and possibly with very high pressure are handled.

The basic problem of the invention is to provide a system of this kind which not only has an especially good cleaning action, but also provides the greatest possible dehumidification.

According to the invention, this problem is solved by a system having the features as described herein.

Due to the fact that, an arrangement for preliminary dehumidification is provided, through which the gas flows before flowing into the actual coalescer casing, the gas is in a preconditioned state, which favors the residual dehumidification by coalescence on the respective filter medium. In this way, one achieves so thorough a dehumidification that the cleaned gas can, if desired, be recycled back into the process.

Preferably, the arrangement for preliminary dehumidification is provided on or in the casing of the filter device.

In advantageous sample embodiments, the arrangement for preliminary dehumidification has at least one cyclone. The use of a cyclone results in a robust and reliable design, since no moving parts are needed.

Sample embodiments in which the respective cyclone is integrated into the casing, which also contains the coalescer, are distinguished by an especially compact design.

The casing in the normal position of installation preferably defines an at least approximately vertical lengthwise axis, while the first chamber is situated in the lower segment of the casing and bounded at the side by a circular annular surface, which is preferably concentric to the lengthwise axis. In this way, an inlet opening for the gas being cleaned can be arranged on the casing so that it flows tangentially against the circular annular surface, such that this circular annular surface forms a cyclone for the preliminary dehumidification.

In these sample embodiments, the casing can be closed at the lower end by a catching container, which receives the liquid separated during the preliminary dehumidification.

The arrangement can be such that a bottom piece forming a drain funnel for the liquid separated on the cyclone can be provided as the lower boundary of the cyclone, between the catching container and the circular annular surface of the cyclone.

Preferably, a filter device can be accommodated in the casing, extending along its lengthwise axis, being configured so that it has an inner cavity for the gas being cleaned, which is surrounded by the filter media, while the second chamber is located between its outer side and the inner wall of the casing, into which the cleaned gas is admitted after it has flowed from the inner cavity of the filter device through the filter elements and to the outside.

The casing can have a floor at the upper end of the circular annular surface forming the cyclone, which separates the first chamber from the second chamber, on which a seat is fashioned, forming a passageway, in which a connection pipe of the filter device leading into the inner cavity of the filter device can be inserted, through which the preliminary dehumidified gas flows from the cyclone into the cavity of the filter device.

Above this floor, i.e., in the region belonging to the second chamber, the casing can have a widening, which forms a chamber for collection of liquid coalesced on the filter device, which can be drained out from the chamber via a drainage opening provided in the wall of the casing.

According to an aspect of the present invention, there is provided a gas cleaning system, comprising:

at least one housing having a first chamber for receiving gas to be cleaned and a second chamber for receiving and discharging clean gas, said at least one housing having a floor separating said first and second chambers;

a filter device extending along a longitudinal axis thereof in said at least one housing and in fluid communication between said first and second chambers through which gas can flow, said filter device having filter media capable of precipitation of solid particles and of dehydration by precipitation of coalesced liquid of the gas passing therethrough and having an inner cavity surrounded by said filter media, said second chamber being between an exterior of said filter media and an inside wall of said at least one housing;

a preliminary gas dehydration cyclone upstream of said filter device provided by a circular ring surface laterally bordering said first chamber;

a seat on said floor forming a passage receiving a connection sleeve on said filter device, said sleeve extending into said inner cavity of said filter device through which gas dehydrated by said dehydration cyclone flows from said dehydration cyclone into said inner cavity of said filter device; and

a spiral formed from a rib projecting from a surface of said floor facing said first chamber and having grooves located therebetween.

According to another aspect of the present invention, there is provided a gas cleaning system, comprising:

at least one housing having a first chamber for receiving gas to be cleaned and a second chamber for receiving and discharging clean gas, said at least one housing having a floor separating said first and second chambers;

a filter device extending along a longitudinal axis thereof in said at least one housing and in fluid communication between said first and second chambers through which gas can flow, said filter device having filter media capable of precipitation of solid particles and of dehydration by precipitation of coalesced liquid of the gas passing therethrough and having an inner cavity surrounded by said filter media, said second chamber being between an exterior of said filter media and an inside wall of said at least one housing;

a preliminary gas dehydration arrangement upstream of said filter device provided by a circular ring surface laterally bordering said first chamber and an inflow opening for the gas to be cleaned arranged tangentially to said ring surface;

a seat on said floor forming a passage coupled to said filter device and in fluid communication with said inner cavity of said filter device through which gas dehydrated by said dehydration arrangement flows from said first chamber into said inner cavity of said filter device; and

a spiral formed from a rib projecting from a surface of said floor facing said first chamber and having grooves located therebetween.

More specifically, the present invention provides a gas cleaning system, comprising:

at least one housing having a first chamber for receiving gas to be cleaned and a second chamber for receiving and discharging clean gas, said at least one housing having a floor separating said first and second chambers;

a filter device extending along a longitudinal axis thereof in said at least one housing and in fluid communication between said first and second chambers through which gas can flow, said filter device having filter media capable of precipitation of solid particles and of dehydration by precipitation of coalesced liquid of the gas passing therethrough and having an inner cavity surrounded by said filter media, said second chamber being between an exterior of said filter media and an inside wall of said at least one housing;

a preliminary gas dehydration cyclone upstream of said filter device provided by a circular ring surface laterally bordering said first chamber;

a seat on said floor forming a passage receiving a connection sleeve on said filter device, said sleeve extending into said inner cavity of said filter device through which gas dehydrated by said dehydration cyclone flows from said dehydration cyclone into said inner cavity of said filter device; and

a spiral formed from a rib projecting from a surface of said floor facing said first chamber and having grooves located therebetween.

The present invention also provides a gas cleaning system, comprising:

at least one housing having a longitudinal axis oriented substantially vertically, a first chamber for gas to be cleaned in a lower section of said housing and a second chamber for receiving and discharging clean gas, said first chamber being defined laterally by a cylindrical surface concentric to said longitudinal axis;

a filter device extending along said longitudinal axis in fluid communication between said first and second chambers through which gas can flow and having filter media surrounding an inner cavity capable of separating out solid particles and for dehumidifying gas by separating out coalesced liquid, a second cavity being between an outside of said filter device and an inner wall of said at least one housing;

a gas pre-dehumidification cyclone within said at least one housing formed by said cylindrical surface;

a collecting tank closing a lower end of said at least one housing and receiving liquid separated during pre-humidification within said first chamber;

a floor on an upper end of said first chamber and separating said first and second chambers;

a seat on said floor forming a passage receiving a connecting sleeve of said filter device leading to said inner cavity of said filter device through which pre-dehumidified gas flows out of said cyclone into said inner cavity;

a widening in said at least one housing above said floor forming a collection chamber for liquid coalesced on said filter device; and

an evacuation opening in a wall of said at least one housing defining said collection chamber through which liquid in said collecting chamber can be removed from said at least one housing.

The present invention also provides a gas cleaning system, comprising:

at least one housing having a first chamber for receiving gas to be cleaned and a second chamber for receiving and discharging clean gas, said at least one housing having a floor separating said first and second chambers;

a filter device extending along a longitudinal axis thereof in said at least one housing and in fluid communication between said first and second chambers through which gas can flow, said filter device having filter media capable of precipitation of solid particles and of dehydration by precipitation of coalesced liquid of the gas passing therethrough and having an inner cavity surrounded by said filter media, said second chamber being between an exterior of said filter media and an inside wall of said at least one housing;

a preliminary gas dehydration arrangement upstream of said filter device provided by a circular ring surface laterally bordering said first chamber and an inflow opening for the gas to be cleaned arranged tangentially to said ring surface;

a seat on said floor forming a passage coupled to said filter device and in fluid communication with said inner cavity of said filter device through which gas dehydrated by said dehydration arrangement flows from said first chamber into said inner cavity of said filter device; and

a spiral formed from a rib projecting from a surface of said floor facing said first chamber and having grooves located therebetween.

The invention is explained in detail hereafter by means of a sample embodiment represented in the drawing. This shows:

- Fig. 1, a front view of a sample embodiment of the invented system with two alternately operating coalescer casings;
- Fig. 2, a schematically simplified longitudinal section through a coalescer casing of the sample embodiment;
- Fig. 3, a longitudinal section similar to Fig. 2, but the coalescer casing is turned by 180 degrees relative to Fig. 2 and is represented without the filter device located inside it;
- Fig. 4, a cross section along line IV-IV of Fig. 3, and
- Fig. 5, a perspective and pulled-apart view, showing only filter media and stabilizing support elements in the filter device used for the invented system.

The invention is described below by means of a sample embodiment, in which two coalescer casings 1 are used, which are identical in configuration except for having a mirror image arrangement of casing openings. A switchover fitting 3 is assigned to the casings 1, making possible a familiar switching of the gas flow taken to the casings 1 and the gas flow emerging from them, so that one or the other casing 1 is activated in alternation. As can be seen from Fig. 1, the switchover fitting 3 has as its control element a switching lever 5, depending on the switched position of which the gas flow is taken from an inlet fitting 7 into one or the other casing, from which the gas flow exits via an outlet fitting 9. The entry of the gas at the casings 1 occurs each time through an inlet opening 11. The exit of the cleaned gas from the respective casing 1 occurs via an outlet opening 13. A pressure equalization line extending between the casings 1 is indicated as 15 in Fig. 1.

Figures 2 to 4 show further details of a sample embodiment of the coalescer casing 1 which can be used with the invented system. As can be seen, the casing 1 is configured as an oblong body, square in contour, whose longitudinal axis is designated as 17. In the normal installation position of the casing 1, the longitudinal axis 17 is oriented vertically. At the upper end, the casing 1 is closed off by a lid piece 19, screwed to it, with sealing elements 21 forming a pressure-tight seal. A central venting bore in the lid piece 23 is designated as 23.

At the opposite, lower end, the casing 1 is closed off by a catching container 25, screwed to it, while again sealing elements 27 form a pressure-tight seal between catching container 25 and casing 1. At the lower side, the catching container 25 has a drainage opening 29.

The various lengthwise segments of the inner space of the casing 1 are each circular cylindrical in shape, while the inner space of the casing 1 is basically divided into two chambers, namely, a first chamber 31, which is connected to the inlet opening 11 and into which flows the gas being cleaned, and a second chamber 33, see Fig. 2, in which the cleaned gas is found, and emerges from this second chamber 33 via the outlet opening 13.

The first chamber 31 and second chamber 33 are separated from each other by a filter device 35, though which the gas can flow; this is shown schematically, merely in outline, in Fig. 2.

The part of the first chamber 31 connected directly to the inlet opening 11 forms a cyclone for the preliminary dehumidification of the gas. For this purpose, the inlet opening 11 is directed at an inner circular annular surface 37 of the casing 1, so that the circular annular surface 37 is struck by the gas flow entering through the inlet opening 11 and a cyclone effect is produced, bringing about a preliminary dehumidification by virtue of the centrifugal forces acting on the flow along the circular annular surface 37.

As Fig. 2 and 3 show, a bottom part 39 is located between the upper end of the catching container 25 and the lower end of the circular annular surface 37 of the cyclone, forming a funnel-shaped floor for the cyclone with a central outlet opening 41, by which liquid separated in the cyclone drains off into the catching container 25.

Above the circular annular surface 37, the casing 1 has a floor 43 separating the first chamber 31 from the second chamber 33, on which there is formed a seat 47 forming a passageway 45, which forms a receptacle for a connection pipe 48 (see Fig. 2) of the filter device 35. This connection pipe 48 leads into the inner cavity of the filter device 35, so that the gas previously dehumidified in the cyclone goes from the cyclone to the interior of the filter device 35.

As has been shown, a particularly good dehumidification effect for the cyclone results when a relieflike profile in the form of a spiral is located on the wall bounding the cyclone or flow chamber at the top. As can be seen from Fig. 2 to 4, for this purpose the underside of the floor 43, which bounds the flow chamber at the top, is not a smooth surface, but instead has a profile which is formed by a projecting rib 71 with a spiral trend, with grooves situated between its turns. As Fig. 4 shows, the spiral 73 thus formed extends from its outside beginning 75, located at the inlet opening 11, spiraling inward and against the direction of the cyclone flow on the circular annular surface 37. Such a configuration favors the buildup of droplets falling from the bottom part 39. The number of spiral revolutions will depend on the flow conditions.

As illustrated in Fig. 5, the inner cavity of the filter device 35 is surrounded by filter media and support elements, through which the previously dehumidified gas flows from the inside to the outside, the filter media being of such a constitution that both a separation of solid particles and a dehumidification by separation of coalesced liquid occurs. For this purpose, the filter device has, as inner layers serving for the particle separation, woven wire folded in star pattern and filter paper folded in star pattern. These layers are designated as 51 in Fig. 5. Next on the outside comes a perforated plate 53, for stability. On top of this is a fiberglass weave 55 for coalescing. Next comes a wire weave 57 for drainage, on top of which is arranged a perforated plate 59 for stabilization. On top of this comes a needle felt 61 for diverting the liquid. A metal basket 63 finally forms the outer enclosure of the structural unit.

As Figures 2 and 3 show, a widening belonging to the second chamber 33 is located above the floor 43 in the casing 1, forming a chamber 65 for collection of liquid coalesced on the filter device 35, which can be drained away via a drain opening 67. An opening in the upper region of the casing 1, designed for connection of the pressure equalization line 15 (Fig. 1), is designated as 69. Of course, the openings 23, 29, 67 and 69, additionally provided on the casing 1 besides the inlet opening 11 and the outlet opening 13, are each provided with pressure-tight fittings, not shown.

While the invention is described by means of an example, wherein two coalescer casings 1 can be operated in alternation by activating a changeover fitting 3, it will be understood that a different layout of the system with only one coalescer casing or a different number of casings can be provided. Instead of a cyclone integrated in the casing 1, the preliminary dehumidification could occur otherwise, for example, with one or more cyclones connected upstream from the casing. The use of cyclones connected alongside each other can also be contemplated, especially in cases where gas flows of different volume rates or different flow velocity have to be managed.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A gas cleaning system, comprising:

at least one housing having a first chamber for receiving gas to be cleaned and a second chamber for receiving and discharging clean gas, said at least one housing having a floor separating said first and second chambers;

a filter device extending along a longitudinal axis thereof in said at least one housing and in fluid communication between said first and second chambers through which gas can flow, said filter device having filter media capable of precipitation of solid particles and of dehydration by precipitation of coalesced liquid of the gas passing therethrough and having an inner cavity surrounded by said filter media, said second chamber being between an exterior of said filter media and an inside wall of said at least one housing;

a preliminary gas dehydration cyclone upstream of said filter device provided by a circular ring surface laterally bordering said first chamber;

a seat on said floor forming a passage receiving a connection sleeve on said filter device, said sleeve extending into said inner cavity of said filter device through which gas dehydrated by said dehydration cyclone flows from said dehydration cyclone into said inner cavity of said filter device; and

a spiral formed from a rib projecting from a surface of said floor facing said first chamber and having grooves located therebetween.

2. A gas cleaning system according to claim 1 wherein

said at least one housing in a normal installation position comprises a longitudinal axis extending at least partially vertically with said first chamber located in a lower section of said housing and with said circular ring surface concentric to said longitudinal axis of said housing.

3. A gas cleaning system according to claim 1 or 2 wherein

said at least one housing comprises an inflow opening for the gas to be cleaned tangentially incident to said circular ring surface.

4. A gas cleaning system according to claim 3 wherein

said spiral extends from an outer end thereof located adjacent the inflow opening tangentially incident to said circular ring surface in a direction opposite gas flow on said circular ring surface.

5. A gas cleaning system according to claim 3 or 4 wherein

said at least one housing comprises a collecting tank on a lower end thereof to hold liquid precipitated during preliminary dehydration in said dehydration cyclone.

6. A gas cleaning system according to claim 5 wherein

a floor part is located between said circular ring surface and said collecting tank and has a drain funnel for liquid precipitated in said first chamber.

7. A gas cleaning system according to any one of claims 1 to 6 wherein

said at least one housing comprises a widening above said floor forming a collection chamber for collecting fluid coalesced on said filter device and an evacuation opening in a wall thereof through which liquid in said collection chamber can be removed from said at least one housing.

8. A gas cleaning system, comprising:

at least one housing having a first chamber for receiving gas to be cleaned and a second chamber for receiving and discharging clean gas, said at least one housing having a floor separating said first and second chambers;

a filter device extending along a longitudinal axis thereof in said at least one housing and in fluid communication between said first and second chambers through which gas can flow, said filter device having filter media capable of precipitation of solid particles and of dehydration by precipitation of coalesced liquid of the gas passing therethrough and having an inner cavity surrounded by said filter media, said second chamber being between an exterior of said filter media and an inside wall of said at least one housing;

a preliminary gas dehydration arrangement upstream of said filter device provided by a circular ring surface laterally bordering said first chamber and an inflow opening for the gas to be cleaned arranged tangentially to said ring surface;

a seat on said floor forming a passage coupled to said filter device and in fluid communication with said inner cavity of said filter device through which gas dehydrated by said dehydration arrangement flows from said first chamber into said inner cavity of said filter device; and

a spiral formed from a rib projecting from a surface of said floor facing said first chamber and having grooves located therebetween.

9. A gas cleaning system according to claim 8 wherein

said at least one housing in a normal installation position comprises a longitudinal axis extending at least partially vertically with said first chamber located in a lower section of said at least one housing and with said circular ring surface concentric to said longitudinal axis of said at least one housing.

10. A gas cleaning system according to claim 9 wherein

a floor part is located between said circular ring surface and said collecting tank and has a drain funnel for liquid precipitated in said first chamber.

11. A gas cleaning system according to any one of claims 8 to 10 wherein

said at least one housing comprises a collecting tank on a lower end thereof to hold liquid precipitated during preliminary dehydration in said first chamber.

12. A gas cleaning system according to any one of claims 8 to 11 wherein

said at least one housing comprises a widening above said floor forming a collection chamber for collecting fluid coalesced on said filter device and an evacuation opening in a wall thereof through which liquid in said collection chamber can be removed from said housing.

13. A gas cleaning system according to any one of claims 8 to 12 wherein

said spiral extends from an outer end thereof located adjacent an inflow opening tangentially incident to said circular ring surface in a direction opposite gas flow on said circular ring surface.

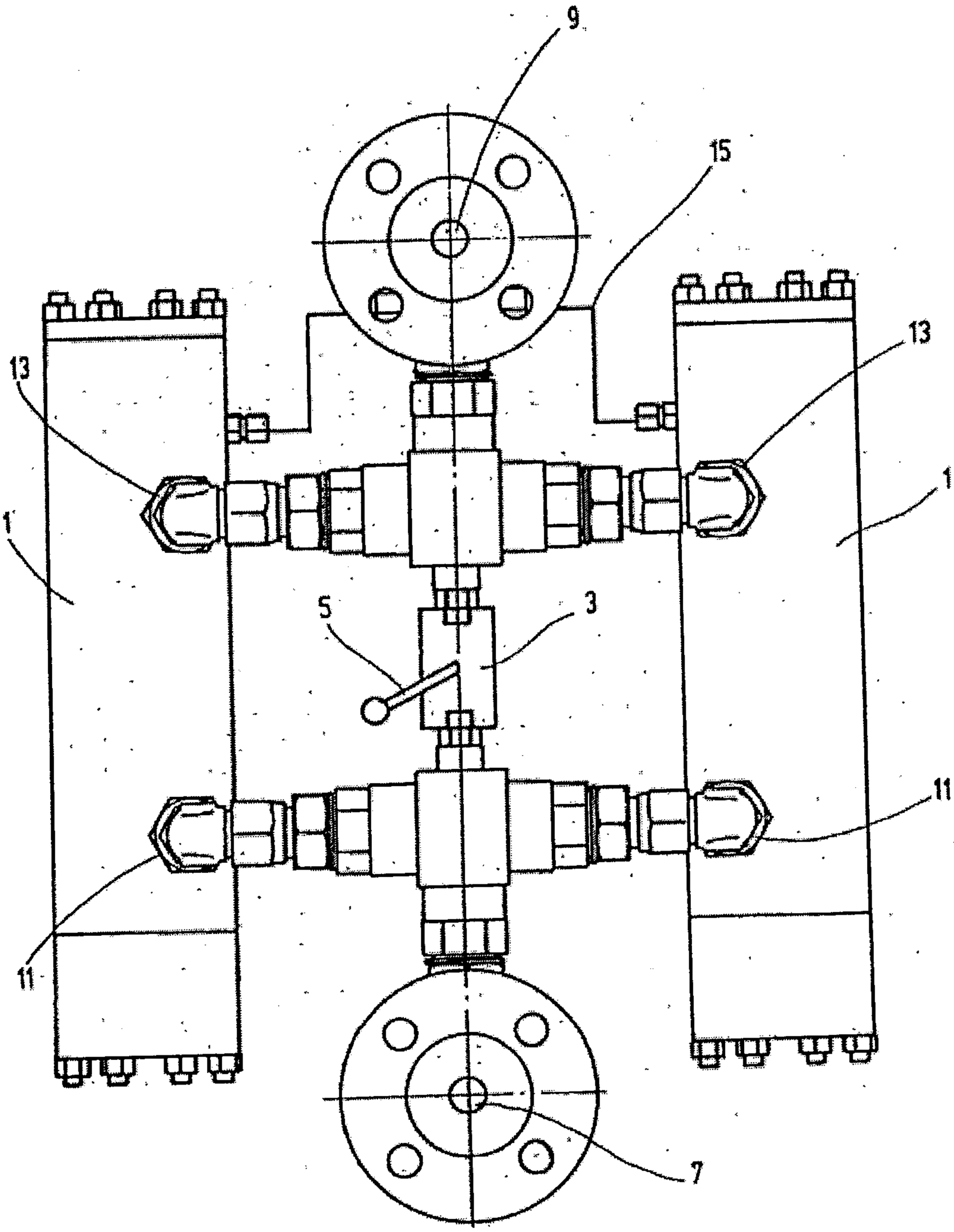


Fig.1

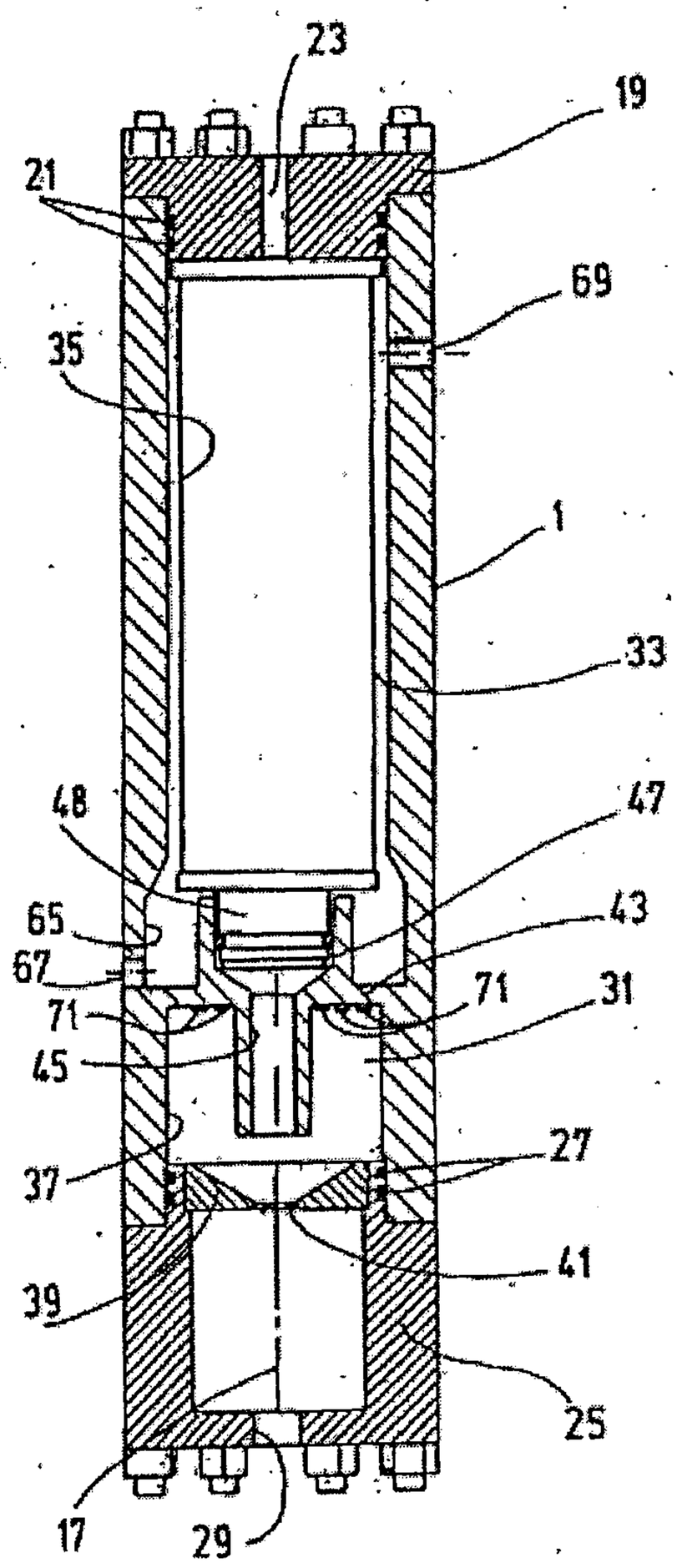


Fig.2

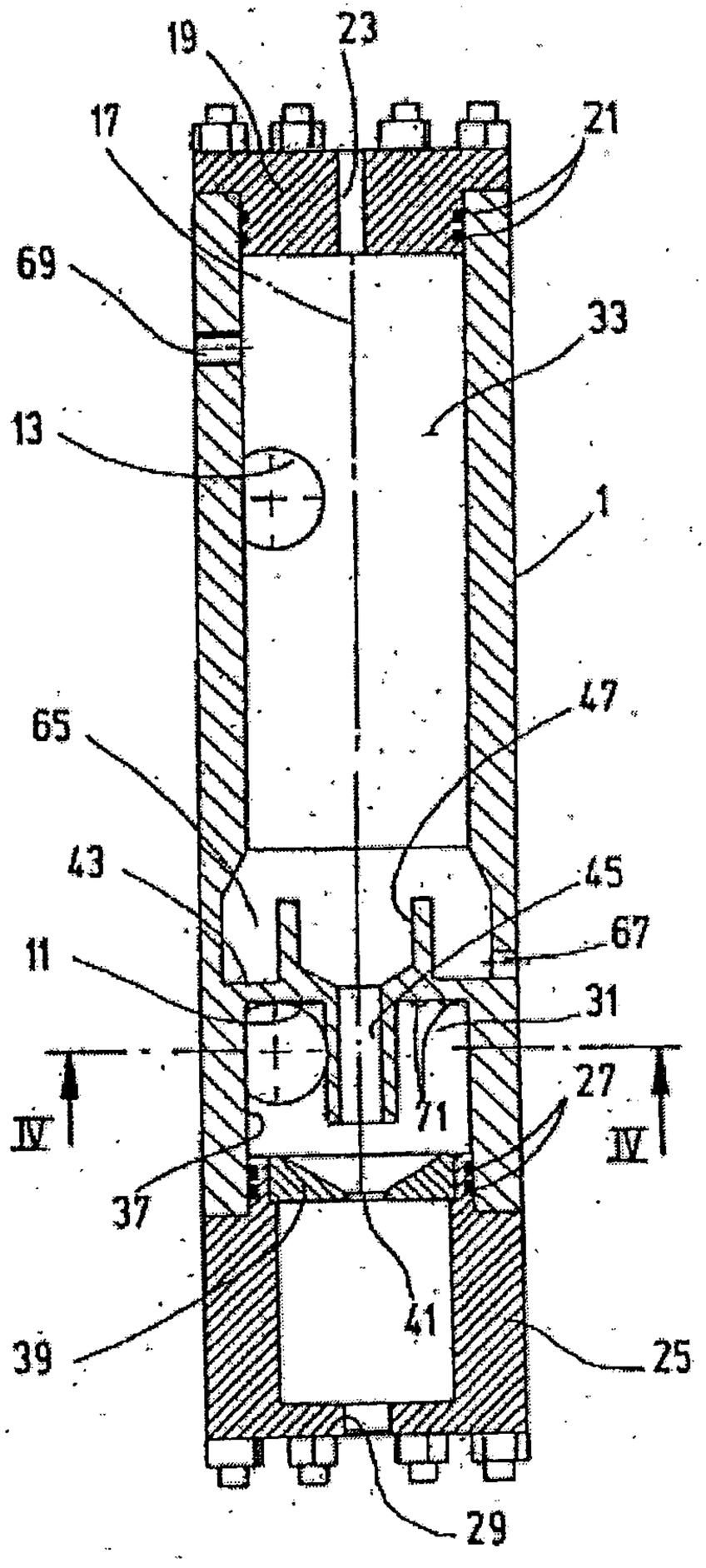


Fig.3

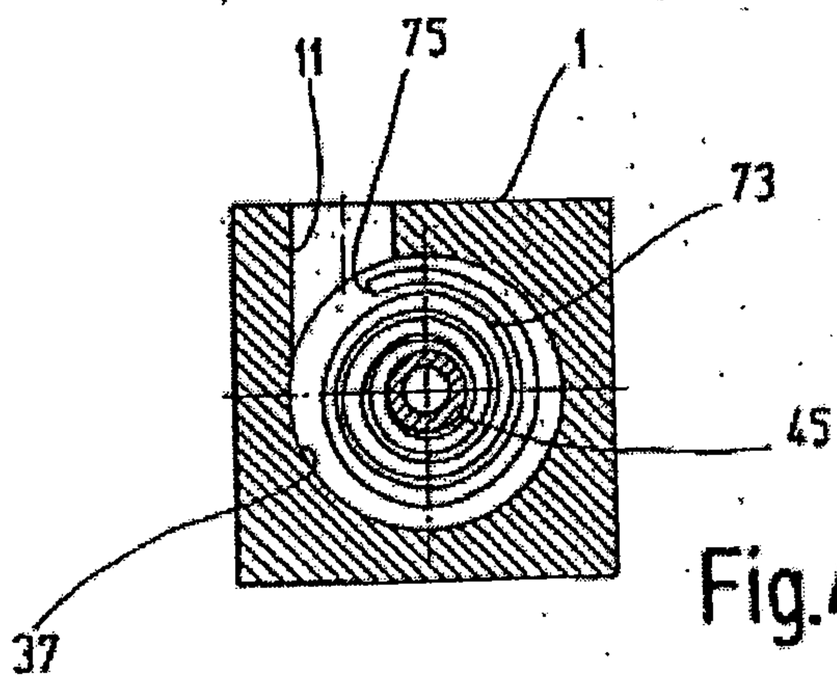


Fig.4

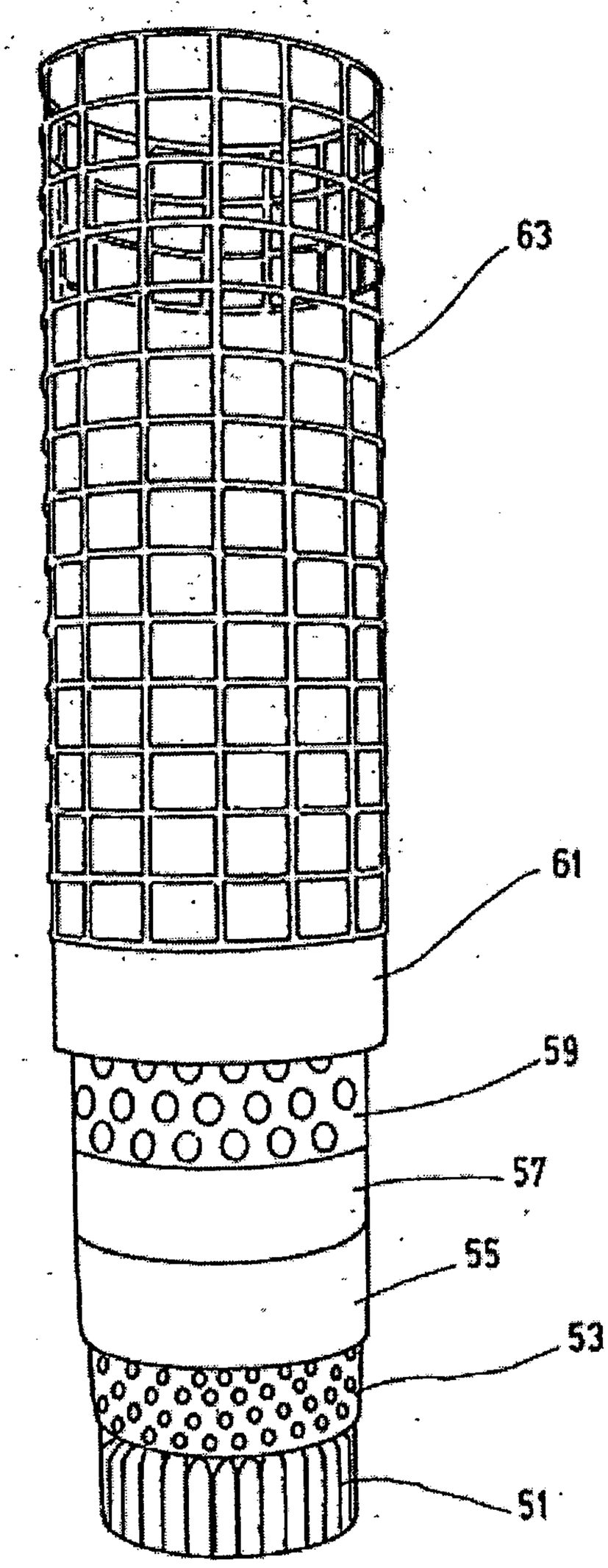
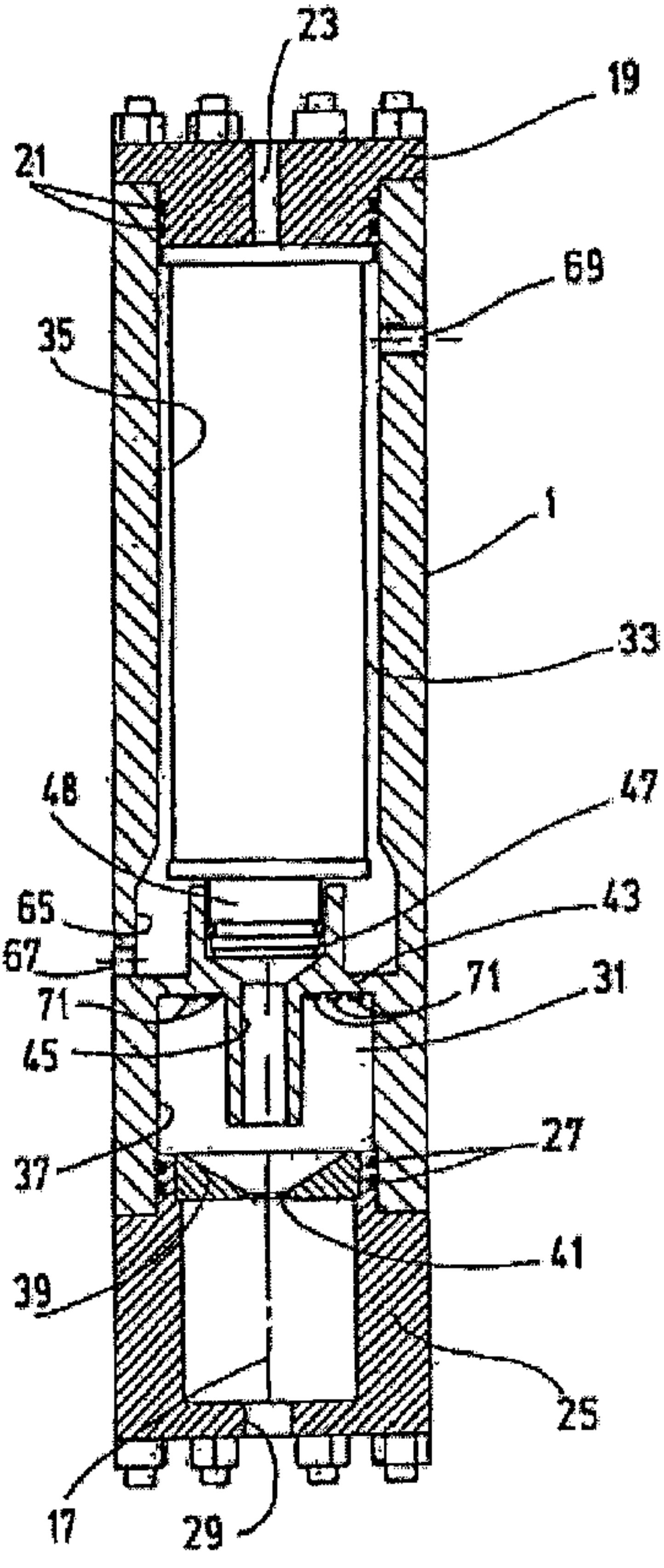


Fig.5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