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(54) **An automatic swimming pool cleaner**

Automatische Vorrichtung für die Reinigung eines Schwimmbeckens

Appareil automatique pour nettoyage de piscines

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FR-A- 2 520 422 **FR-A- 2 584 442**
US-A- 4 275 474 **US-A- 4 351 077**

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Description

The invention relates to a swimming pool cleaner suction head as set forth in the preamble of claim 1. A suction head of this type is known from DE-A-2 620 119.

This reference discloses a cleaning device for a water-filled swimming pool consisting of a disc of flexible plastic material and a housing attached at its upper side in the center of and obliquely inclined against the disc, a connecting sleeve for connection of the end of a suction hose being mounted to the upper end of said housing. A flap valve pivotally mounted in the housing creates a pulsating motion when a water flow caused by a suction pump connected to the other end of said suction hose passes through said housing, said pulsating motion causing the cleaning device to move about the bottom and wall surfaces of the swimming pool in a random fashion.

A very similar cleaning device is known from US-A-4 351 077, working in the same manner as the cleaning device explained before.

A suction head for a swimming pool cleaner system is known from US-A- 4 275 474 (Woodard) which comprises a housing open at its lower side and to whose upper side a connecting sleeve is mounted for connecting a suction hose in turn connected to a suction pump. Brush bristles extend vertically downwardly from the lower edge of the housing. A pole is furthermore attached to the upper side of the suction head which is intended for handling the suction head. This suction head can be handled like an ordinary broom or a vacuum cleaner nozzle. It is not capable of moving automatically across the bottom of the swimming pool to be cleaned, but must be manually guided by means of the pole.

The object of the invention is a suction head which moves automatically in a random fashion through a swimming pool when a suction flow of water is caused to pass through said suction head.

An additional object of the invention is to provide a suction head which can change its direction of movement automatically.

A further object of the invention is to provide a suction head which reliably cleans a swimming pool bottom and side walls.

A still further object of the invention is to provide a suction head which can easily and rapidly be disassembled for cleaning and maintenance purposes and re-assembled without the aid of complex tools.

These and further objects of the present invention are accomplished by a suction head for a swimming pool cleaner as set forth in claim 1. Preferred embodiments of the invention are subject matter of the dependent claims.

When a flow of water is drawn through the suction head by the effect of a suction pump connected to said suction hose, the resulting vibrations of the vibratory element cause the entire suction head to vibrate, including

the flexible bristles which project downwardly from the housing and whose free ends end in a common plane and which are inclined in a specific common direction so that they enclose an angle deviating from the vertical onto the plane defined by their free ends. This vibratory movement of the suction head is imparted to the obliquely disposed bristles which bend and straighten repetitively, so that the bristles produce a pushing force acting on the suction head moving it across the surface engaged by the bristles and to be cleaned. At the same time, the bristles also lift off dirt from the surface to be cleaned, said dirt being sucked through the suction head and away through the suction hose into a filter by the effect of the water flow sucked through the housing.

According to a preferred embodiment of the invention, at least one foot is displaceably mounted eccentrically in the housing, said foot being movable vertically with respect to the plane defined by the free ends of the bristles. A foot driving mechanism is located in the housing and is driven by the suction flow passing through the housing by means of the vibratory element, said foot driving mechanism acting on the at least one foot in a manner that its lower end can be advanced downwardly beyond the plane defined by the free ends of the bristles and can be upwardly returned. In this manner the suction head is temporarily lifted off from the surface to be cleaned one-sidedly by said at least one foot during operation. Where two feet are mounted in the housing, they are disposed on either side of the center of said suction head and are operated in an alternating manner so that the suction head is temporarily partially lifted off from the surface to be cleaned in an alternating manner on either side.

The result of this partially lifting off the suction head is that the suction head is rotated about an axis extending vertically to the surface to be cleaned. This effect is brought about by said foot lifting off an increasing number of bristles from the surface to be cleaned so that they become inactive, whereas the bristles still in contact with the surface to be cleaned push the suction head one-sidedly. Thus, a change of orientation of the suction head results therefrom so that after the return of the foot in its retracted or upper position the suction head will again move off straightly, but in a different direction.

In the preferred embodiment, the at least one foot is formed by a brush support to whose lower side brush bristles are attached which are inclined in opposite fashion to the inclination of the bristles attached to the lower edge of the housing. The bristles on the brush support also perform a bending and straightening movement under the effect of the load force of the suction head when downwardly displaced and, thus, brought into contact with the surface to be cleaned. In this downwardly displaced position, under the vibrating movement of the suction head the bristles of the support do not brake, but even cause a thrust which is opposite to the thrust of the bristles attached to the lower edge of the suction head housing. Thus, the combined thrusts of the bristles re-

sult in a rotational movement of the suction head about an axis which is vertical to the surface to be cleaned.

The driving mechanism for the at least one foot is driven by the vibratory element and comprises transfer means which transfer the pivotal, back and forth going movement of the vibratory element into a unidirectional rotational movement and rotating cam means engaging said at least one foot and driven by said transfer means.

A special advantage of the invention is that the suction head is operative with a flow of water passing through the suction head which is relatively weak as compared with the prior art and, nevertheless, achieves a good cleaning effect, since the movement of the bristles effects the lifting off of dirt from the surface to be cleaned. It must furthermore be noted that the suction head can also be used for cleaning the walls of a swimming pool. A further important advantage of the invention is that the flow of water is substantially continuous and uniform and does not pulsate, which makes for a less noisy operation.

Further features of the invention, their advantages and their effects are explained in more detail in the following with reference to the accompanying drawings, in which:

- Fig. 1 shows a perspective view of the suction head according to the invention and an exploded view of details thereof contained in its housing;
- Fig. 1a shows a perspective view of a suction head similar to Fig. 1 but having two displaceable feet;
- Fig. 2 shows a rear view of the suction head of Fig. 1;
- Fig. 3 shows a top view of a suction head essentially corresponding to that of Fig. 1 but having a more rectangular shape when seen from above;
- Fig. 4 shows a lateral view of the suction head of Fig. 3 from the left;
- Fig. 5 shows a front view of the suction head of Fig. 1 as a vertical section along line V-V of Fig. 3;
- Fig. 5a shows a front view of the suction head of Fig. 1a as a vertical section similar to Fig. 5;
- Fig. 6 shows a lateral view through part of the suction head as a vertical view along the line VI-VI of Fig. 5;
- Fig. 6a shows a cross-sectional view of Fig. 6 along the line VIa-VIa of Fig. 6;

- Fig. 7 shows details of the section through Fig. 5 along the line VII-VII of Fig. 5;
- Fig. 8 shows a cross-sectional view of the one-way clutch along line VIII-VIII of Fig. 8a;
- Fig. 8a shows a cross-sectional view of the one-way clutch along line VIIIa-VIIIa of Fig. 8;
- Fig. 9 shows a section through Fig. 5 along the line IX-IX of Fig. 5;
- Fig. 9a shows a partial view of the lower portion of a modified embodiment of the suction head;
- Fig. 10 shows a detail of the foot driving mechanism from top with a speed reduction gear train.

According to Figs. 1 through 5a, the suction head 1 comprises a housing 2, which has a dome-like prominence 3 enclosing a chamber at its upper side, to whose top a connecting sleeve 4 is rotatably mounted where a suction hose (not shown) is to be attached to operate the suction head 1. The dome-like prominence 3 comprises two parts, a lower part 5 integrally connected to the housing 2 and an upper part 6 detachably mounted thereto, both parts being joined together along a separating line 7. A collar of bristles 9 is exchangeably attached to the lower edge 8 of the housing 2. The free ends of the bristles 9 are in a common plane. The collar of bristles 9 is surrounded by a skirt 10 at the outside, which is also attached to the lower edge 8 of the housing 2 and is to suppress the flow of water through the gaps between the bristles 9. Alternatively, as shown in Fig. 9a, a skirt 59 may be disposed inside of the collar of bristles 9 and may be integrally formed with the housing 2 or as a separate element attached thereto.

The bristles 9 are inclined at a small angle of about 8 to 18 degrees against the vertical onto the plane defined by the free ends of the bristles 9.

When viewed from the top, the housing 2 is of substantially rectangular design, but has in the represented example a slightly curved shape, the front side being convex and the rear side being concave, as seen in Fig. 1, or may be more rectangular, comprising rounded corners, the front side corners being greater than those on the rear side, as seen in Fig. 3.

According to Fig. 5, a vibratory element 11 of crescent-like or airfoil-like cross-section is located in a chamber 32 enclosed by the dome-like prominence 3 and open at its lower side (cf. Figs 1 and 6). Said vibratory element 11 has a pivot axis 12 and its convex side points towards the connecting sleeve 4.

As a means of sealing the vibratory element 11 to the adjacent side walls of chamber 32 from bypassing water and yet allowing sand or other small particles to escape so as not to score the walls of chamber 32 or

the edges of vibratory element 11, soft bristles 58 of plastic or other suitable material are affixed to the side edges of the vibratory element 11. Those bristles 58 are mounted into frames 56 which are pressed into mating slots 57 in the vibratory element 11.

The vibratory element 11 has a projection 13 of out-of-round cross-section at one side in the swivelling axis 12, which is octagonal in the represented example. Said projection extends through an opening 35 in a side wall 31 of chamber 32 into an adjacent gear chamber 33 formed in the dome-like prominence 3 of housing 2. A commercially available one-way clutch 14, which has an inner race 15 with an inner opening of octagonal profile is fitted onto the projection 13 in the gear chamber 33.

Figs. 8 and 8a illustrate the various components of said one-way clutch 14 of which there are numerous ones available in the market. It comprises rollers 42 riding between an inner race 15 and a ramp 54 in an wedge body 51 disposed in an outer cylindrical casing 53. Leaf springs 52 hold the rollers 42 in a wedging manner so that when the inner race 15 is turning in one direction the outer casing 53 is driven thereby in the same direction, whereas when the driving direction reverses, the rollers 42 free themselves and the outer and inner components of the clutch may move independent of each other.

To the outer casing 53, a wheel 16 is affixed, e. g. by press fit, said wheel 16 having a gearwheel 17 of smaller diameter integrally connected thereto. Wheel 16 may be designed as a ratchet, as shown in Fig. 7 into which a flexible detent pawl 41 firmly attached to the upper part 6 of the dome-like prominence 3 engages, preventing wheel 16 to rotate in counter-clockwise direction as seen in Fig. 7.

Three further gearwheels 18, 19 and 20 forming a stepdown gear train with the gearwheel 17, and a gearwheel 22 having a projecting tab 21 are also located in gear chamber 33. The vibratory element 11 along with one-way clutch 14 and gearwheel 17 and the gearwheels 19 and 22 are mounted on a common first axle shaft 23, while the gearwheels 18 and 20 are supported by a second axle shaft extending parallelly to the first axle shaft 23.

It is evident that the gearwheels 18, 19 and 20 have in each case two gear faces of two different diameters which are in mutual engagement and for engagement with the gearwheels 17 and 22, respectively, to form in this manner a 4-step reduction gear train with a high stepdown ratio. A spacer 25 can furthermore be recognized, which is disposed on the second axle shaft 24.

A brush support 26 is also disposed in gear chamber 33 and is movable in vertical direction and supports at its lower end a brush with inclined bristles 27. The inclination of these bristles 27 is opposite to the inclination of the bristles 9 affixed to the housing. The brush support 26 has a lug 28 at its upper portion, said lug 28 being located in a partial section of the movement path of the projecting tab 21 of gearwheel 22 so that it can

be pressed downwardly by said tab 21 against the biasing force of compression return springs 29 supported in the housing 2. Said return springs 29 bias the brush support in a rest position in which the free ends of its bristles 27 are situated in a plane which is upwardly offset from that defined by the bristles 9 attached to the housing 2 so that the bristles 27 are out of contact with the surface to be cleaned.

As can be readily seen in Fig. 5, the rotary connecting sleeve 4 is mounted rotatably on the dome-like prominence 3 by means of a sealed rotary coupling 30.

It can furthermore be seen in Fig. 5 that chamber 32 formed in the dome-like prominence 3 is downwardly open and houses the vibratory element 11, the connecting sleeve 4 opening in said chamber 32, whereas gear chamber 33 separated from aforementioned chamber 32 by separating wall 31 is closed at its bottom by a bottom wall 34. Gear chamber 33 houses the one-way clutch 14 and all gearwheels which are components of a brush support driving mechanism, and it has an opening in bottom wall 34 to allow for the passage of the brush support 26 with attached bristles 27. The closing of gear chamber 33 effected by the bottom wall 34 prevents dirt from entering into the gear chamber 33 from below.

Fig. 5 also shows that the separating line 7 between the upper part 6 and the lower part 5 of the dome-like prominence 3 lies in the same plane in which the axis of the axle shaft 23 lies. The axle shaft 24 for the gearwheels 18 and 20, which cannot be seen in Fig. 5, also lies in the same plane, see Fig. 7. At the plane of the separating line 7 between the lower part 5 and the upper part 6 of the dome-like prominence 3 corresponding bearing journals 36 and 37 are integrally formed with the lower part 5 and the upper part 6, respectively, to support the ends of the axle shafts 23 and 24.

According to Fig. 6, the separating line 7 extends in a single plane. The lower part 5 has flexible clips 38 elongated upwardly beyond the separating line 7, which end in locking hooks 39 engaging into openings 40 formed in the upper part 6, said hooks retaining the upper part 6 in detachable fashion on the lower part 5. The clips 38 can be inwardly bent back by pressing the locking hooks 39 from the outside, whereby it becomes possible to detach the upper part 6 from the lower part 5. The vibratory element 11 and all components of the brush support driving mechanism and the brush support 26 become freely accessible from above in disengaged condition of the lower and upper parts 5 and 6 and can be dismounted without the aid of any further tools for cleaning and repair, if necessary.

It is evident that the assembly of these elements is correspondingly simplified by this structure. For assembly the vibratory element 11 and the one-way clutch 14 must only be plugged together and the pre-assembled unit formed in this fashion is subsequently slipped onto axle shaft 23, then (ratchet) wheel 16 and the gearwheels 19 and 22 are slipped onto the same axle shaft

23. The gearwheels 18 and 20 and the spacer sleeve 25 are slipped onto the other axle shaft 24. After the brush support 26 together with its return springs 29 have been inserted into the gear chamber 33, the aforementioned pre-assembled subassemblies are placed into the lower part 5 by inserting the ends of the axle shafts 23 and 24 into the associated bearing shells 36. The upper part 6 of the dome-like prominence 3 is subsequently placed onto the lower part 5, whereby the bearing shells 37 formed at the upper part 6 engage the axle shaft ends, and the upper part 6 is locked to the lower part 5 by means of the locking hooks 39 locking in the openings 40.

Fig. 6 also shows that the vibratory element 11 can be pivoted between two end positions which are drawn in dash-dotted fashion with 11a and 11b. According to Fig. 6, a flow path results in the one end position 11a, which passes the right hand side of the vibratory element 11 from the bottom to the top in Fig. 6, while in the other end position 11b a flow path results which passes the left hand side of the vibratory element 11. Due to the effect of the flow of water sucked through the suction head, the vibratory element 11 automatically vibrates to and fro between the two end positions 11a and 11b. It does not have a stable position of equilibrium due to the physical phenomena of its crescent-like shaping, whose concave surface points downwardly against the direction of the water flow sucked through the chamber 32. As the effective cross-sectional area of the flow path is not substantially varied by the pivotal movement of the vibratory element 11, no noticeable pulsations are generated in the water flow passing through the suction head.

The to and fro movement of the vibratory element 11 is transferred into a unidirectional rotational movement by the one-way clutch 14 mounted to the vibratory element 11. Thus, gearwheel 22 is finally driven in one direction only.

As is shown in the sectional representation in Fig. 9, the brush support 26 is guided vertically within the lower part 5 of the dome-like prominence 3. The helical compression return springs 29, which are each supported at the bottom on a lug 44 formed at the housing 2, bias the brush support upwardly. The gearwheel 22 of the brush support driving mechanism is located adjacent to the brush support 26, and the projecting tab 21 is formed on the side of the gearwheel facing said brush support 26. The latter is formed with a lug 28 which is situated in a partial section of the movement path of the tab 21 defined by rotation of the gearwheel 22. Thus, upon clockwise rotation of the gearwheel as seen in Fig. 9, the projecting tab 21 is aligned with the lug 28 and thereby presses the brush support 26 downwardly from the rest position represented in Fig. 9 so that the free ends of the bristles 27 attached to it are downwardly advanced beyond the plane defined by the free ends of the bristles 9 attached to the housing 2. In the position of the projecting tab 21 shown in dashed lines by 21a in

Fig. 9 the tab 21 disengages from the lug 28 so that the brush support 26 is returned to its rest position by the action of the return springs 29. It can be seen that the lug 28 is in engagement with the projecting tab 21 across about 45° only of the movement path of said tab 21 so that, based on a full rotation of the gearwheel 22, the brush support 26 is downwardly advanced during 1/8 only of the entire time of rotation of the gearwheel 22. The time during which the bristles 27 are downwardly advanced beyond the plane defined by the free ends of the bristles 9 is consequently only about 1/8 or somewhat less of the operating time of the suction head. The movement path of the suction head is substantially determined by the action caused by the bristles 9 attached to the housing, while a change in the direction of movement is caused in the aforementioned manner by the downward advance of the brush support 26 during relatively short intermediate periods.

As may be seen from Fig. 1a, the suction head may be provided with another, second brush support 50 of similar design as the first brush support 26 explained above and having bristles 27 at its lower end. Said second brush support 50 is positioned symmetrically to the first brush support 26 with respect to the center of the suction head 1 defined by the connecting sleeve 4. An actuation wheel 49 similar to gearwheel 22 but not toothed and being likewise provided with a projecting tab 21 is associated to the second brush support 50. In this embodiment of the invention, the first axle shaft 23 is extended to the side opposite to gear chamber 33 and traverses another chamber 33a formed in the dome-like prominence 3 symmetrically with respect to gear chamber 33, said other chamber 33a housing the actuation wheel 49, the second brush support 50 and associated return springs 29. The gearwheel 22 driving the first brush support 26 by means of tab 21 and lug 28 is fixed to the axle shaft 23 for co-rotation therewith at one of its end portions, whereas the actuation wheel 49 associated to the second brush support 50 is fixed to the axle shaft 23 for co-rotation therewith at the other end portion thereof. Co-rotation of axle shaft 23 and wheels 22 and 49 may be established by out-of-round cross sections of the axle shaft end portions mounting said wheels 22 and 49 and of the respective mating central openings in wheels 22 and 49, so that simplified assembly of the components by slipping the wheels onto the axle shaft 23 is still possible. Other means to fix the axle shaft 23 to wheels 22 and 49 may be chosen as well, e.g. press pins and the like. Thus, rotational movement of gearwheel 22 is transmitted via axle shaft 23 to actuation wheel 49.

As is shown in Fig. 1a, the tabs 21 at gearwheel 22 and actuation wheel 49 are offset with respect to each other by 180°. Thus, upon rotation of gearwheel 22, the brush supports 26 and 50 are alternately advanced downwardly. The suction head 1 is therefore partially lifted at one side and, after return of the respective brush support in its rest position, subsequently at the other side

and so on.

It is further possible to give the suction head a round shape or any other shape of monoplane configuration as the motion producing phenomenon is not affected by the bristle outline configuration.

The components of the suction head, in particular the housing parts, the vibratory element and the wheels of the foot driving mechanism, the connecting sleeve and the brush support consist preferably of plastic material, whereas the axle shafts and rollers consist of stainless steel.

During operation the suction head 1 is connected at its rotary connecting sleeve 4 to a suction hose which in turn is connected to the suction side of a water pump and it is placed into the swimming pool to be cleaned. Under the action of the flow of water created by the water pump and flowing through the chamber 32, the vibratory element 11 performs a vibrating motion. The result of this is that the force with which the suction head 1 rests on the surface to be cleaned is pulsating. And therefore, the bristles 9 are bent and straightened repetitively in the frequency of the pulsation. Thereby, the bristles cause the advance effect mentioned in the opening portion of this specification. The one-way clutch 14 transfers the to and fro going pivotal movement of the vibratory element 11 in a unidirectional rotation by which the gearwheel 22 is driven via gearwheels 17, 18, 19 and 20 to bring the tab(s) 21 in contact with the lug(s) 28 of the brush support(s) 26 (and 50) to advance it (them) gradually downwardly against the bias force of the return springs 29. Due to this, the suction head 1 is lifted at one side as is shown in Fig. 5 by line A. The bristles 9 represented on the lefthand side of Fig. 5, which are still in contact with the surface to be cleaned continue to produce their advance movement, while the bristles 9 represented at the righthand side lose their effect since they are no longer in contact with the surface to be cleaned. However, in lieu of this, the bristles 27 attached to the brush support 26 (or 50) produce an advance movement in the opposite direction which entails in cooperation with the still active bristles 9 that the suction head 1 rotates about an axis vertical to the surface to be cleaned.

It is obvious that the same result, although with reduced effect, can be attained if the brush support 26 does not have bristles 27 but acts as a foot with a preferably high friction coefficient and can be brought into contact with the surface to be cleaned and brakes the movement of the suction head 1 at one side.

By changing the gear train ratios the length of the periods of straight motion and the rotary motion may be varied with respect to each other. Various other modifications may be carried out in the described suction head without leaving the spirit of the present invention, as defined by the appended claims.

Claims

1. A swimming pool cleaner suction head (1) of the type having a housing (2) forming a chamber (32) open at its lower side and a rotary connection sleeve (4) for a hose by which a remote suction pump establishes a water flow through the chamber (32) and into the hose, and further comprising a swivelling element (11) pivotally mounted in said chamber (32) to vibrate the suction head in response to flow of water through the chamber (32), characterized in that said swivelling element is a vibratory element (11) and flexible bristles (9) are secured to the lower edge of the housing (2) and project downwardly therefrom to terminate in free bristle ends arranged in a common plane and adapted to support the suction head on a surface to be cleaned, the bristles (9) being inclined such that, when the bristle ends engage a horizontal surface to be cleaned, such bristles (9) deviate from vertical in a specific common direction; whereby such bristles (9) and vibratory element (11) work together to cause forward movement of the suction head over the surface to be cleaned, and vibratory cleaning action at the bristle ends is provided.
2. The swimming pool cleaner suction head of claim 1 wherein the chamber includes a horizontal axis (12) about which the vibratory element is pivotably mounted.
3. A suction head (1) as set forth in claim 1 or 2 comprising furthermore at least one movable foot (26) having a lower end and being disposed in the housing (2) offset from a center of the suction head (1) and being displaceable vertically with respect to the plane defined by the free ends of the bristles (9), and a foot-driving mechanism in the housing (2) which is driven by the pivotal movement of the vibratory element (11) via means (14) for transferring said pivotal to and fro movement of the vibratory element (11) into a unidirectional rotational movement, said foot driving mechanism periodically acting on said at least one foot (26) so as to advance it from a raised rest position in which the lower end of said foot (26) is retracted with respect to the plane defined by the free ends of said bristles (9) to a lowered active position in which the lower end of said foot (26) projects beyond said plane so as to lift said suction head (1) one-sidedly from the surface to be cleaned, and further comprising return means (29) for returning said foot (26) into its raised rest position.
4. A suction head (1) as set forth in claim 3 wherein said means for transferring the pivotal to and fro movement of said vibratory element is a one-way

clutch (14) mounted to a projection (13) of the vibratory element (11) in the pivot axis (12) thereof.

5. A suction head (1) as set forth in claim 4 wherein said projection (13) has an out-of-round cross-section and said one-way clutch (14) has a complementary center opening mating therewith, said one-way clutch (14) being plugged onto said projection (13).
6. A suction head (1) as set forth in claim 3 wherein said foot driving mechanism (16-25) comprises among other components a gearwheel (22) provided with a projecting tab (21) and rotatably mounted in the housing (2), said tab (21) describing a circular movement path upon rotation of the gearwheel (22), the foot (26) having a lug (28) which is located in a partial section of said circular movement path so that said lug (28) together with the foot (26) is pushed by said tab (21) downwardly in the direction of said plane defined by the free ends of the bristles (9) upon rotation of said gearwheel (22), and further comprising at least one return spring (29) in the housing (2) biasing the foot (26) into the rest position when said tab (21) disengages from said lug (28) upon continued rotation of said gearwheel (22).
7. A suction head (1) as set forth in claim 3 wherein the foot is formed by a brush support (26) having flexible foot bristles (27) attached thereto, the foot bristles (27) being inclined in a direction opposite to the inclination of the bristles (9) attached to the housing (2), the free ends of the foot bristles (27) attached to the brush support (26) forming the lower end of the foot.
8. A suction head (1) as set forth in claim 3 wherein the foot driving mechanism comprises a stepdown gear train with several pairs of meshing gearwheels (17-22).
9. A suction head (1) as set forth in claim 8 wherein the vibratory element (11) and said gearwheels (17-22) are disposed on two axle shafts (23,24) and the housing (2) consists of at least two parts (5,6) which are connected to each other along a separating line (7), which extends through the axes of said axle shafts (23,24).
10. A suction head (1) as set forth in claim 9 wherein the two housing parts (5,6) are detachably connected with each other.
11. A suction head (1) as set forth in claim 1 wherein the bristles (9) are exchangeably attached to the lower edge (8) of the housing (2).
12. A suction head (1) as set forth in claim 3 wherein

the foot (26,27) is exchangeably supported in the housing (2).

13. A suction head (1) as set forth in claim 6 comprising a second movable foot (50) having a lower end and being disposed in said housing (2) symmetrically to said foot (26) with respect to the center of said suction head (1) said second foot (50) being vertically displaceable from raised rest position in which the lower end of said second foot (50) is raised with respect to the plane defined by the free ends of the bristles (9) into a lower position in which the lower end of said second foot (50) projects downwardly beyond said plane, and driving means (49,21) connected to said foot driving mechanism (16-25) for displacing said second foot (50) into the lowered position, and return means (29) biasing said second foot (50) into its raised rest position.
14. A suction head (1) as set forth in claim 13 wherein said driving means (49,21) of said second foot (50) comprise, among other components, a wheel (49) fixed for co-rotation with the gearwheel (22) driving the first-mentioned foot (26) on a common axle shaft (23), said wheel (49) having a tab (21) for engaging a lug formed at said second foot (50).
15. A suction head (1) as set forth in claim 14 wherein said tabs are offset from each other by an angle of 180° so that said feet (26,50) are alternately displaced by said foot driving mechanism (16-25).
16. A suction head (1) as set forth in any one of claims 13 to 15 wherein the second foot is formed by a brush support (50) to which bristles (27) are affixed, said bristles (27) having an inclination opposite to the inclination of the bristles (9) attached to the housing (2), the free ends of said bristles (27) attached to the brush support (50) being the lower end of said second foot.
17. A suction head (1) as set forth in claim 1 wherein the housing (2) has a substantially rectangular shape when seen from above, the rotary connection sleeve (4) being disposed approximately in the center of the top of the housing (2) and the angle of inclination of the bristles (9) extending in a plane being in parallel to the narrow sides of the housing (2).
18. A suction head (1) as set forth in claims 3 and 17 wherein the movable foot (26) is disposed in the housing (2) between the center of the housing (2) and one of the narrow sides.
19. A suction head (1) as set forth in claims 13 and 17 wherein a movable foot (26,50) is disposed in the housing (2) to either side of the center of the hous-

ing (2) between said center and the narrow sides of the housing (2), respectively.

20. A suction head (1) as set forth in claim 6 wherein at least one of the group of individual components comprising the housing (2), the vibratory element (11), the gearwheels (16-22) and the connecting sleeve (4) consists of plastic material.

Patentansprüche

1. Schwimmbadreiniger-Saugkopf, (1) mit einem Gehäuse (2), das eine an ihrer Unterseite offene Kammer (32) ausbildet, und einem drehbaren Anschlußstutzen (4) für einen Schlauch, durch den eine entfernte Saugpumpe eine Wasserströmung durch die Kammer (32) und in den Schlauch hinein erzeugt, und weiterhin enthaltend ein Schwenkelement (11), das in der Kammer (32) schwenkbar gelagert ist, um als Folge der Wasserströmung durch die Kammer (32) den Saugkopf in Schwingung zu versetzen, dadurch **gekennzeichnet**, daß das Schwenkelement ein Schwingelement (11) ist und am unteren Rand des Gehäuses (2) flexible Borsten (9) angebracht sind, die vom unteren Rand des Gehäuses nach unten vorstehen und deren freie Enden in einer gemeinsamen Ebene liegen und dazu dienen, den Saugkopf auf einer zu reinigenden Oberfläche abzustützen, wobei die Borsten (9) derart geneigt sind, daß wenn die Borstenenden auf einer zu reinigenden horizontalen Oberfläche aufliegen, die Borsten (9) von der Vertikalen in einer vorgegebenen gemeinsamen Richtung abweichen, wodurch die Borsten (9) und das Schwingelement (11) zusammenwirken, um eine Vorwärtsbewegung des Saugkopfes über die zu reinigende Oberfläche hervorzurufen, und eine schwingende Reinigungswirkung an den Borstenenden hervorgebracht wird.
2. Schwimmbadreiniger-Saugkopf nach Anspruch 1, bei dem die Kammer eine horizontale Achse (12) aufweist, um die das Schwingelement schwenkbar gelagert ist.
3. Saugkopf (1) nach Anspruch 1 oder 2, enthaltend weiterhin wenigstens einen beweglichen Fuß (26), der ein unteres Ende aufweist und der in dem Gehäuse (2) gegenüber der Mitte des Saugkopfes (1) versetzt angeordnet ist und vertikal bezüglich der von den freien Enden der Borsten (9) definierten Ebene verstellbar ist, und einen Fußantriebsmechanismus in dem Gehäuse (2), der von der Schwenkbewegung des Schwingelements (11) über Einrichtungen (14) zum Umsetzen der schwenkenden Hin- und Herbewegung des Schwingelements (11) in eine unidirektionale Drehbewegung angetrieben ist, wobei der Fußantriebs-

mechanismus periodisch auf den wenigstens einen Fuß (26) derart einwirkt, daß dieser aus einer angehobenen Ruhestellung, in der das untere Ende des Fußes (26) gegenüber der von den freien Enden der Borsten (9) definierten Ebene zurückgezogen ist, in eine abgesenkte aktive Position vorgeschoben wird, in der das untere Ende des Fußes (26) über die genannte Ebene vorsteht, um den Saugkopf (1) einseitig von der zu reinigenden Oberfläche abzuheben, und weiterhin enthaltend eine Rückführeinrichtung (26) zum Rückführen des Fußes (26) in seine angehobene Ruhestellung.

4. Saugkopf (1) nach Anspruch 3, bei dem die Einrichtung zum Umsetzen der schwenkenden Hin- und Herbewegung des Schwingelements eine Einwegkupplung (14) ist, die an einem Vorsprung (13) des Schwingelements (11) in der Schwenkachse (12) desselben befestigt ist.
5. Saugkopf (1) nach Anspruch 4, bei dem der Vorsprung (13) einen unrunder Querschnitt und die Einwegkupplung eine dazu passende komplementäre Mittenöffnung aufweist, wobei die Einwegkupplung (14) auf den Vorsprung (13) aufgesteckt ist.
6. Saugkopf (1) nach Anspruch 3, bei dem der Fußantriebsmechanismus (16-25) neben anderen Komponenten ein mit einer vorstehenden Nase (21) versehenes Zahnrad (22) aufweist, das in dem Gehäuse (2) drehbar gelagert ist, wobei die Nase (21) bei Drehung des Zahnrades (22) einen kreisförmigen Bewegungsweg beschreibt, der Fuß (26) einen Vorsprung (28) hat, der in einem Teilabschnitt des genannten kreisförmigen Bewegungsweges angeordnet ist, sodaß der Vorsprung (28) zusammen mit dem Fuß (26) von der Nase (21) nach unten in die Richtung der genannten, von den freien Enden der Borsten (9) definierten Ebene gedrückt wird, wenn sich das Zahnrad (22) dreht, und weiterhin enthaltend wenigstens eine Rückführfeder (29) in dem Gehäuse (2), die den Fuß (26) in die Ruhestellung drückt, wenn bei fortgesetzter Drehung des Zahnrades (22) sich die Nase (21) von dem Vorsprung (28) löst.
7. Saugkopf (1) nach Anspruch 3, bei dem der Fuß von einem Bürstenhalter (26) gebildet ist, an dem flexible Fußborsten (27) befestigt sind, die in einer Richtung entgegengesetzt zur Neigungsrichtung der an dem Gehäuse (2) befestigten Borsten (9) geneigt sind, wobei die freien Enden der an den Bürstenhalter (26) befestigten Fußborsten (27) das untere Ende des Fußes bilden.
8. Saugkopf (1) nach Anspruch 3, bei dem der Fußantriebsmechanismus ein Untersetzungsgetriebe mit mehreren Paaren ineinander kämmender

Zahnräder (17-22) enthält.

9. Saugkopf (1) nach Anspruch 8, bei dem das Schwingelement (11) und die Zahnräder (17-22) auf zwei Achswellen (23,24) angeordnet sind und das Gehäuse (2) aus wenigstens zwei Teilen (5,6) besteht, die miteinander längs einer Trennlinie (7) verbunden sind, die sich durch die Achsen der genannten Achswellen (23,24) erstreckt.
10. Saugkopf (1) nach Anspruch 9, bei dem die zwei Gehäuseteile (5,6) lösbar miteinander verbunden sind.
11. Saugkopf (1) nach Anspruch 1, bei dem die Borsten (9) am unteren Rand (2) des Gehäuses (2) austauschbar befestigt sind.
12. Saugkopf (1) nach Anspruch 3, bei dem der Fuß (26,27) im Gehäuse (2) austauschbar gehalten ist.
13. Saugkopf (1) nach Anspruch 6, enthaltend einen zweiten beweglichen Fuß (50), der ein unteres Ende aufweist und in dem Gehäuse (2) symmetrisch zum genannten Fuß (26) bezügl. der Mitte des Saugkopfes (1) angeordnet ist, wobei der zweite Fuß (26) aus einer angehobenen Ruhestellung, in der das untere Ende des zweiten Fußes (50) gegenüber der von den freien Enden der Borsten (9) definierten Ebene angehoben ist, in eine untere Position vertikal verstellbar ist, in der das untere Ende des zweiten Fußes (50) nach unten über die genannte Ebene vorsteht, und eine Antriebseinrichtung (29,21), die mit dem Fußantriebsmechanismus (16-25) verbunden ist, um den zweiten Fuß (50) in die abgesenkte Position zu verstellen, und eine Rückführeinrichtung (29), die den zweiten Fuß (50) in seine angehobene Ruhestellung vorspannt.
14. Saugkopf (1) nach Anspruch 13, bei dem der Antriebsmechanismus (49,21) des zweiten Fußes (50) neben anderen Komponenten ein mit dem den erstgenannten Fuß (26) antreibenden Zahnrad (22) auf gemeinsamer Achswelle (23) drehfest verbundenes Rad (49) aufweist, das eine Nase (21) zum Auflaufen auf einen an dem zweiten Fuß (50) ausgebildeten Vorsprung hat.
15. Saugkopf (1) nach Anspruch 14, bei dem die Nasen gegeneinander um einen Winkel von 180° versetzt sind, sodaß die Füße (26,50) alternierend von dem Fußantriebsmechanismus (16-25) verstellt werden.
16. Saugkopf (1) nach einem der Ansprüche 13 bis 15, bei dem der zweite Fuß von einem Bürstenhalter (50) gebildet ist, an dem Borsten (27) befestigt sind, die eine zur Neigung der an dem Gehäuse (2) befestigten Borsten (9) entgegengesetzte Neigung

aufweisen, wobei die freien Enden der an dem Bürstenhalter (50) befestigten Borsten (27) das untere Ende des zweiten Fußes bilden.

17. Saugkopf (1) nach Anspruch 1, bei dem das Gehäuse (2) von oben gesehen eine im wesentlichen rechteckige Gestalt aufweist, wobei der drehbare Anschlußstutzen (4) etwa in der Mitte der Oberseite des Gehäuses (2) angeordnet ist und der Neigungswinkel der Borsten (9) sich in einer Ebene erstreckt, die parallel zu den Schmalseiten des Gehäuses (2) ist.
18. Saugkopf (1) nach den Ansprüchen 3 und 17, bei dem der bewegliche Fuß (26) in dem Gehäuse (2) zwischen der Mitte des Gehäuses (2) und einer der Schmalseiten angeordnet ist.
19. Saugkopf (1) nach den Ansprüchen 13 und 17, bei dem jeweils ein beweglicher Fuß (26,50) im Gehäuse (2) zu beiden Seiten der Mitte des Gehäuses (2) zwischen dieser Mitte und den Schmalseiten des Gehäuses (2) angeordnet ist.
20. Saugkopf (1) nach Anspruch 6, bei dem wenigstens eines aus der Gruppe von Einzelbauteilen, umfassend das Gehäuse (2), das Schwingungselement (11), die Zahnräder (16-22) und die Anschlußbuchse (4), aus Plastikmaterial besteht.

Revendications

1. Une tête d'aspiration (1) d'un appareil pour le nettoyage de piscines, du type comportant une enveloppe (2) formant une chambre (32) ouverte sur son côté inférieur et un manchon tournant (4) de liaison pour un tuyau par lequel une pompe d'aspiration placée à distance établit un courant d'eau à travers la chambre (32) et dans le tuyau, et comportant au surplus un élément basculant (11) monté de manière pivotante dans ladite chambre (32) pour faire vibrer la tête d'aspiration en réponse au courant d'eau à travers la chambre (32), caractérisée en ce que ledit élément basculant est un élément vibrant (11) et des poils souples (9) sont fixés sur le bord inférieur de l'enveloppe (2) et font saillie vers le bas à partir de celui-ci pour se terminer par des extrémités libres de poils situées dans un plan commun et agencées pour supporter la tête d'aspiration sur une surface à nettoyer, les poils (9) étant inclinés de telle manière que, lorsque les extrémités de poils coopèrent avec une surface horizontale à nettoyer, ces poils (9) s'écartent de la verticale dans une direction commune spécifique ;
de sorte que les poils (9) et l'élément vibrant (11) travaillent conjointement pour provoquer le mouvement vers l'avant de la tête d'aspiration sur

la surface à nettoyer, et qu'une action de nettoyage vibratoire est obtenue aux extrémités des poils.

2. La tête d'aspiration d'un appareil pour le nettoyage de piscines de la revendication 1, dans laquelle la chambre comporte un axe horizontal (12) autour duquel l'élément vibrant est monté de manière pivotante.
3. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 1 ou 2, comportant au surplus au moins un pied mobile (26) présentant une extrémité inférieure et disposé dans l'enveloppe (2) en étant décalé du centre de la tête d'aspiration (1) et étant déplaçable verticalement par rapport au plan défini par les extrémités libres des poils (9), et un dispositif d'entraînement du pied dans l'enveloppe (2), qui est entraîné par le mouvement pivotant de l'élément vibrant (11) par l'intermédiaire de moyens (14) pour transformer ledit mouvement pivotant vers l'avant et vers l'arrière de l'élément vibrant (11) en un mouvement de rotation unidirectionnel, ledit dispositif d'entraînement du pied agissant de manière périodique sur ledit pied (26) de manière à avancer celui-ci depuis une position soulevée de repos, dans laquelle l'extrémité inférieure dudit pied (26) est rétractée par rapport au plan défini par les extrémités libres desdits poils (9), jusqu'à une position active abaissée dans laquelle l'extrémité inférieure dudit pied (26) fait saillie au-delà dudit plan de manière à soulever ladite tête d'aspiration (1) d'un côté par rapport à la surface à nettoyer, et comportant au surplus des moyens de rappel (29) pour ramener ledit pied (26) dans sa position soulevée de repos.
4. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 3, dans laquelle lesdits moyens pour transformer le mouvement pivotant vers l'avant et vers l'arrière dudit élément vibrant est un embrayage unidirectionnel (14) monté sur une saillie (13) de l'élément vibrant (11), dans l'axe de pivotement (12) de celui-ci.
5. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 4, dans laquelle ladite saillie (13) présente une section droite non circulaire et ledit embrayage unidirectionnel (14) présente une ouverture centrale complémentaire correspondant à celle-ci, ledit embrayage unidirectionnel (14) étant enfilé sur ladite saillie (13).
6. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 3, dans laquelle ledit mécanisme (16-25) d'entraînement du pied comporte, entre autres constituants, une roue dentée (22) munie d'un doigt en saillie (21) et montée de manière tournante dans l'enveloppe (2), ledit doigt (21) décrivant un trajet de mouvement circulaire lors de la rotation

de la roue dentée (22), le pied (26) comportant une patte (28) qui est située dans une section partielle dudit trajet de mouvement circulaire, de telle manière que ladite patte (28), conjointement avec le pied (26), est poussée par ledit doigt (21) vers le bas dans la direction dudit plan défini par les extrémités libres des poils (9) lors de la rotation de ladite roue dentée (22), et comportant au surplus au moins un ressort de rappel (29), dans l'enveloppe (2), rappelant le pied (26) dans la position de repos lorsque ledit doigt (21) se sépare de ladite patte (28) lors de la poursuite de la rotation de ladite roue dentée (22).

7. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 3, dans laquelle le pied est formé par un support de brosse (26) sur lequel sont assujettis des poils souples (27) de pied, les poils de pied (27) étant inclinés dans un sens opposé à l'inclinaison des poils (9) assujettis à l'enveloppe (2), les extrémités libres des poils de pied (27) assujettis au support de brosse (26) formant l'extrémité inférieure du pied.
8. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 3, dans laquelle le mécanisme d'entraînement du pied comporte un train d'engrenage réducteur avec plusieurs paires de roues dentées en engrènement (17-22).
9. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 8, dans laquelle l'élément vibrant (11) et lesdites roues dentées (17-22) sont disposés sur deux arbres (23,24), et l'enveloppe (2) consiste en au moins deux parties (5,6) qui sont reliées l'une à l'autre le long d'une ligne de séparation (7) qui traverse les axes desdits arbres (23,24).
10. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 9, dans laquelle les deux parties d'enveloppe (5,6) sont reliées l'une à l'autre de manière séparable.
11. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 1, dans laquelle les poils (9) sont assujettis de manière échangeable sur le bord inférieur (8) de l'enveloppe (2).
12. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 3, dans laquelle le pied (26,27) est supporté de manière échangeable dans l'enveloppe (2).
13. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 6, comportant un second pied mobile (50) présentant une extrémité inférieure et disposé dans l'enveloppe (2) symétriquement audit pied (26) par rapport au centre de ladite tête d'aspiration

(1), ledit second pied (50) étant déplaçable verticalement depuis une position soulevée de repos, pour laquelle l'extrémité inférieure dudit second pied (50) est soulevée par rapport au plan défini par les extrémités libres des poils (9), jusqu'à une position inférieure pour laquelle l'extrémité inférieure dudit second pied (50) fait saillie vers le bas au-delà dudit plan, et des moyens d'entraînement (49,21) reliés audit mécanisme d'entraînement de pied (16-25) pour déplacer ledit second pied (50) dans la position abaissée, et des moyens de retour (29) rappelant ledit second pied (50) dans sa position soulevée de repos.

14. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 13, dans laquelle lesdits moyens (49,21) d'entraînement dudit second pied (50) comportent, entre autres constituants, une roue (49) fixée pour tourner conjointement avec la roue dentée (22) entraînant le pied (26) mentionné en premier lieu sur un arbre commun (23), ladite roue (49) comportant un doigt (21) pour coopérer avec une patte formée sur ledit second pied (50). 15
15. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 14, dans laquelle lesdites doigts sont décalées l'une par rapport à l'autre d'un angle de 180°, de telle manière que lesdits pieds (26,50) sont déplacés alternativement par ledit mécanisme d'entraînement de pied (16-25). 20 25 30
16. Une tête d'aspiration (1) telle qu'indiquée dans l'une quelconque des revendications 13 à 15, dans laquelle le second pied est formé par un support de brosse (50) auquel sont fixés des poils (27), lesdits poils (27) ayant une inclinaison opposée à l'inclinaison des poils (9) assujettis à l'enveloppe (2), les extrémités libres desdits poils (27) assujettis au support de brosse (50) formant l'extrémité inférieure dudit second pied. 35 40
17. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 1, dans laquelle l'enveloppe (2) présente une forme essentiellement rectangulaire en vue de dessus, le manchon tournant de liaison (4) étant disposé approximativement au centre de la partie supérieure de l'enveloppe (2), et l'angle d'inclinaison des poils (9) s'étendant dans un plan étant en parallèle aux petits côtés de l'enveloppe (2). 45 50
18. Une tête d'aspiration (1) telle qu'indiquée dans les revendications 3 et 17, dans laquelle le pied mobile (26) est disposé dans l'enveloppe (2) entre le centre de l'enveloppe (2) et l'un des petits côtés. 55
19. Une tête d'aspiration (1) telle qu'indiquée dans les revendications 13 et 17, dans laquelle un pied mobile (26,50) est disposé dans l'enveloppe (2) de part

et d'autre du centre de l'enveloppe (2), respectivement entre ledit centre et les petits côtés de l'enveloppe (2).

- 5 20. Une tête d'aspiration (1) telle qu'indiquée dans la revendication 6, dans laquelle au moins l'un du groupe des composants individuels comportant l'enveloppe (2), l'élément vibrant (11), les roues dentées (16-22) et le manchon de liaison (4) est constitué en matière plastique. 10

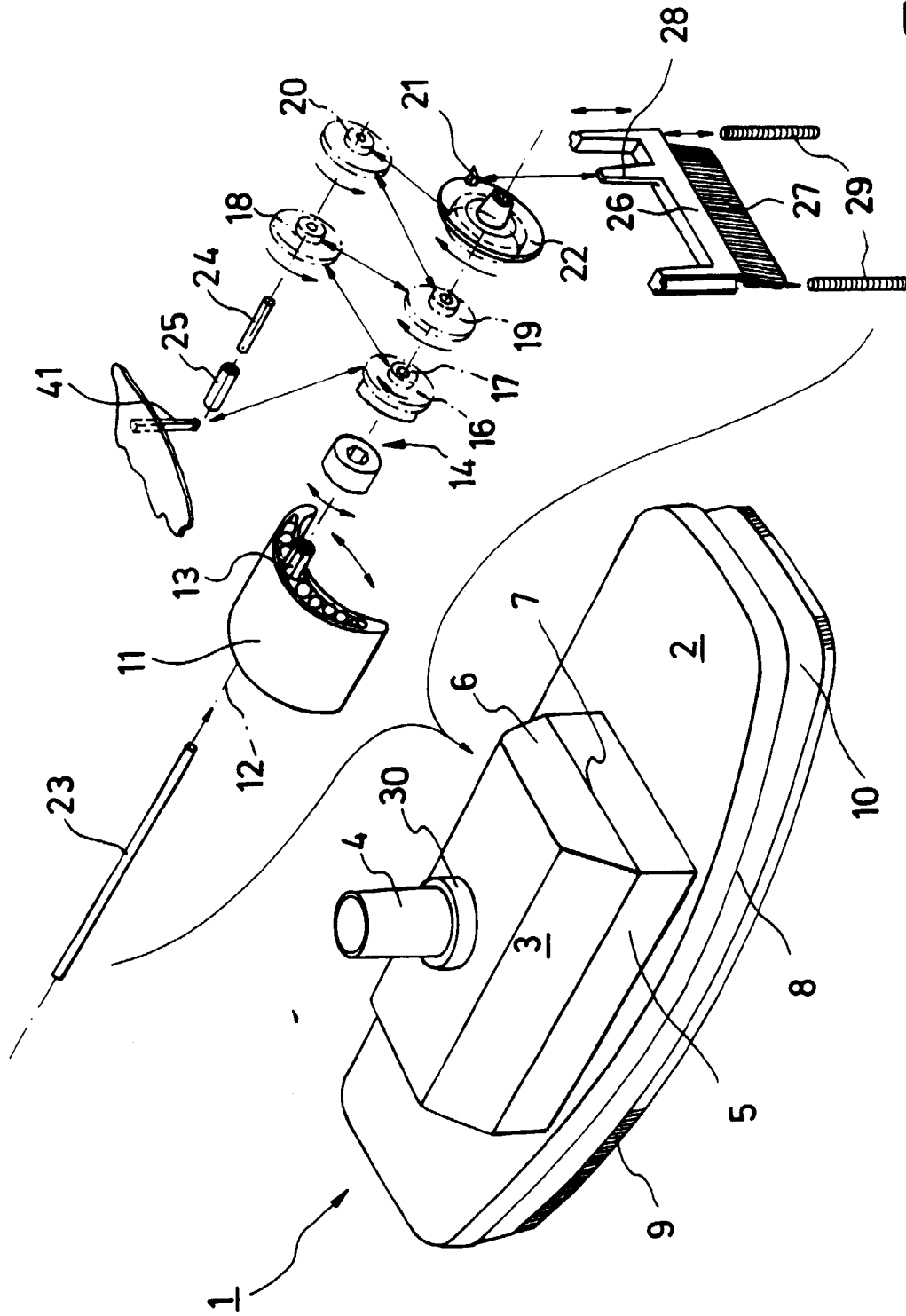


FIG.1

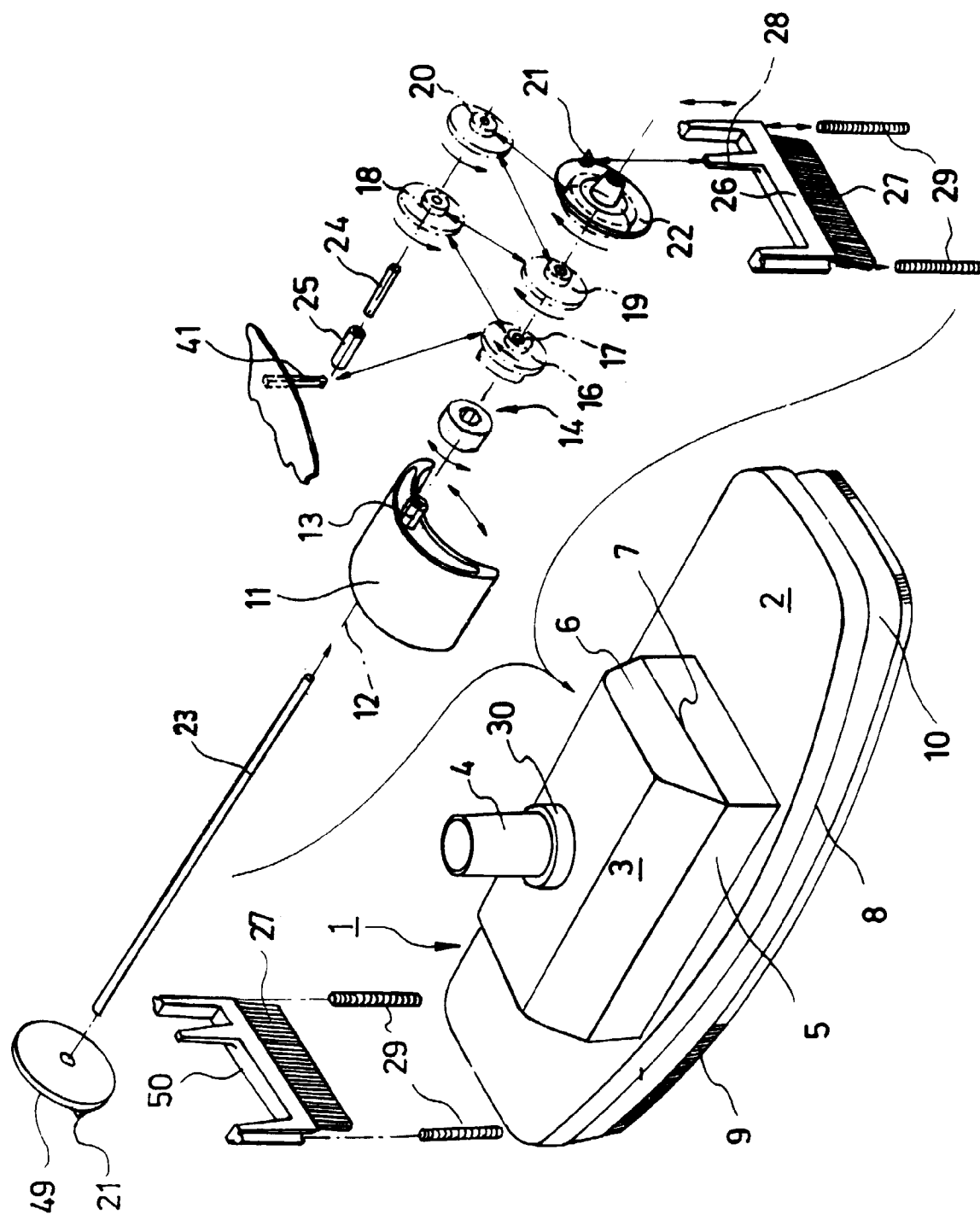


FIG.1a

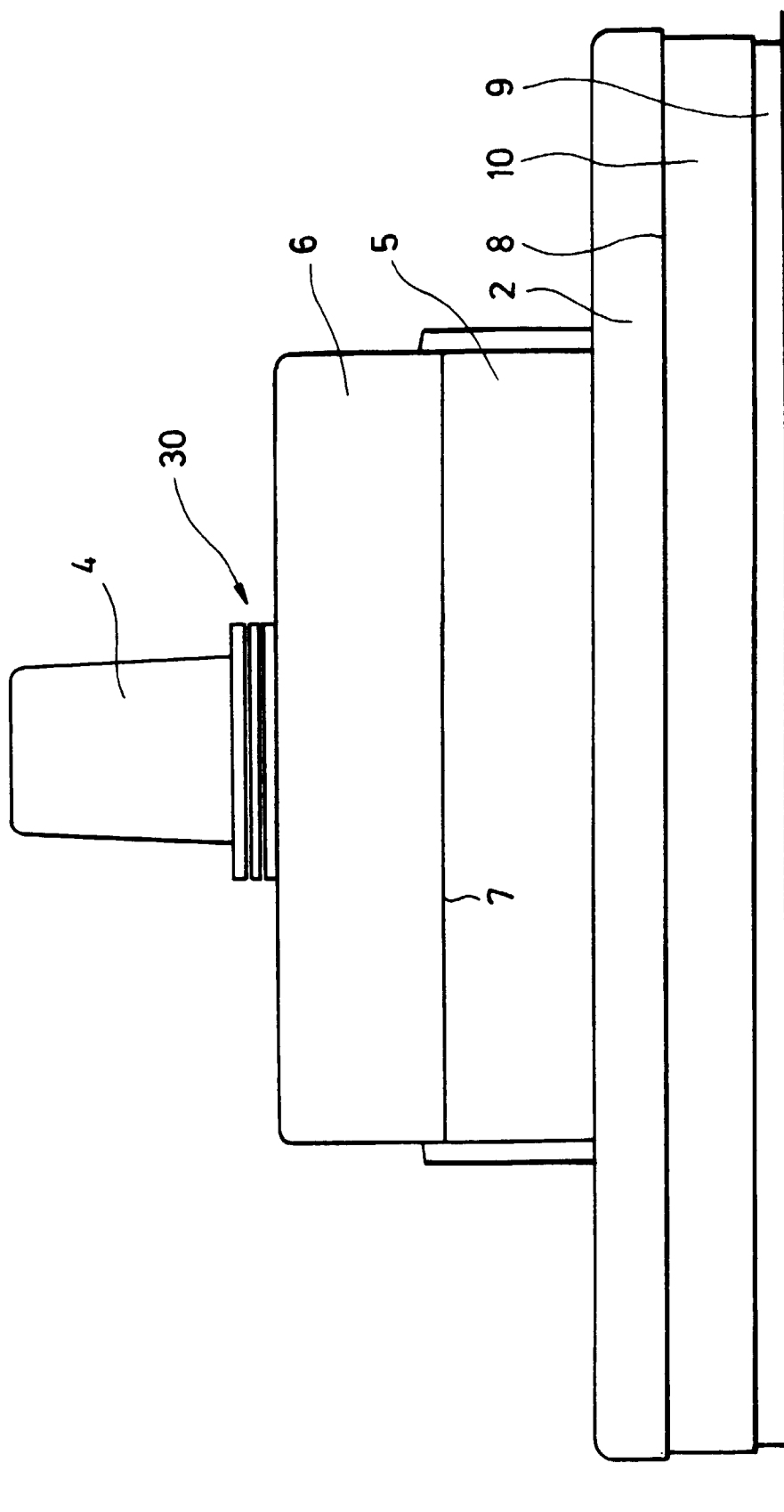


FIG. 2

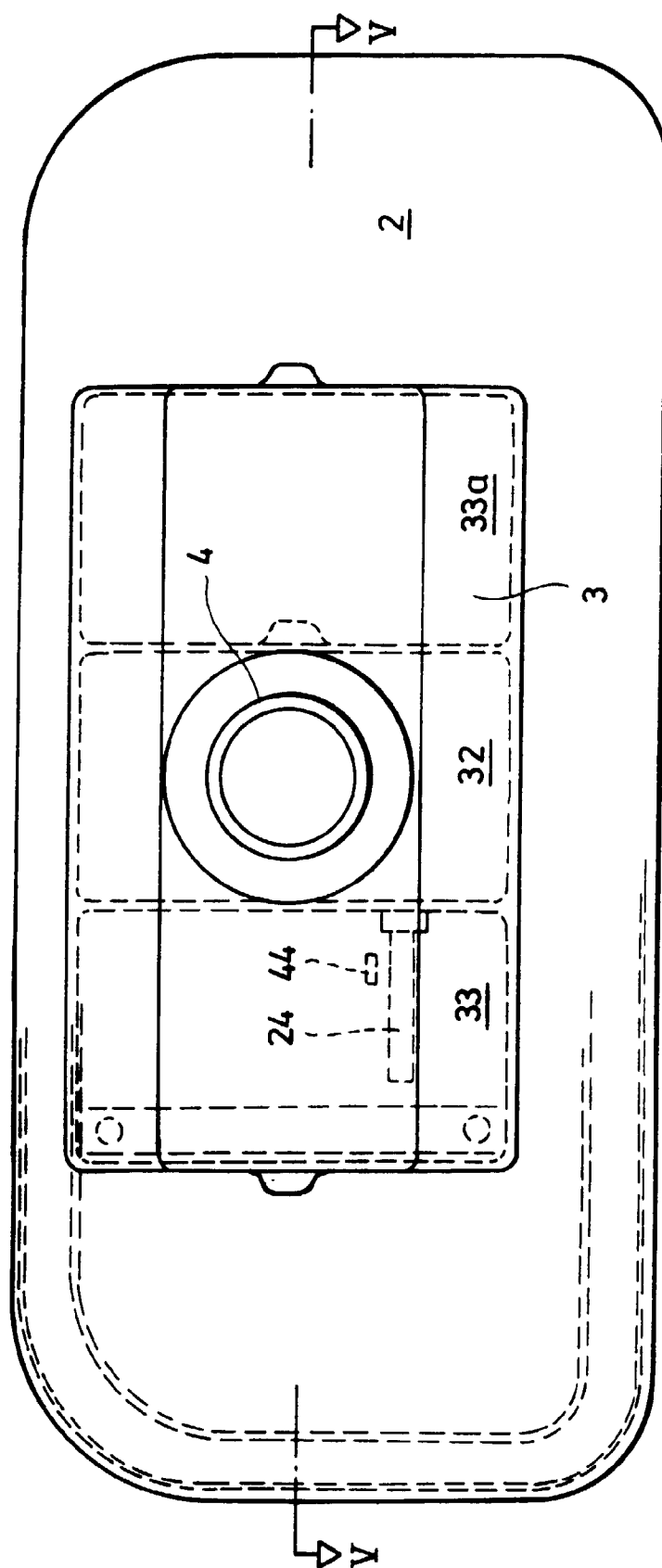


FIG.3

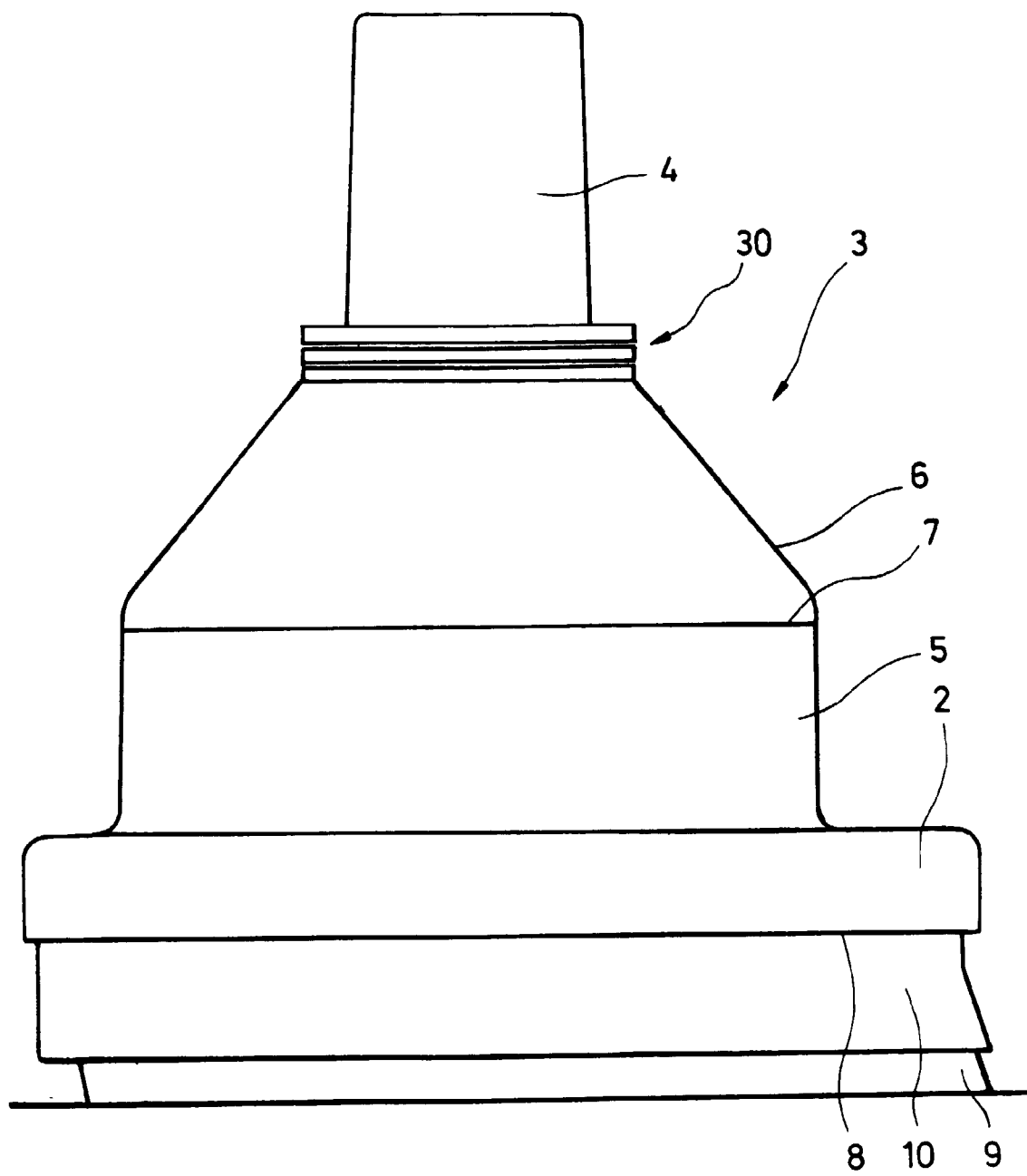


FIG.4

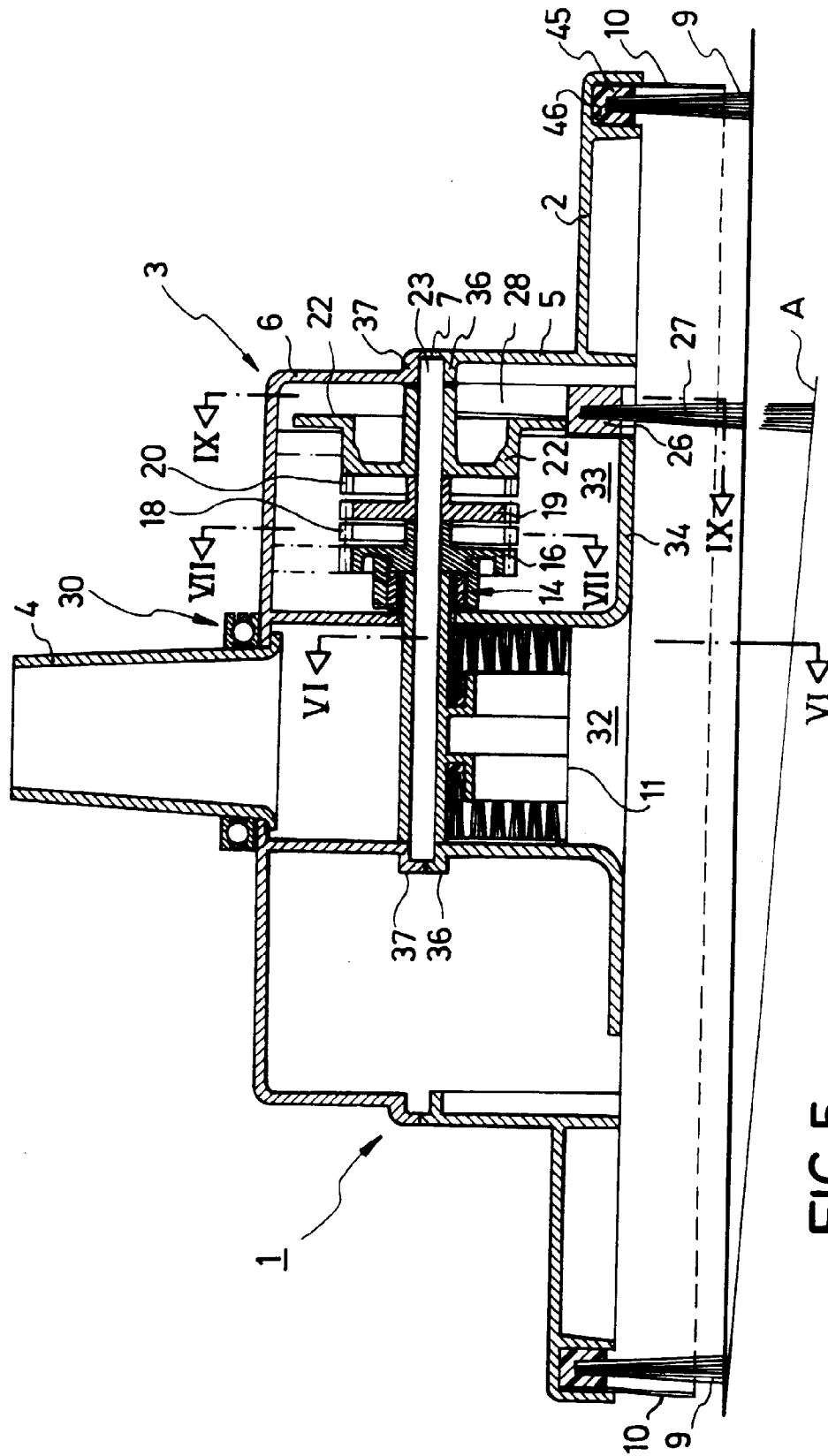


FIG. 5

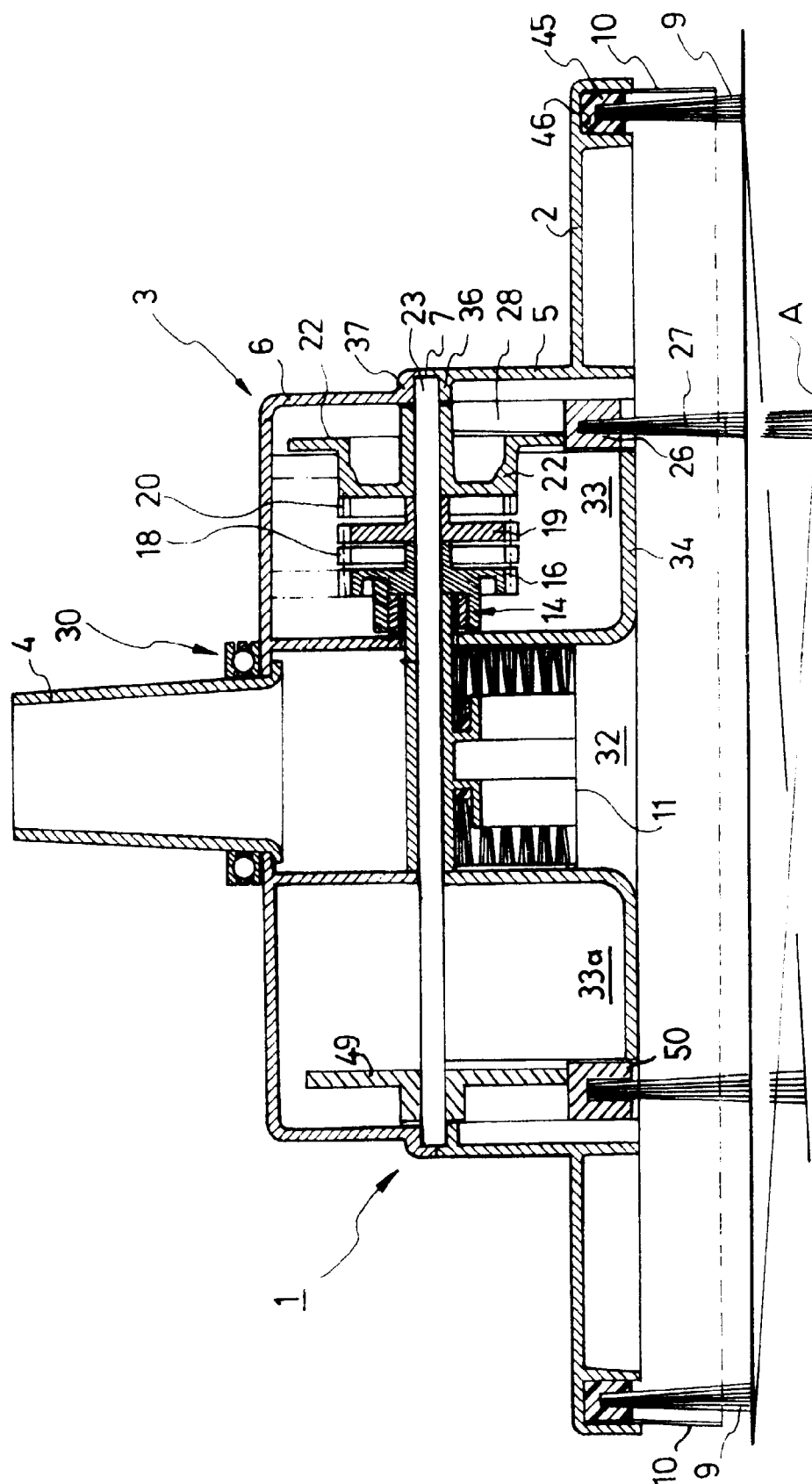


FIG. 5a

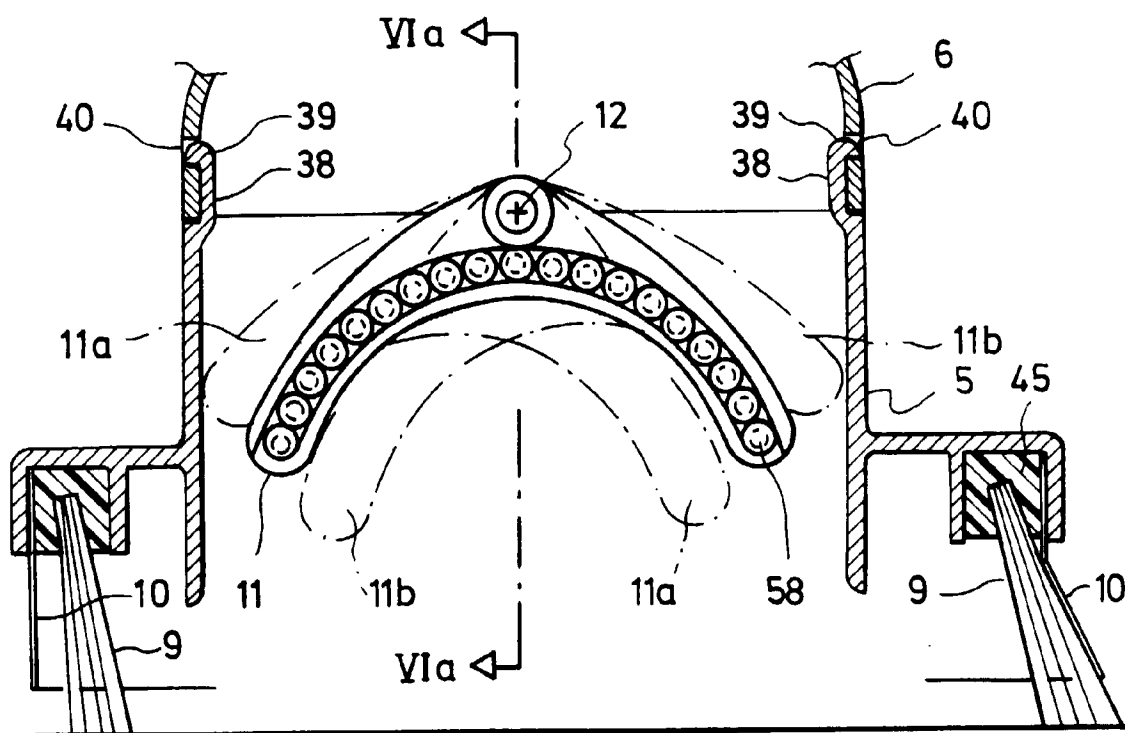


FIG. 6

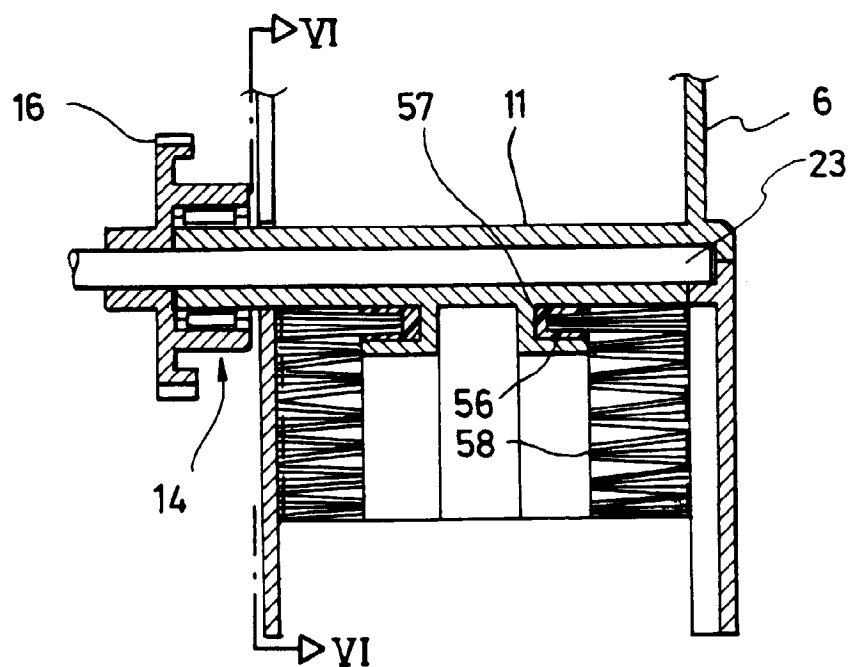


FIG. 6a

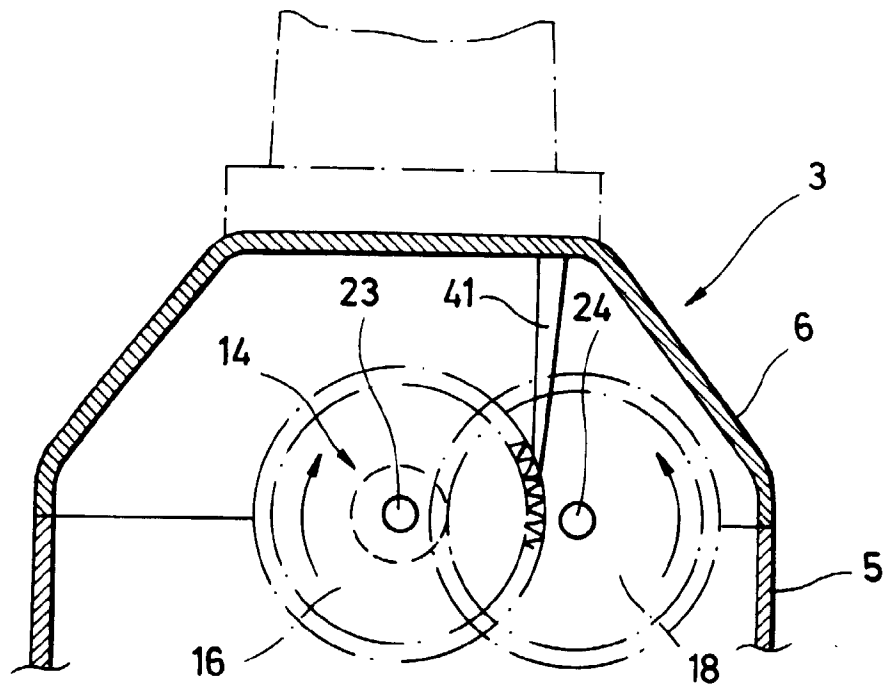


FIG. 7

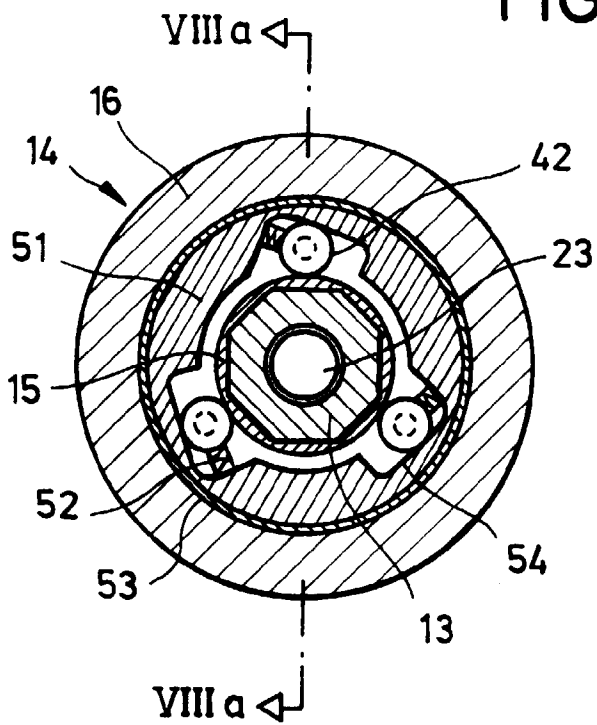


FIG. 8

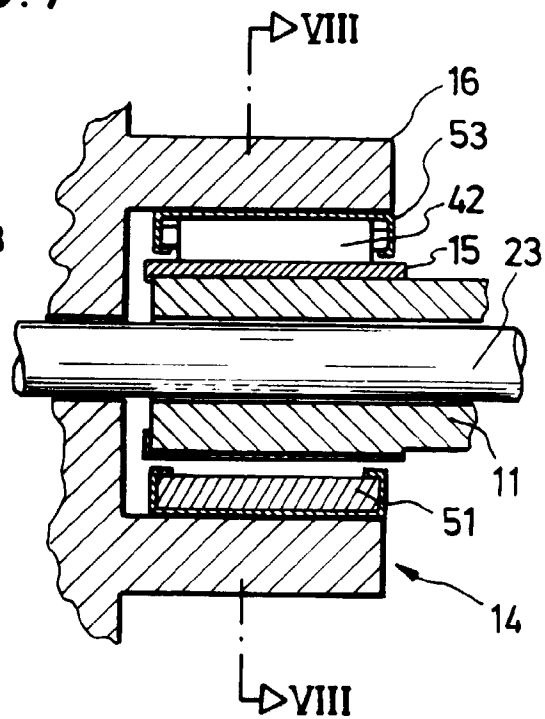


FIG. 8a

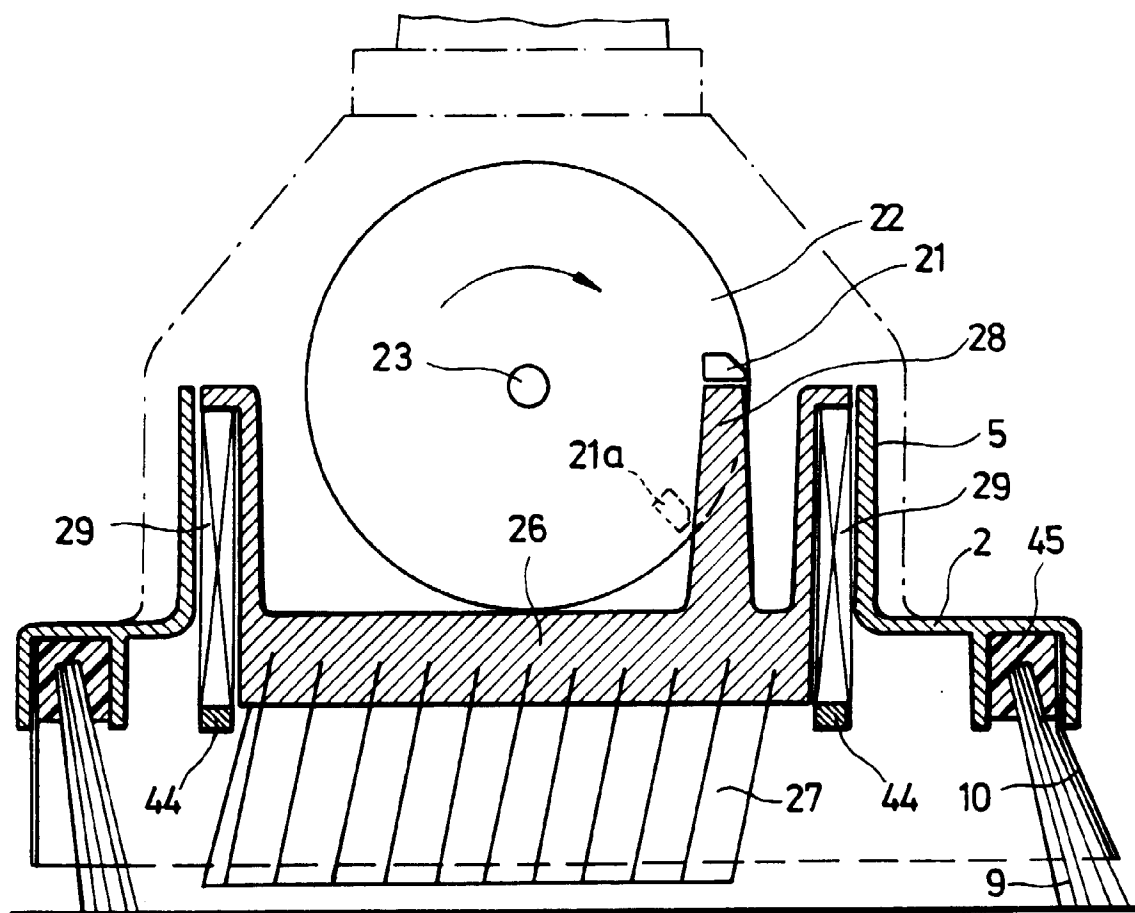


FIG. 9

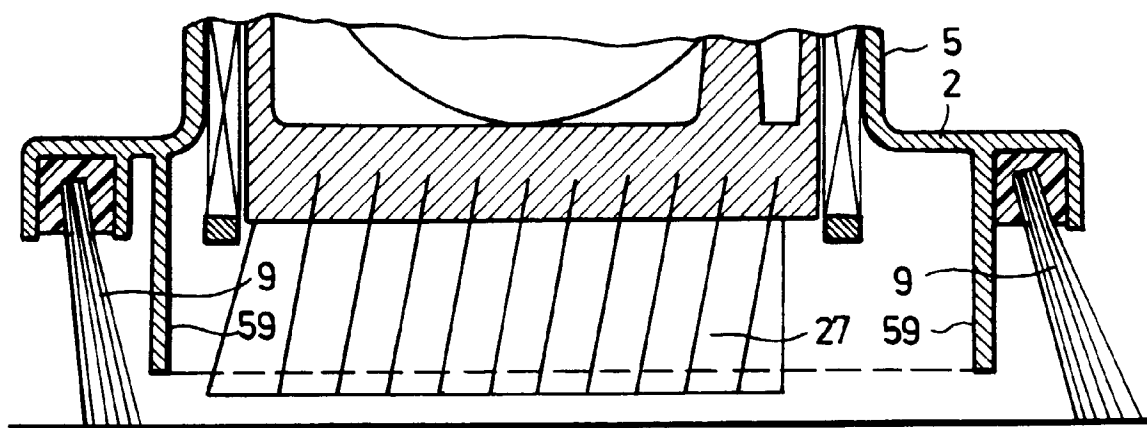


FIG. 9a

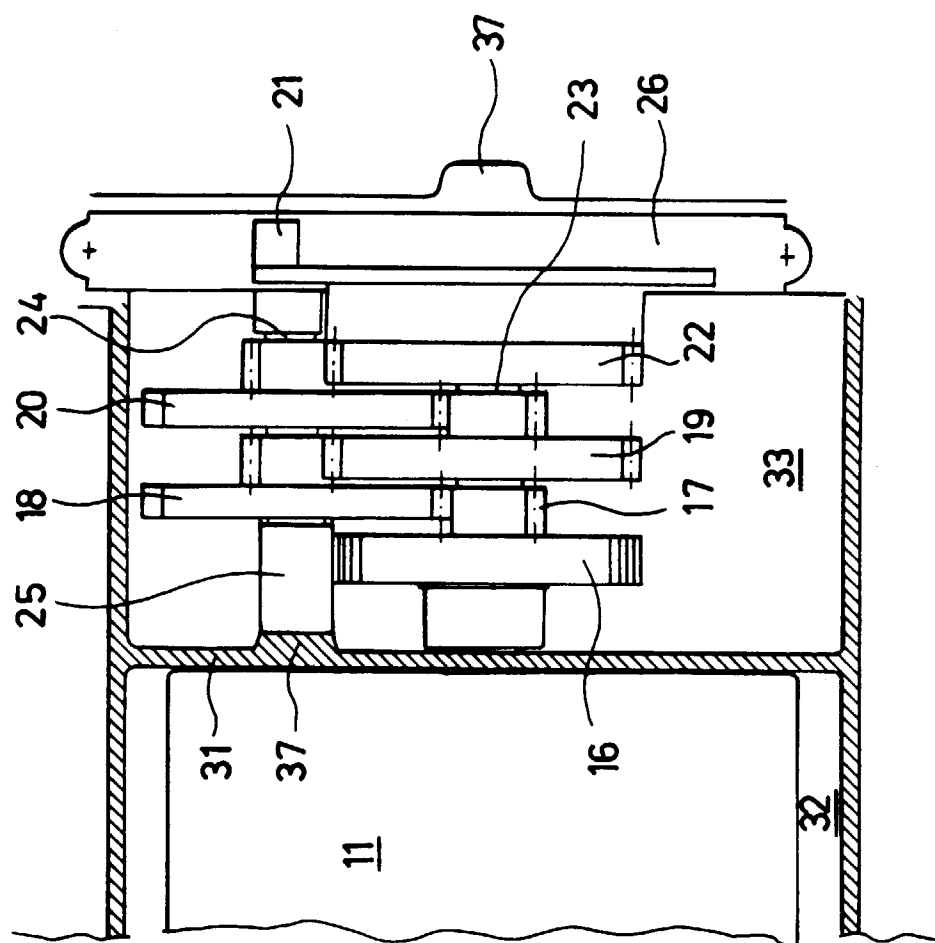


FIG.10