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(54) FEEDING DEVICE FOR A FLUSH TANK

(57) A feeding device (1) for a flush tank, comprises an internally hollow body (2), a valve assembly (3) housed inside the body (2) and operated by a float (4), a feeding pipe (5) that can be connected to a water supply network to supply a water flow to the valve assembly (3), and a filling pipe (6) through which the water that flows through the valve assembly (3) is poured into the tank; the body (2) houses an inlet conduit (7) and an outlet conduit (8) arranged respectively upstream and downstream of the valve assembly (3) and respectively connected to the feeding pipe (5) and to an outlet (19) facing a mouth (42) of the filling pipe (6) and positioned above said mouth (42) and spaced apart therefrom; the outlet (19) is provided with a flow regulator device (30), configured so as to regulate a liquid flow passing therethrough by dividing the flow in a plurality of adjacent streams.

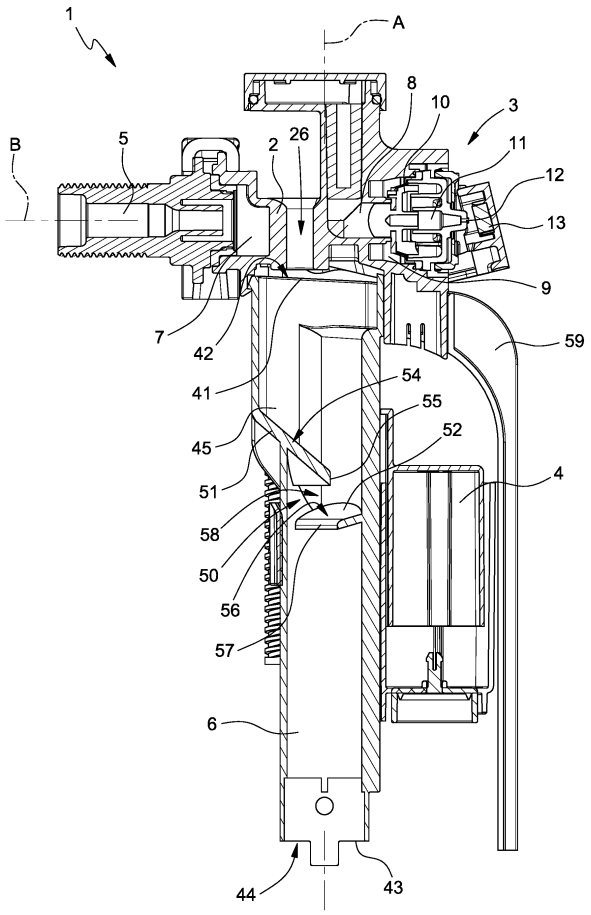

FIG. 3

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102019000014145 filed on 06/08/2019.

TECHNICAL FIELD

[0002] This invention relates to a feeding device for a flush tank of a sanitary appliance.

BACKGROUND ART

[0003] As is known, a flush tank of a sanitary appliance, in addition to a discharge valve, is also generally provided with a feeding device connected to the water supply network for the filling of the tank after the water has been discharged into the sanitary appliance.

[0004] A commonly used feeding device comprises, in general terms, an inlet tube having a fitting for connection to the water supply network, a valve assembly housed in a casing and controlled by a float, an outlet tube that lets the water that has flowed through the valve assembly into the tank.

[0005] The valve assembly, in particular, may be of the so-called back pressure or diaphragm closing type, in which the float operates a cut-off acting on a vent nozzle of a back pressure chamber delimited by a diaphragm or membrane; the diaphragm separates two conduits from each other, connected to the inlet tube and the outlet tube, respectively. When the float, as a result of the discharge of water from the tank, falls, it opens the vent nozzle, and the diaphragm elastically deforms under the water pressure and puts the conduits into communication with each other, thus allowing the passage of water and the filling of the tank. When the float rises, it closes the vent nozzle, and the pressure in the back pressure chamber balances that of the incoming water and causes the diaphragm to separate the conduits again, stopping the water from entering the tank.

[0006] As also required by specific regulations and standards, the feeding devices must be equipped with systems to prevent backflow to the water supply network in the event of malfunctions.

[0007] To this end, for example, the valve assembly is provided with an air outlet opening, communicating with the outside of the feeding device to allow the exit of air from the feeding device and therefore avoid any suction of water from the tank.

[0008] However, the presence of the air outlet opening causes, during normal operation of the feeding device, the formation of a water/air mixture in the feeding device. Entry of air into the water flow circulating in the feeding device can cause turbulent motion phenomena with a consequent increase in noise during the filling of the tank.

[0009] Some anti-backflow regulations, for example the one that recently came into force in the United Kingdom, are also particularly stringent and require specific measures to prevent the backflow of water into the water supply network. However, these measures can be particularly complicated and costly to implement, resulting in complicated, poorly efficient, and extremely noisy feeding devices.

[0010] The need therefore arises to provide feeding devices that meet the most stringent standards and are fully satisfactory in terms of simplicity of construction and operation and noise-reduction capacity.

DISCLOSURE OF INVENTION

[0011] It is one purpose of this invention to provide a feeding device, which ensures compliance with the strictest anti-backflow standards, while being simple, effective, and reliable, enabling a significant reduction in noise.

[0012] Therefore, this invention relates to a feeding device for a flush tank, as defined essentially in the appended claim 1 and, in its additional features, in the dependent claims.

[0013] The feeding device in accordance with the invention not only meets the criteria laid down by the most stringent anti-backflow standards, like those in effect in the United Kingdom, by being effectively capable of preventing water from backflowing into the water supply network, but at the same time avoids the problems related to entry of air into the water flow circulating in the feeding device. In addition, it particularly reduces the noise during the filling of the tank, while being simple to manufacture and simple and reliable in its operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Additional features and advantages of this invention will be apparent from the following description of a non-limiting embodiment thereof, with reference to the figures of the accompanying drawings, wherein:

- Figure 1 is a side elevation view of a feeding device according to the invention;
- Figure 2 is a plan view from above of the feeding device in Figure 1;
- Figure 3 is a cross-section view along the plane III-III in Figure 2;
- Figure 4 is a perspective view on an enlarged scale with parts removed for clarity of a detail of the feeding device in Figure 1;
- Figure 5 is a cross-section view along the plane V-V in Figure 2, with parts removed for clarity;
- Figure 6 is a perspective view on an enlarged scale of an isolated component of the feeding device in Figure 1;
- Figure 7 is a perspective view, on an enlarged scale, of an additional, isolated component of the feeding device in Figure 1;

- Figure 8 is a cross-section view along the plane VIII-VIII in Figure 2, with parts removed for clarity.

BEST MODE FOR CARRYING OUT THE INVENTION

[0015] In Figures 1 and 2, the reference number 1 indicates, as a whole, a feeding device for a flush tank (known and not shown for simplicity) of a sanitary appliance.

[0016] The feeding device 1 substantially extends along a longitudinal axis A, substantially vertical in use; here and below, the terms horizontal/vertical and high/low are understood to refer to the normal use position of the feeding device 1 in the flush tank.

[0017] The feeding device comprises an internally hollow body 2, a valve assembly 3 housed inside the body 2 and controlled by a float 4, a feeding pipe 5 that can be connected to a water supply network to carry a water flow to the valve assembly 3, and a filling pipe 6 through which the water flowing through the valve assembly 3 is fed into the tank.

[0018] In the non-limiting example illustrated (but not necessarily), the feeding pipe 5 and the filling pipe 6 are substantially orthogonal to each other, extending along respective axes orthogonal to each other. In particular, the filling pipe 6 extends along the axis A and is, thus, substantially vertical in use and the feeding pipe 5 extends along a transverse axis B, which is perpendicular to the axis A and substantially horizontal in use, of the feeding device 1.

[0019] It is understood that other configurations are possible: for example, the feeding pipe 5 and the filling pipe 6 can be substantially parallel to each other and to the axis A, both basically extending vertically.

[0020] The valve assembly 3 is a back pressure valve assembly substantially known in and of itself.

[0021] With reference also to Figures 3-4, the valve assembly 3 is connected to an inlet conduit 7 and to an outlet conduit 8 and comprises: an internal connecting passage 9 connecting the inlet conduit 7 to the outlet conduit 8; an elastically deformable or movable discoidal diaphragm 10 selectively closing the passage 9; and a back pressure chamber 11 delimited by the diaphragm 10 and provided with a vent nozzle 12, which connects the back pressure chamber 11 to the outside of the body 2 and is closed by a movable cut-off 13 actuated by the float 4.

[0022] The inlet conduit 7 and the outlet conduit 8 are formed inside the body 2 and are respectively arranged downstream and upstream of the valve assembly 3 and, specifically, of the passage 9 and of the diaphragm 10 (in the direction of the normal circulation of the water that flows from the water supply network to fill the tank).

[0023] When the nozzle 12 is closed by the cut-off 13, the diaphragm 10 keeps the passage 9 closed because the water pressure in the inlet conduit 7 is counterbalanced by the pressure inside the back pressure chamber 11, and the water in the inlet conduit 7 is unable to deform or move the diaphragm 10.

[0024] When the nozzle 12 opens, following a downward movement of the float 4 as a result of a lowering of the water level in the tank (i.e. when the water is discharged from the tank), the water pressure in the inlet conduit 7 exceeds the pressure in the back pressure chamber 11 and the diaphragm 10 elastically deforms or moves, thus opening the passage 9 and allowing the water to flow from the inlet conduit 7 to the outlet conduit 8 and from here, through the filling pipe 6, into the tank.

[0025] The float 4 (Figure 1) is axially slidably mounted on a guide element 15 positioned outside the filling pipe 6 and is mechanically connected, for example by means of a lever mechanism 16, to the cut-off 13 cooperating with the nozzle 12 in order to control the operation of the valve assembly 3.

[0026] With specific reference to Figures 3-5, the inlet conduit 7 extends into the body 2 and connects the feeding pipe 5 to the passage 9. In the non-limiting example illustrated (but not necessarily), the inlet conduit 7 substantially extends parallel to the axis B.

[0027] The outlet conduit 8 has an inlet 18 that communicates with the passage 9, and an outlet 19, arranged at a height (measured parallel to the axis A) greater than the inlet 18.

[0028] In the non-limiting example illustrated (but not necessarily), the outlet conduit 8 comprises an access portion 21, communicating with the passage 9 through the inlet 18 and, for example, substantially parallel to the axis B; a head 22 above, defining an inverted U-shaped passage 23 and provided with an outlet 19; and a connection portion 24 that connects the access portion 21 to the head 22 and is, for example, substantially parallel to the axis A.

[0029] The inlet 18 is, for example, formed through a wall 25 inside the body 2 substantially parallel to the axis A and perpendicular to the axis B; the outlet 19 is positioned in the head 22 and faces downwards and is axially aligned with a hollow 26 in the body 2, so that the outlet 19 directly faces, as better described below, the filling pipe 6.

[0030] The outlet 19 is provided with a flow regulator device 30 (or jet breaker), i.e. a device configured so as to adjust a liquid flow that flows through it, dividing the flow into a plurality of adjacent streams.

[0031] The device 30 can be variously shaped: in the non-limiting example illustrated, the device 30 (shown in greater detail in Figure 6) comprises a cup-shaped body 31 housed in a site formed in the head 22 at the outlet 19, and a plurality of adjacent channels 32 formed in the cup-shaped body 31 and configured so as to divide the water flow that flows through the cup-shaped body 31 into a plurality of streams and to uniform and homogenise the water flow that flows through the cup-shaped body 31.

[0032] In particular, the cup-shaped body 31 extends along and around a central axis C, parallel to the axis A; and the channels 32 are substantially parallel to the axis C.

[0033] For example, the channels 32 are defined by respective circular holes 33 that are formed to pass through the base wall 34 of the cup-shaped body 31 and arranged on concentric rings around the axis C of the cup-shaped body 31.

[0034] Clearly, the holes 33 (or other similar elements, such as meshes or thin plates etc., defining the channels 32) may be variously shaped and/or arranged.

[0035] The device 30 is configured so that the water flow that flows through the device 30, in particular the cup-shaped body 31, is divided into separate streams and takes on a substantially laminar motion overall.

[0036] In addition, the flow exiting has an aperture angle (understood as the angle formed by the flow in relation to the axis C) that is no greater than a prefixed angle, in particular approximately 20°.

[0037] The outlet conduit 8 is, in addition, provided with a pressurization element 35 (Figure 5), positioned between the inlet 18 and the outlet 19 and housed, in particular, in the connection portion 24 of the outlet conduit 8.

[0038] The pressurization element 35 is configured so as to increase the pressure of the water flow that flows through the outlet conduit 8, for example, by reducing the passage cross-section inside the outlet conduit 8 and, in particular, in the connection portion 24.

[0039] For example, as shown in detail in Figure 7, the pressurization element 35 comprises a prismatic bar 36 that is substantially straight, extending, in particular, parallel to the axis A and having a plurality of longitudinal grooves 37 formed on an outer lateral surface of the bar 36 and defining, inside the outlet conduit 8 and, specifically, inside its connection portion 24, respective parallel ducts 38. The grooves 37 are separated from each other by longitudinal ribs 39 that radially project from the bar 36.

[0040] Preferably, but not necessarily, the grooves 37 have curved cross sections, for example, shaped as an arc of a circle.

[0041] Preferably, but not necessarily, the grooves 37 have, at a longitudinal end of the pressurization element 35 facing towards the inlet 18, respective tapered inlet edges 40.

[0042] The pressurization element 35 is shaped so that the passage section available for the passage of fluid through the pressurization element 35 (the sum of the cross sections of the ducts 38) is smaller than the internal section of the outlet conduit 8 and, in particular, of the connection portion 24.

[0043] As shown, in particular, in Figures 1, 3 and 8, the filling pipe 6 extends along the axis A (or parallel to the axis A) between an upper end 41, equipped with a mouth 42 facing upwards, and a lower end 43 equipped with a water outlet opening 44.

[0044] The mouth 42 is positioned below the hollow 26 and faces and is aligned with the outlet 19, so that the water flow leaving the outlet 19 through the flow regulator device 30 is entirely directed inside the mouth 42 and, thus, into the filling pipe 6.

[0045] The mouth 42 has, advantageously, a cross section (perpendicular to the axis A) that is greater than the cross section of the outlet 19.

[0046] Preferably, the filling pipe 6 is basically cylindrical and has a cross section that is smaller than the cross section of the mouth 42; and the filling pipe 6 comprises an upper mouth portion 45, positioned at the end 41 and provided with a mouth 42 and tapered downwards along the axis A.

[0047] The filling pipe 6 is preferably also provided with a flow deflection device 50 positioned inside the filling pipe 6.

[0048] The device 50 comprises a pair of inclined and opposite baffles 51, 52, slanted in relation to the axis A and spaced axially along the axis A.

[0049] The baffle 51 is positioned in the mouth portion 45 and extends from a peripheral edge 53 of the mouth 42 downwards and radially towards the inside of the filling pipe 6.

[0050] In particular, the baffle 51 defines an inclined lateral wall of the mouth portion 45 tapered downwards.

[0051] The baffle 51 has an upper surface 54 facing upwards and towards the mouth 42, substantially flat and inclined downwards in relation to the axis A and ends with a free end edge 55, for example, substantially straight and positioned, for example, near the axis A and of a middle diametric plane (passing through the axis A) of the filling pipe 6.

[0052] The baffle 52 is positioned below the other baffle 51 and extends from an inner lateral surface of the filling pipe 6 downwards and radially towards the inside of the filling pipe 6.

[0053] The baffle 52 has an upper surface 56 that is substantially flat and inclined downwards in relation to the axis A and ends with a free end edge 57, for example substantially straight, positioned below the edge 55 of the baffle 51 and substantially aligned with it. This edge 57, like the other edge 55 of the baffle 51, is also, thus, positioned, for example, near the axis A and near a middle diametric plane (passing through the axis A) of the filling pipe 6.

[0054] The pair of baffles 51, 52 defines a narrowing 58 inside the filling pipe 6 that has the function of flooding the filling pipe 6 during the passage of the water through the filling pipe 6, in particular filling the mouth portion 45 and creating, thus, a water chamber that takes up the whole of the cross section of the filling pipe 6 and prevents the inlet of air into the filling pipe 6, so as to avoid or at least reduce noise during the tank-filling step.

[0055] The filling pipe 6 is, optionally, equipped with a lateral slide 59, which begins at the mouth 42 and extends, then, parallel to the filling pipe 6 to define an auxiliary channel that can serve to convey water coming from the outlet conduit 8 into the tank and that, for some reason (in particular when there too much pressure from the mains water) does not flow regularly into the filling pipe 6.

[0056] In use, after the water contained in the tank is discharged, the float 4 opens the nozzle 12 and the mains water pressure in the inlet conduit 7 deforms the dia-

phragm 10, opening the passage 9; a water flow then flows from the inlet conduit 7 into the outlet conduit 8.

[0057] The water flow traverses the outlet conduit 8, passing, in particular, through the pressurization element 35, where the water flow is subject to an increase in pressure, and reaches the head 22 and, from there, having flowed through the flow regulator device 30, exits through the outlet 19.

[0058] When flowing through the device 30, the water flow exiting the outlet 19 takes on a substantially laminar motion and a prefixed aperture angle, determined by the device 30.

[0059] The water exiting from the outlet 19 enters the filling pipe 6 through the mouth 42 and then flows through the filling pipe 6 into the tank.

[0060] The filling pipe 6, due to the presence of the baffles 51, 52, is completely flooded, reducing noise.

[0061] Once the tank 2 is full, the float 4 closes the nozzle 12, thus stopping the flow of water.

[0062] It is understood that the feeding device as described and illustrated herein can be subject to numerous modifications and variations that do not depart from the scope of the appended claims.

Claims

1. A feeding device (1) for a flush tank, extending substantially along a longitudinal axis (A), substantially vertical in use, and comprising an internally hollow body (2); a valve assembly (3) housed inside the body (2) and operated by a float (4); a feeding pipe (5) that can be connected to a water supply network to supply a water flow to the valve assembly (3); and a filling pipe (6) for pouring water from the valve assembly (3) into the tank; wherein the body (2) houses an inlet conduit (7) and an outlet conduit (8) arranged respectively upstream and downstream of the valve assembly (3) and respectively connected to the feeding pipe (5) and to an outlet (19), facing a mouth (42) of the filling pipe (6) and positioned above said mouth (42) and spaced apart therefrom; **characterized in that** said outlet (19) is provided with a flow regulator device (30), configured so as to regulate a liquid flow passing therethrough by dividing said flow in a plurality of adjacent streams.

2. The feeding device according to claim 1, wherein the flow regulator device (30) is configured so as the water flow passing through the flow regulator device (30) is divided in separate streams and assumes, exiting from the flow regulator device (30), a substantially laminar motion.

3. The feeding device according to claim 1 or 2, wherein the flow regulator device (30) is configured so as the water flow exiting from the flow regulator device (30) has an aperture angle not greater that a pre-set angle, in particular about 20°.

4. The feeding device according to one of the preceding claims, wherein the flow regulator device (30) comprises a cup-shaped body (31) provided with a plurality of adjacent channels (32) shaped so as to divide the water flow passing through the cup-shaped body (31) in a plurality of streams and to uniform and homogenize the water flow passing through the cup-shaped body (31).

5. The feeding device according to claim 4, wherein the cup-shaped body (31) extends along and about a central axis (C), parallel to the longitudinal axis (A); and the channels (32) are substantially parallel to the central axis (C) and arranged on concentric rings about the central axis (C) .

6. The feeding device according to one of the preceding claims, wherein the outlet conduit (8) has an inlet (18) communicating with the valve assembly (3) and positioned at a height, measured parallel to the longitudinal axis (A), lower than the outlet (19).

7. The feeding device according to claim 6, wherein the outlet conduit (8) comprises an access portion (21), communicating with the valve assembly (3) via the inlet (18) ; an upper head (22), defining an inverted-U shaped passage (23) and provided with the outlet (19); and a connection portion (24) connecting the access portion (21) to the head (22); the flow regulator device (30) being housed in the head (22).

8. The feeding device according to one of the preceding claims, wherein the outlet (19) faces downwards and is axially aligned to a hollow (26) of the body (2); and the outlet (19) directly faces and is aligned to the mouth (42) of the filling pipe (6), so as the water flow exiting from the outlet (19) through the flow regulator device (30) is entirely channelled inside the mouth (42) and hence in the filling pipe (6).

9. The feeding device according to one of the preceding claims, wherein the outlet conduit (8) is provided with a pressurization element (35), positioned upstream of the flow regulator device (30) and configured so as to increase the pressure of the water flow passing through the outlet conduit (8), for example by reducing the passage section inside at least one portion of the outlet conduit (8) .

10. The feeding device according to claim 9, wherein the pressurization element (35) comprises a substantially straight prismatic bar (36), extending substantially parallel to the longitudinal axis (A), and having a plurality of longitudinal grooves (37) formed on an outer lateral surface of the bar (36) and defining, inside the outlet conduit (8), respective parallel ducts (38).

11. A feeding device according to claim 10, wherein the grooves (37) have curved cross section, for example shaped as an arc of a circle; and/or have, at a longitudinal end of the pressurization element (35) facing towards the inlet (18), respective tapered inlet edges (40).

12. The feeding device according to one of the preceding claims, wherein the mouth (42) has a cross section larger than the cross section of the outlet (19).

13. The feeding device according to one of the preceding claims, wherein the filling pipe (6) is provided with a flow deflection device (50) arranged inside the filling pipe (6) and comprising a pair of inclined and opposite baffles (51, 52), slanted with respect to the longitudinal axis (A) and axially spaced apart along the longitudinal axis (A) and defining a narrowing (58) inside the filling pipe (6).

14. The feeding device according to claim 13, wherein the baffles (51, 52) extend from an inner lateral surface of the filling pipe (6) downwards and radially inwards in the filling pipe (6) and towards the longitudinal axis (A), converging toward each other.

15. The feeding device according to claim 13 or 14, wherein the baffles (51, 52) have respective free end edges (55, 57), for example substantially rectilinear, positioned one above the other and substantially aligned to each other in proximity of the longitudinal axis (A) and of a middle diametric plane of the filling pipe (6).

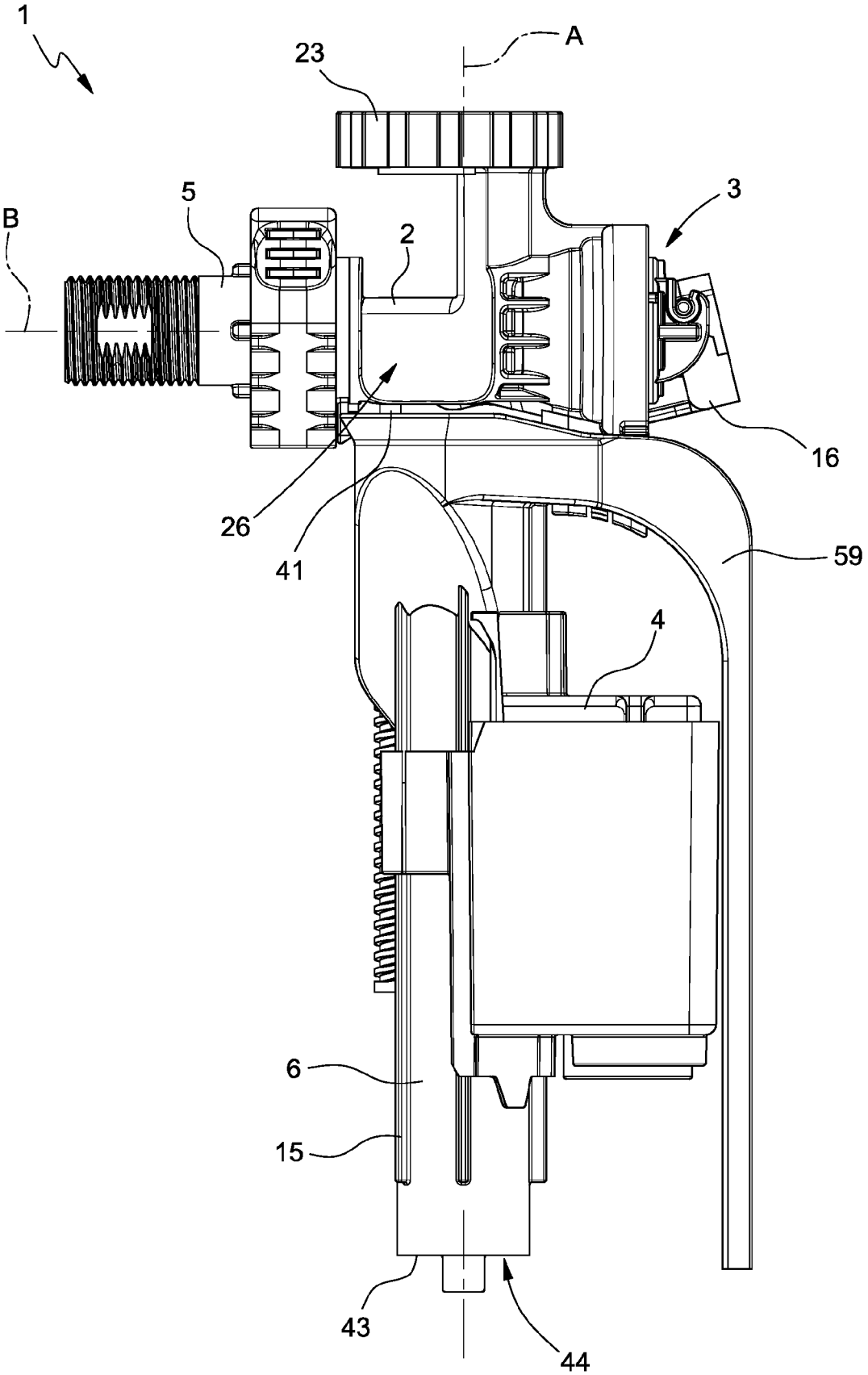

FIG. 1

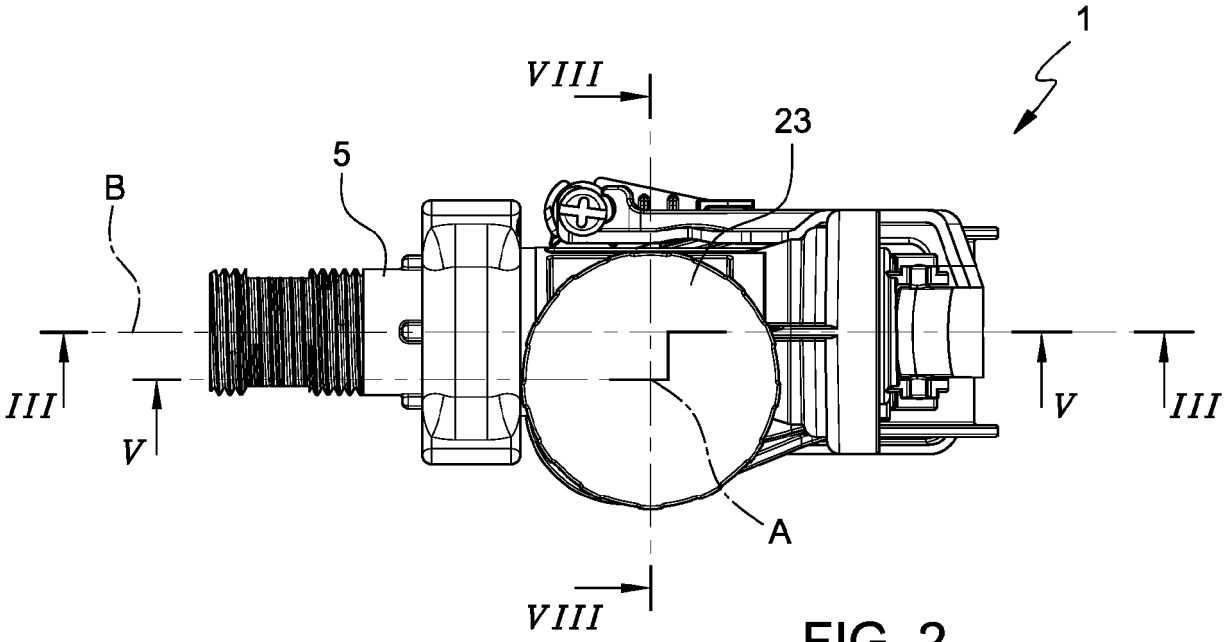

FIG. 2

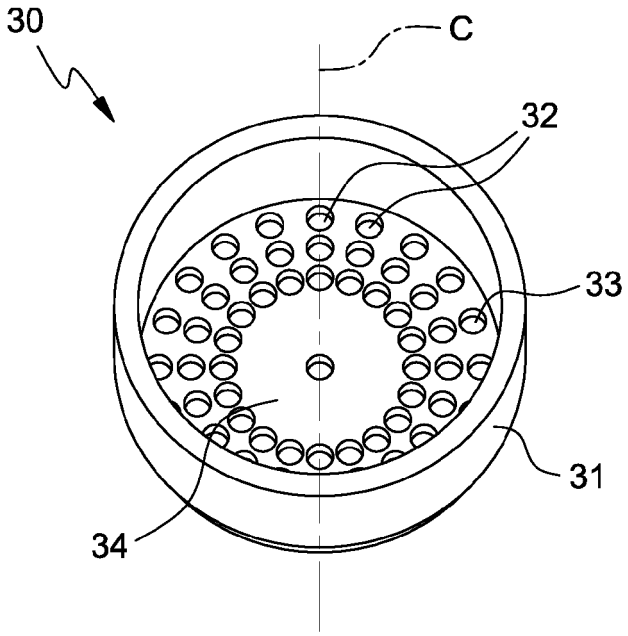

FIG. 6

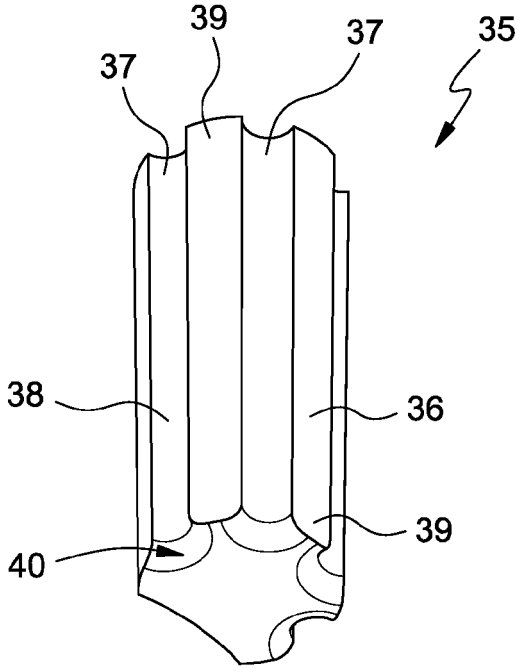

FIG. 7

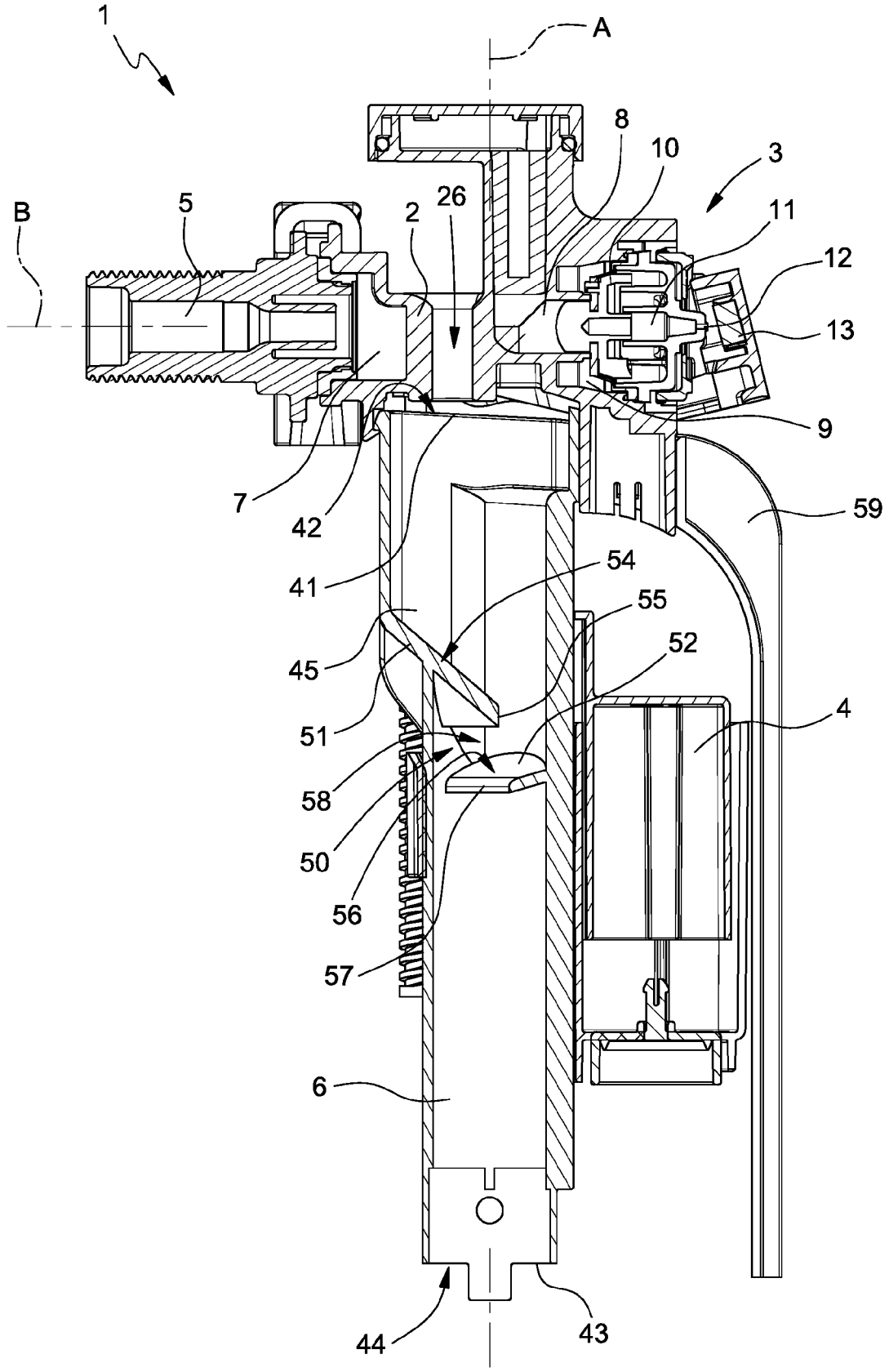

FIG. 3

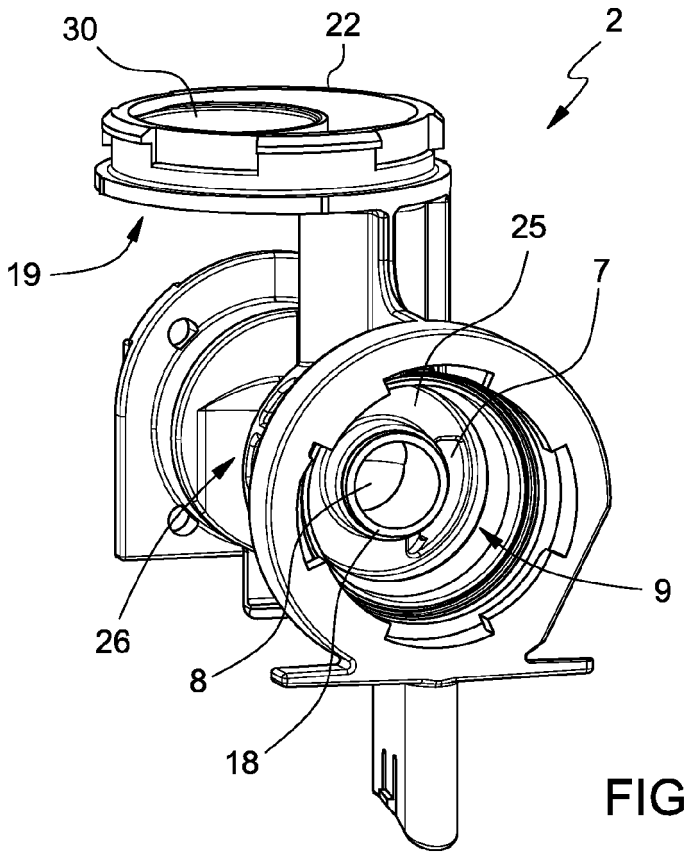

FIG. 4

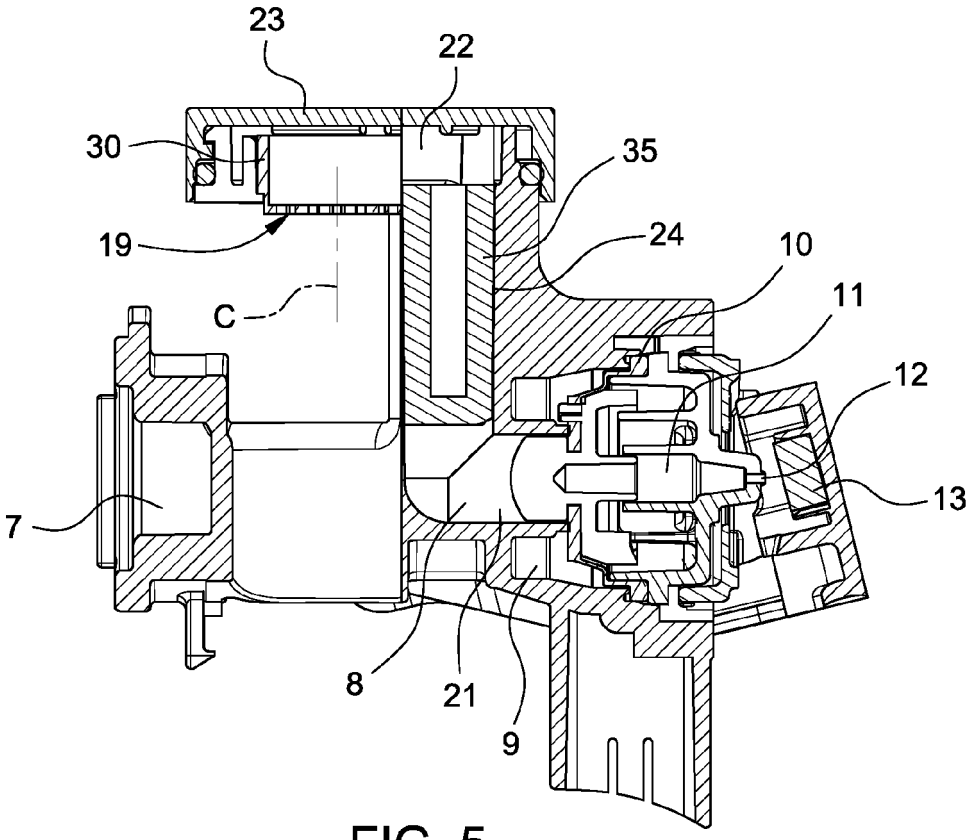

FIG. 5

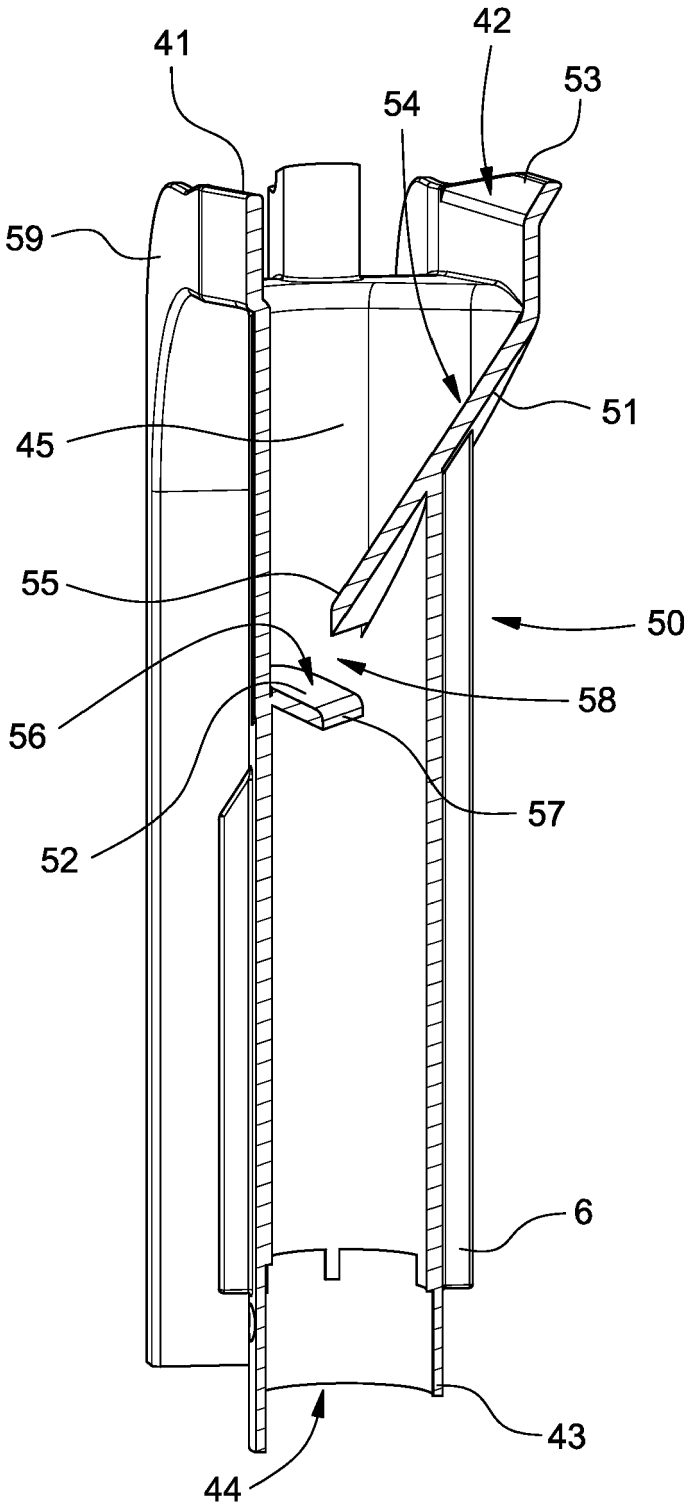

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 9458

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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
Munich	8 December 2020	Posavec, Daniel

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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