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Remarks:
A request for correction incurring two clerical errors with reference to Figures 1 and 9 has been filed pursuant to Rule 88 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

(54) A forced discharge compressed-air operated device for sanitary fixtures

(57) A forced discharge device for sanitary fixtures comprises a generally cylindrical body (11), which is shaped with an inlet opening (12) and an outlet opening (13); a cup-shaped element that moves in the body between an extended position, in which it closes the inlet opening and a retracted position in which it leaves said inlet opening free; a distributor element (16) fixed in the body, having ducts for compressed air; a twin piston element (15) movable inside the cup between a retracted position and an extended expelling position.

The device is suitable for sanitary fixtures of various types, including tip-up foldaway fixtures.

The device operates efficiently and reliably even in situations in which the discharge has a very small section or an upward, long or winding course; it allows water consumption to be limited; it allows a moderate power consumption.

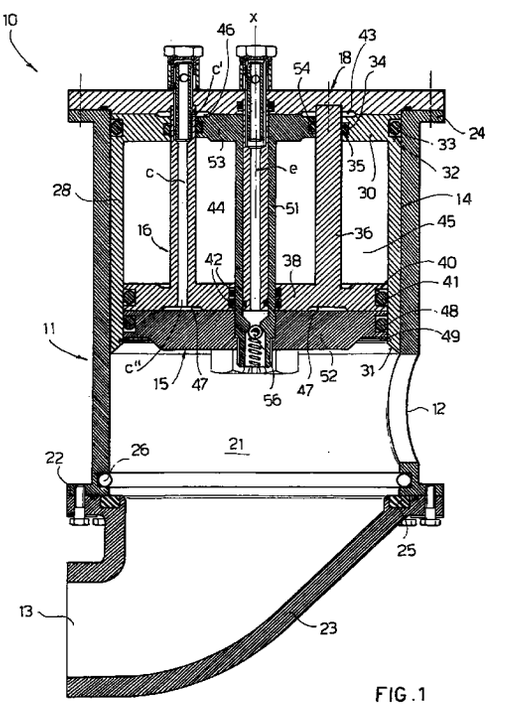


FIG.1

EP 0 806 527 A2

Description

The invention refers to the field of forced discharge sanitary fixtures, as are widely used, for example, on means of transport such as ships, airplanes or trains.

It is known that motorized systems, for evacuation of wastewater from sanitary fixtures for instance, have considerable drawbacks. For example, known systems that use a rotor are subject to breakage thereof when a hard object such as a fruit stone is accidentally thrown into the fixture.

The vacuum systems currently in use, which have been used for a long time in the shipping sector and more recently in the rail sector, have the drawback that reverse flow may occur when they are accidentally subjected to changes in the pressure situation.

An aim of the present invention is to exclude the possibility of accidents due to dangerous backflow that might involve the user. A further aim is to eliminate or drastically reduce the possibility of damage to the sanitary fixtures or downtime thereof.

A further aim is to achieve the above advantages with reduced water consumption and moderate power consumption.

A further aim is to provide such devices that can also be adapted to foldaway fixtures.

The above aims have been achieved with a device as stated in claim 1. Further characteristics of the device are stated in the subsequent claims.

In other words, the new device comprises a body that can be mounted on the sanitary fixture, the body being provided with an inlet opening for entry of wastewater and an outlet opening for discharge thereof and defining an inner chamber in which a cup-shaped shutting element can move between an extended position, in which it shuts the inlet opening, and a retracted position in which it leaves said opening free, to the body, or to a cover fixed thereto, being fixed a distributor element, provided with input and output ducts for a fluid, generally compressed air, and further comprises a twin piston element, movable inside the cup-shaped element between an extended position (with the cup-element extended) and a retracted position.

The new device achieves the above aims, and in particular it eliminates the possibility of backflow of expelled wastewater, it provides for a perfect separation, in a closed position, between the discharge network and the sanitary fixture; it can be adapted not only to fixed sanitary fixtures but also to foldaway sanitary fixtures; it requires reduced water consumption and reduced power consumption: its operation is efficient and reliable even in situations where the waste pipe has a very small section or an upward, long or winding course.

An exemplary unrestrictive embodiment of the invention will be described below with reference to the appended drawings, in which:

Figure 1 is an axial sectional view of the device according to the invention in a first embodiment; the plane of the sectional view is indicated by 1-1 in Figure 2;

Figure 2 is a top plan view of the device in Figure 1, with the cover removed to show underlying parts;

Figure 3 is an axial sectional of the distributor element of the device alone, taken along a plane indicated by line 3-3 in Figure 2;

Figure 4 is an axial sectional view of the distributor alone, taken along a plane indicated by line 4-4 in Figure 2;

Figure 5 is an axial sectional view of the distributor alone, taken along the plane indicated by line 5-5 in Figure 2;

Figure 6 shows the device fitted to a sanitary fixture of a traditional type;

Figure 7 shows the device fitted to a tip-up foldaway sanitary fixture shown positioned for use;

Figure 8 shows the fixture in Figure 7 in a raised idle position;

Figures 9 to 12 are schematic pictures of the device, shown in various purely illustrative sectional views, which show four stages of operation of the forced discharge device.

With reference first to Figures 1 to 5, a forced discharge device is indicated as a whole by reference number 10 and comprises a hollow body 11, generally but not necessarily cylindrical, that has an inlet opening 12 to let wastewater in and an outlet opening 13 to let wastewater out. Inside the body 11 a cup shaped element indicated as a whole by reference number 14 can slide axially (in a direction defined by the x axis of the body). A twin piston element indicated as a whole by 15 can slide axially inside and with respect to the cup-shaped element 14. A distributor element 16 is fixed with respect to the body 11 and more precisely is supported by a cover 18 fixed to the body 11.

The above elements will now be described in detail.

The body 11 is formed with an internal a chamber 21, in which said inlet opening 12 opens. This opening is made in the side wall of body 11. The body 11 also has a lower flange 22 for attachment of an outlet part 23, in which said outlet opening 13 opens. The body 11 also has an upper flange 24 on which said cover 18 is screwed. The coupling and fixing screws are not drawn but simply indicated with their axes drawn with dashed and dotted lines.

At an end thereof towards part 23, the body 11 has an internal seat for an O-ring or sealing ring 26, whilst the part 23 itself has a seat for an abutment ring 25, thus allowing the cup-shaped shutting element 14 to seal the

chamber 21 tightly.

The cup-shaped shutting element 14 has a cylindrical skirt part 28, of a suitable size and shape to be able to slide inside the chamber 21 of the body, and an upper (in fig. 1) flange part 30, extending inside from the skirt part. The skirt part is preferably thinner at one end 31; at the opposite end it has a seat 32 opening towards the outside for an O-ring 33, and a seat 34, facing inwards, for an O-ring 35.

The fixed distributor element 16 comprises a cylindrical portion 36, from which a lower (in fig. 1) plate portion 38 extends; it has a circumferential peripheral seat 40 for an O-ring 41 to provide a seal against the inner surface of the cup-shaped element 14 and a through hole 39 with seats for O-rings 42, 42, for a stem of piston 15. The cylindrical portion of distributor 16 has a plurality of ducts for an operating fluid, said ducts being circumferentially spaced apart and referenced respectively a, b, c and d as can be seen in the plan view in Figure 2. The operating fluid is preferably compressed air, supplied by a compressor or a special system (not illustrated). The ducts a, b, c and d have a threaded mouthpiece for connection to said supply system, by means of solenoid valves or opening and closing devices managed by an electronic, electrical or mechanical logic.

The duct a, which can also be seen in Figure 3, extends with its axis parallel to the axis of the device and ends in the vicinity of plate 38 in a radial passage towards the outside, indicated by a', which opens into an annular chamber 45 defined between the distributor and the cup-shaped element.

The passage or duct b, which can also be seen in Figure 5, has a limited axial extension and opens outwards radially at the top into the annular chamber 43 through a hole b' defined between the cup-shaped element 30 and the cover 18.

The duct c, which can also be seen in Figure 1, extends in an axial direction, has a radial opening c' in a chamber 46 between the cover and the piston and an end opening c" in the outermost surface of the distributor, facing the piston 15; that is to say, the opening c" opens into a chamber 47 defined between plate 38 and piston 15.

The duct d, which can also be seen in Figure 4, extends in an axial direction and has a radial opening d' at an end near the plate 38, facing towards the chamber 44 of the distributor (that is, with the device assembled, towards the chamber defined between the distributor and the piston).

The piston 15 comprises a stem 51, a working head 52, a drive head 53 all integral with each other. The working head slides inside the cup 14, forming a seal with O-ring 48; 49 is a stop on the cup. As the stem slides inside the plate of the distributor a seal is formed by the O-rings 42. The drive head slides along the inside wall of the distributor, a seal being formed by the upper O-ring 54 accommodated in the head 53. An axial duct for compressed air is defined inside the stem 51 and this duct is indicated as a whole by the letter e. A check valve 56 is situated on the bottom of the duct and indicated schematically by a spring-loaded ball.

The forced discharge device is mounted downstream of the bowl of a sanitary fixture as can be seen in Figure 6 or in Figures 7 and 8. In Figure 6 the sanitary fixture is indicated with the reference number 60 and is of a traditional type. The device 10 is mounted with the longitudinal axis x lying horizontally, with the opening 12 at the outlet of the bowl and the opening 13 connected to a per se known rotary exhaust valve which will therefore not be described in detail.

The sanitary fixture of Figures 7 and 8 is a tip-up foldaway fixture, which is shown in the position of use in Figure 7. The device 10 is mounted with the x axis vertical and the opening 12 at the opening of the bowl of the sanitary fixture 70. In figure 8 the device 10 is shown tipped with the sanitary fixture, in the resting position.

With reference now to Figures 9 to 12 various stages of operation of the device will be described.

At rest (Figure 9) the cup-shaped shutting element 14 is in a fully extended position, so that it completely covers the inlet opening 12, thus closing it tightly, that is to say forming a seal on O-ring 26, on O-ring 33 and on the abutment ring 25.

When the device 10 starts to operate (Fig. 9), compressed air is introduced through the duct d of the distributor and the opening d', between the plate part 38 of the distributor and the drive head 53 of the piston. Since the plate part 38 is fixed, the head 53 and the whole piston 15 rise, expelling air through the openings c' and c" and the duct c (Fig. 12).

A vacuum is created in the chamber 21.

Compressed air is then introduced through the duct a of the distributor and the opening a' between the plate part 38 of the distributor and the flange 30 of the cup (Fig. 10).

Since the plate part 38 is fixed, the flange 30 and the whole cup 14 rise, expelling air through opening b' and duct b (which for simplicity's sake has been indicated in the scheme of Figures 9 to 12 as being connected directly to the body rather than made in the distributor, as is actually the case (Fig. 5)).

At the end of its stroke, the distributor is therefore in the position shown in Figure 11, with the cup-shaped shutting element completely retracted so as to free the opening 12.

Through it, the wastewater can fill the chamber 21.

Compressed air is then introduced through the duct b at the same time allowing air to evacuate through the duct a. The cup-shaped element 14 is thus again pushed into the extended position in Fig. 12, shutting the inlet opening 12 and preventing any return of wastewater or odors through the sanitary fixture.

At this point the piston 15 enters into operation and is pushed into the extended state (Fig. 9) to expel the wastewater through the discharge opening 13. Operation of the piston 15 is carried out by introducing compressed air through the duct c and the openings c' and

c" (Fig. 12), so as to act simultaneously on the upper surfaces of the larger working head and of the smaller drive head of piston 15.

Compressed air may be introduced through the duct e at this stage to facilitate evacuation of the wastewater.

The cycle is ended, and in any case can be repeated, on the basis of a programmable logic, until the wastewater has been completely evacuated.

It will be understood that in this way a functional and efficient device has been provided to close the wastewater inflow opening completely and prevent any return of wastewater and odours.

Claims

1. A forced discharge device for fluids, preferably wastewater and the like, characterized in that it comprises:

   - a body (11) forming an inner chamber (21) with an inlet opening (12) and an outlet opening (13);
   - a hollow, cup-shaped shutting element (14) movable inside said body between an extended position in which it closes said inlet opening (12) and a retracted position, in which it leaves said inlet opening (12) at least partly free;
   - a distributor element (16) that is fixed with respect to the body and has a widened plate part (38);
   - a piston element (15) comprising a stem (51), a working head (52), a drive head (53), that can slide with respect to said distributor and said cup-shaped shutting element;
   - ducts (a, b, c, d) for a drive fluid.

2. A device according to claim 1, characterized in that said ducts are made at least partly in the distributor.

3. A device according to claim 1, characterized in that it comprises a further duct (e) for fluid in the piston stem, closed by a check valve, to facilitate evacuation of wastewater.

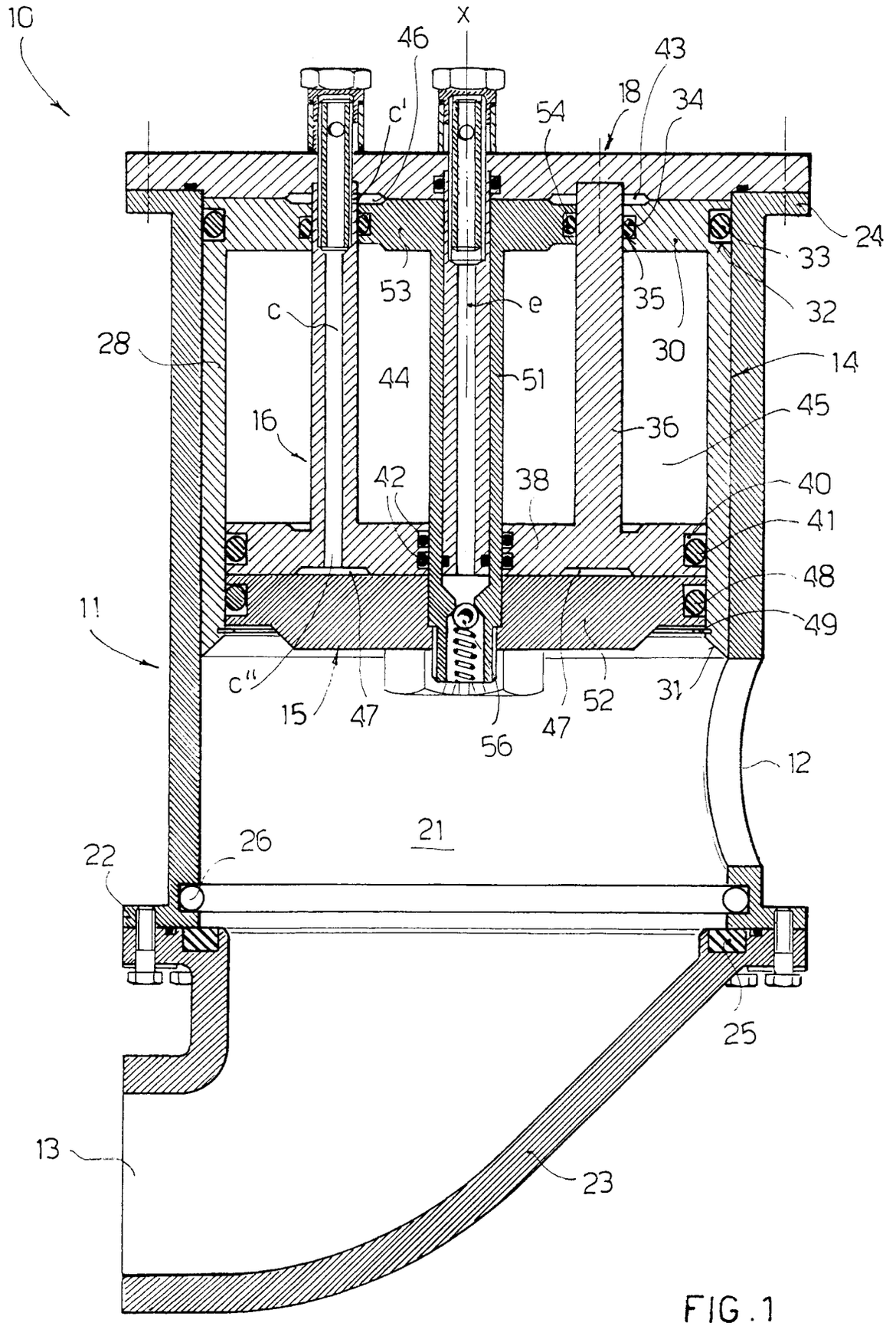
4. A device according to claim 1, characterized in that it comprises a cover (18) fixed to the body and said distributor is fixed to the cover.

5. A device according to claim 1, characterized in that the ducts for the drive fluid comprise:

   - a duct (a) with a radial opening (a') in the vicinity of the plate part of the distributor,
   - a duct (b) with an opening (b') situated in a position near the cover,
   - a duct (c) with an opening (c', c") to act on corresponding surfaces of the piston heads (52; 53)
   - a duct (d) having an opening (d') in the vicinity of the distributor plate and facing toward the piston stem.

6. A device according to claim 1, characterized in that the operating fluid is compressed air.

7. A device according to claim 1, that can be mounted on fixed sanitary fixtures or on tip-up foldaway sanitary fixtures.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X
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18
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54
c'
24
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53
e
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c
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14
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38
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41
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11
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c''
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FIG.1

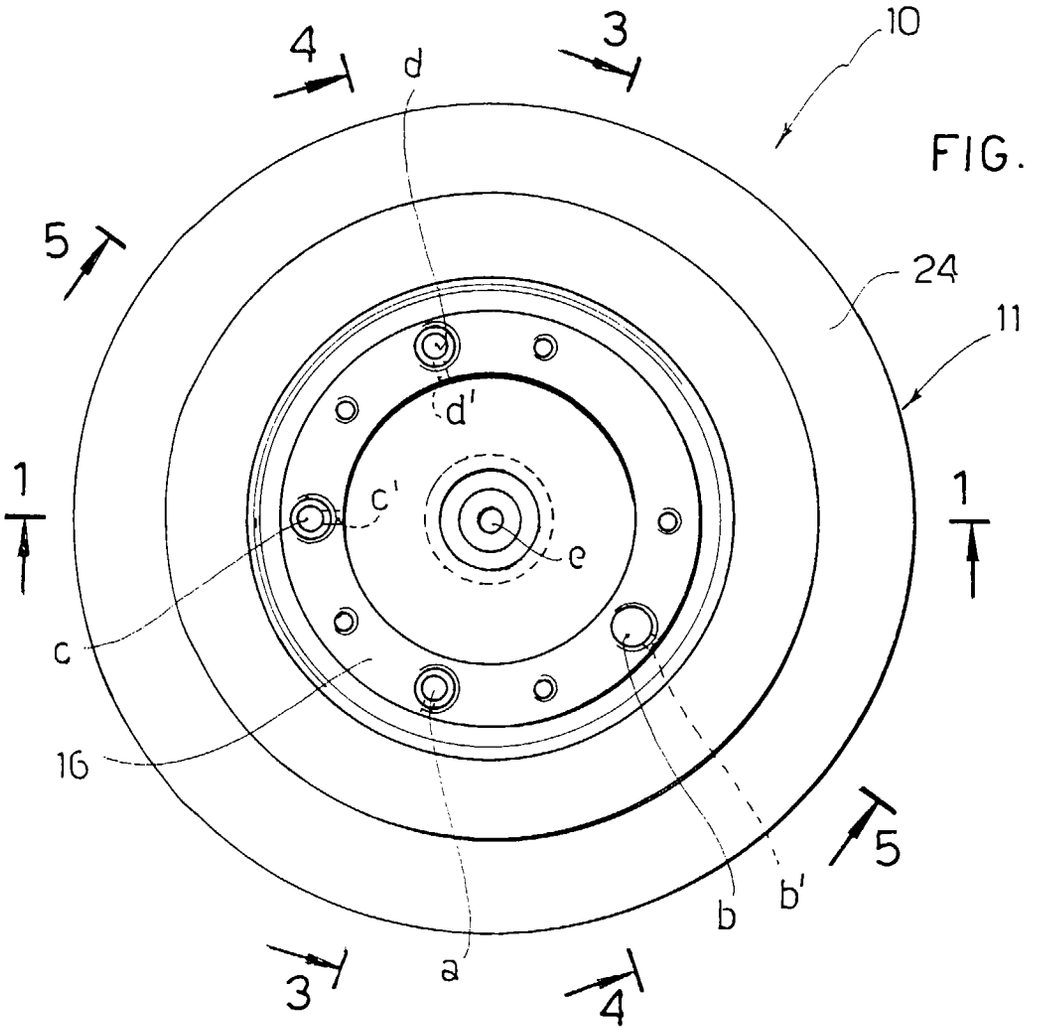


FIG. 2

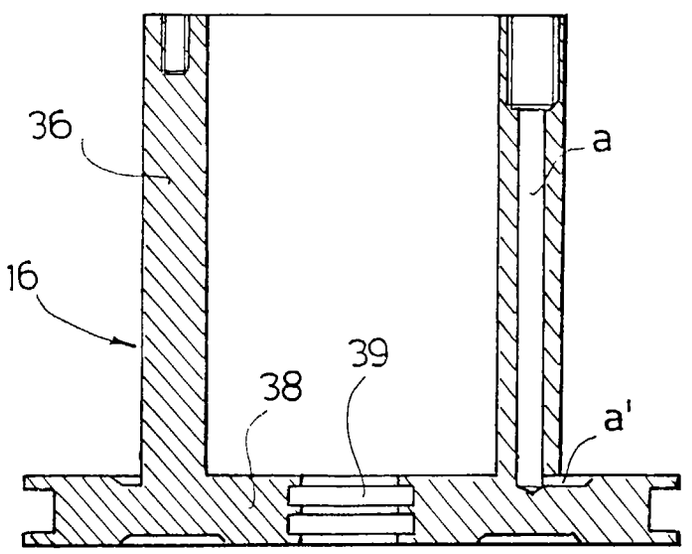


FIG. 3

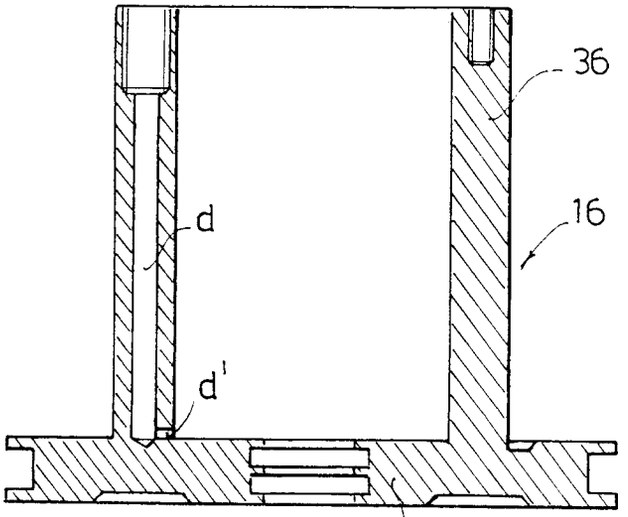
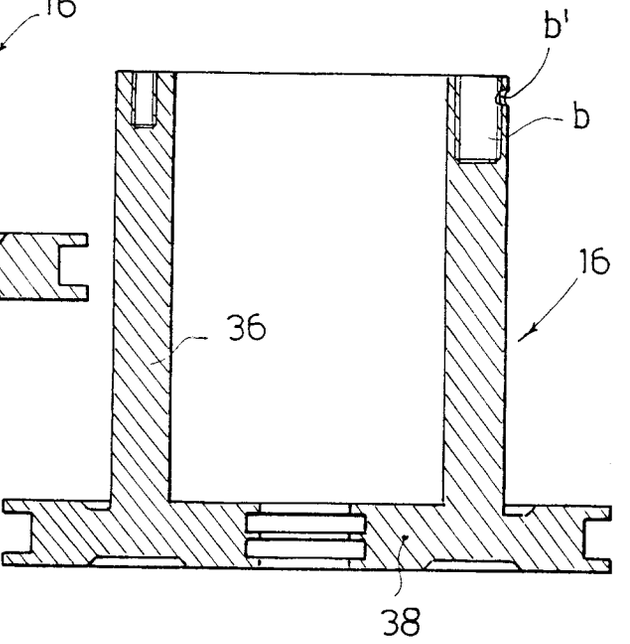


FIG.4

FIG.5



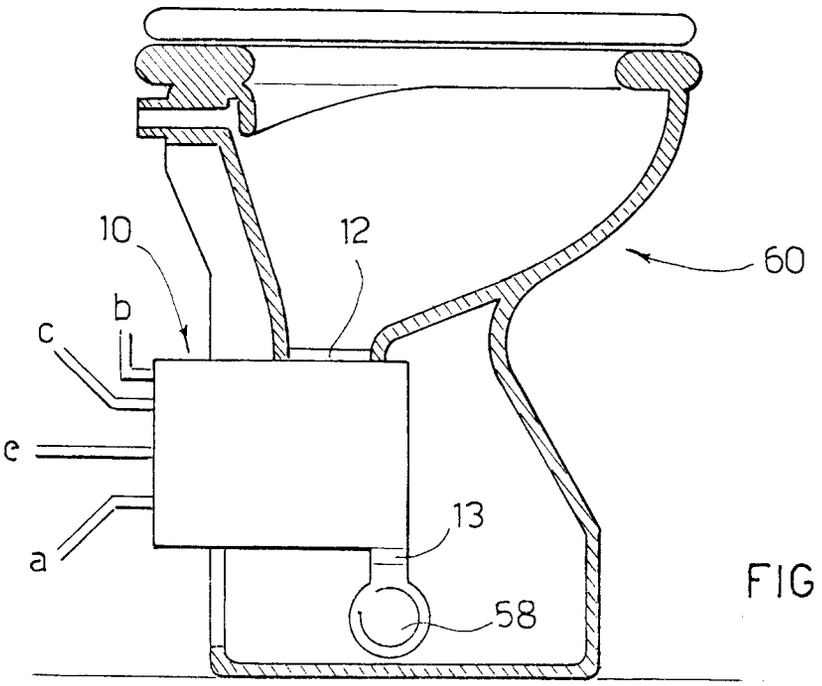
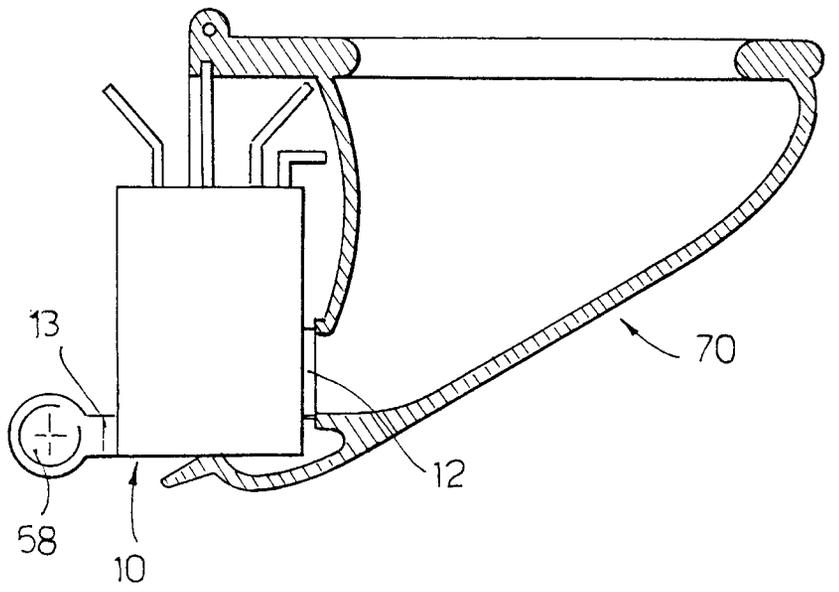


FIG.6

FIG. 7



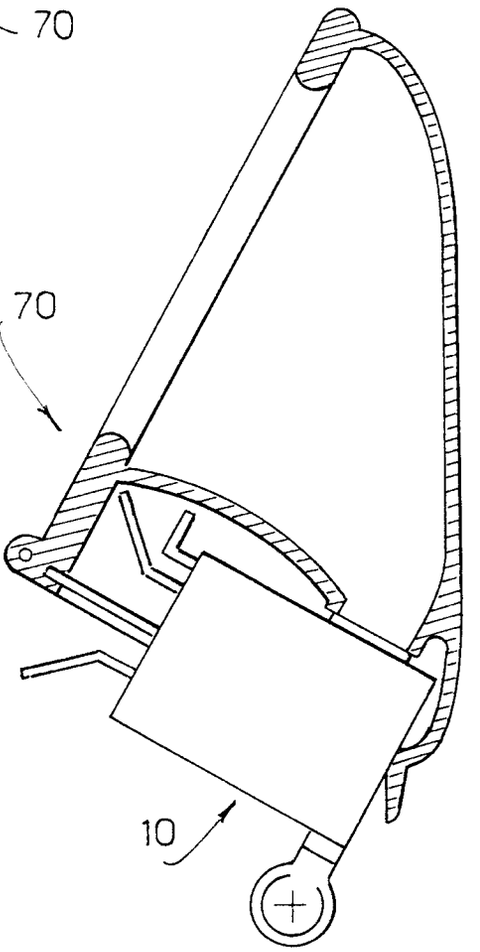


FIG. 8

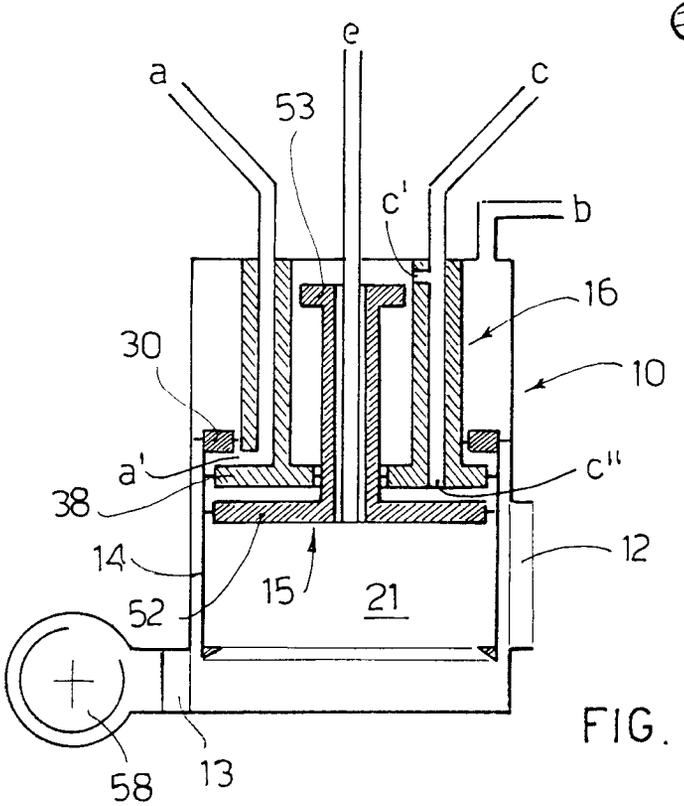


FIG. 10

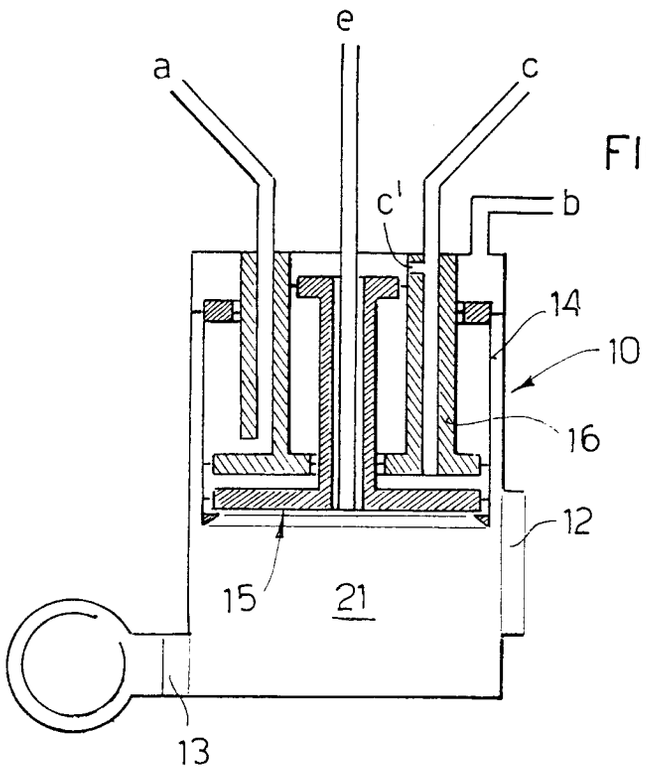


FIG.11

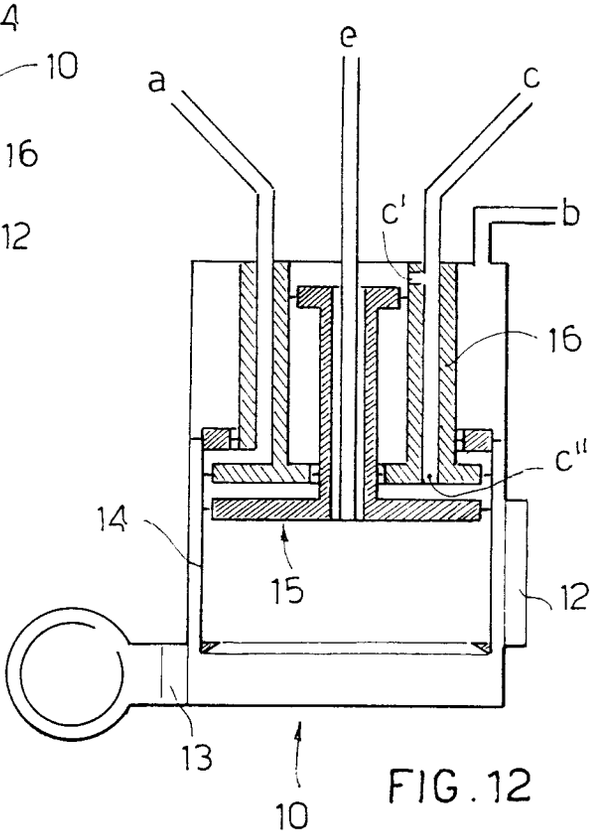


FIG.12

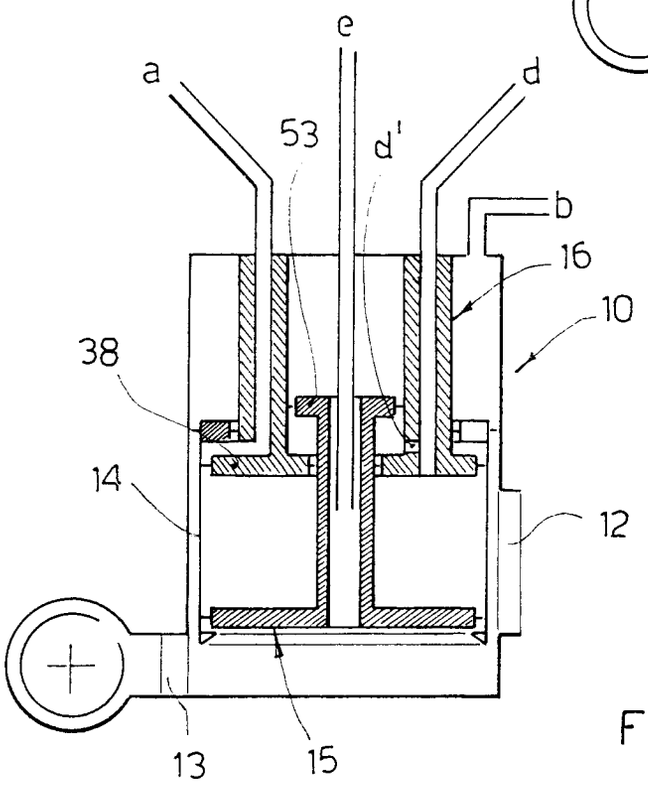


FIG.9