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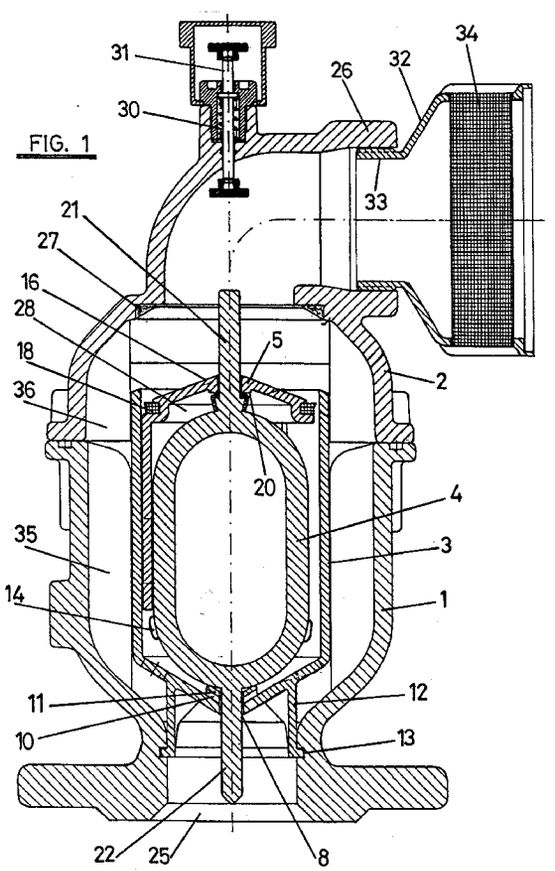
(54) Aeration valve for hydraulic circuits

(57) Aeration valve for hydraulic circuits made up of a frame (1-2) fitted with inlet and outlet openings (25, 26) inside which is housed a float (4) fitted with an upper closure capsule (5) further fitted with a joint (18) capable of resting against a seating surface (27) of the housing whenever the float is displaced towards its upper limiting position. Inside the housing is arranged a fixed sleeve (3) that incorporates a lower seating surface (10), upon which rests the float at its lower limiting position, and which forms, together with the housing, a ring shaped passage.

FIG. 1



EP 0 735 281 A2

Description

This invention refers to an aeration valve for hydraulic circuits, designed so that it automatically guarantees both full circuit air output and air admission during circuit emptying operations.

Hydraulic circuits must be fitted with aeration valves, which purpose is to effect the outlet of any air trapped within the circuit introduced either during the progress of circuit filling operations or as a consequence of undesirable operating effects.

Among the aeration valves are already well known those called "venting" valves, made up of a housing that defines a passage chamber, fitted with inlet and outlet openings, and housing a float that incorporates an upper closure capsule fitted with an external sealing joint. The valve is capable of vertical displacement between its lower and upper limiting positions. Its lower limiting position is reached whenever the housing of the valve is empty of any hydraulic circuit fluid, whereas whenever it is full of fluid the float goes then on to occupy, due to its buoyancy effect, its upper limiting position, in which the sealing joint of the upper closure capsule rests firmly against an opposite housing seating surface.

Whenever the hydraulic circuit fills up, as the fluid progressively fills up the housing of the aeration valve the float is then pushed upwards by its own buoyancy until the sealing joint of the upper capsule rests firmly against the housing seating surface. In theory the elevation of the float will take place due to the buoyancy effect as the fluid level rises within the valve housing. Notwithstanding this, during the hydraulic circuit filling operation the air initially occupying said circuits necessarily must scape through the aeration valves. The outlet of this air usually takes place with so much speed and pressure that in most cases it pushes the float and capsule upwards, to the point where it reaches its upper limiting position in which the capsule sealing joint rests against the housing seating surface. The valve is then closed in this situation, causing air outlet to cease and thus preventing its total evacuation, at the same time preventing the buoyancy effect of the fluid pushing the float upwards, causing the circuit pipes to collapse, which may even cause them to explode.

The object of this invention is an aeration valve of the previously described type, designed so that it automatically guarantees the total expulsion of the air contained within the hydraulic circuit, during its hydraulic fluid filling operations, as well as the outlet of any air that may remain within the circuit after it has been filled, or which presence may be due to the occurrence of undesirable effects during the operation of the hydraulic circuit.

The valve object of this invention does further allow air to be admitted into the circuit in order to prevent the occurrence of vacuum effects during the progress of circuit emptying operations.

In accordance with this invention, a fixed sleeve is arranged within the housing of the valve, said sleeve made up of a cylindrical shell sized so as to be capable of housing the float and upper closure capsule, duly allowing their free vertical displacement. Said cylindrical shell is open at its upper end, whereas at its lower end it forms a seat upon which the float rests at its lower limiting position.

The upper end of the cylindrical shell of the sleeve is below and at a given distance of the upper housing seating surface.

There is a vertical ring-shaped passage opening located between the cylindrical sleeve shell and the housing wall, through which the air will be let out, as explained further on. The vertical sleeve shell is further fitted with a number of lower openings.

The lower sleeve seating surface is also fitted with tilted drainage channels that lead downwards to a central passage opening.

The fixed sleeve is arranged within the housing in the vertical position, duly anchored to prevent displacements in any direction.

The float of the valve object of the invention is fitted, as an extension of its vertical axis, with two external rods, the lower one of which passes, with a certain amount of clearance, through the central opening of the lower sleeve seating surface, whereas the upper rod passes through a central hole of the capsule, so that it is located across a manually operated purging device fitted on the housing.

The features offered by the valve object of this invention and the advantages derived therefrom are set out below more clearly, with the aid of the enclosed drawings, which represent a non-limitative example of execution.

In the drawings:

Figure 1 is a diametral cross section view of a valve made pursuant to the invention.

Figure 2 is a side elevation view of the sleeve of the valve shown in figure 1.

Figure 3 is a diametral cross section view of the sleeve, taken as per the III-III cut away line of figure 4.

Figure 4 is a cross section view of the sleeve, taken as per the IV-IV cut away line of figure 3.

Figure 5 is a side elevation view of the capsule arranged over the float.

Figure 6 is an upper plan view of the capsule shown in figure 5.

Figure 7 is a vertical cross section view of the capsule, taken as per the VII-VII cut away line of figure 6.

Figure 8 corresponds to detail A of figure VII at a larger scale.

Figure 9 is an upper plan view of the valve housing cover.

Figure 10 is an upper plan view of the valve housing body.

The valve shown in figure 1 incorporates a housing made up of a lower body 1 and an upper cover 2, which define a chamber within which is fitted a fixed sleeve 3, inside which sleeve is housed a float 4 on top of which is then fitted a capsule 5.

As may be more advantageously observed in figures 2 to 4, the sleeve 3 has a cylindrical shell 6 open at its upper end, whereas at its lower end it is shaped as a cone 7 crowned by a central passage opening 8 internally lined by a wall 9 upwardly forming a seating surface 10 for float 4. Said wall is traversed by drill holes 11 leading to the central opening 8. From the lower surface of the cone shaped surface 7 extend supporting and anchoring legs 12 with an elbow shaped ending designed to fit into a surrounding slot 13 practised into the lower body 1 of the valve housing, as may be observed in figure 1.

The cylindrical wall 6 of sleeve 3 is fitted with openings 14.

Figures 5 to 8 represent the upper capsule 5 arranged onto the float 4. Said capsule is made up of a tapered cover 15 fitted at its summit with a passage opening 16 and at its base with a surrounding channel 17 that incorporates a sealing joint, figure 1.

From the surrounding periphery of this capsule extend axial legs 19 that will fit between the side surface of the float 4 and the internal side surface of sleeve 3, as may be observed in figure 1. The legs 19 may be further fitted with crossing ribs or projections which purpose will be to ensure its attachment to float 4 and to reduce friction against the internal surface of the sleeve 3 during the vertical displacement of the float 4 and capsule 5.

As may be better observed in figure 8, the opening 16 of the capsule 5 is surrounded, on the internal surface of said capsule, by a ring shaped rib 20.

As may be observed in figure 1, the float 4 has, as an extension of its lengthwise axis, two rods 21 and 22. The lower rod 22 has been designed to fit through the conical bottom opening 8 of the sleeve 3, being the diameter of said opening slightly larger than that of the rod, in order to allow its passage with a certain amount of clearance. The upper rod 21 fits through the opening 16 of the upper capsule 5. This rod 21 has, at its initial portion, a widening 23 around which is fitted a elastic material joint 24 designed to rest against the ring shaped rib 20 running around opening 16.

With the above described constitution, whenever, for example, hydraulic circuit filling starts, the air being let out of said circuit will arrive to the valve through the lower opening 25, rising through the ring shaped passage defined between the sleeve 3 and the valve housing wall, until it reaches the upper outlet opening 26. Thus the outlet air practically does not exert any action whatsoever against float 4 and, there will not, therefore, be any risk of said float being dragged by the air whenever it is circulating at a excessively high speed. Once the circuit fluid is rising through the valve, it does then gradually exert an upward pressure upon float 4, which will cause capsule 5 to be dragged until the sealing joint 18 rests against a lower seating surface 27 formed on cover 2 of the valve. This situation will come about whenever all of the hydraulic circuit air has been let out in the previously described manner. The elevation of float 4 will take place as the valve does progressively fill up with fluid and as said fluid enters the sleeve 3 through the openings 14, figures 2 and 3, practised on its surrounding shell.

The valve object of this invention has been designed so that, once the previously described closure situation is reached, the automatic purging of any possible bubbles or of any other air pockets initially remaining in the hydraulic circuit, or that may be later produced during its operation, may then take place. Said air bubbles, upon reaching the valve, will then rise through it until they reach the internal space defined between capsule 5 and float 4, which will then be at their upper limiting position, resting the joint 18 upon the seating surface 27 of the valve cover. This space, shown in figure 1 with item reference number 28, is located above the closure line defined between joint 18 and seating surface 27. Under these conditions, the pressure that may then be exerted by the air upon float 4, added to the reduction of its buoyancy, the float will then move downwards until it causes the joint 24 arranged around rod 21 of the float to move apart from rib 20 of capsule 5, causing the air to be let off through the space defined between the upper rod 21 of the float and hole 16 of capsule 5. When the air contained within the space 28 flows out, the downward pressure will then disappear and the float 4 will once again reach its upper limiting position, resting the joint 24 upon the ring shaped rib 20 in order to recover once again its sealing condition.

Whenever the hydraulic circuit is to be emptied, the float 4 moves downwards as soon as the fluid level within the valve descends, causing the joint 18 to move away from the seating surface 27, allowing the air to penetrate through opening 26 of the valve cover. All of the fluid inside the valve may then be let out, initially through the openings 14 on the shell of sleeve 3 and finally through the conduits 11, practised under the seating surface 10 of the float 4, and through the ring shaped space left between the hole 8 at the lower end of the sleeve 3 and the lower rod 22 of the float.

The openings 14 are also used to equalize pressures between the internal and external surfaces of sleeve 3, in order to prevent the occurrence of vacuum

effects.

To recap, the valve object of the invention allows the total expulsion of the air during the circuit filling procedure, as well as the further expulsion of any air bubbles or air pockets that may either have remained or may alternatively be produced during the operation of the installation, and also emptying out the circuit without any vacuum effects being experienced.

Cover 2 of the valve is fitted, as may be observed in figure 1, with an upper push down device 30, of constitution already known, that includes a rod 31 capable of axial displacement and which is sized so as to rest upon the upper rod 21 of float 4, whenever it is at its upper limiting position, and cause it to move downwards, thus allowing a manual emergency venting or purge to be effected.

As may be observed in figure 1, at opening 26 of the cover 2 of the valve shall be arranged a filter 32, which may be fitted with a neck portion 33 externally threaded so that it may be duly fixed to opening 36. This filter conforms a chamber housing the filtering elements 34. The arrangement of this filter will make it possible to purify the inlet air and prevent the introduction into the valve of external particles that may damage the hydraulic circuit. Further elements may be optionally added to enable air input and output to be directed as required.

As may be observed in figures 1 and 10, the body 1 of the valve and the cover 2 are internally fitted with axial ribs 35-36 that will secure the coaxial arrangement of the sleeve 3.

Claims

1. Aeration valve for hydraulic circuits, made up of a housing defining a passage chamber, with inlet and outlet opening, inside which is housed a float upon which is fitted an upper closure capsule that carries an external joint that rests against an upper housing seating surface, when the float is displaced towards its upper limiting position, characterized because inside the housing is arranged a fixed sleeve made up of a cylindrical shell, inside which is housed the float and upper closure capsule capable of free upwards displacement, and a lower seating surface upon which the float rests at its lower limiting position, which cylindrical wall determines, together with the wall of the housing, a ring shaped vertical passage and is further fitted with a number of lower openings, and which seating surface has tilted drainage conduits leading down towards a central passage opening.

2. Valve as per claim 1, characterized because the float has, as an extension of its vertical axis, two external rods, of which the lower one passes, with a certain amount of clearance, through the central hole of the lower sleeve seating surface, whereas the upper rod passes through a central hole of the capsule and ends up located across an aeration push down device fitted into the housing.

3. Valve as per claim 1, characterized because the upper rod of the float has at its lower end a surrounding widening upon which is arranged an elastic material ring that rests against a seating surface formed around the central hole of the capsule, against the internal surface of said capsule, whenever the float is at its upper limiting position.

FIG. 1

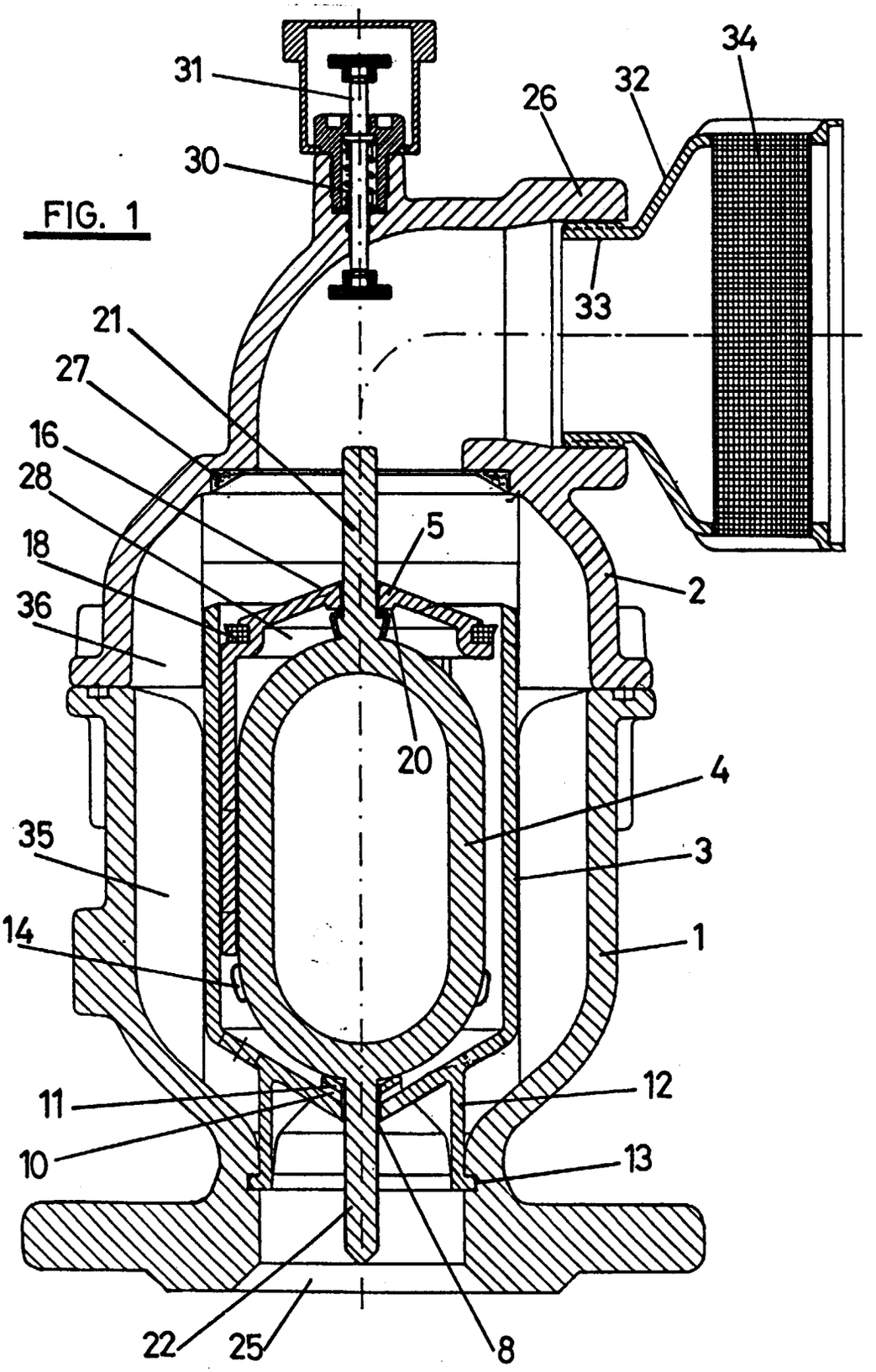


FIG. 2

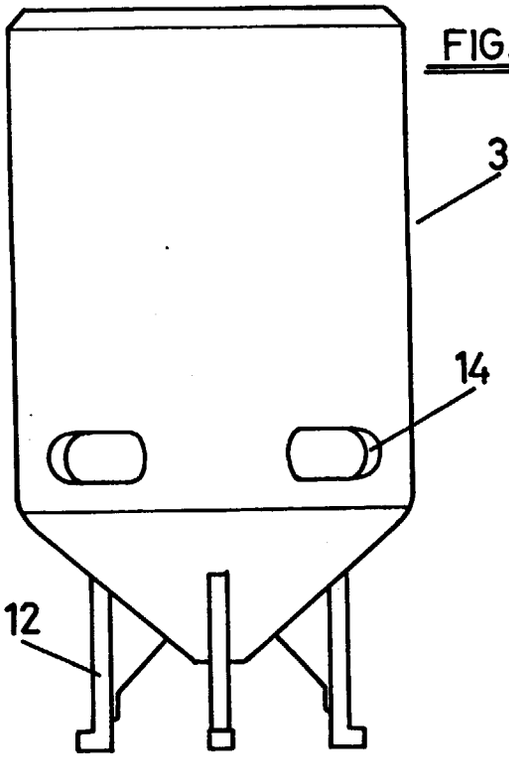


FIG. 3

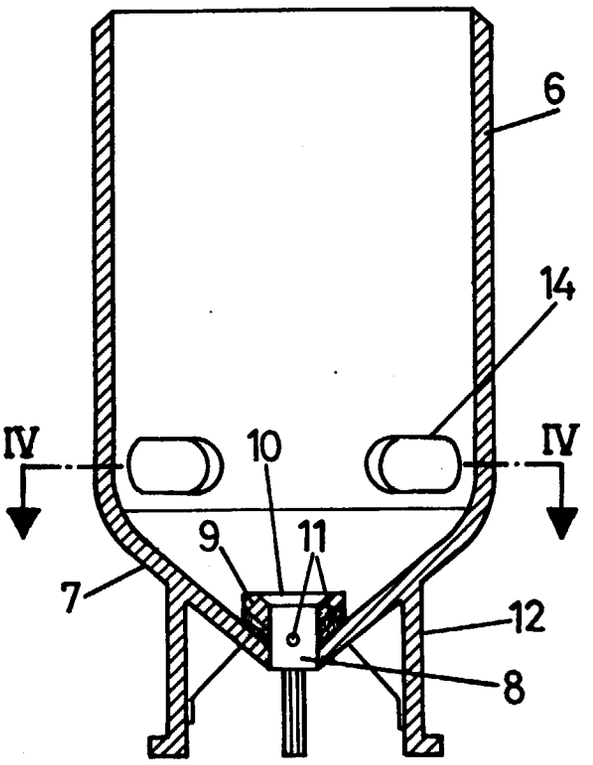
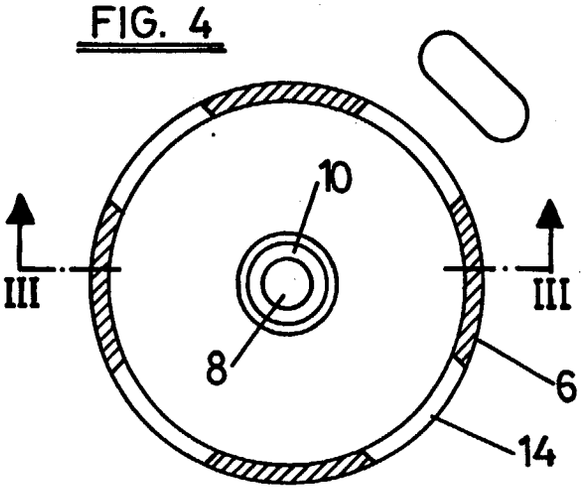


FIG. 4



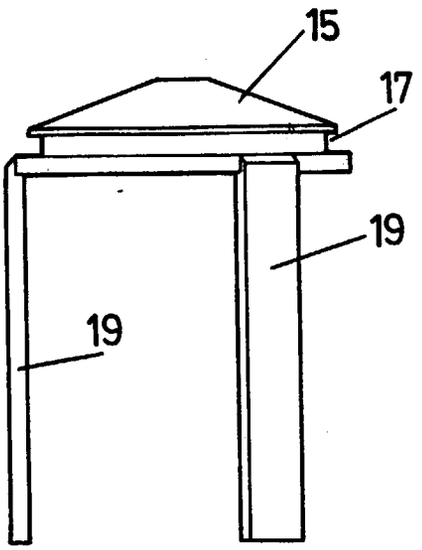


FIG. 5

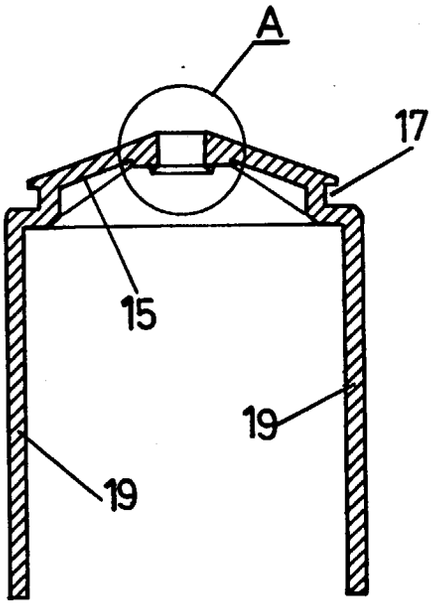


FIG. 7

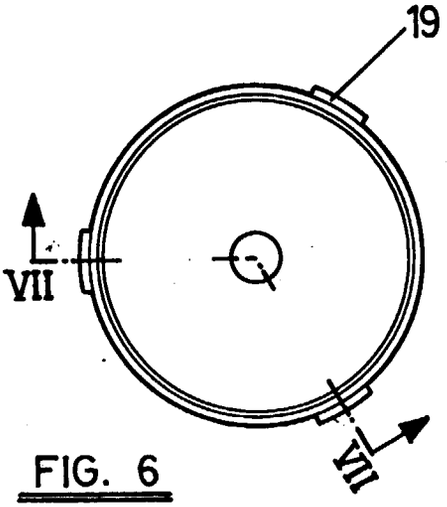


FIG. 6

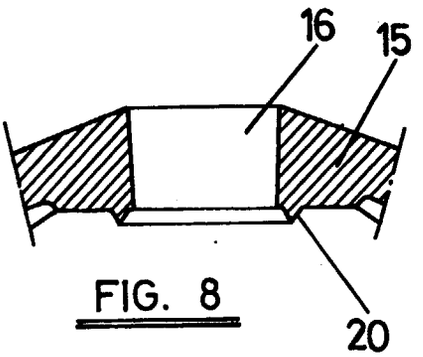


FIG. 8

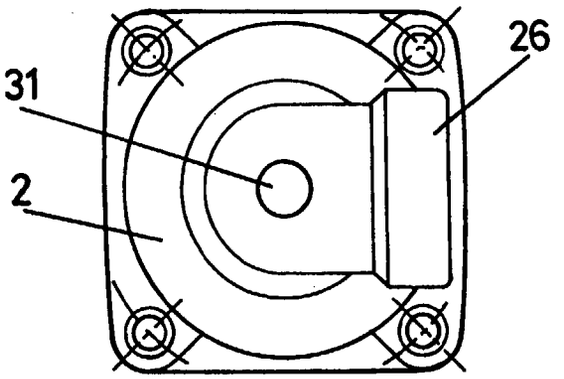


FIG. 9

FIG. 10