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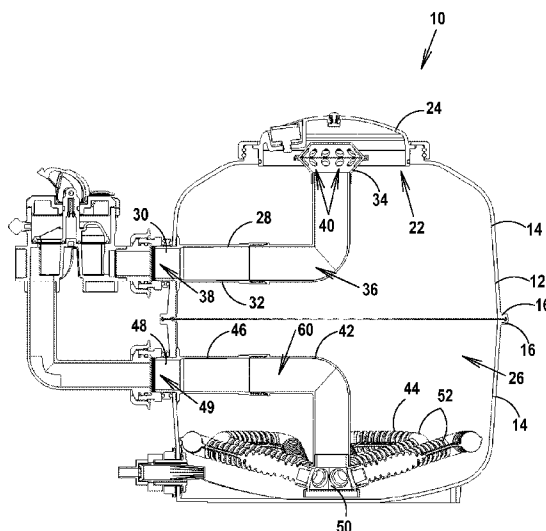
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(54) Title: A WATER FILTER



(57) **Abstract:** This invention relates to a water filter. The filter includes a tank that operatively contains filter sand through which water is pumped for filtering the water. The filter includes a collector in a bottom region of the tank. The collector includes a central hollow hub and a plurality of laterals, extending radially from the hub and in a circumferentially spaced arrangement about the hub. Each lateral includes a length of tubing defining a stem that projects laterally from the hub and a length of tubing defining the loop, the lateral bifurcating from the stem into the loop. Each length of tubing defines a plurality of openings through its wall that permit water flow from the inside of the tank into the collector, in use of the filter. The invention extends also to such a collector, per se.

A WATER FILTER

THIS INVENTION relates to a water filter.

The invention relates particularly to a water filter that uses sand as a filter medium and that is used for filtering swimming pool water. A known filter of the type includes a tank
5 that operatively contains such sand. The filter is operatively connected in line with a pipe line, a pump, and a swimming pool in a configuration providing for the pump to circulate water in the pool through the filter and the pool. The filter typically has an inlet assembly including an inlet pipe that terminates in a diffuser near the operative top of the tank. The filter has also an outlet assembly including an outlet pipe that originates from a
10 collector in an operative bottom region of the tank. In a filtration mode of the filter, water enters the tank via the inlet pipe and the diffuser, flows through the filter sand, is collected by the collector, and exits the tank via the outlet pipe. In plan, the collector typically is spread out generally horizontally across the said operative bottom region with the aim of inducing a substantially even flow of water, and thus effective filtering of the
15 water, through the sand contained in the tank, i.e. from the top to the bottom of the tank.

Insofar as the operation of a water filter of the above type is already well known, this is

not described in further detail herein.

The collector of a known water filter of the type includes a plurality of straight perforated tube sections, known as laterals, that project radially from a central hollow hub of the collector and that communicate, via the hub, with the outlet pipe of the filter. Insofar as the laterals are substantially "evenly perforated" along their lengths, water flowing through sand, operatively contained in the tank within which the tube sections are located, will follow a path through the sand towards the laterals, entering the laterals mainly through perforations on the operative top side of the tube sections. As such, the sand will tend to form "dead pockets" between adjacent laterals in the region level with and below the laterals, i.e. areas through which water being filtered does not flow. The potential filtering efficiency of the filter is thus detrimentally affected, while hardening of the sand within the tank, particularly below the tube sections, can also result.

In the light of the above it is an object of this invention to provide a water filter, of the general type referred to above for filtering swimming pool water, in respect of which the dead pockets are at least ameliorated so as to enhance its filtering efficiency.

Any reference hereinafter to a filter must be interpreted as a reference to a water filter of the general type referred to above for filtering swimming pool water, which uses sand as a filter medium.

According to a first aspect of this invention there is provided water filter which includes, defined in an upright orientation thereof,

a tank that defines an enclosed space therein for containing sand as a filter medium;

a water inlet assembly which defines therethrough a water flow passage between an external inlet of the filter and an inlet of the tank in a top region of the tank; and

a water outlet assembly which includes

- 5 a water collector in an operative bottom region of the tank, including a central hollow hub and a plurality of laterals, extending radially from the hub and in a circumferentially spaced arrangement about the hub, each lateral including a length of tubing that defines a loop and that defines a plurality of openings through its wall that permit water flow from the space defined in the tank into the collector, in use of the filter; and
- 10 an outlet pipe originating in the hub and terminating in an external outlet of the filter.

The filter is operatively connected in line with a pipe line, a pump, and a swimming pool in a configuration providing for the pump to circulate water in the pool through the filter and the pool. The water inlet assembly typically includes an inlet pipe that terminates in a diffuser near the operative top of the tank, the diffuser defining the inlet of the tank of the filter. During a filtration cycle of the filter, water enters the tank via the inlet pipe and the diffuser, flows through the filter sand, is collected by the collector, and exits the tank via the outlet pipe. The water is filtered as it passes through the sand. During a backwash cycle of the filter, the water flow is reversed. Insofar as the operation of such a filter is largely conventional, it will not be described in full detail herein.

A water collector as herein envisaged, including laterals defining loops, may be configured to yield a more even distribution of the laterals throughout sand in the bottom region of a tank of a water filter than is possible with a water collector including only straight laterals. This is particularly the case where the loops of a collector as herein envisaged define the extremities of the laterals remote from the hub and where the loops are disposed at least near horizontal. As such, the potential for dead pockets, as referred to above, to form in the sand is minimized.

The sum of the flow cross-sectional areas of openings on the underside of each lateral may exceed the sum of the flow cross-sectional areas of openings on the top side of the lateral by at least 50%. It is envisaged that this may direct water flow more towards the sand in the region underneath the collector, minimizing the potential for the formation of dead pockets, as referred to above, in the sand between and underneath the laterals.

Each lateral may include both a length of tubing defining a stem that projects laterally from the hub and the length of tubing defining the loop, the lateral bifurcating from the stem into the loop.

The distribution of the openings defined through the wall of each lateral may be such as to yield a substantially even flow of water through the sand in the tank of the filter throughout a horizontal cross-section above the collector, in use of the filter.

The openings defined by the laterals may include transverse slits. In addition, each lateral may be corrugated. In this case, the slits of the lateral may include slits that are disposed in outer crests of the corrugation. Alternatively or additionally in the said case, the slits of the lateral may include slits that are disposed in outer valleys of the corrugation. The Applicant envisages that, with the laterals having slits disposed in their outer valleys, sand will be urged into the valleys by water flow during filtering of swimming pool water. The sand will thus be compacted in the valleys and its filtering efficiency, particularly its ability to capture small particulate impurities, will thus be enhanced.

Clearly, the width of the slits, where provided, will be such as to operatively prevent filter sand from entering the collector through the slits.

Each slit may be tapered in cross-section, its sides converging towards the outside of the lateral by which it is defined.

It will be understood that the exact configuration of the water collector of the filter of the first aspect of the invention and particularly of the laterals thereof are greatly variable, while still embodying the essential principles of this aspect of the invention, which provides for an arrangement in relation to which dead pockets within the sand contained within the tank of the filter and hardening of the sand is largely eliminated, while a substantially even flow of water through the entire mass of the sand also is effected.

According to a second aspect of this invention there is provided a water collector, for location in an operative bottom region of a tank of a water filter that operatively contains sand as a filter medium, which includes a central hollow hub and a plurality of laterals, extending radially from the hub and in a circumferentially spaced arrangement about the hub, each lateral including a length of tubing that defines a loop and that defines a plurality of openings through its wall to operatively permit water flow from the space defined in a tank of a filter of which the collector operatively forms a part into the collector, in use of the filter.

The sum of the flow cross-sectional areas of openings on the operative underside of each lateral may exceed the sum of the flow cross-sectional areas of openings on the operative top side of the lateral by at least 50%.

Each lateral may include both a length of tubing defining a stem that projects laterally from the hub and the length of tubing defining the loop, the lateral bifurcating from the stem into the loop.

The distribution of the openings in each lateral may be such as to, in use of a filter of which the collector operatively forms a part, yield a substantially even flow of water through sand in the tank of the filter throughout a horizontal cross-section above the collector.

The openings defined by the laterals may include transverse slits. In addition, each lateral may be corrugated. In this case, the slits of the lateral may include slits that are disposed in outer crests of the corrugation. Alternatively or additionally in the said case, the slits of the lateral may include slits that are disposed in outer valleys of the corrugation.

Clearly, the width of the slits, where provided, will be such as to operatively prevent filter sand from entering the collector through the slits.

Each slit may be tapered in cross-section, its sides converging towards the outside of the lateral by which it is defined.

The invention is described below by way of an example of a water filter, in accordance with the first aspect of the invention, which includes a water collector, in accordance with the second aspect of the invention, and which is illustrated in the accompanying diagrammatic drawings. In the drawings:

Figure 1 shows a diagrammatic sectional elevation of an embodiment of a water filter, in accordance with the first aspect of the invention, incorporating an embodiment of a water collector, in accordance with the second aspect of the invention;

Figure 2 shows a diagrammatic top view of the water collector of Figure 1;

Figure 3 shows a diagrammatic detailed three-dimensional view of a part of a wall of a lateral of the water collector of Figure 2;

Figure 4 shows a diagrammatic sectional elevation of the filter of Figure 1 during a filtration cycle thereof; and

Figure 5 shows a diagrammatic sectional elevation of the filter of Figure 1 during

a backwash cycle thereof.

Referring initially to Figure 1, a water filter which is suitable for filtering swimming pool water and which uses sand as a filter medium is designated generally by the reference numeral 10. The filter 10 includes a tank 12 that is made up of two tank halves 14. The tank halves 14 are injection moulded bodies of a reinforced synthetic plastic material, typically an engineering polymer known in the trade as PPGF30, which is glass loaded. The tank halves 14 define peripheral flanges 16 where they abut one another, the halves being secured together by heat welding.

The top tank half 14 defines at its top centre an access opening 22 and has a closure 24 for the opening removably secured thereto. With the closure 24 in place, it seals off the opening 22 so that an enclosed internal space 26 is defined in the tank 12. The tank 12 can then withstand internal pressures which are generated during operation of the filter 10.

The filter 10 includes also a water inlet assembly 28 which includes a coupling 30, mounted on a wall of the top tank half 14 and extending through a hole defined through the wall, an elbow pipe 32, and a diffuser 34. The assembly 28 defines therethrough a water flow passage 36 between an inlet 38 of the filter 10 and a plurality of outlets 40 defined by the diffuser 34, serving as inlets of the tank 12. Insofar as the assembly 28 may be essentially conventional, it is not described in more detail herein.

The filter 10 includes also a water outlet assembly 42 which includes a water collector 44, an outlet pipe 46, and a coupling 48, mounted on a wall of the bottom tank half 14 and extending through a hole defined through the wall. The outlet pipe 46 defines an outlet 49 of the filter 10. The collector 44 includes a central hollow hub 50 located in the centre of the tank 12 near its bottom and six identical laterals 52 extending radially from the hub and in a circumferentially spaced arrangement about the hub.

In Figure 2, the collector 44, including the hub 50 and six laterals 52, are shown in top view. Each lateral 52 includes both a length of tubing 54 defining a stem that projects laterally from the hub 50 and a length of tubing 56 defining a substantially triangular loop, the lateral bifurcating from the stem into the loop. Each length of tubing 54 defines
5 a socket 58 within which a complementary spigot (not shown) forming a part of the hub 50 is received. Each spigot and the corresponding socket define complementary bayonet-type engagement formations via which the corresponding lateral is detachably attached to the hub 50. In the attached configuration of the laterals 52, water flow passages defined in the lengths of tubing 54 and 56 are in communication with the
10 inside of the hub 50 and a flow passage 60 (see Figure 1) defined in the pipe 46.

It will be understood that the dimensions of the hub 50 and the diameter of each length of tubing 54 extending therefrom limit the number of laterals that can extend from the hub 50. The looped configurations of the lengths of tubing 56 ensure that the collector
15 44 is essentially more evenly distributed throughout the sand in the bottom region of the tank 12 (see Figure 1) than would be the case with six straight laterals projecting from the hub 50.

As is also apparent from Figure 2, each lateral 52 is corrugated along the major part of
20 the length of its tubing 54 and 56.

Figure 3 shows a sectional view of a part of a wall 62 of one of the laterals 52. The wall, being corrugated, defines outer peaks 64, outer valleys 66, and corresponding inner valleys and peaks, respectively. In the outer peaks 64 and outer valleys 66, the wall 62
25 defines openings in the form of slits 68 via which the space 26 (see Figure 1) defined in the tank 12 (see Figure 1) communicates with the passage defined inside the lateral 52, here designated by the reference numeral 70. It will be noted that the configuration of the wall 62 is such that each slit 68 is defined by an inner valley 72 which tapers inwardly towards the outside of the wall. As such, each slit 68 is tapered in cross-
30 section. Each slit 68 has a width of approximately 0.14mm, which is such that typical

sand used as a filter medium in the tank 12 (see Figure 1) is not permitted to pass through the slit into the passage 70. The distribution of the slits 68 is such that approximately 50% more flow cross-sectional area of slit is provided on the underside of the lateral 52 than on its top side. The purpose of this aspect of the distribution of the
5 slits 68 will be described hereinafter along with another aspect of their distribution.

With reference now particularly to Figures 4 and 5, in use of the filter 10, its inlet 38 and outlet 49 are connected in line with a pipe line, a pump, and a swimming pool in a configuration providing for the pump to circulate water through the pool and the filter 10.
10 Sand 74 as a filter medium within the tank 12 typically will fill the tank up to a suitable level, e.g. a level 76 as shown, water entering the tank 12 thus filling the space within the tank above the sand.

With reference now particularly to Figure 4, during a filtration cycle of the filter 10, water,
15 displaced by the pump, enters the filter 10 via the inlet 38, enters the tank 12 via the diffuser 34, flows downwardly through the sand 74, is collected by the collector 44, particularly entering the laterals 52 of the collector via the slits defined in them, and exits the filter via the outlet 49. The water is filtered as it passes through the sand 74, the filtered water thus entering the laterals 52. The direction of the flow of water in the
20 filtration cycle is indicated by the arrows in the drawing.

In order to induce a substantially even flow of water across a horizontal cross-section of the mass of sand 74 above the collector 44, the slits 68 (see Figure 3) within the laterals 52 may be distributed in an arrangement that induces substantially equal flow into the
25 laterals across the entire area covered by the laterals. It is envisaged that, for example, the concentration of slits in regions on the laterals 52 remote from the hub 54 will be higher than in regions nearer the hub. Insofar as an arrangement of slits suitable for achieving such substantially even flow may be determined by experimentation, it is not elaborated on in detail herein.

Still further, in order to prevent or minimize the formation of dead pockets between and below the laterals 52, as is stated above, a larger total flow cross-sectional area of slits will be provided in the undersides of the laterals 52 than in their top sides, thus inducing water flow beyond the laterals and into the laterals from their undersides. Because the laterals effectively cover the cross-sectional area defined by the sand more effectively than is the case with straight laterals, due to their looped configuration in the former case, the possibility of dead pockets forming also is significantly reduced, this same arrangement simultaneously avoiding hardening of sand in regions below the laterals 52. By providing for this even flow of water through the sand 74 of the tank 10 and by minimizing dead pockets and hardening of sand within the tank, filtering efficiency is effectively maximized, as will be clearly apparent. Still further, as water flows into the laterals 52 during filtering, sand will be urged by the water into the outer valleys 66 (see Figure 3), effectively compacting the sand in the valleys, which will still further enhance the filtering efficiency of the filter, particularly in respect of the removal of small particulate impurities. The Applicant thus envisages that the filter 10 will have a filtering efficiency that is superior to that of known filters, providing for cleaner swimming pool water, while also reducing the frequency with which the filter needs to be backwashed for cleaning. By reducing the frequency of required backwashing, the use of the filter 10 will also be associated with significant water savings.

20

Figure 5 illustrates the flow direction of water through the filter 10 during a backwash cycle, which is essentially the reverse of the flow direction during a filtration cycle and which is indicated by the arrows in the drawing. The configuration of the water collector 44 in this cycle will ensure the effective movement of sand 74 particularly below the collector, thus reducing the possibility of hardening of sand within the tank 12 and ensuring effective cleaning of the sand. The configuration of the water collector 44 further ensures a substantially even flow of water upwardly through the sand 74 to ensure that the entire mass of sand is effectively cleaned during backwashing.

30 It will further be appreciated that with the diffuser 34 located as shown above the level

76 of sand 74 within the tank 12, the filtration area is maximized.

Due to the tapered cross-section of the slits 68, as shown in Figure 3, tapering particularly from the inside of the walls of the laterals 52 to their outsides, the pressure
5 of water exiting the slits is increased during backwashing, thus ensuring that any compacted regions of sand below the collector 44, notably in the outer valleys 66, are effectively cleared during backwashing.

It must be understood that the various features of the filter of the invention, as described
10 above by way of example, are greatly variable, particularly also in relation to the design of the water collector and particularly the laterals thereof which, in accordance with the invention, maximizes the effective coverage of the cross-sectional area of the tank and provide for even flow of water through the mass of sand, thus ensuring that the entire mass of sand is effectively used for filtering purposes. In the particular configuration of
15 the collector 44 as shown, the effective area covered thereby is approximately 2.8 times greater than that covered by a conventional collector including straight laterals extending from a hub thereof.

The second aspect of the invention covers a water collector as defined herein, *per se*, of
20 which the water collector 44 is an example.

CLAIMS

1. A water filter which includes, defined in an upright orientation thereof,
 - 5 a tank that defines an enclosed space therein for containing sand as a filter medium;

a water inlet assembly which defines therethrough a water flow passage between an external inlet of the filter and an inlet of the tank in a top region of the tank; and
 - 10 a water outlet assembly which includes

a water collector in an operative bottom region of the tank, including a central hollow hub and a plurality of laterals, extending radially from the hub and in a circumferentially spaced arrangement about the hub, each lateral including
 - 15 a length of tubing that defines a loop and that defines a plurality of openings through its wall that permit water flow from the space defined in the tank into the collector, in use of the filter; and
 - 20 an outlet pipe originating in the hub and terminating in an external outlet of the filter.
2. A filter as claimed in claim 1, in which the sum of the flow cross-sectional areas of openings on the underside of each lateral exceeds the sum of the flow cross-
- 25 sectional areas of openings on the top side of the lateral by at least 50%.
3. A filter as claimed in either of the preceding claims, in which each lateral includes both a length of tubing defining a stem that projects laterally from the hub and the length of tubing defining the loop, the lateral bifurcating from the stem into the
- 30 loop.

4. A filter as claimed in any one of the preceding claims, in which the distribution of the openings defined through the wall of each lateral is such as to yield a substantially even flow of water through sand in the tank of the filter throughout a horizontal cross-section above the collector, in use of the filter.
5. A filter as claimed in any one of the preceding claims, in which the openings defined by the laterals are transverse slits.
6. A filter as claimed in claim 5, in which each lateral is corrugated and in which the slits of the lateral include slits that are disposed in outer crests of the corrugation.
7. A filter as claimed in claim 5 or in claim 6, in which each lateral is corrugated and in which the slits of the lateral include slits that are disposed in outer valleys of the corrugation.
8. A filter as claimed in any one of claims 5 to 7, in which each slit is tapered in cross-section, its sides converging towards the outside of the lateral by which it is defined.
9. A water collector, for location in an operative bottom region of a tank of a water filter that operatively contains sand as a filter medium, which includes a central hollow hub and a plurality of laterals, extending radially from the hub and in a circumferentially spaced arrangement about the hub, each lateral including a length of tubing that defines a loop and that defines a plurality of openings through its wall to operatively permit water flow from the space defined in a tank of a filter of which it operatively forms a part into the collector, in use of the filter.
10. A collector as claimed in claim 9, in which the sum of the flow cross-sectional areas of openings on the operative underside of each lateral exceeds the sum of

the flow cross-sectional areas of openings on the operative top side of the lateral by at least 50%.

- 5 11. A collector as claimed in claim 9 or in claim 10, in which each lateral includes both a length of tubing defining a stem that projects laterally from the hub and the length of tubing defining the loop of the lateral, the lateral bifurcating from the stem into the loop.
- 10 12. A collector as claimed in any one of claims 9 to 11, in which the distribution of the openings in each lateral is such as to, in use of a filter of which the collector operatively forms a part, yield a substantially even flow of water through sand in the tank of the filter throughout a horizontal cross-section above the collector.
- 15 13. A collector as claimed in any one of claims 9 to 12, in which the openings defined by the laterals are transverse slits.
- 20 14. A collector as claimed in claim 13, in which each lateral is corrugated and in which the slits of the lateral include slits that are disposed in crests of the corrugation.
- 25 15. A collector as claimed in claim 13 or in claim 14, in which each lateral is corrugated and in which the slits of the lateral include slits that are disposed in outer valleys of the corrugation.
- 30 16. A collector as claimed in any one of claims 13 to 15, in which each slit is tapered in cross-section, its sides converging towards the outside of the lateral by which it is defined.
17. A filter as claimed in claim 1, substantially as herein described with reference to and as illustrated in the accompanying diagrammatic drawings.

18. A collector as claimed in claim 9, substantially as herein described with reference to and as illustrated in the accompanying diagrammatic drawings.

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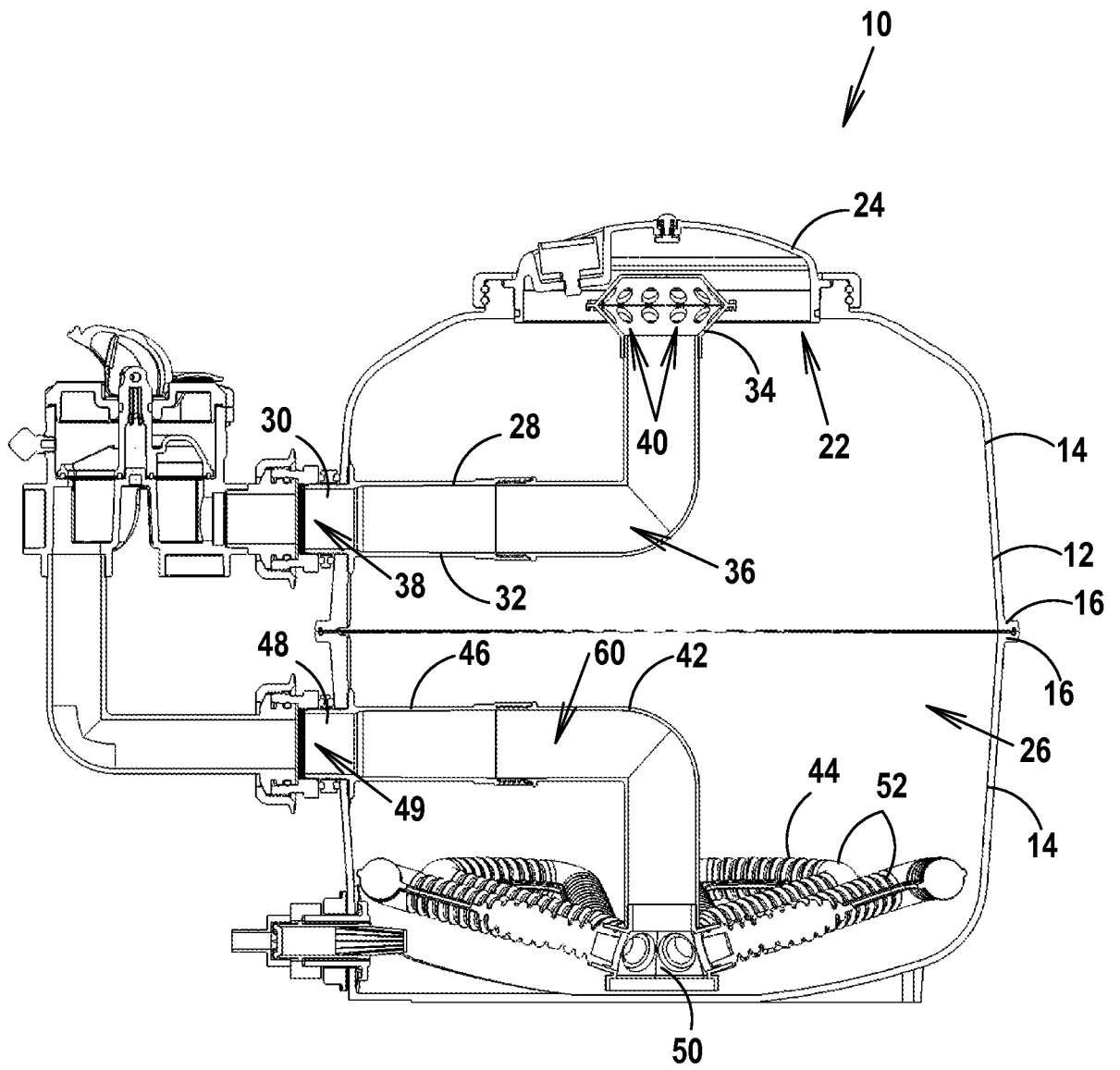


FIG. 1

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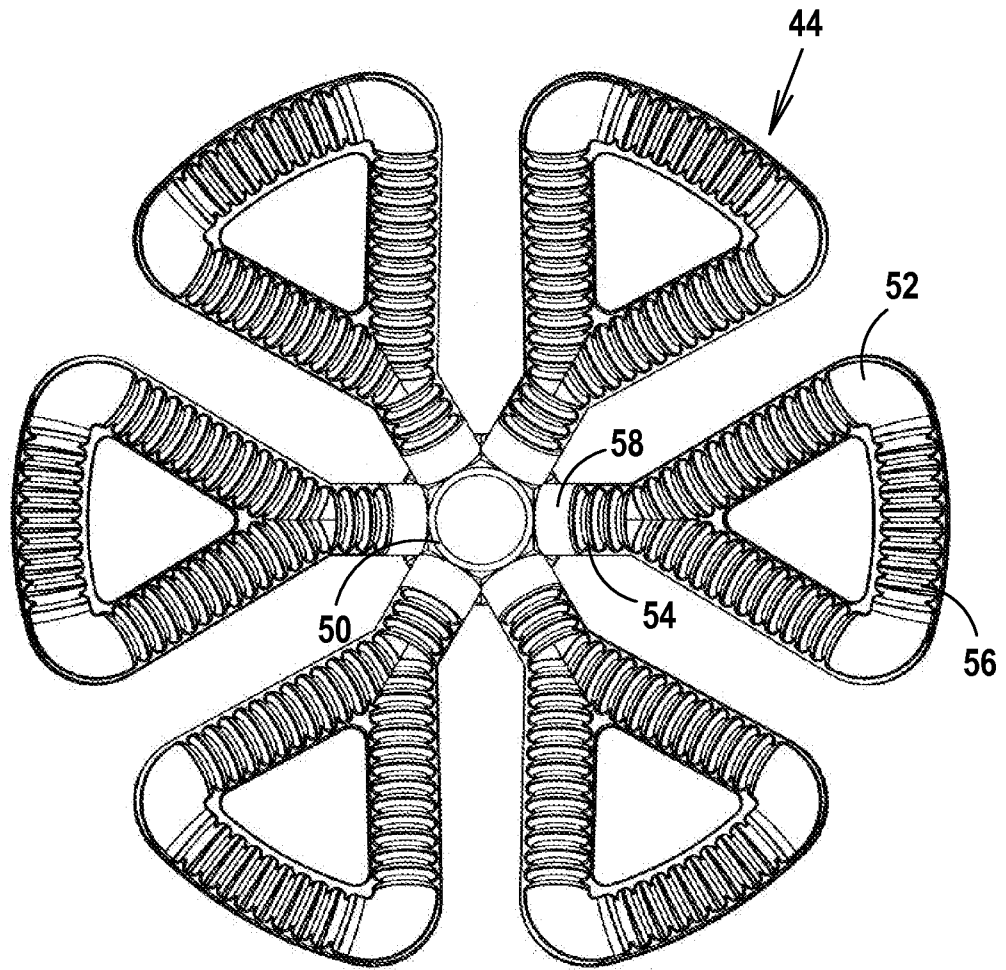


FIG. 2

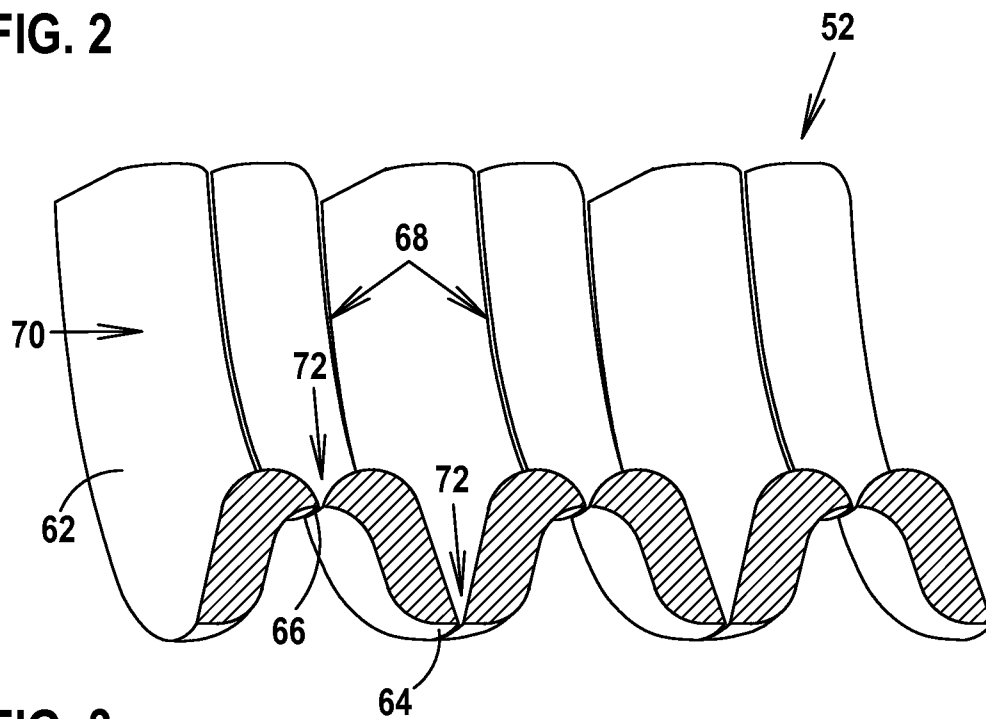


FIG. 3

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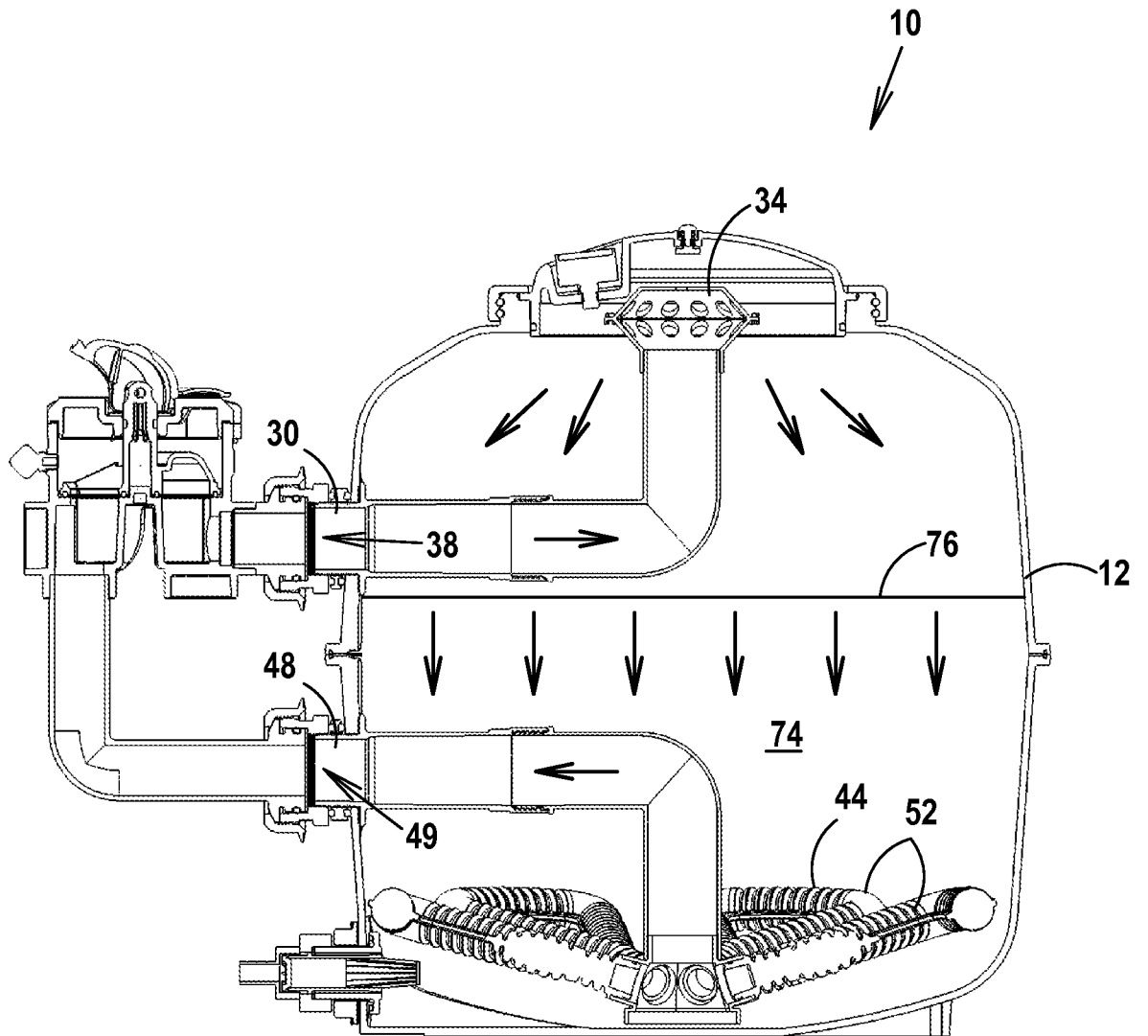


FIG. 4

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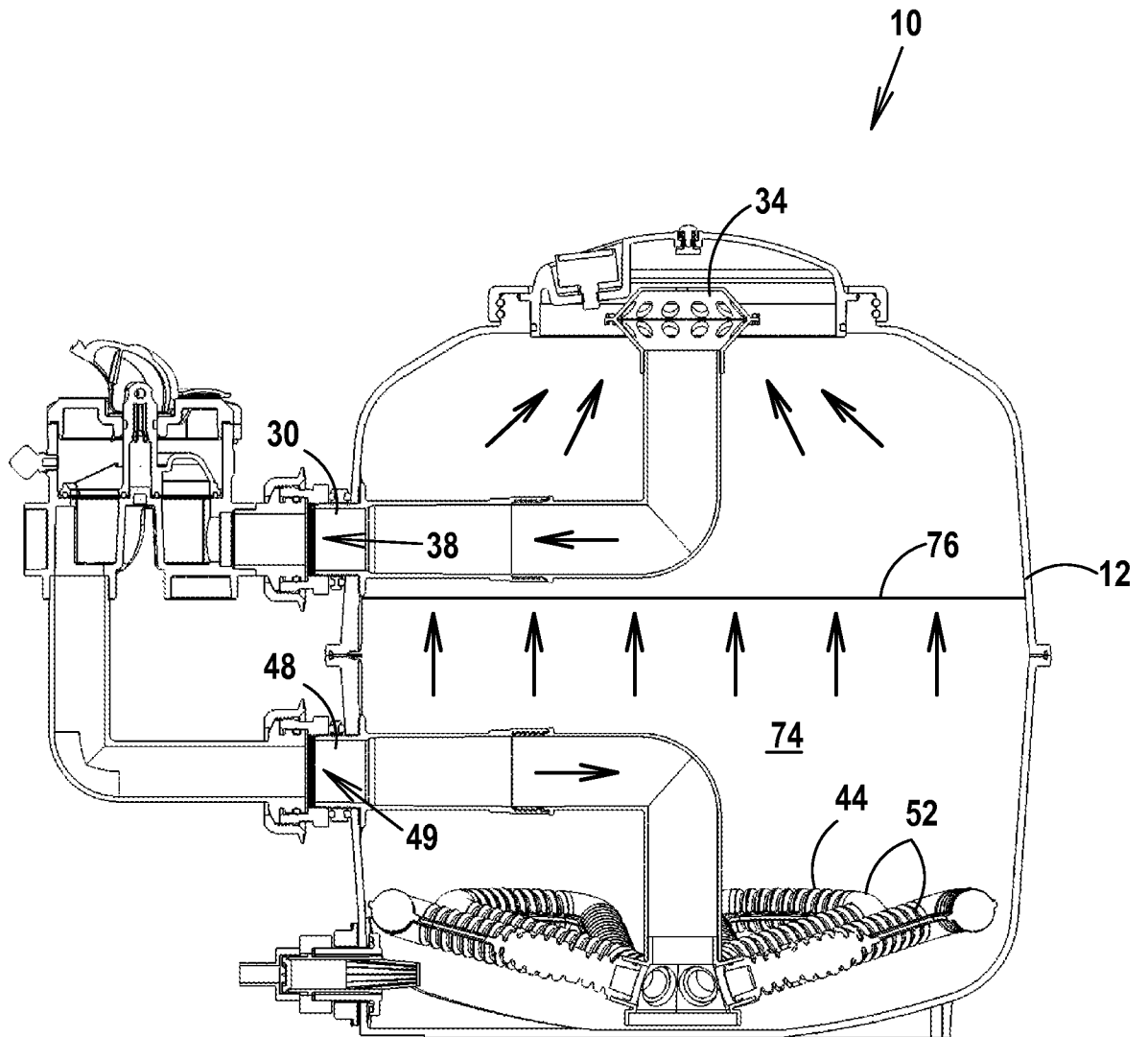


FIG. 5