

①②

EUROPEAN PATENT APPLICATION

②① Application number: **87106288.1**

⑤① Int. Cl.⁴: **B 24 B 31/12, B 24 B 57/02**

②② Date of filing: **30.04.87**

③① Priority: **05.05.86 IT 2030986**
24.03.87 IT 1981687

⑦① Applicant: **Polenghi, Roberto, Viale Bligny 11,**
I-20100 Milano (IT)

④③ Date of publication of application: **11.11.87**
Bulletin 87/46

⑦② Inventor: **Polenghi, Roberto, Viale Bligny 11,**
I-20100 Milano (IT)

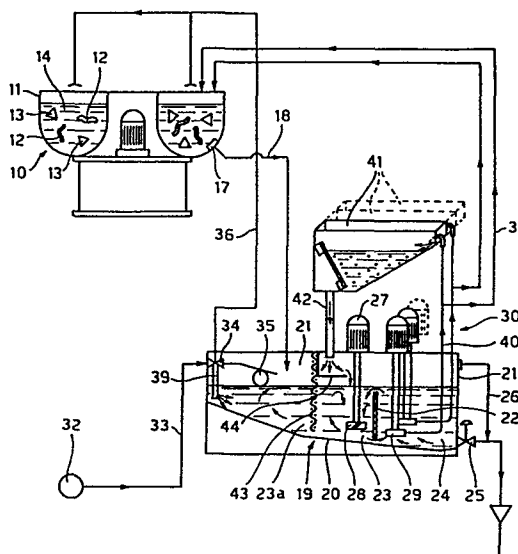
⑥④ Designated Contracting States: **AT CH DE ES FR GB LI**
SE

⑦④ Representative: **Petruzzielli, Antonio, Via E. De Amicis**
No. 25, I-20123 Milan (IT)

⑤④ **Method and device for feeding a cleaning solution with suspended abrasive substances, into work-piece finishing machine.**

⑤⑦ A method and a device for the feeding of a cleaning solution with suspended powdered abrasive substances, into work-piece finishing machines.

The finishing tank (11) of the machine is connected by a closed circuit with a recycling tank (19) which includes a stirring device (28) to keep a powdered abrasive substance suspended in a cleaning solution which is constantly fed into the finishing tank (11) by a pump (29). A second recycling circuit (40, 42) is used to remove the detergent from special containers (41) with a strong flow of liquid drawn from the recycling tank (19) which is then returned into the stirring area (28).



This invention refers to a method and a device for feeding a cleaning solution with powdered abrasive substances, in suspension, into the finishing tank of work-piece finishing machines; such as tum-
5 blers, centrifugal and vibratory finishing machines and the like.

As is well known, the finishing and cleaning of metal or non-metal pieces, is done with special
10 finishing machines which include a finishing tank in which the pieces to be finished and the finishing materials are placed randomly.

The pieces to be treated and finishing materials
15 undergo shaking and vibratory motions, in order to continuously make the pieces to be finished and finishing materials rub against each other, in the presence of a cleaning solution. The cleaning solution can be enriched with a powdered abrasive
20 substance in order to improve on the action of the finishing materials. The cleaning solution in the finishing tank of the machine is usually substituted with a fresh solution, while continuously draining the dirty solution from the finishing
25 tank, into a second tank, also known as recycling or decanting tank; from this tank the fresh solution is recycled in metered amounts into the finishing tank over the loose mass. The necessity of feeding into the finishing tank a fresh
30 solution has been considered an essential require-

ment to the smooth running of the machine and the finishing of the pieces to be treated. Therefore in the recycling tank, where most of the dirt picked up by the cleaning solution drained from
5 the machine was deposited, the tendency was to keep quiet conditions to avoid putting the deposited dirt back into circulation. For this reason the cleaning solution lost more and more of the abrasive substance, which was decanted to the
10 bottom of the recycling tank, thus reducing the effectiveness of the solution and of the cleaning materials; the machine cycle was made longer and the desired finish on the pieces was not achieved.

15 Another problem with existing machines is the difficulty of dissolving the detergent in the cleaning solution and of dispersing the abrasive substance at the beginning of each machine cycle, due to the fact that these substances, upon
20 contact with water, form lups which are hard to dissolve and can jam the recycling pump device.

It would therefore be convenient to keep the abrasive powder suspended for the duration of each
25 machine cycle or part thereof, and to dissolve the detergent in the initial phase, with the aim of improving the effectiveness of the machine while shortening the machine cycle. Therefore, the scope of this invention is to provide a method and a
30 device through which the powdered abrasive sub-

stances can be suspended and maintained in that state in the cleaning solution which is fed into the finishing tank, by structurally simple and inexpensive means.

5

A further scope of the invention is to provide a method and a device as specified above, which will further dissolve the detergent and the powdered abrasive substance in a short time, at
10 the beginning of each machine cycle, allowing in addition for the substances to be drawn from special containers.

Presently we know of no devices which can
15 accomplish the scopes mentioned above. Contrarily to the present trend, the invention is based on a principle according to which creating turbulence within the cleaning solution in the recycling tank has no negative effects on the finishing of the
20 pieces during a certain part of the finishing cycle, even if the solution that is recycled or fed into the finishing tank still contains part of the dirt previously removed, while it gives definitely better results in terms of the ef-
25 fectiveness of the finishing materials, since the turbulence in the recycling tank keeps suspended all the abrasive substance that would otherwise settle on the bottom of the tank.

30 Yet another scope of the invention is to provide

an apparatus or device which can put into action the method being claimed, which is able to operate totally independently, in a short amount of time, using one or more detergents, while keeping the
5 structure and operation of the machine extremely simple.

All the above is made possible through the claimed method of claim 1 and the claimed device. Further
10 preferential embodiments are claimed in the dependent claims. According to the invention one tank is used to perform different functions since it is initially used as a recycling and/or detergent and powdered abrasive substance disper-
15 sion tank at the beginning and at least during one phase of the finishing machine cycle, while it can be used as a traditional recycling or dirt decanting tank, during the other phases of said machine cycle.

20

The invention will be described hereunder in further detail, with reference to the enclosed drawings of which:

25 Fig. 1 is a general scheme of a vibratory finishing machine with a device according to the invention.

Fig. 2 is an enlarged view of a possible
30 embodiment for a detergent container.

Fig. 3 is a cross sectional view along the line 3-3 in figure 2.

In figure 1, 10 stands for a generic finishing machine having a finishing tank 11 in which are placed the pieces 12 to be treated together with the finishing materials 13 in a loose fashion and a cleaning solution 14 which can contain a certain amount of suspended powdered abrasive substance.

10

The machine finishing tank 11, near the bottom, is provided with a discharge opening 17 for solution drainage, which is fitted with a grate that keeps in the pieces 12 and the finishing materials 13, while allowing the liquid solution to flow out with the eventual suspended abrasive powder. The drainage opening 17 is in turn connected with a recycling tank 19, by a conduit 18 to drain the cleaning solution from the finishing tank 11 to the recycling tank 19.

Tank 19, as is shown, includes a slanted bottom 20, outer walls 21 and a partition 22 which extends downward, ending at a certain distance from the bottom 20 of the tank. The partition 22 is usually below the surface of the liquid in tank 19 and is mainly used to divide area 23 from area 24. Area 23 of tank 19 during certain phases of the machine cycle, and specifically at the

beginning and during part of the cycle, is used to created turbulence within the solution towards the bottom 20 of tank 19 to suspend the abrasive powder dispersed in it, as will be explained
 5 later. The second area 24 of the tank is used for the suction of the solution to be recycled into the finishing tank 11 of the machine 20. Figure 1 shows that the bottom 20 of the recycling tank is slanted downward beginning at an area 23a, where
 10 the dirt is collected, towards the suction area 24, where a valve 25 allows for drainage into the sewers whenever the tank has to be emptied; 26 stands for an overflow conduit.

15 Corresponding to the stirring area 23, next to the partition 22, the tank 19 includes a stirring device of any kind, hydraulic or mechanical for instance, whose stirrer 28 is submerged completely in the liquid reaching almost to the bottom 20 of
 20 the tank so as to create a strong turbulence and a strong flow of liquid from the top towards the bottom 20 of the tank 19; a recycling pump 29 is used to feed the cleaning solution contained in the tank 19, into the finishing tank 11 through
 25 the conduit 31 respectively to feed the same solution along the recycling circuit 30 in order to pick up the cleaning solution, as explained later.

30 The recycling tank 19 is fed with water from the

main supply 32 through the conduit 33 and a valve 34 which can be activated by a float which detects the level of the liquid in the tank 19. Alternatively the finishing tank 11 can be fed by the main
 5 water supply 32 through the float valve 34 and a conduit 36. In this way the level of the liquid can be kept constant in tanks 11 and 19 that means that tanks and pieces can be washed in separate phases. For this reason the valve 34 has one or
 10 more nozzles 39 near the slanted bottom 20, the nozzles being directed downward towards the bottom 20 in order to allow for the proper washing of the bottom and of the abrasive material or the dirt deposited on it.

15

As mentioned previously, an essential feature of the method and of the device according to this invention is the creation of strong turbulence in the liquid or in the cleaning solution contained
 20 in the recycling tank 19, for example near the bottom 20 of the tank; in this way a turbulent circulation of the liquid is achieved thus lifting and keeping suspended the abrasive powder which has been previously dispersed into the solution,
 25 which would otherwise tend to settle on the bottom of the tank itself, thus augmenting the effectiveness of the machine 10. The presence of the partition 22 also prevents the turbulent motion of the liquid from spreading in an uncontrolled mode
 30 to the area from which the pump 29 draws which

could cause cavitation problems in the pump.

Turbulence of the cleaning solution in the tank 19 can be maintained for the time necessary for the treatment of the pieces 12 in the finishing tank; the fact that during this phase of the cycle the stirrer 28 prevents the decantation of solid particles of the cleaning solution, which drains out of the machine's finishing tank 11 and which are drained into the recycling tank 19, does not constitute a negative element, on the contrary, this turbulence is created on purpose and used to some advantage in lifting and keeping suspended the abrasive powder particles previously dispersed into the solution. The machine cycle time is thus greatly reduced due to the effectiveness of the solution 14 and of the finishing materials 13 upon the pieces 12 in the finishing tank 11. When the initial treatment phase is over, or rather when the machine's working cycle requires it to be, the stirrer 27, 28 in the recycling tank is stopped, while the pump 29 is kept running. In this way, since the turbulence in tank 19 subsides, the dirt and the abrasive substance drained out of the finishing tank 11 into the recycling tank 19, are decanted and settle at the bottom of it. Therefore only the fresh cleaning solution is kept in circulation for the final finishing or polishing phases of the work-pieces. At the end of the machine cycle the cleaning solution contained in

tanks 11 and 19 is drained out by opening the drainage valve 25 and the float valve 34 at the same time thus connecting both the nozzles 39 and the conduit 36 with the main water supply 32 at the bottom 20 of the tank 19 and the mass of material 12, 13 in the finishing tank 11 are thus properly washed. By closing up the drainage valve 25 the level of the liquid in the recycling tank 19 is restored which causes the float valve 34 to shut, starting up a new machine cycle.

As mentioned previously, the stirrer 28 in the recycling tank 19 facilitates the dissolving of the detergent and the dispersion of the abrasive powder from the very beginning of the cycle, at which point a new amount of detergent or cleaning substance and abrasive powder is added to the water in the tank 19.

Having to take into account, however, the automatic use of several cleaning solutions, the problem arises of how to draw at the right time the amount of detergent needed to make the new solution, and how to rapidly dissolve it.

25

Among the various available systems, water could be made to flow through containers, each containing a given amount of detergent, and then feed the resulting solution into the finishing tank 11 of the machine, according to a sequence or machine

30

cycle of choice. However such a system has some significant limitations; the flow of liquid which is fed into the finishing tank 11 as a solution cannot be compatible with the requirements of the
5 machine. In this way much of the detergent would not be picked up or dissolved in real time, or rather wouldn't dissolve at all since it would tend to lump or to form a thick residue which would remain in the containers for the detergent.

10

The use of mechanical dispersing devices to dissolve the detergent in a separate container would not be a valid and economical solution to the problem since it would imply a complex and
15 expensive structure for the machine which would be difficult to build and use due to the lack of available space and to the additional consumption of energy. According to a further feature of the invention, then, a method and a device have been
20 provided, as described above, in which a strong flow of water or liquid, is drawn by the recycling pump 29 from the recycling tank 19, and most all of the flow is fed through a detergent container 41 so as to constantly flush against the detergent
25 in said container, which is thus picked up in a short time, together with eventual abrasive powder, and carried to the recycling tank 19 where the turbulence caused by the stirrer 28 completely dissolves and disperses it. Only a small or
30 metered quantity of the main flow used to dissolve

the detergent is drawn form the conduit 30 and fed, through conduit 31, into the finishing tank 11 from which it will then go back to the recycling tank 19, as previously explained. In the
5 case when the device must feed several cleaning solutions during different phases of the same machine cycle, advantageously each detergent container 41 has its own recycling conduit 31 to the tank 19 with a respective pump 29 for the flow
10 of the liquid into the detergent container 41, as previously explained. All of the above is achieved through a simple device set-up which is resistant to malfuncions that could arise from solid suspended particles in the cleaning solution which
15 is recycled.

Therefore, as mentioned, the device includes for each detergent to be dissolved, two distinct recycling circuits or paths, one of which draws
20 the cleaning solution suspended in it, form the respective containers while the other recycles the cleaning solution, with the suspended abrasive powder, into the machine's finishing tank 11. The first path 30 or main path is made up of an closed
25 circuit and includes the solution suction area 24 of the tank 19, the pump 29 with the respective conduit 40, a container 41 for the detergent to be dissolved, and a discharge tube 42 which discharges the detergent in the container 41 directly
30 into the tank 19 within the stirring area 23 which

is defined by the partition 22 and a protection netting 43 which separates the stirring area proper, where the powdered abrasive substance is lifted up, and the area 23a where the eventual
5 dirt floating on the solution is trapped. The flow of solution pouring out of the conduit 42, preferably does not go directly into the tank 19, but rather over a flow quieting member 44 placed under the conduit, as shown.

10

The main circuit 30 is used to lift and dissolve the detergent in the container 41. This circuit must therefore be sized to carry a large flow and in any case a volume of liquid greater than that
15 necessary for the finishing tank 11 of the machine; in this way the drawing of the detergent from the respective container 41 and dissolving it are facilitated. On the other hand, the conduit 31 used to recycle the liquid into the finishing tank
20 11 can be sized for the volume of flow needed solely by the machine 10 to work under the best conditions. In this way the detergent can be completely removed from the container 41 quickly and in a controlled mode, as a function of the
25 speed and volume of the flow of liquid which is poured by the pump 29 into the container 41.

The quick removal and dissolving of the detergent can be improved by making the container in a
30 particular way, as shown in figures 2 and 3 of the

enclosed drawings. As can be seen, the container 41 for each main circuit 30 includes outer walls 45 and a bottom wall with a forward horizontal part 46 and a rear slanted part 47 over which
5 opens the tube 40 feeding the liquid for dissolving the detergent, which conduit is part of the main recycling circuit. As can be seen in figure 2, the flow of water which is constantly recycled by the tube 40 is towards the slanted wall 47 at the
10 bottom of the container, so as to cause the liquid to flow over the detergent 48 in the container 41 both on the top, the sides and the bottom. The detergent 48 is held by a perforated plate, or restraining grate 49, slanted in the opposite
15 direction of the bottom wall 47. In order to insure that the flow of liquid flushes over the powdered detergent 48 over the largest possible surface, without allowing lopsided flow or insufficient dissolving of the detergent, the grate 49
20 is provided with resting pacers 50 which separate it from the bottom 46 and is narrower than the container 41 in order to create a gap 51 for the solution to flow between the edges of the grate, the bottom and the side walls of the container 41.
25 In this way the liquid flow tends to dig into the detergent both under and on the side of the lump of detergent, facilitating its dissolving and removal. A spacer 52 separates the upper edge of the grate 49 from the lateral wall of the
30 container, so as to create a sort of overflow

which, due to the presence of appropriate holes in the plate, adjusts itself to the level of detergent which is left in the container. The configuration of the detergent container or vat 41 and of the restraining grate 49, allows the detergent to dissolve rapidly due not only to the action of the liquid flow fed with augmented volume by the pump 29, but also to the creation of a surface flow which constantly flushes over the detergent 48 in the container.

In the case shown in figure 1 only one container is shown, linked to a corresponding main recycling circuit 30 and a secondary recycling circuit 31; however it is evident that if several cleaning substances are used, the device can be equipped with several recycling and detergent drawing circuits with their respective pumps, similar to the one shown.

20

The operation of the device described up to this point can be briefly explained as follows; initially a certain amount of water is fed into the recycling tank 19 until it reaches a set level and at the same time the various containers 41 are loaded with an amount of detergent which can be mixed with a powdered abrasive substance. The finishing machine 10 is then started; which also starts the stirrer 28 and the recycling pump 29. The pump 29 initially creates a strong flow of

water through the main circuit 30, thus drawing up the detergent contained in the container 41 together with the abrasive powder. At the same time, part of the water or of the cleaning solution being formed, is deviated into the conduit 31 and fed in an appropriate quantity into the finishing tank 11 of the machine 10 from which the liquid is drained back into the tank 19. Together with the solution and the dirt, the powdered abrasive substance which would otherwise settle on the bottom of the tank 19 is entrained into circulation, since the turbulence, caused by the stirrer 28, keeps the abrasive substance suspended in the cleaning solution, which then circulates throughout with it. The stirrer 28 can be actuated constantly, or it can be intermittently or off when the abrasive substance needs to be decanted, during a final or intermediate phase of the treatment cycle, in order to run a finishing or polishing phase with only the cleaning solution.

When the treatment cycle is over, the cleaning solution and the dirt removed, can be discharged; the pieces treated in the tank 11 can be washed with water alone, and at the same time the recycling tank 19 can be washed by the stream of water coming out of the float valve 34, which washes off the bottom of the tank removing all the deposits.

Claims

1. method for feeding a cleaning solution into a work-piece finishing machine (10), in which the cleaning solution is fed from a recycling tank (19) into a finishing tank (11) of the machine from which it is then returned to the recycling tank (19), characterized by the steps of diffusing into the cleaning solution and by keeping suspended in it a powdered abrasive substance by vigorously stirring the cleaning solution in the recycling tank (19) and by the feeding of said solution with the abrasive powder suspended in it, into the finishing tank (11) of the machine (19).

2. method, as claimed in claim 1, characterized by creating turbulence in the cleaning solution at least in a limited area (23) of the recycling tank (19) producing a turbulent flow of liquid towards the bottom (20) of the recycling tank (19).

3. method, as claimed in claim 1, characterized by feeding a flow of the cleaning solution from the recycling tank (19) into at least one detergent container (41), drawing up the detergent by the flow of liquid and discharging said flow of liquid with the detergent, into the recycling tank (19) in the stirring area (23).

4. method, as claimed in claim 2, characterized by

removing the detergent from the container (41)
together with a powdered abrasive substance and to
suspend said powdered abrasive substance into the
cleaning solution within the recycling tank (19)
5 in the stirring area (23).

5. method, as claimed in claim 3, characterized by
the fact that a flow of detergent with the
suspended abrasive substance is derived from the
10 flow of liquid circulation from the recycling tank
(19) and the detergent container (41) feeding said
derived flow of liquid into the finishing tank
(11) of the machine.

15 6. method, as claimed in claim 5, characterized by
the fact that said flow of detergent is derived
between the recycling pump (29) and the detergent
container (41).

20 7. method, as claimed in claim 1 or claim 5,
characterized by stopping the stirring phase of
the cleaning solution in the recycling tank (19)
feeding the cleaning solution without the abrasive
powder into the finishing tank (11) of the machine
25 (10).

8. Device for feeding a cleaning solution into the
finishing tank (11) of a work-piece finishing
machine (10), said finishing tank (11) being
30 connected through a conduit (18) to a recycling

tank (19) which includes a pump device (29) to feed the cleaning solution into said finishing tank (11), characterized by the fact that said recycling tank (19) includes a stirring means (28) to create turbulence in the liquid at least in an area (23) of the recycling tank (19).

9. Device, as claimed in claim 8, characterized by the fact that said stirring means (23) is placed near the bottom (20) of the recycling tank (19).

10. Device, as claimed in claim 8, characterized by including at least one detergent container (41), a main recycling circuit (30) between said recycling tank (19) and said detergent container (41), a pumping device (29) to circulate a strong flow of liquid from the recycling tank (19) through the detergent container (41), and a second recycling circuit (31) to feed the cleaning solution with the possible suspended abrasive powder into the finishing tank (11) of the machine (10).

11. Device, as claimed in claim 10, characterized by the second recycling circuit (31) being derived from the main recycling circuit (30) in the section between the recycling pump (29) and the detergent container (41).

12. Device, as claimed in claim 10, characterized

in that the detergent container (41) has a slanted bottom wall (47) and a detergent restraining grate (49) which is placed between said bottom wall (47) and a discharge tube (42), and in that a gap (51) 5 for the flow of the liquid is provided between the side (41) and the bottom (47) walls of the container and the edge of said grate (49).

13. Device, as claimed in claim 10, characterized 10 by the main recycling circuit (30) discharging into the recycling tank (19) above the liquid contained in the same tank (19) over the stirring area (23) and by the presence of a flow quieting member (44) at the discharge position.

15

14. Device, as claimed in claim 10 and one or more subsequent claims, characterized by the fact of including several detergent containers (41), each detergent container (41) being provided with a 20 main recycling pump (29) and secondary circuit (31) for feeding the solution into the finishing tank (11) of the machine.

15. Device, as claimed in claim 1, for feeding a 25 liquid cleaning solution, together with possible powdered abrasive substances, into the finishing tank (11) of a work-piece finishing machine, in which the pieces (12) are placed together with finishing materials (13), and a recycling tank 30 (19) containing a cleaning solution, characteri-

zed by feeding a strong flow of liquid along a main recycling circuit (30) between the recycling tank (19) and a detergent container (41); by rapidly removing the detergent from the container 5 by flushing over it the liquid fed and recycling of the liquid with the detergent into a stirring area (23) of the recycling tank (19); to dissolve the detergent and diffuse the abrasive powder by creating turbulence towards the bottom (20) of the 10 recycling tank (19) and at the same time feeding a quantity of the cleaning solution with possible suspended abrasive powder from the main recycling circuit (30), into the finishing tank (11) of the machine.

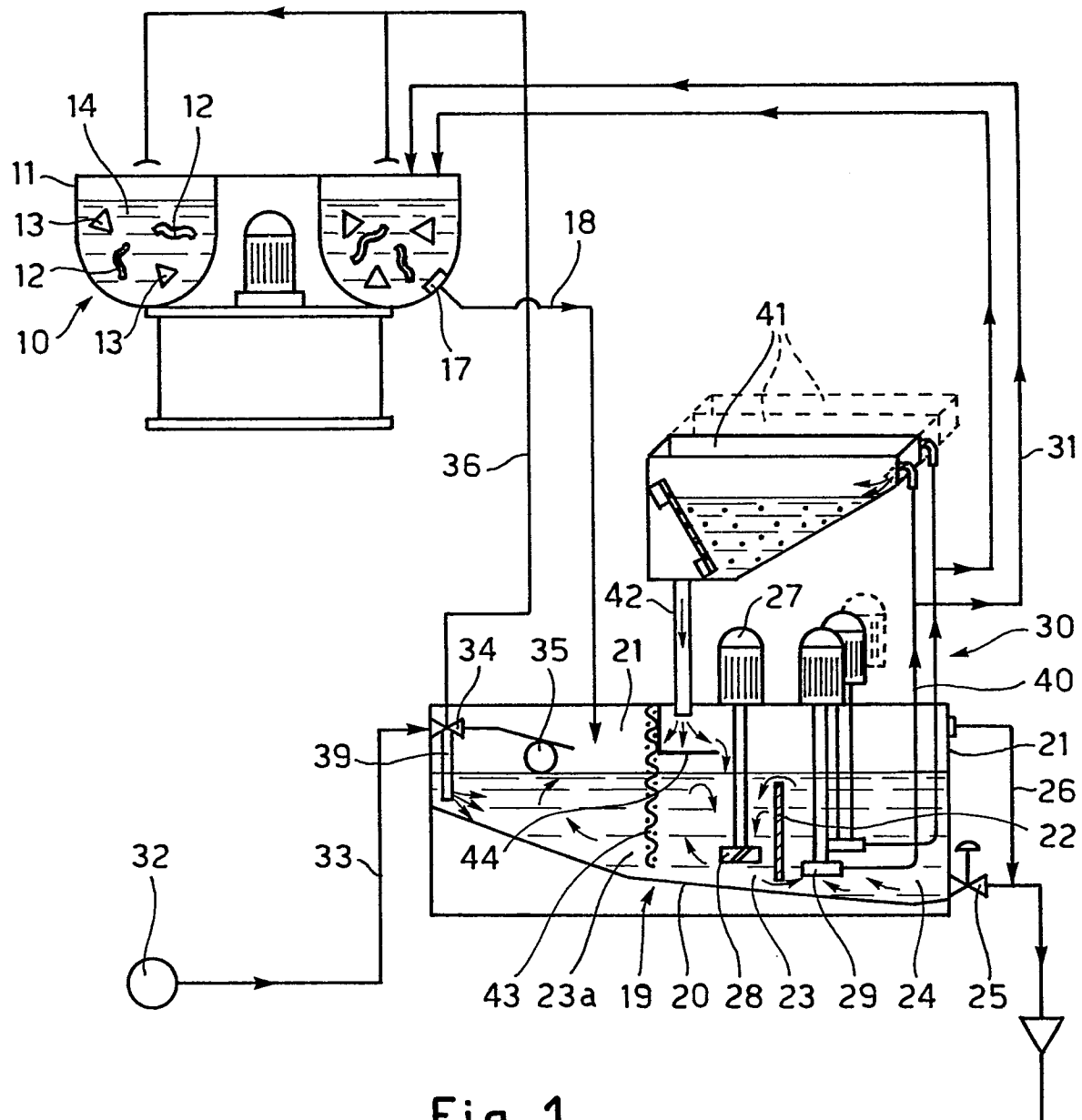


Fig. 1

