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(54) A water closet facility with self-cleaning bowl.

(57) The w.c. facility disclosed is self-cleaning, and comprises a pair of bowls (1) mounted back to back and symmetrical at either side of a movable partition (7) which rotates about a vertical axis coinciding with that of a branched waste pipe (35) serving the two bowls. A fixed partition (4) separates the closet (5) from a service compartment (6) accommodating a flush-and-disinfect device (2), leaving an opening (8) occupied by the movable partition (7), and incorporates a drying device (3) which is made to operate during passage of a single bowl (1) from the service compartment (6), where it will have been flushed and sterilized, back into the closet (5).

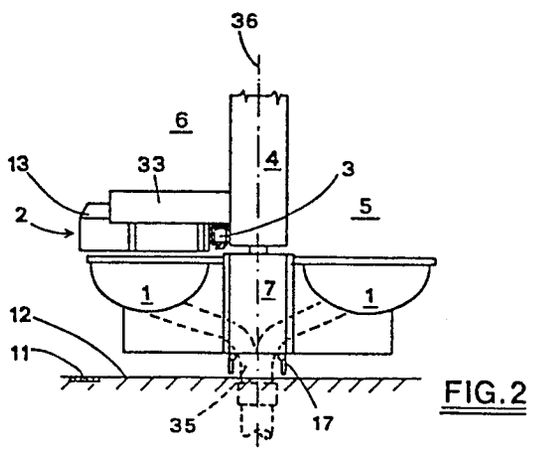

FIG.2

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A water closet facility with self-cleaning bowl.

The invention described herein relates to a water closet facility which features unassisted cleaning, inasmuch as it is provided with devices for flushing and disinfecting, and for drying the w.c. bowl.

The problems that the invention sets out to overcome are those connected with automated public lavatories where general upkeep is the work of one attendant. Essentially, such facilities envisage the use of a w.c. bowl which, following use by an individual on each single occasion, must be flushed, disinfected, and then dried, by entirely automatic means.

To this end, the prior art embraces apparatus for flushing-and-disinfecting and drying the bowl of a w.c. which, following operation, can be stowed out of sight in a recess located in the wall against which the bowl is installed.

In a first type of embodiment, the apparatus swings down from a raised position, in which it is stowed inside the recess in the wall, to a lowered position in which contact is made with the bowl.

The apparatus is provided with means for flushing and disinfecting and then drying the bowl, which are rotated by appropriate mechanical means, and operate only when the apparatus is in the lowered position.

In a second type of embodiment, the apparatus traverses from the stowed position, inside the recess, to a position outside the recess and above the bowl.

Both types of prior art embodiment are beset by a number of drawbacks, not least of which is the fact that their various components must be both movable, and stowable in a small recess, in order that an individual may use the w.c. unhindered; the result is that such facilities tend to be complex in construction and require frequent servicing.

The significant drawback of prior art apparatus is that of down time occasioned by flushing and disinfecting, and drying of the bowl, during which no use of the w.c. is possible. Down time cannot be reduced beyond a certain limit however, since the flush-and-disinfect and drying means require a given minimum technical time lapse in which to operate; moreover, the apparatus cannot be stowed at too great a speed without running the risk of such means becoming damaged when swung or traversed back into the recess.

One drawback manifested particularly by the second type of prior art embodiment is that drying will be only partial and localized in certain instances, due to the structural characteristics of components and the need for compactness.

The prior art also embraces water closets in which the bowl is tilted or turned toward flush-and-disinfect and drying apparatus, which in such an instance remains stationary, a working principle the exact opposite of the water closets first described. Such facilities present the same drawbacks as mentioned above, compounded further by the lack of a faultless watertight seal with which a bowl tilted about a

horizontal axis needs to be provided. On the other hand, where a bowl turns on a vertical axis coinciding with that of the waste pipe, the additional problem arises of how the bowl may be covered during flush-and-disinfect and drying operations; this can be accomplished by incorporation of a movable lid associated with the bowl, though such an addition complicates an already complex construction still further.

The prior art embraces other types of water closet wherein the problem of restricted space in which to carry out flushing-sterilizing-and-drying operations is overcome by providing a completely independent service compartment in which to install the cleaning apparatus, though the fundamental problem of down time remains unsolved inasmuch as the facility cannot be used while cleaning is in progress.

The object of the invention is that of overcoming the drawbacks described above.

The object of providing a water closet with a self-cleaning bowl is realized with a facility as described herein and as characterized by appended claims; such a facility can be constructed in a far stronger and more durable fashion than that of prior art embodiments by virtue of the flush-and-disinfect and drying devices being installed in a service compartment that is separate from the closet and therefore easily accessible even when the closet is in use.

Separating the closet from the service compartment enables embodiment of the various devices according

to preference and for maximum efficiency, without having continually to bear in mind the necessity for their being stowed or otherwise moved any appreciable distance from the working position. The drying device, for example, can be fitted simply and to best advantage direct to the partition wall inside the service compartment, or in the wall itself; what is more, the dimensions of such a device need not be binding in the least, and the device itself can be directed at a cleaned bowl exiting from the service compartment with no problems whatever.

A further advantage offered by the invention is that it envisages the use of two interchangeable bowls; down time is therefore eliminated completely, inasmuch the soiled bowl in the closet can be replaced immediately following use by the bowl currently occupying the service compartment. This signifies that the time available for flushing and disinfecting the bowl can be increased considerably, while a vacant bowl remains continuously available for use.

The provision of a spacious service compartment for flushing and disinfecting the bowl also allows of keeping the floor of the closet clean at all times, or at all events, free from splashes of liquid that might spill out during the cleaning operation.

Yet another advantage of the invention is that it features fixed location of the jet, or the entire flush-and-disinfect device, or if not fixed, then spring-biased upward into an at-rest position and movable through a vertical path, with downward move-

ment produced solely by pressure of the flushing and disinfecting liquid. Such a method of embodiment not only reduces the number of control components, from which defective operation or total breakdown of the facility can otherwise originate, but ensures better operation and renders the design more practical.

A facility according to the invention is made still more practical and functional thanks to the adoption of a rotary jet which is operated by pressure of the flushing liquid and provided with a precision calibrated outlet that ensures an effective spray action covering the entire internal surface of the bowl.

An embodiment of the invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

fig 1 is the schematic representation of a facility according to the invention viewed in frontal elevation, from the side of the service compartment, with certain parts omitted better to reveal others;

figs 2 and 3 are side elevations of an embodiment of the facility in the at-rest and operating positions, respectively, viewed transversely to the fixed partition enclosing a service compartment;

fig 4 is a cross section on enlarged scale showing other components of a facility according to the invention, with certain parts omitted better to reveal others;

figs 5 and 6 are side elevations of two further embodiments of a facility according to the invention, also viewed transversely to the fixed partition.

It will be seen from figs 2, 3, 5 and 6 that a water closet facility with self-cleaning bowl according to the invention consists essentially of at least one w.c. bowl 1 positioned against a fixed partition 4, with one automatic device 2 for flushing and disinfecting the bowl 1, and a further automatic device 3 for drying it.

According to the invention, the fixed partition 4 separates the closet proper, denoted 5 and occupied by the single bowl 1, from a service compartment 6. The flush-and-disinfect device 2 and the drying device 3 are located inside the service compartment 6, mounted to the fixed partition 4.

It will be observed that the fixed partition 4 is located directly above an opening 8 occupied by a movable partition 7, to which the bowl 1 is mounted. In a preferred embodiment, the movable partition 7 will carry two bowls 1 mounted back to back and symmetrical either side of the movable partition 7 in relation to a vertical median plane coinciding both with the axis of rotation of the movable partition itself and with the axis of a branched waste pipe 35 serving the two bowls 1.

36 denotes a vertical shaft, disposed coaxial with the branched waste pipe 35 and extending upwards into the fixed partition 4, about which the movable partition 7 rotates; conventional means (not illustrated) are incorporated which, when operated, rotate the movable partition 7 alternately in one direction or the other, denoted S, through 180°. Needless to

say, in a facility as described thus far, and as described further hereinafter, the movable partition 7 might also be made to rotate in one direction only.

The flush-and-disinfect device 2 is provided with a jet 15 designed to project flushing and disinfecting liquid at the internal part of the bowl 1 from an outlet slot 16 (see fig 3 or 5); a shield is provided in the shape of a hood 13 designed to fit over the top of the bowl 1 occupying the service compartment 6.

The jet 15 is a rotary type, operated by pressure of the flushing liquid flowing through it, and the outlet slot 16 is calibrated in such a way that flushing liquid projected assumes the aspect of a revolving blade of fluid which, sufficiently pressurized, will reach all points of the internal surface of the bowl 1 to good effect.

The flush-and-disinfect device 2 might be embodied either fixed as in fig 5, or movable as in figs 2, 3 and 6.

In the case of a fixed embodiment (fig 5) the device will be disposed at a height such as will permit its bottom edge 14 to ride over the uppermost edges 9 and 10 of the bowls 1 and the movable partition 7, respectively, whenever the movable partition is rotated, the two edges 9 and 10 in question occupying a common horizontal plane. The jet 15 in this instance would be best embodied telescopically (see positions as in fig 5, one of which 15a in broken line), with downward movement into the bowl 1 brought about pre-

ferably by pressure of the flushing liquid, nothing more. Thus, the jet 15 will move from a raised and spring-biased at-rest position, marginally above the bottom edge 14 of the hood 13, to a lowered working position inside the bowl 1 currently occupying the service compartment 6.

Alternatively, the entire flush-and-disinfect device 2 might be movable through a vertical path, mounted thus to a frame 33 projecting from the fixed partition 4 (see figs 2 and 3) in such a way as to move downward when operated, likewise by pressure of the flushing liquid. In this instance, the location of the jet 15 itself may be fixed, permanently occupying the position denoted 15a in fig 5, whilst the flush-and-disinfect device 2 is moved bodily from a raised, spring-biased at-rest position affording no obstruction to the bowls 1, which are thus free to rotate together with the movable partition 7 (see fig 2), down to a lowered working position in which the hood 13 fits over the bowl 1 currently occupying the service compartment 6 (see fig 3).

Again, the flush-and-disinfect device 2 might well be hinged, direct to the fixed partition 4 in this instance, and swung from a raised position in which no obstruction is offered to the bowls 1 (see fig 6, in which 13a denotes the raised hood), to a lowered position in which the hood 13 fits over the soiled bowl 1 (as in fig 6). Movement of the flush-and-disinfect device 2 in such an embodiment would be produced, say, by a fluid power cylinder 22 hinged to

the fixed partition 4.

Flushing liquid will not easily splash from between the hood 13 and the bowl 1 during cleaning thanks to the calibrated type of outlet slot 16 with which the jet 15 is provided; nonetheless, a drain point 11 is provided in the floor 12 of the service compartment. The drying device 3 is incorporated to best advantage in the fixed partition 4, directed thus at the bowl 1 as it passes through. Observing fig 1, the device consists of two separate channels 23a and 23b disposed at either side of the axis about which the movable partition 7 rotates. The two channels 23a and 23b are embodied such that a clean bowl 1 passing beneath will be invested in its entirety by the flow of air produced, and are supplied independently by respective ducts 34a and 34b connecting with a common source. The ducts 34a and 34b are operated singly and in alternation by the appropriate signal from a control unit in such a way as to dry only a clean bowl 1 passing beneath either one of the two channels 23a or 23b; in a preferred embodiment, in fact, the two w.c. bowls 1 will swing back and forth through 180° between the closet and the service compartment.

A water closet facility according to the invention also comprises means 37 (see fig 4) for aligning and locking the movable partition 7 in position relative to the fixed partition 4, and skirtings 17 which extend or retract, when operated, from and toward the bottom of the movable partition 7, substantially at

floor level, in order to allow passage of cleaning fluid directed from the floor of the closet 5 to the floor 12 of the service compartment 6.

Means for alignment of the movable partition 7 consist essentially of at least one plunger 18 exhibit-cone frustum shape, which is integral with the rod 24a of a fluid power cylinder 24 mounted vertically to the fixed partition 4; the plunger 18 slides in a sleeve 26 integral with the fixed partition 4 and coaxial with the fluid power cylinder 24, and is designed to engage in a corresponding tapered socket 19 offered by the top of the movable partition 7, which is hollow.

The skirtings 17 are hinged to the movable partition 7 as well as to an upright rod 21, in the latter instance via corresponding link-rods 20. The upright rod 21 is movable in a vertical direction, guided in such movement by the coaxial holes of a bushing 29, at bottom, and a cross-member 30 uppermost, integral with the movable partition 7; a spring 32 and thrust ring 32 are fitted to the upright rod 21 between the bushing 29 and the cross-member 30. The spring 32, urging against the bushing 29 on the one hand and against the thrust ring 31 on the other, pushes the upright rod 21 upwards in such a way that the skirtings 17 are forced to turn one toward the other and lift away from the floor 12, whereas the upright rod 21, aligned vertically with the cylinder rod 24a, is pushed down against the bias of the spring 32 by the self-same rod 24a whenever the plunger 18 is forced

downwards and into engagement with the socket 19 in the movable partition 7.

The control unit aforementioned (not illustrated) will incorporate a variety of switching, transducing and timing components designed to coordinate all-automatic operation of a w.c. facility according to the invention.

Once a soiled bowl 1 occupying the closet 5 is ready to be cleaned, operation comes about as follows. The rod 24a of the fluid power cylinder 24 will retract in order to free the movable partition 7 completely and leave the upright rod 21 subject to the bias of the spring 32, and the skirtings 17 are duly raised. The time taken by the flush-and-disinfect device 2 in cleaning a bowl 1 being less than that required by a given individual to make use of the closet 5, the bowl 1 occupying the service compartment 6 will already be clean, and the flush-and-disinfect device 2 will have returned to its at-rest position.

The at-rest position of the device 2 is that shown in fig 2, in the case of the vertically movable embodiment, or in fig 5, in the case of the fixed embodiment with movable jet positioned at 15a, or in fig 6, in the case of a hinged embodiment positioned at 13a.

As the movable partition 7 turns, air is supplied to whichever channel 23a or 23b the clean bowl 1 passes beneath, such that the bowl is fully dried. Once the movable partition 7 has turned through 180°, it is

stopped, and the cylinder or cylinders 24 will operate, causing the respective tapered plungers 18 to locate in the sockets 19 of the movable partition 7 and bring about its alignment. In descending, the rods 24a of the cylinders 24 urge downward on each upright rod 21 against the bias of the spring 32 so that the skirtings 17 are made to turn into their lowered position, aligned with the surfaces of the movable partition 7. In the event of provision being made for periodic wash-down of the floor 12 in the closet 5, the cylinder 24 will be actuated only when cleaning of the floor 12 has been completed, likewise automatically and by way of suitable apparatus, whereupon the cleaning liquid utilized will pass beneath the movable partition 7 and run out through the drain 11 in the service compartment 6.

The flush-and-disinfect device 2 is moved into working position either by operation of the cylinder 22, in the case of a device 2 as in fig 6, or by supplying cleaning liquid in order to lower the jet 15 (as in fig 5) or the device 2 as a whole (as in fig 3). With the bowl 1 occupying the service compartment 6 duly flushed and disinfected, the supply of liquid is cut off and the device 2 returns naturally to the at-rest position (figs 3 and 5) or is returned by operation of the relative cylinder 22 (fig 6).

The facility will now remain in this configuration until such time as the closet 5 is either vacated or re-utilized, whereupon the sequence of operations will be repeated.

Claims

1) A water closet facility with self-cleaning bowl, provided with a flush-and-disinfect device (2) and a drying device (3), a closet (5) and a service compartment (6),
characterized
-in that it comprises: a fixed partition (4) separating the closet (5) from the service compartment (6) in which the flush-and-disinfect device (2) is located; a movable partition (7), carrying at least two w.c. bowls (1) mounted symmetrically back to back, which fills an opening (8) between the fixed partition (4) and the floor (12) of the closet and is rotatable about a central vertical axis coinciding with the axis of a branched waste pipe (35), in order to permit of transferring each bowl (1) from a vacant position in which it occupies the closet (5), to a cleaning position in which it occupies the service compartment (6); and
-in that the drying device (3) is integral with the fixed partition (4) at a point adjacent to the opening (8), and made to operate during the return of a single bowl (1) to the vacant position.

2) W.c. facility as in claim 1, wherein the flush-and-disinfect device (2) is located internally of a hood (13) designed to limit any egress of liquid during cleaning of the bowl (1), and comprises at least one

jet (15) which sprays the internal surface of the bowl (1); and wherein the hood (13) of the flush-and disinfect device (2) is integral with the fixed partition (4) and disposed with its bottom edge (14) on a level with the uppermost edge (9) of the bowl (1), in such a way that the jet (15) remains accommodated within the dimensions of the hood.

.3) W.c. facility as in claim 1, wherein the jet (15) of the flush-and-disinfect device (2) is rotatable, and set in rotation by pressure of the flushing and disinfecting liquid.

4) W.c. facility as in claim 3, wherein the jet (15) is spring-biased normally into a raised position offering no obstruction to rotation of the bowl (1), and lowered as a result of being moved in a downwards direction by pressure of the flushing and disinfecting liquid.

5) W.c. facility as in claim 4, wherein the jet (15) exhibits an outlet slot (16) which is calibrated to precision in such as way as to project a revolving blade of flushing and disinfecting liquid at the entire internal surface of the bowl (1).

6) W.c. facility as in claim 1, wherein the flush-and-disinfect device (2) is spring-biased normally into a raised position, and moved downward vertically by pressure of the flushing and disinfecting liquid.

7) W.c. facility as in claim 1, wherein the fixed partition (4) is provided with means (37) for aligning and locking the movable partition (7) in relation to the fixed partition, which comprise at least one tapered plunger (18) that can be moved vertically from a raised position, whereby the movable partition (7) is able to rotate about its vertical axis, to a lowered position in which the self-same plunger engages a tapered socket (19) offered by the top of the movable partition (7).

8) W.c. facility as in claim 1, wherein skirtings (17) extend from the bottom of the movable partition (7) which are vertically aligned with the movable partition when in a lowered position, and are hinged to the movable partition so as to permit of rotation about horizontal axes; and wherein the inside face of each such skirting (17) hinges with one end of at least one link-rod (20), the remaining end of which hinges with at least one upright rod (21) that is spring-biased upward continually, and urged downward by a relative plunger (18) in order to rotate the skirtings (17) into the lowered position.

9) W.c. facility as in claim 1, wherein the drying device (3) comprises two separate channels (23a, 23b) each supplied by a relative duct (34a, 34b) connecting with control means which will direct air alternately into one only of the two ducts (34a, 34b), in particular, into that duct beneath which a flushed

and disinfected bowl (1) happens to be passing; and wherein the w.c. bowls (1) swing back and forth in alternation through 180° between the vacant position and the cleaning position.

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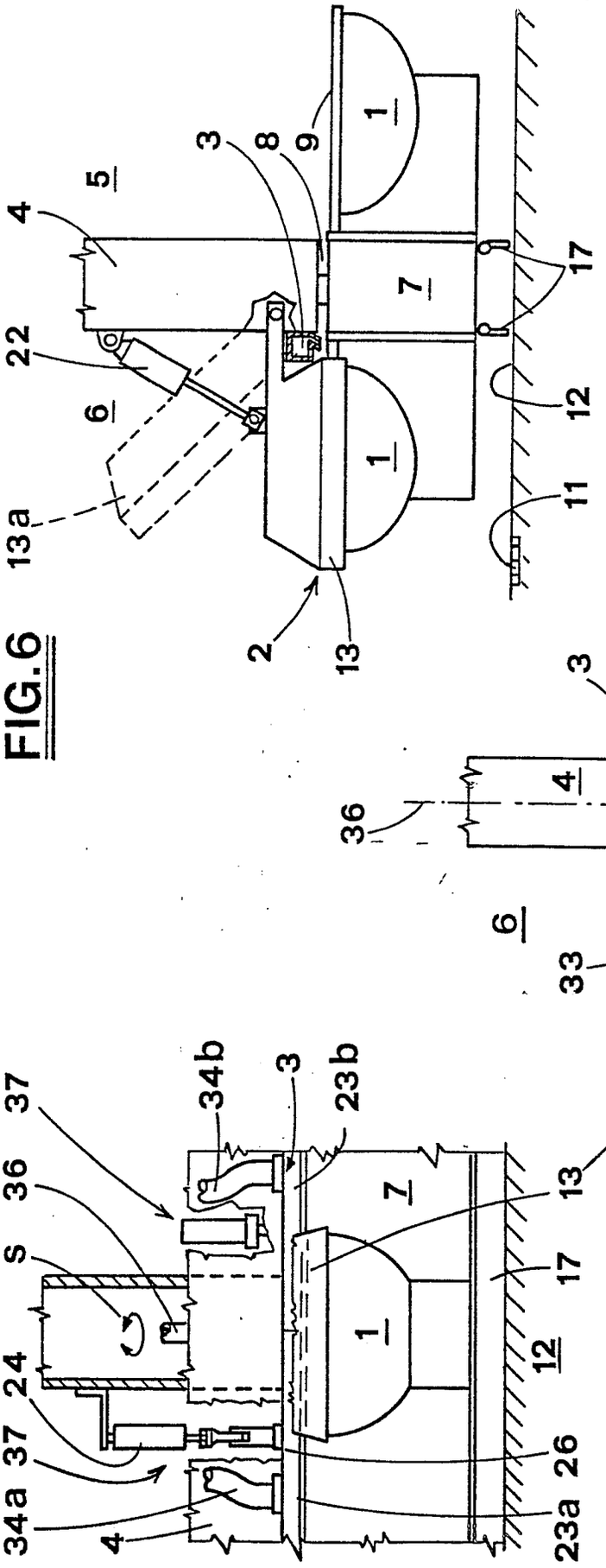

FIG.6

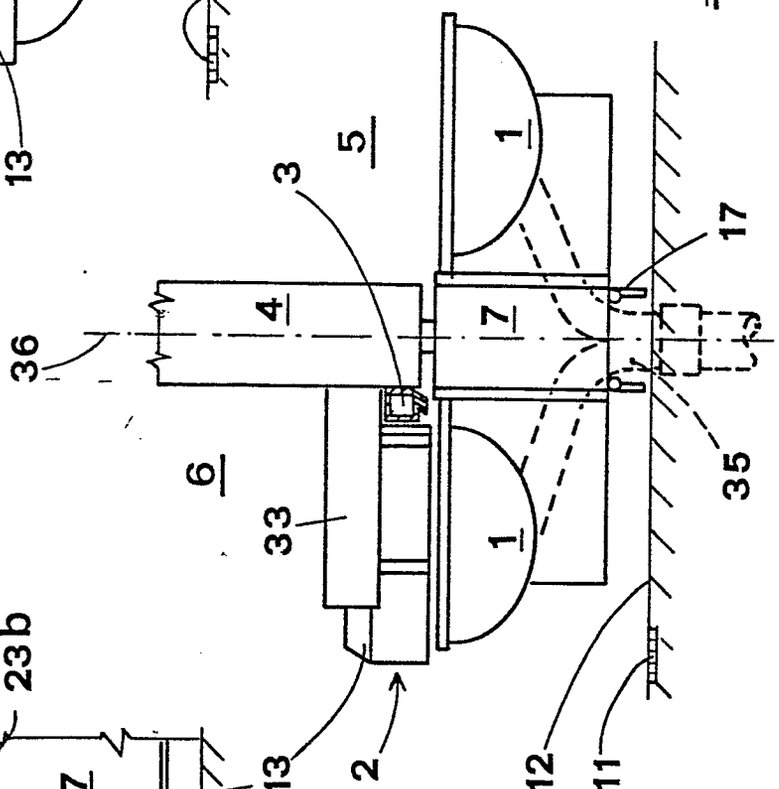

FIG.2

FIG.1

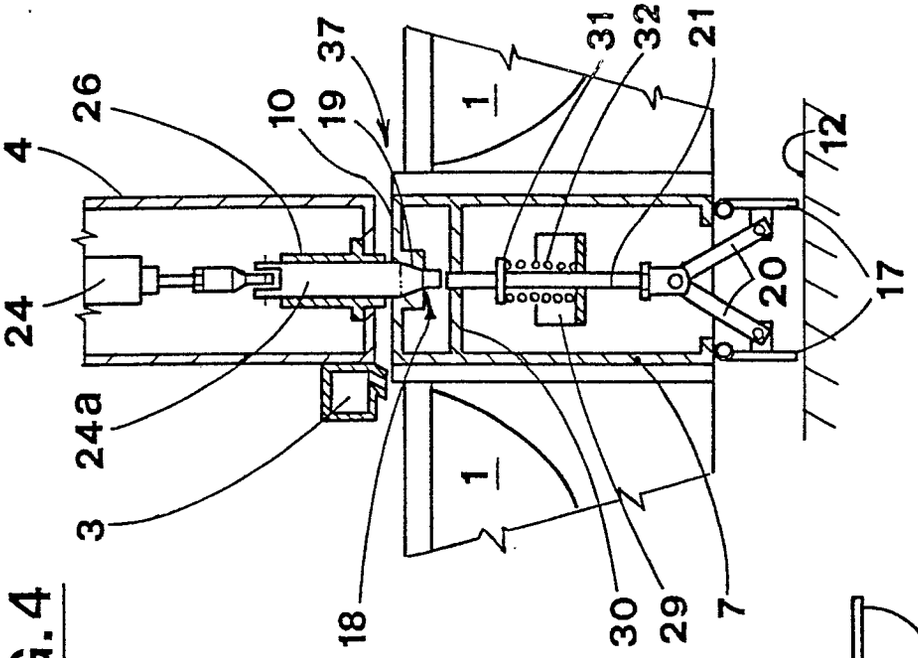

FIG.4

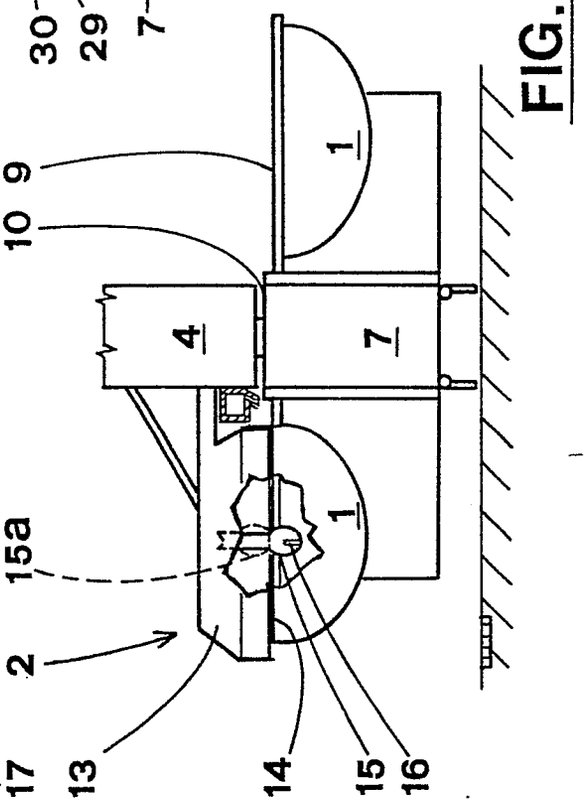

FIG.5

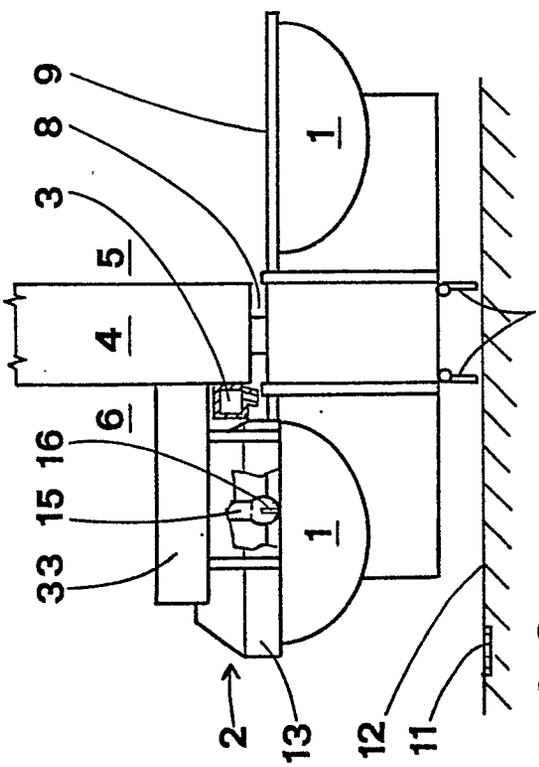

FIG.3