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(54) **AQUARIUM FILTER HAVING SELF-PRIMING ARRANGEMENT**

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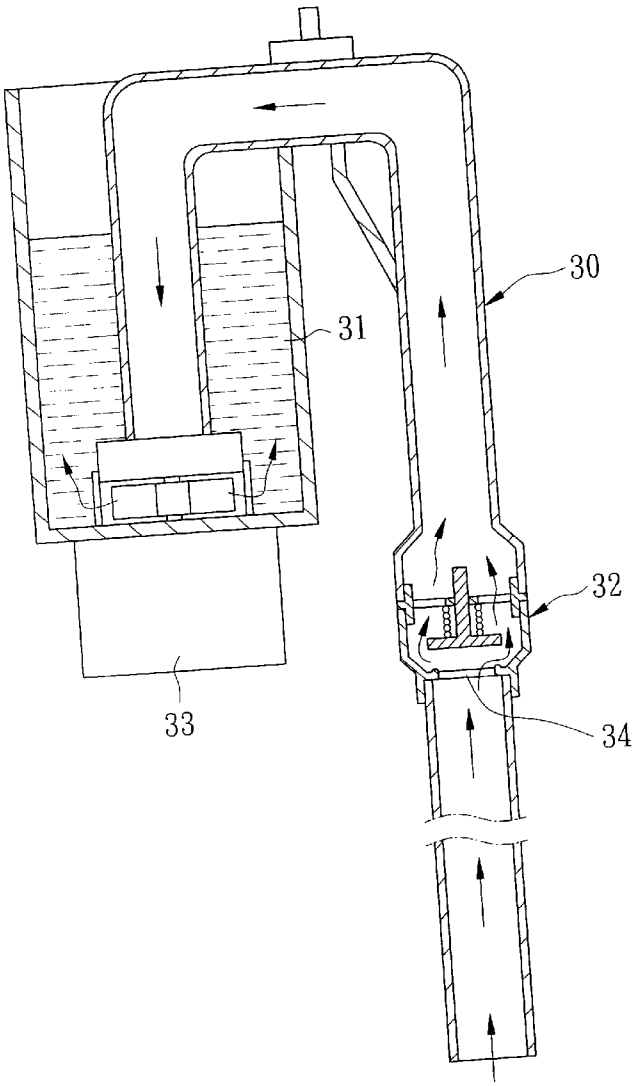
(57) **ABSTRACT**

An external aquarium filter comprises a flow resistive, porous member disposed between a partition wall and the filter housing. Responsive to stopping the pump, water in the intake chamber begins to reversely flow out of the intake chamber into the aquarium tank through the intake tube due to siphoning, water in the filtering chamber flows back to the intake chamber through the porous member, the reverse flow is faster than water flowing into the intake chamber such that the siphoning breaks when the water level of the intake chamber drops below that of the filtering chamber, the water in the filtering chamber continues to flow back to the intake chamber through the porous member until both the filtering chamber and the intake chamber have the same water level, and sufficient priming water is thus stored in the intake chamber for a future restarting of the filter.



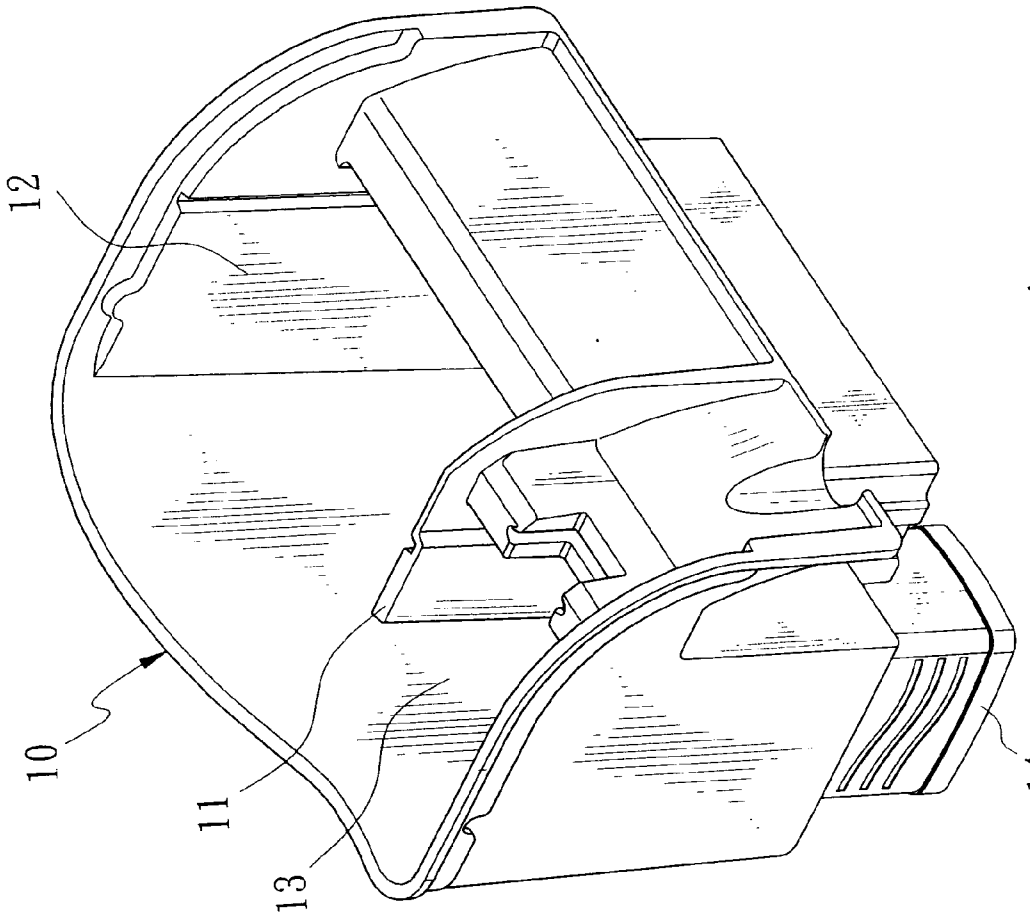



FIG. 1A
PRIOR ART

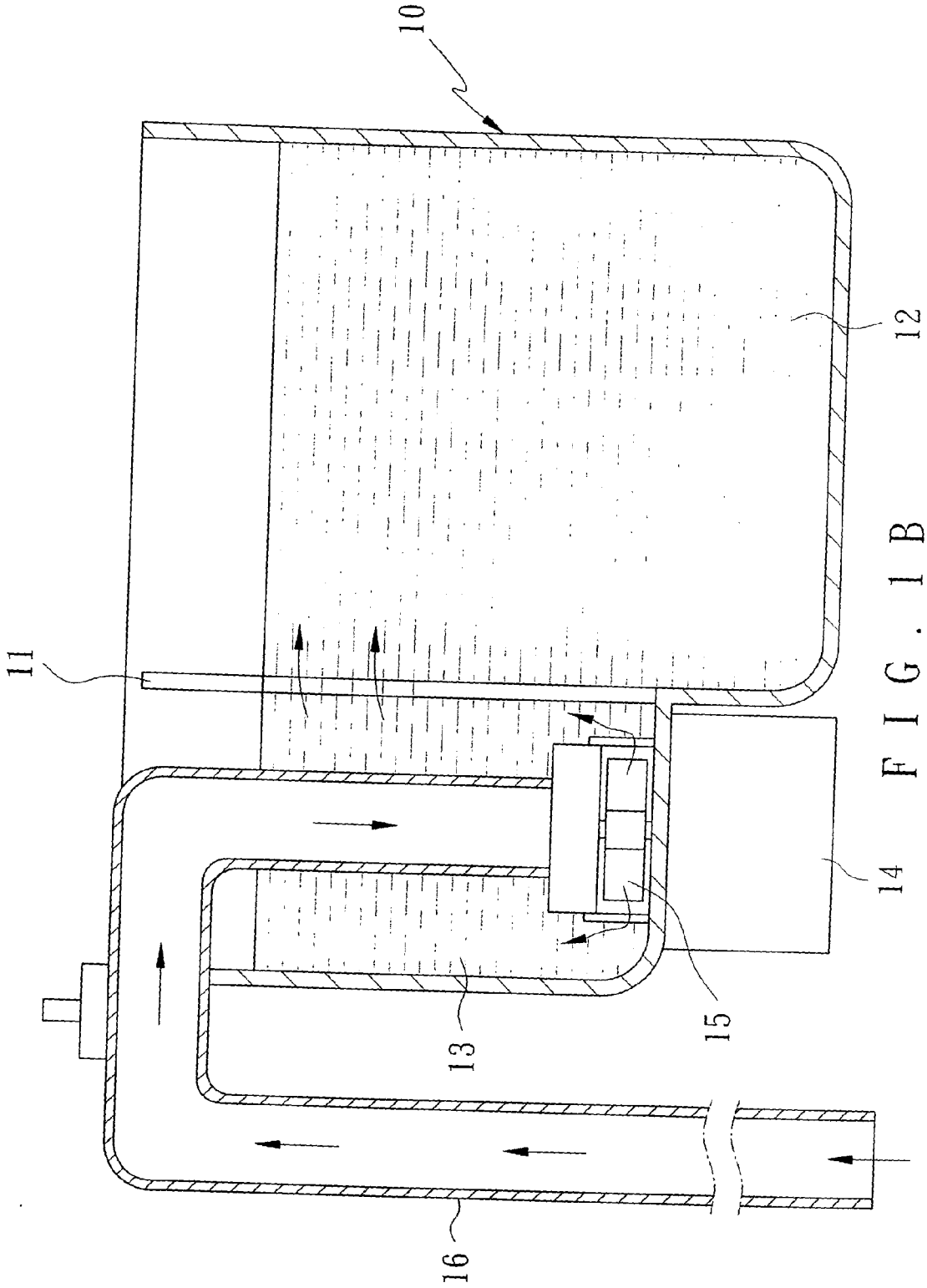



FIG. 1B
PRIOR ART

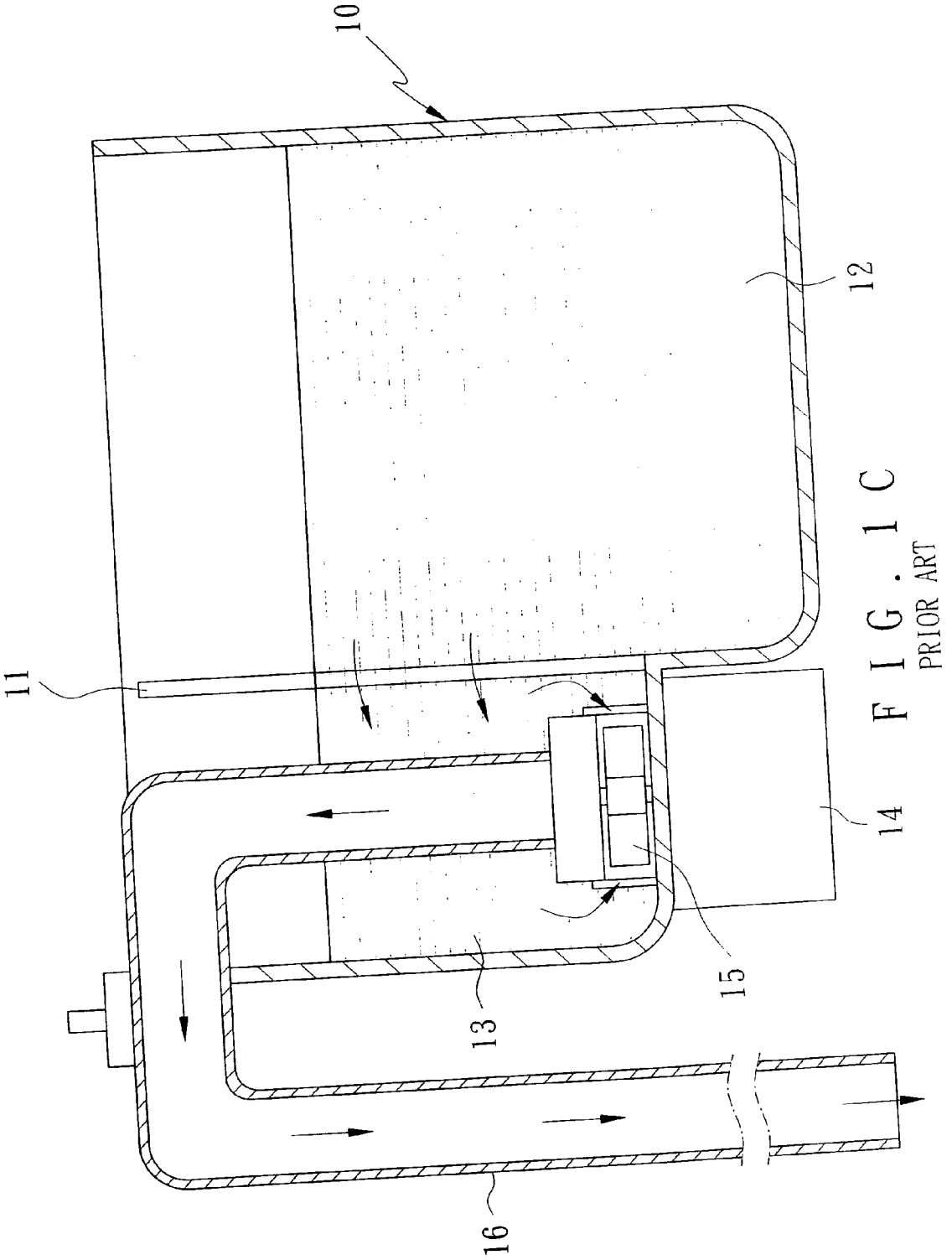



FIG. 1C
PRIOR ART

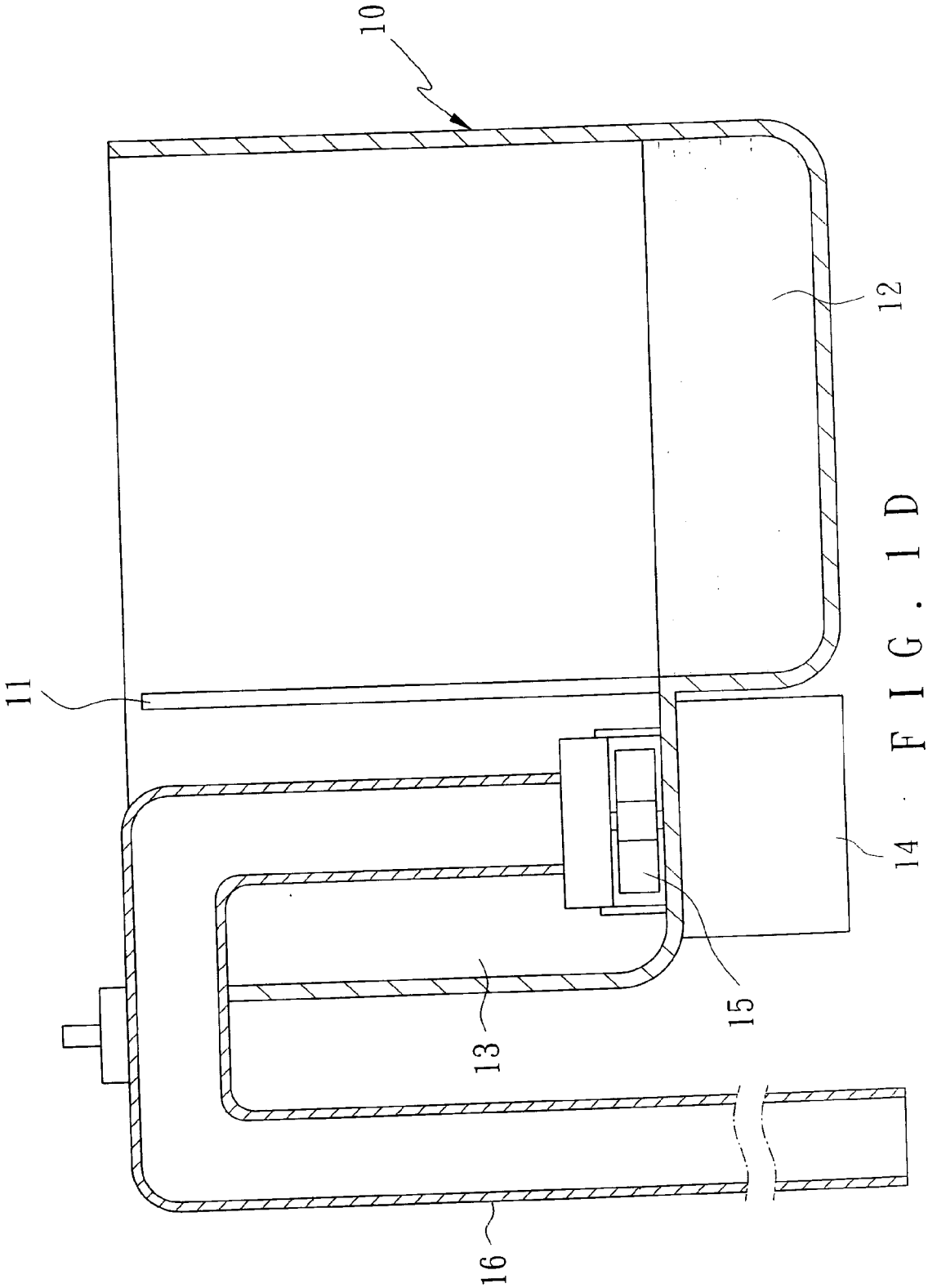



FIG. 1D
PRIOR ART

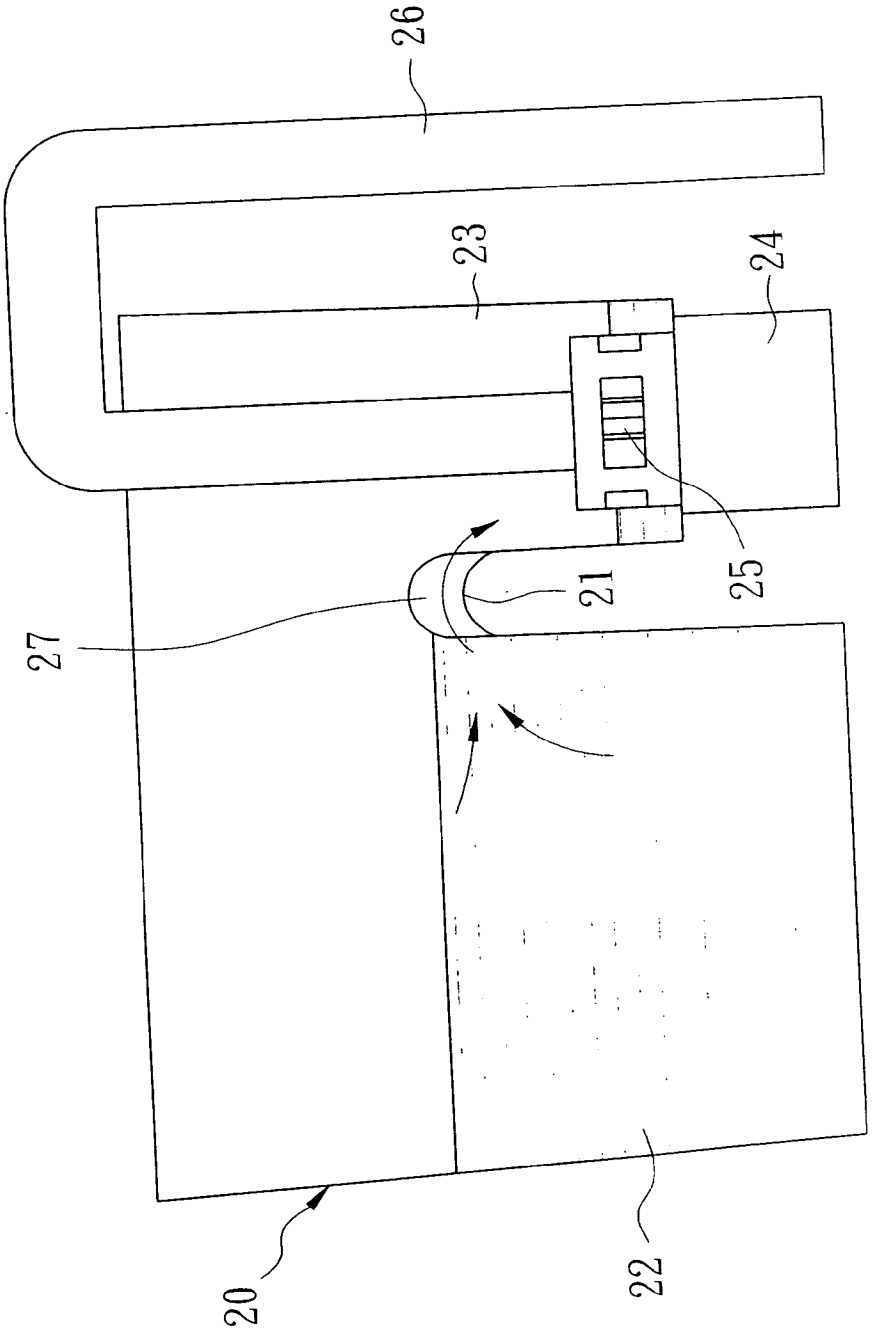



FIG. 2A
PRIOR ART

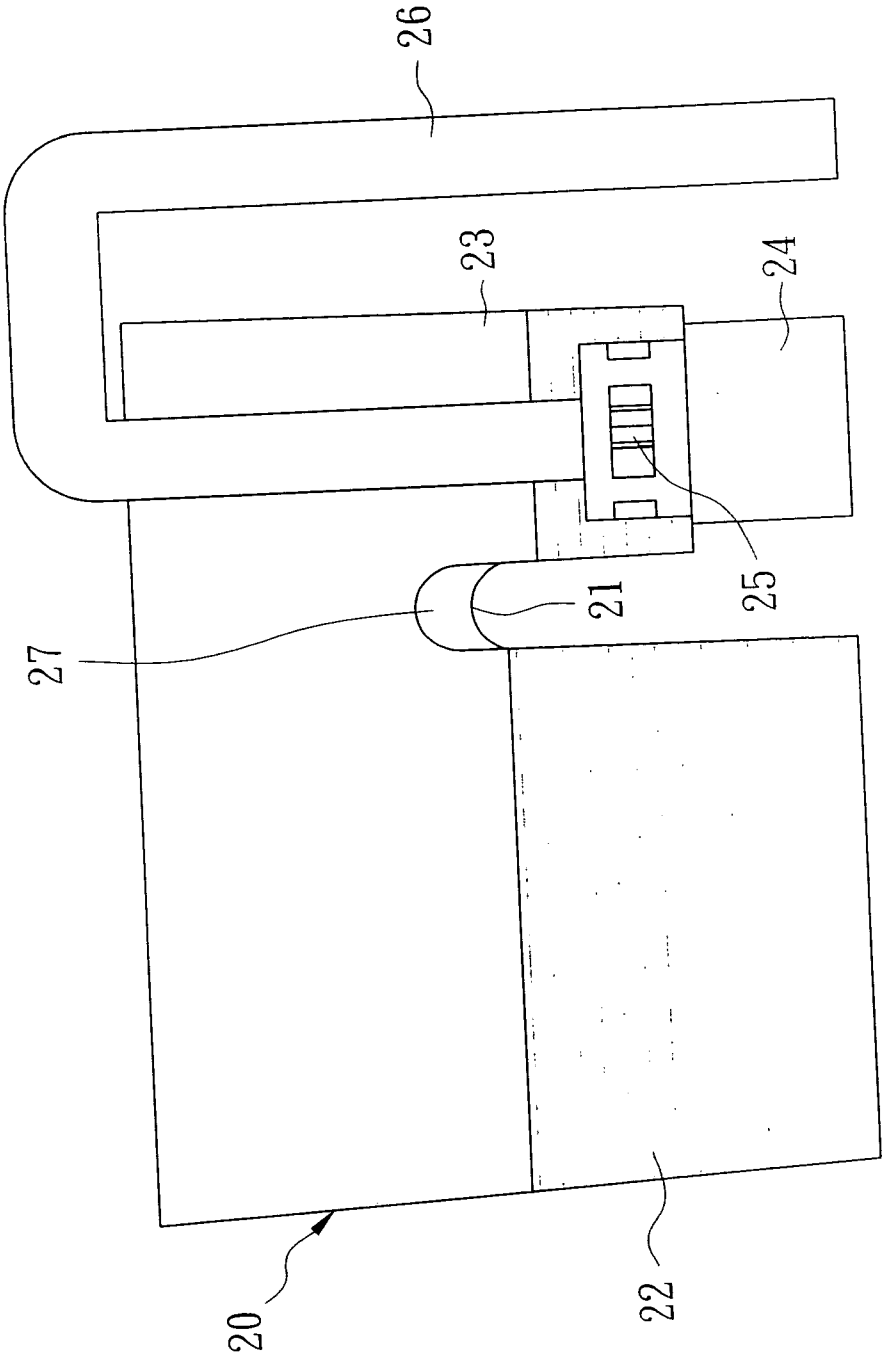



FIG. 2B
PRIOR ART

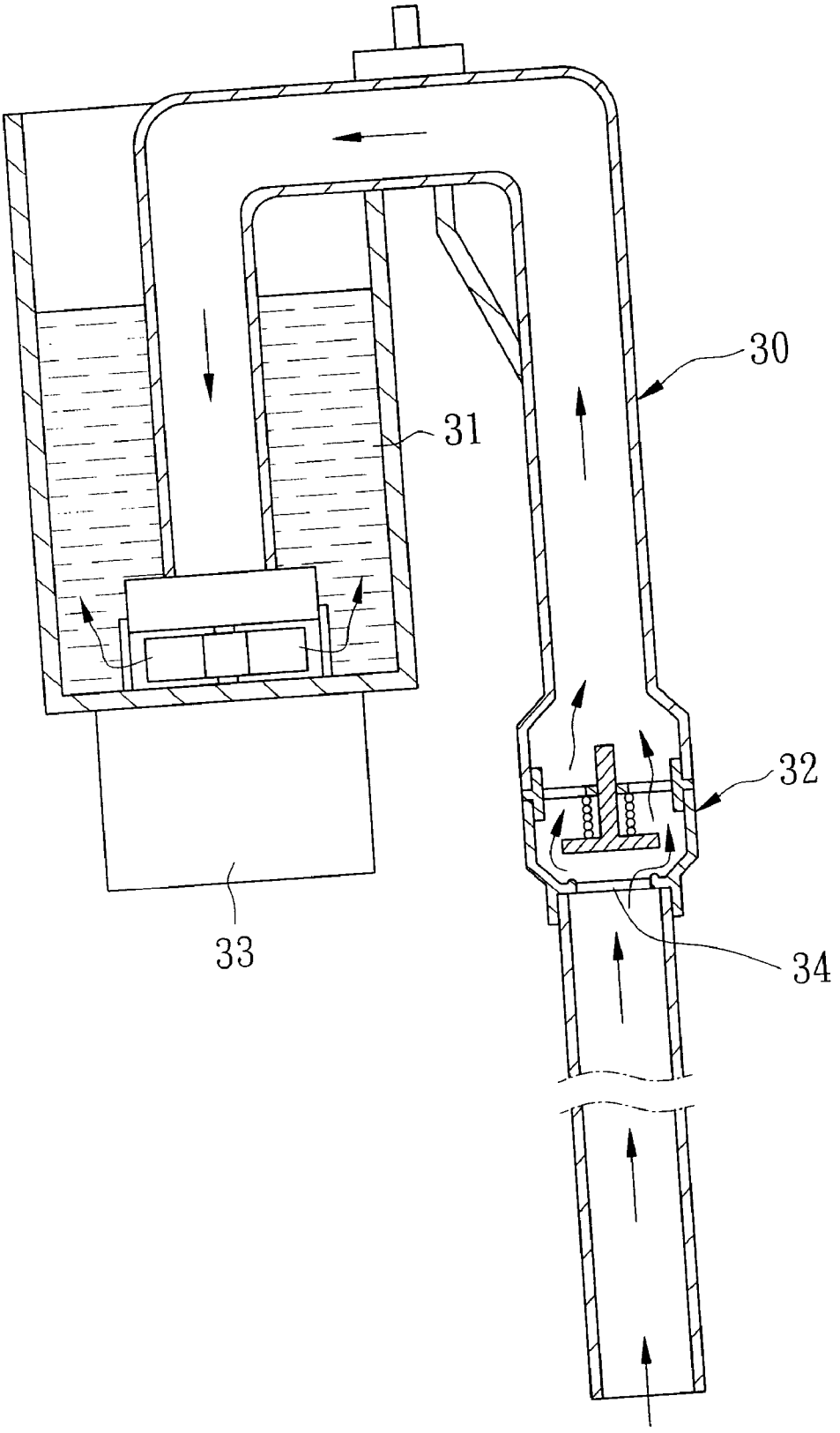



FIG. 3A

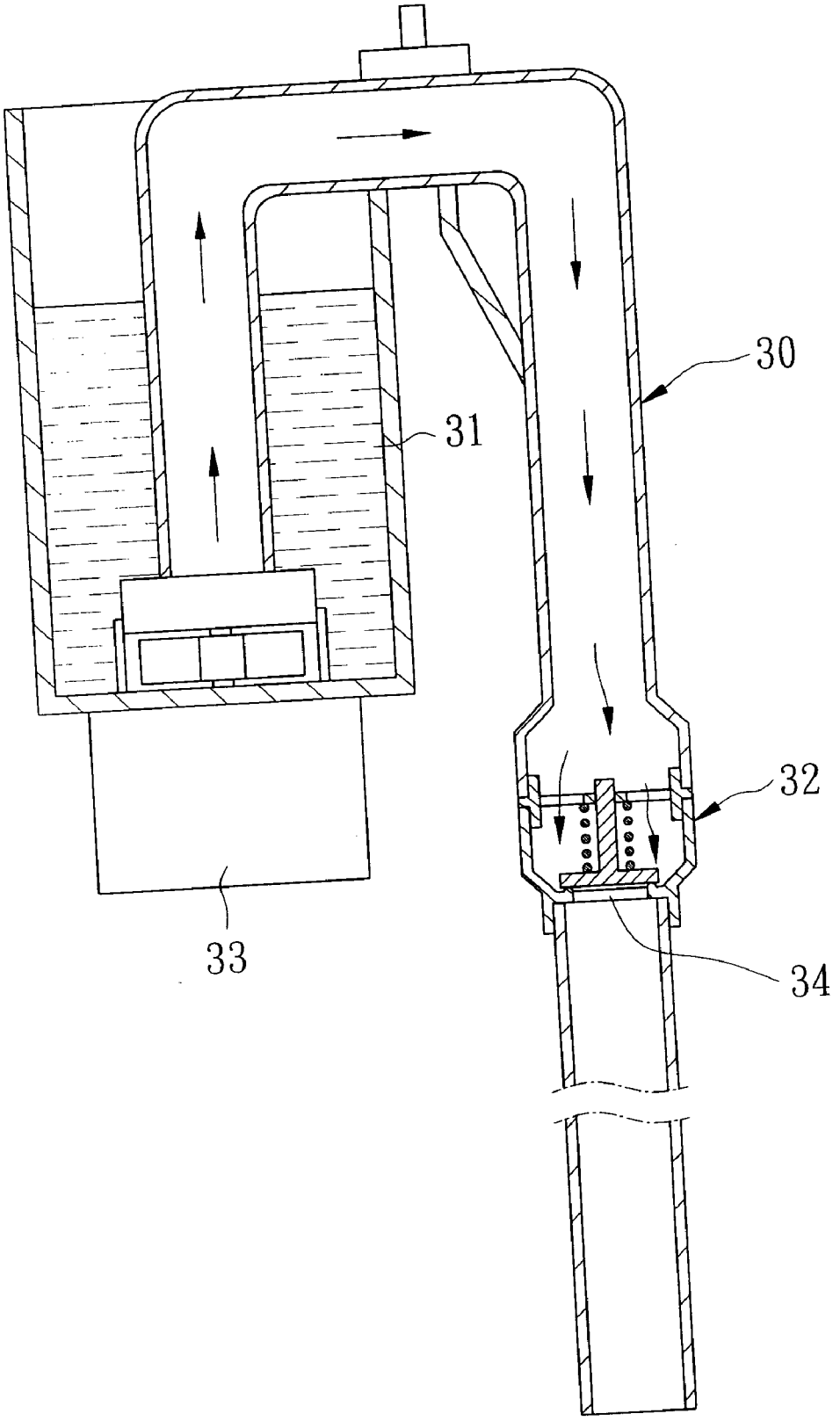
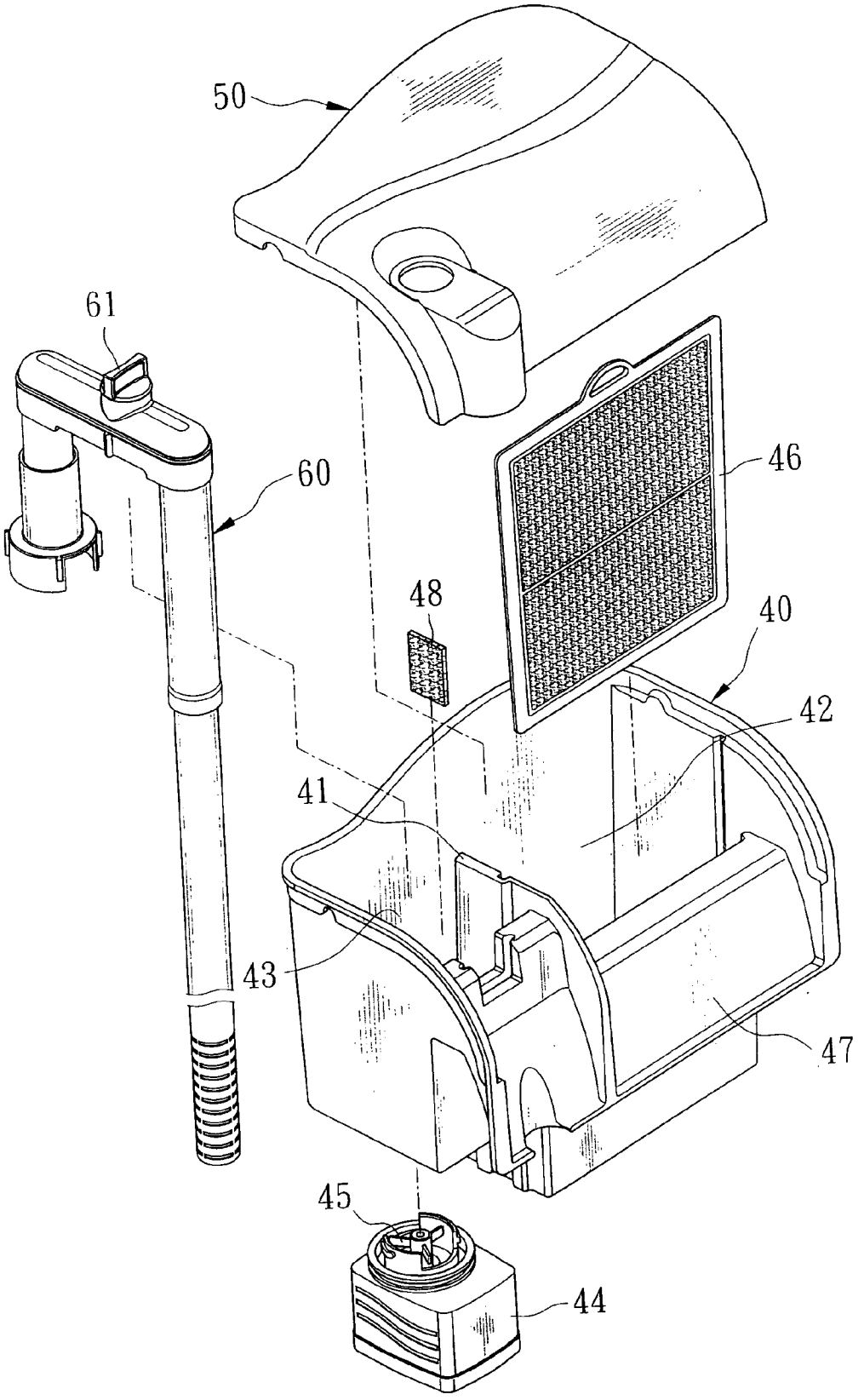



FIG. 3B

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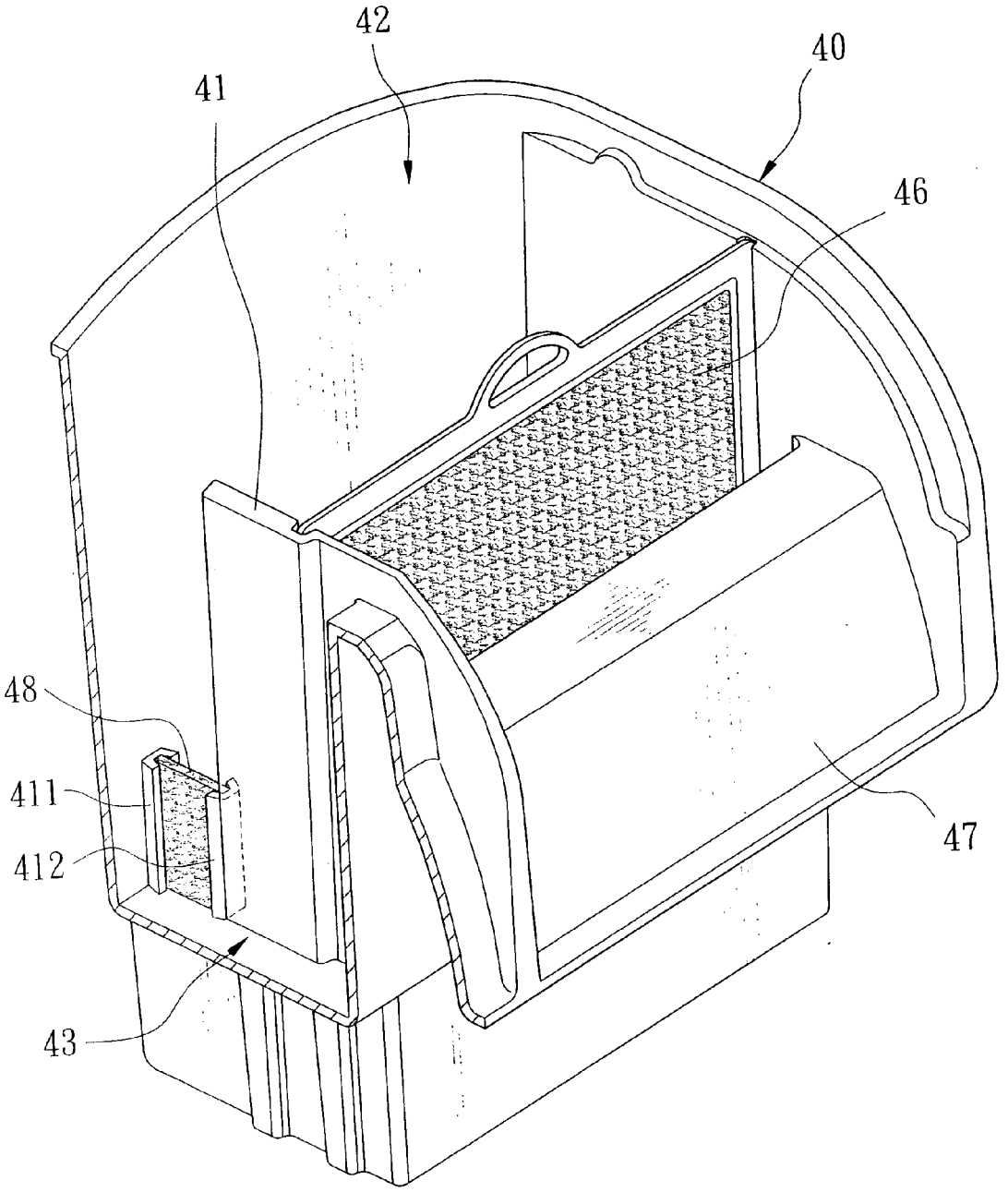


FIG. 5

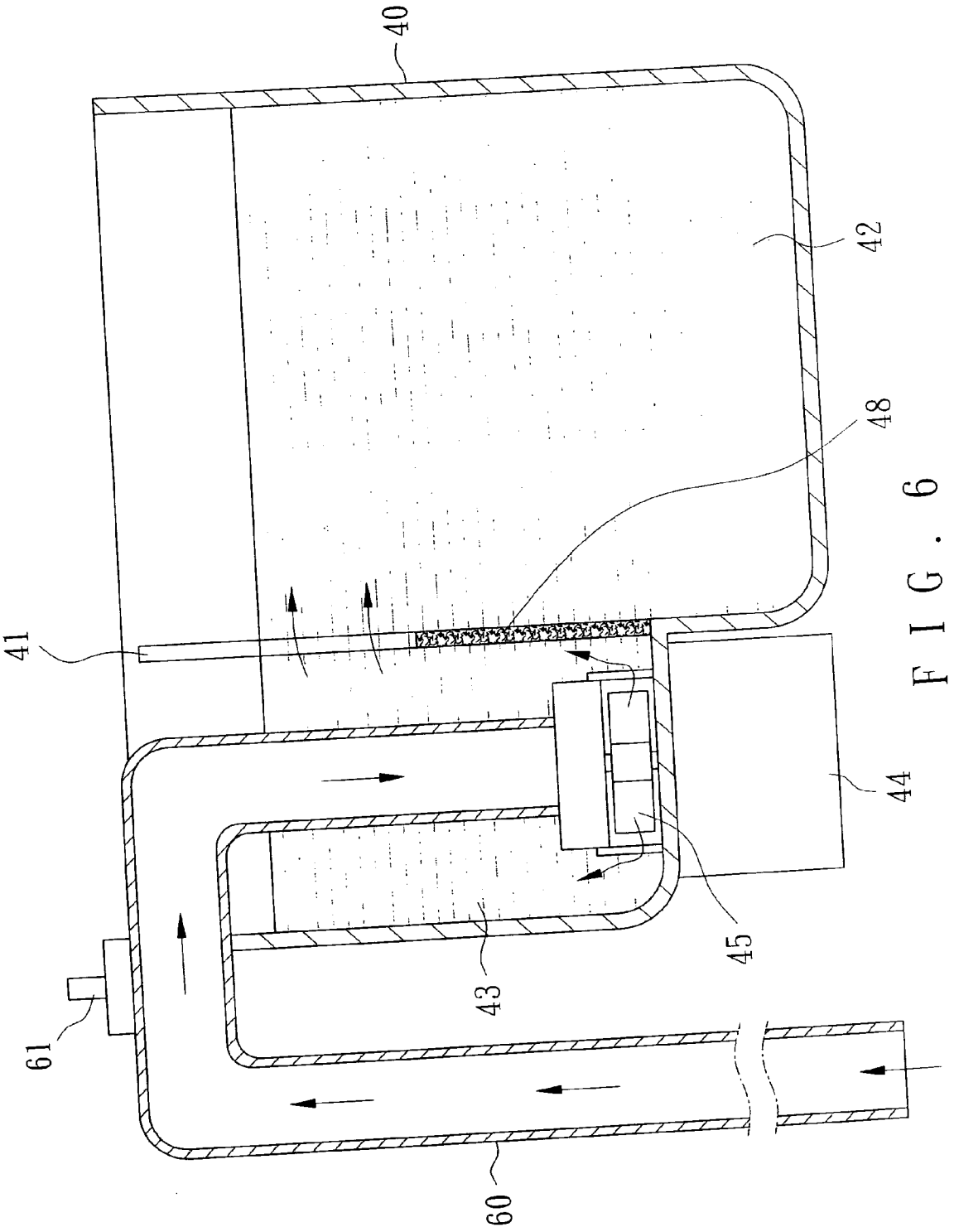


FIG. 6

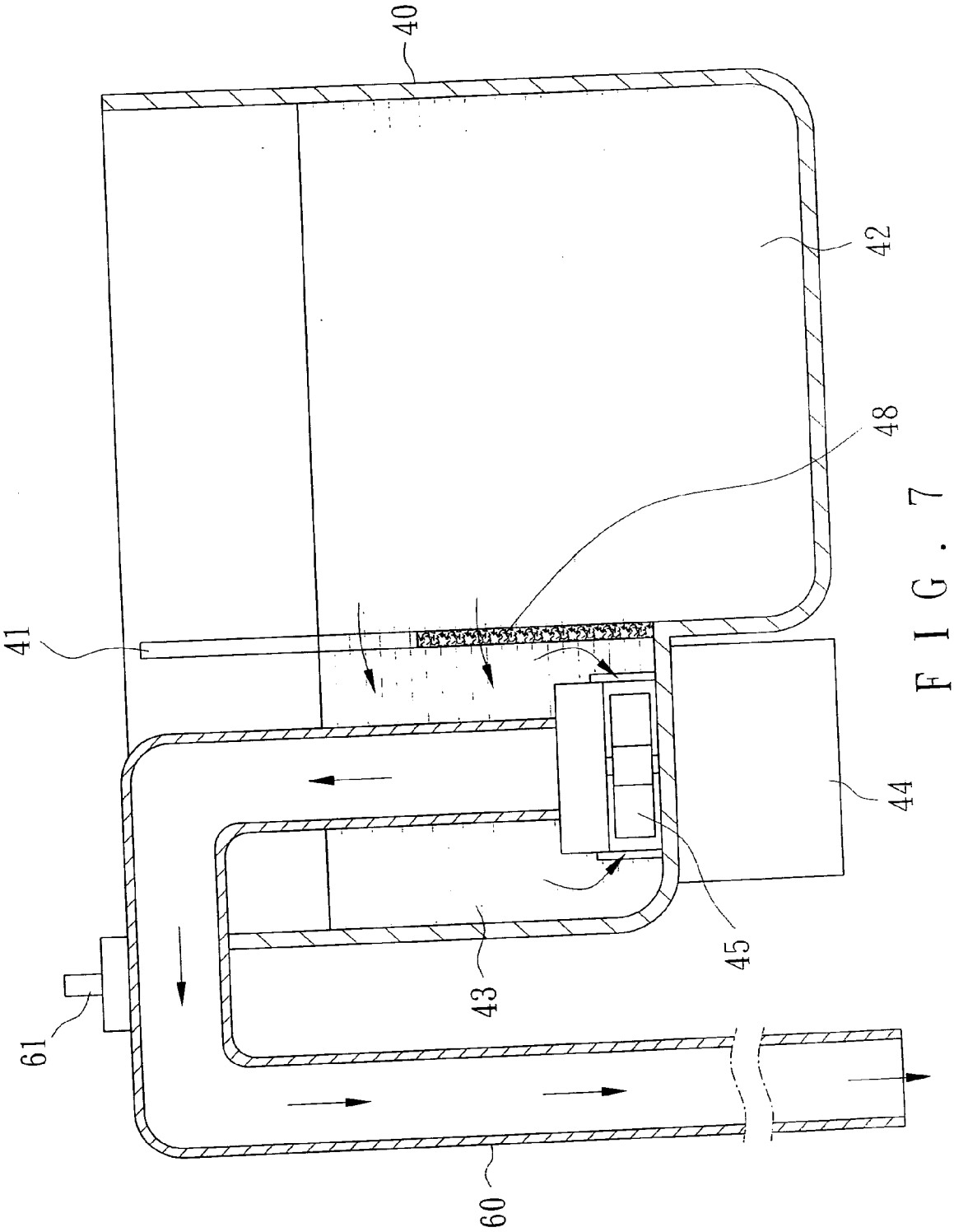


FIG. 7

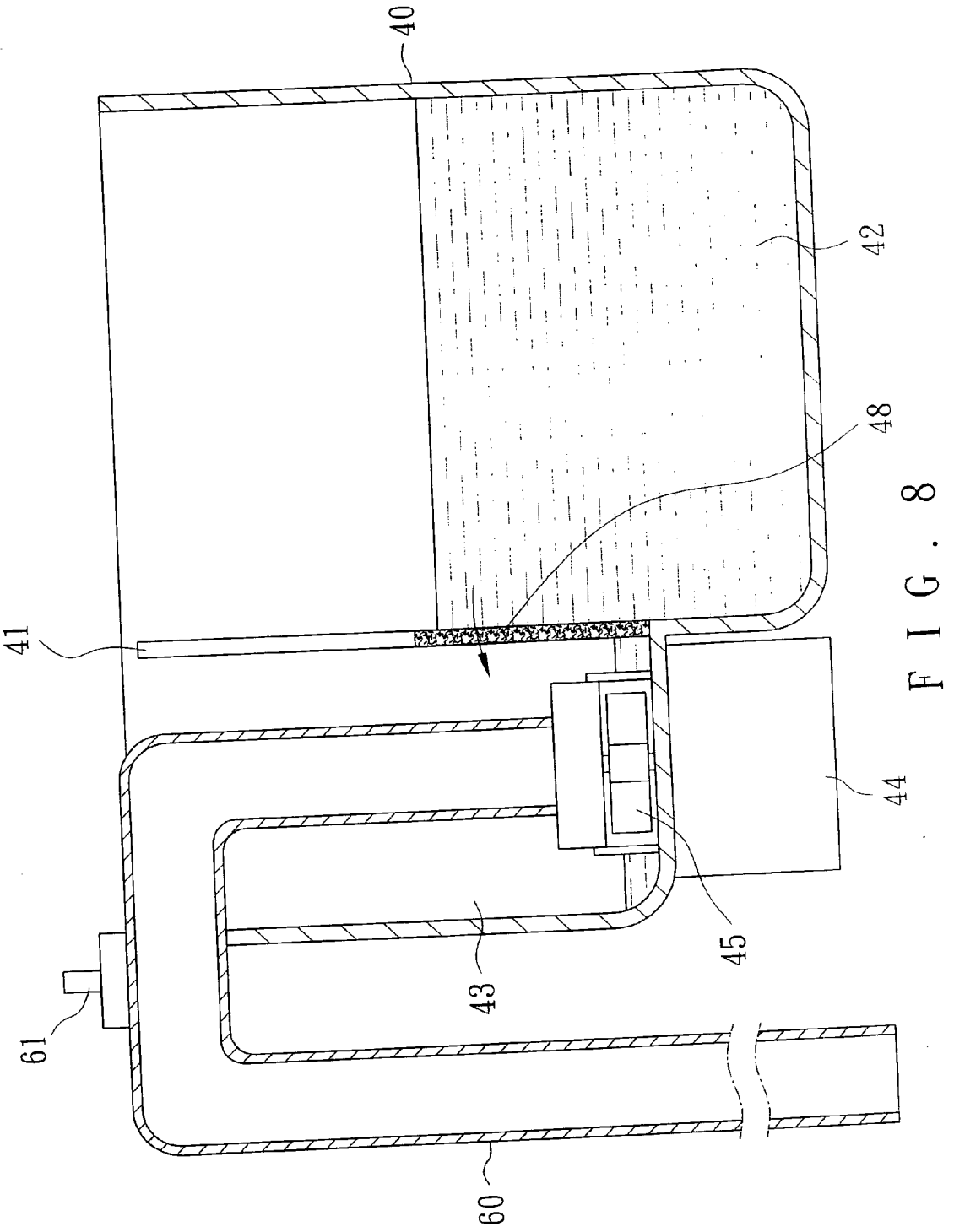


FIG. 8

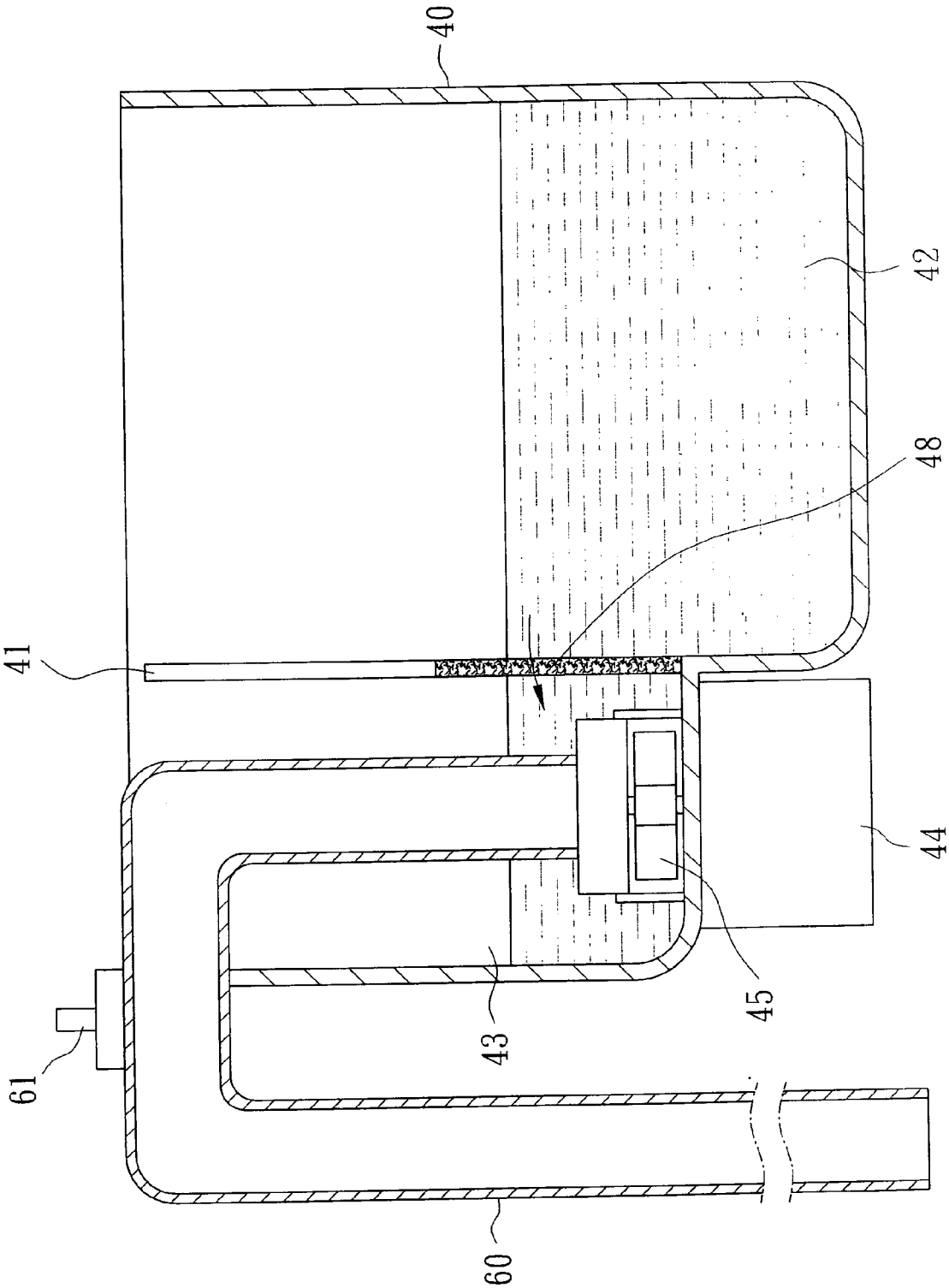


FIG. 9

# AQUARIUM FILTER HAVING SELF-PRIMING ARRANGEMENT

## FIELD OF THE INVENTION

[0001] The present invention relates to aquarium filters and more particularly to an improved aquarium filter having a self-priming arrangement so as to restart the filter after the filter stops due to halting of the pump.

## BACKGROUND OF THE INVENTION

[0002] Referring to **FIGS. 1A and 1B**, it shows the normal flow of aquarium water through a conventional filter. As illustrated, the filter housing **10** comprises an intake chamber **13** and a filtering chamber **12** which are separated by a partition wall **11**. A pump **14** is provided under the intake chamber **13**. An impeller **15** is disposed in the intake chamber **13** and is rotatably coupled to the pump **14**. A U-shaped intake tube **16** has one end positioned in an aquarium tank (not shown) and the other end proximate the impeller **15**. Upon energizing the pump **14** and thus the impeller **15**, water from the aquarium tank is sucked into the intake tube **16**. Water then flows up through the intake tube **16** and is drawn into the intake chamber **13**. The water filled in the intake chamber **13** will overflow the partition wall **11** into the filtering chamber **12** if it has a sufficient height. The filtration material provided in the filtering chamber **12** is used to filter the water. The filtered water then passes back into the aquarium tank.

[0003] Referring to **FIG. 1C**, it is assumed that power outage has occurred or the impeller **15** failed to operate normally due to a piece of debris getting stuck therein. When such stoppage occurs, water in the intake chamber **13** begins to reversely flow out of the intake chamber **13** due to a siphoning action since the filter is provided at a level higher than the external aquarium tank. At the same time, water in the filtering chamber **12** flows backward over the partition wall **11** for filling the intake chamber **13** prior to flowing back to the aquarium tank through the intake tube **16**.

[0004] Referring to **FIG. 1D**, water in the intake chamber **13** is completely drained after water has gradually flowed back into the aquarium tank through the intake tube **16** and the water level of the filtering chamber **12** is no more higher than that of the intake chamber **13**. At this time, the siphoning action stops. If the power to the pump **14** resumes, the filter will not begin but will remain in the stage shown in **FIG. 1D**. In order for the filter to begin, it must be primed whereby sufficient water is placed in the intake chamber **13** to cover the impeller **15** so that the impeller **15** will be able to spread water out and cause a reduced pressure thereby sucking in additional water. In the absence of such priming water, the filter will not restart and will remain in the state shown in **FIG. 1D**. However, since the electricity will begin flowing to the pump **14**, the pump **14** will heat up. Since there is no circulating water in the pump **14**, the pump **14** will continue to generate heat. This heat may cause damage to the intake chamber **13**. Moreover, the failure of the filter to provide adequate filtration to the aquarium tank may cause damage and harm to the contents of the aquarium itself.

[0005] U.S. Pat. No. 4,761,227 discloses a self priming aquarium filter for overcoming the above drawback as illustrated in **FIGS. 2A and 2B**. A narrow passageway **27** is provided in the partition wall **21**. The cross-sectional area of the passageway **27** is less than that of the intake tube **26**. Accordingly, after the majority of water has flowed over the partition wall **21** (see **FIG. 2B**), and when water level of the filtering chamber **22** has reached the upper end of the partition wall **21**, a small trickle flow will still flow through the passageway **27** from the filtering chamber **22** back into the intake chamber **23**. But the siphoning action of the intake tube **26** with respect to the intake chamber **23** will operate faster than the trickle flow. Hence, the siphoning flow will cause the water to drain out of the intake chamber **23** faster than the trickle flow flows into the intake chamber **23**. As an end, the water will deplete from the intake chamber **23** beneath the level of the impeller **25**. Thereafter, the siphon breaks and no more water will flow outwardly from the intake chamber **23**. When this occurs, the continuous trickle flow passing through the passageway **27** will now begin accumulating in the intake chamber **23**. As a result, the intake chamber **23** is filled with sufficient priming water. Upon resumption of power, the filter and thus the impeller **25** will automatically start a normal operation without adding priming water manually. The patent aids in permitting the siphoning action to break prior to providing a sufficient trickle flow to reprime the filter.

[0006] Taiwanese Patent Application No. 93,112,070, entitled "Aquarium Filter Having Check Valve", as invented by the present inventor is shown in **FIGS. 3A and 3B**. A check valve **32** is provided in a vertical portion of the intake tube **30**. In operation (i.e., the pump **33** is energized) as shown in **FIG. 3A**, water flows from the aquarium tank to the intake chamber **31** via the intake tube **30** and the check valve **32**. In an inoperative state of the filter (i.e., the pump **33** is deenergized) as shown in **FIG. 3B**, the inlet **34** of the check valve **32** is completely blocked due to its spring mechanism. As such, a small trickle flow due to the siphoning action of the intake tube **30** will not flow through the check valve **32**. As a result, sufficient water is placed in the intake chamber **31** for ensuring a self-priming of the filter when power resumes. While it is advantageous in the self-priming arrangement, the provision of the check valve **32** can increase the difficulty of assembly, the complexity of parts, and cost. Thus, the need for improvement still exists.

## SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide an aquarium filter for mounting externally of an aquarium tank comprising an intake chamber for receiving contaminated water from the aquarium tank; a filtering chamber in flow communication with the intake chamber, the filtering chamber including a filtration member for filtering the contaminated water to return clean water back to the aquarium tank; a partition wall disposed between the intake chamber and the filtering chamber for overflowing water from the intake chamber into the filtering chamber; an intake tube for supplying water from the aquarium tank to the intake chamber; a flow resistive, porous member disposed between the partition wall and an inner wall of the aquarium filter; and pump means having an impeller for drawing water from the aquarium filter into the intake chamber through the intake tube, wherein responsive to stopping the pump means, water in the intake chamber begins to reversely flow out of the intake chamber into the aquarium tank through the intake tube due to a siphoning action, water in the filtering chamber flows back to the intake chamber through the

porous member and over the porous member if a water level of the filtering chamber is higher than that of the intake chamber, the reverse flow is faster than the water flowing into the intake chamber such that the siphoning action breaks when the water level of the intake chamber drops below that of the filtering chamber by a predetermined distance with the impeller being exposed, the water in the filtering chamber continues to flow back to the intake chamber through the porous member until the water level of the filtering chamber is equal to that of the intake chamber, and at this time a sufficient amount of water is stored in the intake chamber as priming water for a future restarting of the aquarium filter.

[0008] The above and other objects, features and advantages of the present invention will become apparent from the following detailed description taken with the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1A** is a perspective view of a well known aquarium filter;

[0010] **FIG. 1B** shows the normal flow of the aquarium water through the well known filter;

[0011] **FIG. 1C** shows a reversal of water flow due to a siphoning action when power to the pump is stopped so that the pump is no longer operating;

[0012] **FIG. 1D** shows draining of the intake chamber that occurs with the well known filter due to the siphoning action;

[0013] **FIG. 2A** shows the presence of the passageway in the partition wall which permits a continued trickle flow back from the filtering chamber to the intake chamber as disclosed in U.S. Pat. No. 4,761,227;

[0014] **FIG. 2B** shows the resultant water retained in the intake chamber for self-priming of the filter for restarting of the filter operation according to the patent shown in **FIG. 2A**;

[0015] **FIG. 3A** is a sectional view showing the provision of a check valve in an intake tube according to Taiwanese Patent Application No. 93,112,070, where water normally flows through the intake tube;

[0016] **FIG. 3B** is a view similar to **FIG. 3A**, where a trickle flow is stopped by the closed check valve when the pump is deenergized;

[0017] **FIG. 4** is an exploded view of a preferred embodiment of aquarium filter according to the invention;

[0018] **FIG. 5** is a perspective view of a portion of the assembled aquarium filter shown in **FIG. 4**;

[0019] **FIG. 6** is a schematic sectional view depicting a normal filtering operation of the aquarium filter according to the invention; and

[0020] **FIGS. 7, 8**, and **9** are views similar to **FIG. 6** for illustrating water flow in the aquarium filter when the pump is deenergized.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Referring to **FIGS. 4 and 5**, there is shown an external aquarium filter constructed in accordance with the invention. The filter comprises a filter housing **40** having an internal space divided into an intake chamber **43** and a filtering chamber **42** by a partition wall **41**, and a removable cover **50** snugly fitted onto a peripheral lip on a top of the filter housing **40**. A pump **44** is provided under the intake chamber **43**. An impeller **45** is disposed in the intake chamber **43** and is rotatably coupled to the pump **44**. A filter cartridge **46** is vertically removably mounted in the filtering chamber **42**. A spillway **47** is extended obliquely downwardly from a top edge of the filtering chamber **42** such that the aquarium filter is adapted to mount externally of an aquarium tank (not shown) by hanging the spillway **47** thereon. An L-shaped intake tube **60** is held on a top notch of the frame of the intake chamber **43** and has one end positioned in the aquarium tank and the other end proximate the impeller **45**. A flow-control valve **61** is provided in a horizontal section of the intake tube **60**. Moreover, two opposite vertical guide grooves **411** and **412** are disposed between the intake chamber **43** and the filtering chamber **42** in which one guide groove **411** is formed on an inner wall of the filter housing **40** and the other guide groove **412** is formed with the partition wall **41**. A rectangular porous member (e.g., sponge) **48** is slid into and between the guide grooves **411** and **412** for positioning. The provision of the porous member **48** aims at decreasing water flowing from the intake chamber **43** into the filtering chamber **42** (i.e., increased flow resistance) as compared with water flowed into the intake chamber **43** from the intake tube **60**.

[0022] Referring to **FIG. 6**, upon energizing the pump **24**, water will be drawn from the aquarium tank into the intake chamber **43** through the intake tube **60**. The water in the intake chamber **43** will overflow the porous member **48** into the filtering chamber **42** if it has a sufficient height. The filtration material of the filter cartridge **46** is used to filter the water in the filtering chamber **42**. The filtered water then passes back into the aquarium tank through the spillway **47**.

[0023] Referring to **FIG. 7**, if the pump **44** stops due to power outage, water in the intake chamber **43** begins to reversely flow out of the intake chamber **43** into the aquarium tank through the intake tube **60** due to a siphoning action in the **1** intake tube **60**. Also, water in the filtering chamber **42** flows back to the intake chamber **43** over the porous member **48** and through the porous member **48**.

[0024] Referring to **FIG. 8**, once the water level of the filtering chamber **42** falls below the top edge of the porous member **48** flow rate of water flowing back to the intake chamber **43** from the filtering chamber **42** will decrease because, as stated above, water passes the porous member **48**. As such, water drawn out of the intake chamber **43** is more than water flowing into the intake chamber **43**. As such, air is drawn into the intake tube **60**. As a result, the siphoning action breaks (i.e., water is blocked from flowing back to the aquarium tank). At this time, the water level of the intake chamber **43** is lower than that of the filtering chamber **42**.

[0025] Referring to **FIG. 9**, while the water is blocked from flowing back to the aquarium tank, water in the filtering chamber **42** continues to flow back to the intake chamber **43** through the porous member **48** until the water level of the filtering chamber **42** is equal to that of the intake chamber **43**. The water level of the intake chamber **43** is higher than a joining portion of the intake tube **60** and the

impeller **45** (i.e., covered the impeller **45**) when water in the filtering chamber **42** stops flowing back to the intake chamber **43**. In other words, there is sufficient priming water stored in the intake chamber **43**. Therefore, if the power to the pump **24** resumes, the filter will automatically begin to operate normally without adding priming water manually.

[**0026**] While the invention herein disclosed has been described by means of specific embodiments, numerous modifications and variations could be made thereto by those skilled in the art without departing from the scope and spirit of the invention set forth in the claims.

What is claimed is:

**1**. An aquarium filter for mounting externally of an aquarium tank, comprising:

an intake chamber for receiving contaminated water from the aquarium tank;

a filtering chamber in flow communication with the intake chamber, the filtering chamber including a filtration member for filtering the contaminated water to return clean water back to the aquarium tank;

a partition wall disposed between the intake chamber and the filtering chamber for overflowing water from the intake chamber into the filtering chamber;

an intake tube for supplying water from the aquarium tank to the intake chamber;

a flow resistive, porous member disposed between the partition wall and an inner wall of the aquarium filter; and

pump means having an impeller for drawing water from the aquarium filter into the intake chamber through the intake tube,

wherein responsive to stopping the pump means, water in the intake chamber begins to reversely flow out of the intake chamber into the aquarium tank through the intake tube due to a siphoning action, water in the filtering chamber flows back to the intake chamber through the porous member and over the porous member if a water level of the filtering chamber is higher than that of the intake chamber, the reverse flow is faster than the water flowing into the intake chamber such that the siphoning action breaks when the water level of the intake chamber drops below that of the filtering chamber by a predetermined distance with the impeller being exposed, the water in the filtering chamber continues to flow back to the intake chamber through the porous member until the water level of the filtering chamber is equal to that of the intake chamber, and at this time a sufficient amount of water is stored in the intake chamber as priming water for a future restarting of the aquarium filter.

**2**. The aquarium filter of claim 1, further comprising a first vertical guide § groove formed on the inner wall of the aquarium filter and a second opposite, vertical guide groove formed with the partition wall, and wherein the porous member is slid into and between the guide grooves for positioning.

**3**. The aquarium filter of claim 1, wherein the porous member is a sponge.

**4**. The aquarium filter of claim 1, further comprising a flow-control valve disposed in a predetermined position of the intake tube.

* * * * *