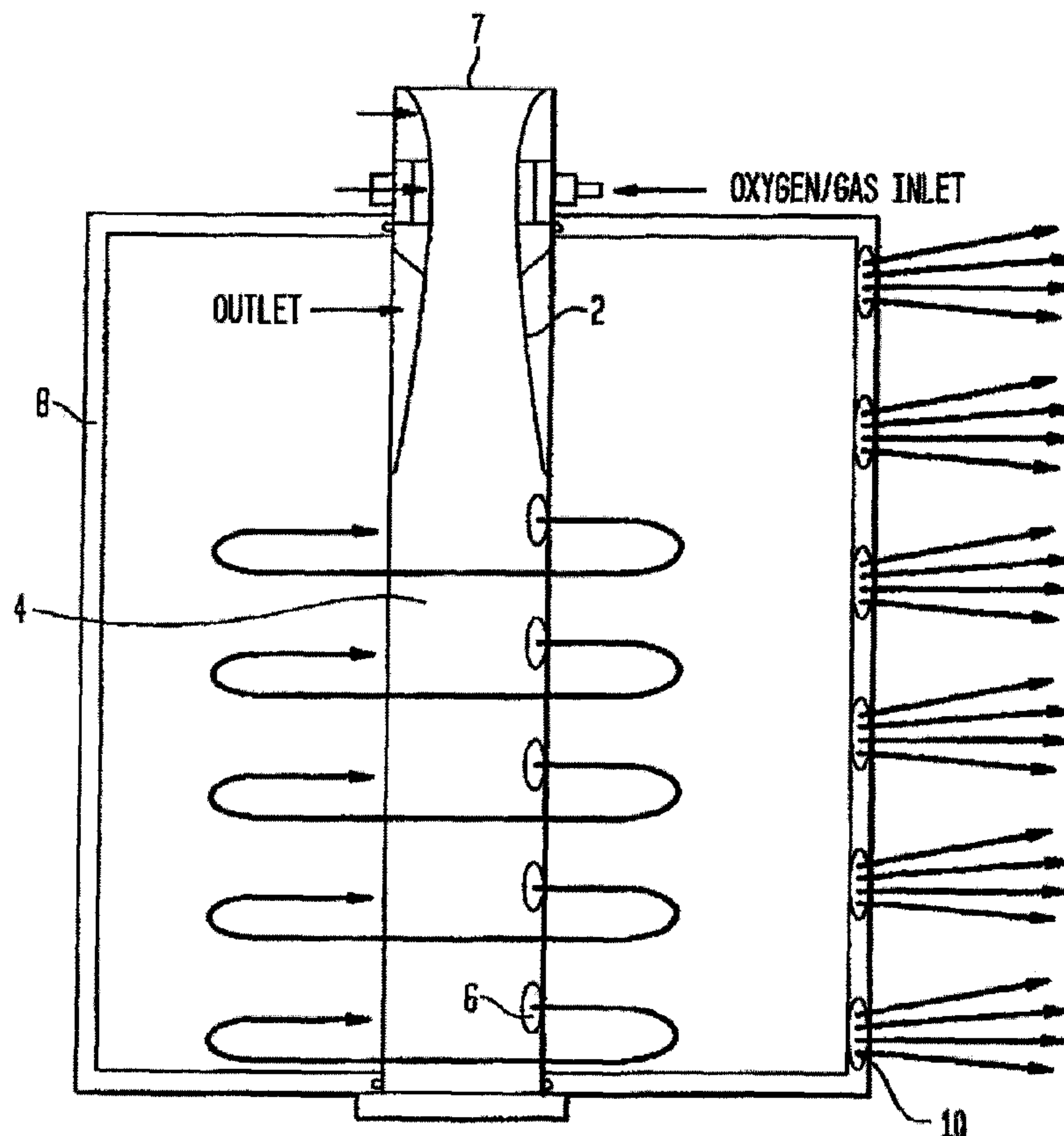




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(54) **Titre : DISPOSITIF D'APPORT DE GAZ DANS L'EAU**
 (54) **Title: DEVICE FOR SUPPLYING GAS INTO WATER**



(57) **Abrégé/Abstract:**

The invention relates to a device for supplying gas into water, especially for aquaculture. For enhanced oxygenation we propose a water inlet arrangement with a pipe (4) having a plurality of openings (6) and a Venturi type gas dissolver unit (2) built in the pipe (4), and a surrounding second element (8) having a plurality of openings (10) and/or a fixed or adjustable shield (12).



Abstract

The invention relates to a device for supplying gas into water, especially for aquaculture. For enhanced oxygenation we propose a water inlet arrangement with a pipe (4) having a plurality of openings (6) and a Venturi type gas dissolver unit (2) built in the pipe (4), and a surrounding second element (8) having a plurality of openings (10) and/or a fixed or adjustable shield (12).

(Figure 1)

DescriptionDevice for supplying Gas into Water

The present invention relates to a device for supplying gas into water combined with a water inlet arrangement. This can be used in tanks, ponds and sea cages.

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In aquaculture it is important that the content of dissolved oxygen in the water is kept optimal. This is necessary for the health and the growing of the fishes. Because the solubility of gases in water is reduced by increasing the temperature while the oxygen need of the fish is increasing at high temperature, there is a particularly great need for oxygen in warm periods. Increasing the capacity of oxygen dissolvers is, therefore, highly useful for the fish farmer. In addition, most of the fish hatcheries produce more fish per liter water than the installation originally was dimensioned for. The amount of water is, therefore, the limiting factor of the installation. A better utilization of the water, a higher consumption of the oxygen and an improved dissolving capacity are therefore required.

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Most hatcheries use pressurized oxygen dissolvers with a working pressure of 1-4 bars. By small amounts of water, it is normal to let all of the water flow go through the dissolver, but most commonly there is an outlet leading a part of the flow from the main pipe to a booster pump which pressurizes the dissolver. The oxygenated water is thereafter led back to the main pipe where it is mixed with untreated water. Most dissolving systems use 0 – 2, 5 kWh per kilo O₂ dissolved depending of efficiency and available water pressure.

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US 2005/0275119A1 and the parallel EP 1 598 106 A3 describe an oxygenating nozzle unit for the injection of gas in a liquid flow. The arrangement can for example be mounted on any pipe transporting liquid and with a need for the supply of gas, for example on the pipe supply to the basin for the farming of fish, on the pipe after circulation pump on a boat for live fish transportation, on the pipe after a circulation pump for vehicles for live fish transportation, on the pipe after a circulation pump on a container or other arrangement for live fish transportation or on pressurized dissolvers for increasing the oxygenating capacity. The known venturi system generates micro bubbles in sea water. By the means of gas diffusion and redistribution of dissolved gas

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components in water one can dissolve and add gas at a very low pressure, preferred for sea water applications.

5 EP 2 008 513 A1 discloses a water inlet arrangement for the use in fish tanks in aquaculture with a pipe to feed water into the tank, whereby the pipe has a plurality of openings. For a better adjustment of the flow a surrounding second element, having a plurality of openings, and/or a fixed or adjustable shield are provided.

10 This arrangement improves the water circulation in the tank. The document is silent about where and how the oxygen is supplied.

The not yet published European application 08022177.3 proposes a device for supplying gas into water in sea cages, tanks or ponds with a submerged pump and a dissolver for the gas. The oxygen enriched water is fed into the sea cage / tank / pond
15 by a "normal" nozzle, a tube with holes or a perforated hose.

The problems to be solved by the invention are:

20 To oxygenate and create good hydraulic conditions in a fish basin at a lowest possible energy consumption, for individual oxygenation into every fish basin.

To reduce the amount of dissolved nitrogen and thereby the total gas pressure in the water introduced into the fish tank. This will eliminate the possible problem of bends disease.
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This problems are solved by a device with the features of claim 1. Embodiments of the device are subjects of the dependent claims. Details of the water inlet arrangement used in this invention are disclosed in the EP 2 008 513 A1.
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The invention is built up from an inner pipe and an outer pipe. The parts are easy to disassemble to allow proper cleaning and disinfection. The Venturi/dissolver is situated in the inlet of the inner pipe. The holes/openings in the inner pipe "shoot" the water out into the volume of the outer pipe and create turbulence. This turbulence prevents the
35 gas bubbles in the water flow from combining to form larger gas bubbles

(coalescence). This will increase efficiency and transfer speed between gas and liquid. The rotation and the design/placement of the holes/openings in the inner type will equalize the water pressure in the outer pipe. This will again create equal water flow/water speed/water energy from all of the holes/openings in the outer pipe. The invention has no moving parts and, therefore, needs no maintenance except cleaning and possible disinfection.

The oxygen dissolving unit can be from any known type, especially a Venturi type, but the best solution is if the device is from the overlapping nozzle type like disclosed in EP 1 598 106 A.

Adding oxygen to fish tanks, sea cages or ponds in aquaculture with this embodiment creates good hydraulic conditions in the fish basin and homogeneous distribution of oxygen. This can be done with around 0,5 meter of water column available head pressure, depending on installation. With the invention we are able to oxygenate individually into every singly basin with an easy installable/removable unit. The situation of the Venturi secures that there is no degassing in the piping into the basin, which is a known problem. This because the gas is introduced directly into the basin below the water surface and the oxygenated water is thereby always kept under pressure.

Areas of application can be in all situations where water is to be distributed into a tank/pool/basin, preferably in breeding of fish or other organisms living in water, but can also be used in open areas such as lakes or rivers. Also it is possible to use this device for adding oxygen to sewage water or to expel unwanted gases out of water or another liquid. Adding any other gas can so be used to reduce the concentration of unwanted gas, like nitrogen or carbon dioxide. It is also possible to use the device for adding carbon dioxide to water.

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The invention has the following advantages:

- Reduced need of water pressure thus reducing energy demand.
- Easier installation.
- Reduced cost and complexity of installation.

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- No degassing in water pipe system.
- Eliminates the need of plastic valves as water is oxygenated after it has passed the valves (reduced potential of corrosion).
- Reduced possibility for mistakes during installation, as complexity is reduced and vulnerable parts of the oxygenating process is taken away. E.g. possible degassing zones in pipe system at lowered pressures.
- Achieve a good and homogenous circulation throughout the whole water column.
- Give self cleaning in the tank regarding waste products like faeces etc.
- Good and even distribution of feed particles inner tank.
- Good and even distribution and mixing of oxygen or other gases in the tank.
- To be able to increase efficiency of oxygenating processes.
- Reduce degassing in the situation where over or super saturated water is introduced into a basin.
- Eliminate the need for aeration of inlet water
- Reduce nitrogen levels in water and thereby reduce total gas pressure in water
- Easier adjustment of flow direction in basin
- Easier cleaning and disinfection
- In sweet water installations this invention will increase oxygen concentration, reduce nitrogen concentration as a good alternative to other aeration methods.

The invention can be manufactured from various materials. Preferably it is made from non-corrosive materials such as polypropylene, polyoxymethylene or polyvinyl-chloride or any other plastic.

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The invention is further described in more detail by the use of four drawings. They show:

- Figure 1: an embodiment of an oxygenating device according to the invention;
- Figure 2: another embodiment of the invention;
- Figure 3: a third embodiment of the invention;
- Figure 4: Some examples of shields.

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Figure 1 shows a pipe 4 which is connected to the water inlet pipe by the means of a muff coupling or a flange. In the pipe 4 there is arranged a gas dissolving unit of the Venturi type. The pipe 4 is surrounded by a second element 8, which has here the form of a cylinder. The pipe 4 has a row/rows of openings 6 for feeding the water into the volume between the pipe and the second element 8. The second element 8 has also a row of openings 10 for feeding the water into the not shown tank / pond / sea cage. The turbulence or rotation is generated by the differing orientation of the row / rows of holes 6 in the pipe.

Figure 2 shows a similar embodiment. The gas dissolver unit is not drawn, but incorporated in the pipe 4. The orientation of the openings 6 is chosen different from the orientation in Figure 1, namely more or less opposite.

Figure 3 shows another embodiment of the invention drawn schematically, while Figure 3B shows the embodiment in a tank. Figures 3A and 3B show the pipe 4, The invention shows the pipe 4, surrounded by the second element 8 and the openings 10 surrounded by the second element 8 and the openings for feeding the water into the tank. This embodiment has additional shield 12. The shield 12 can be of different shapes/forms. The shape/form should be designated so that the water jet streams are forced to bend and turn. The shield 12 surrounds the second the second element on that place, where the openings 10 are arranged. Shown is the circulation flow in the fish tank which is affected by the new element. The shield 12 surrounds the second element 8 or (not shown) the pipe 4 with a circumferential-angle of 60° to 200° , preferred 90° to 180° , this means between a quarter to one half.

Figure 4 shows six different shields 12 which can be used for example according to the invention. All shields 12 are arranged in neighborhood to the second element 8 and shield it against the flow in the fish tank. It can be adapted to the flow like the first example, or a segment of a circle like the second one. The third shows a rectangular shield 12. The fourth an acute-angled, the fifth a polygonal one. The last one shown has the rounded shape. It is shown that a lot of forms can be chosen by the man skilled in the art without departing from the invention.

What is claimed is:

1. A device for supplying gas into water, comprising:
 - a water inlet arrangement with a pipe (4) having a first plurality of openings ;
 - a surrounding second element having a second plurality of openings ; and
 - a Venturi type gas dissolver unit situated in the water inlet of the pipe below the water surface.
2. The device according to claim 1, wherein the Venturi type dissolver unit is of the overlapping nozzle type.
3. The device according to claim 1 or claim 2, wherein the gas is oxygen, air enriched with oxygen or carbon dioxide, nitrogen or air.
4. The device according to any one of claims 1-3, wherein the first plurality of openings are arranged in one or more rows.
5. The device according to any one of claims 1-3, wherein the first plurality of openings are arranged in two rows.
6. The device according to any one of claims 1-5, characterized in that the openings of the second element are oriented in a different direction than the first plurality of openings of the pipe.
7. The device according to any one of claims 1-6, wherein the second element is rotatable around the pipe (4).
8. The device according to any one of claims 1-7, wherein the second element is dismantlable from the pipe.

9. The device according to any one of claims 1-8, wherein the second element comprises a fixed shield.

10. The device according to any one of claims 1-8, wherein the second element comprises an adjustable shield.

FIG. 1

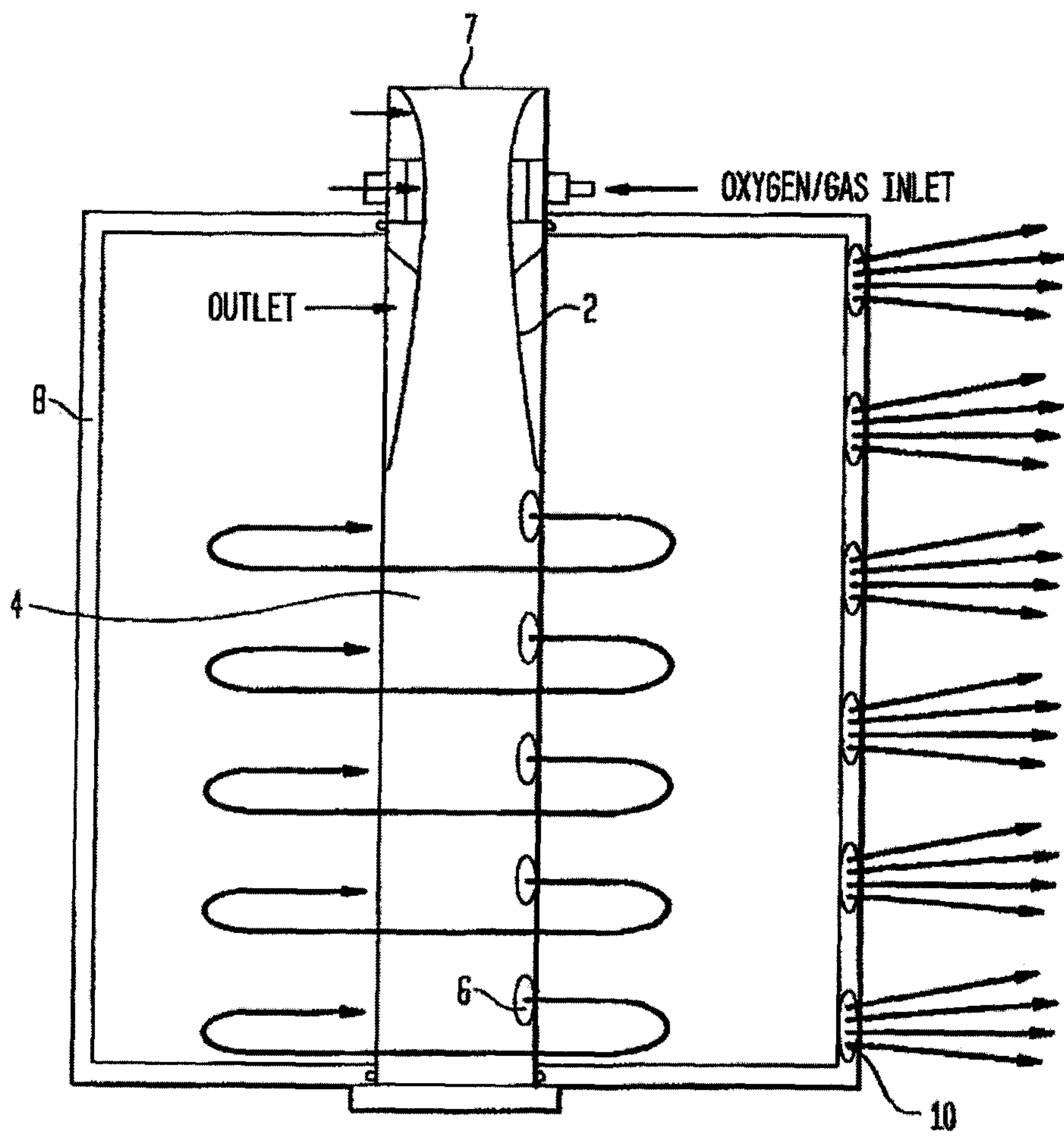


FIG. 2

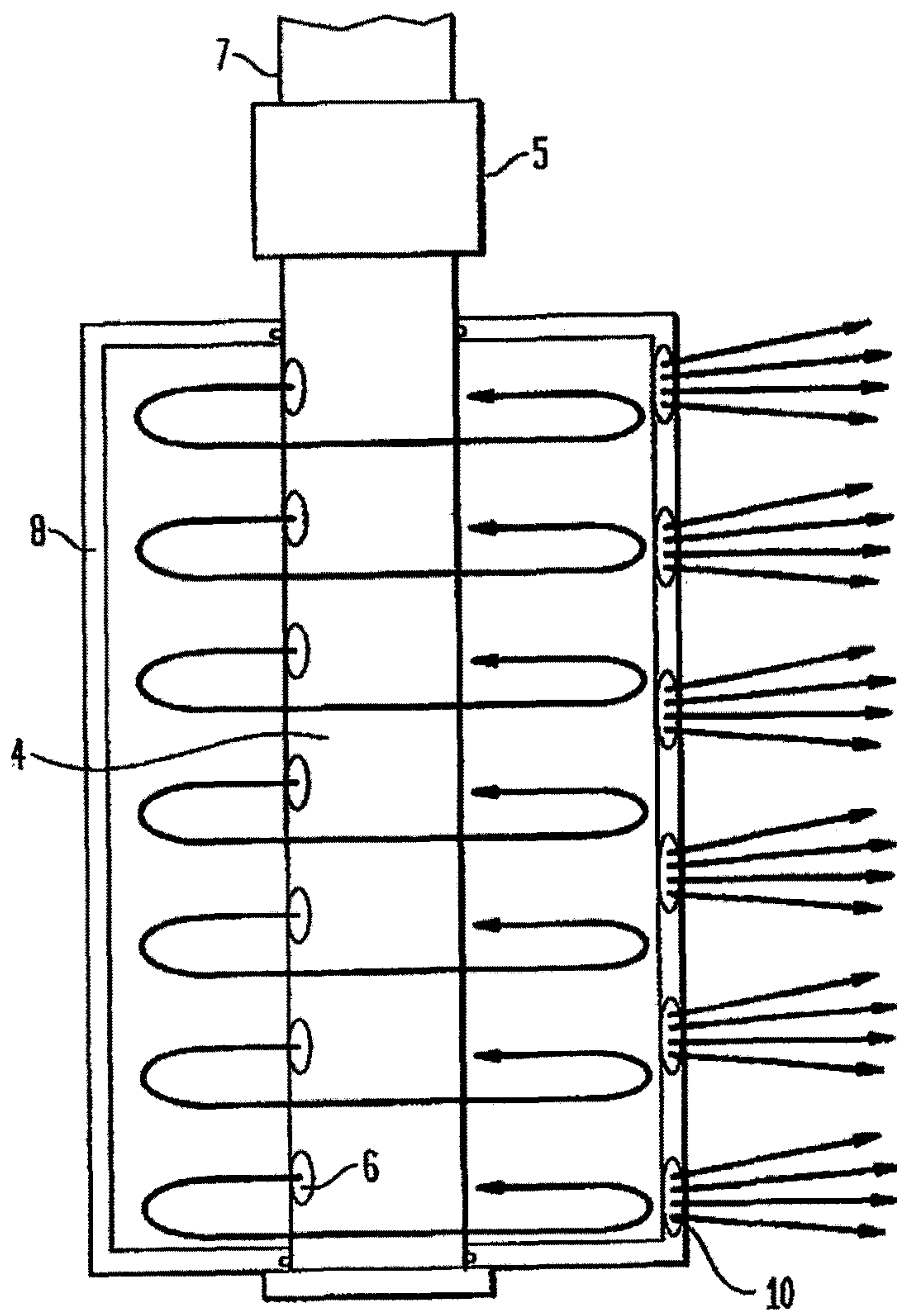


FIG. 3A

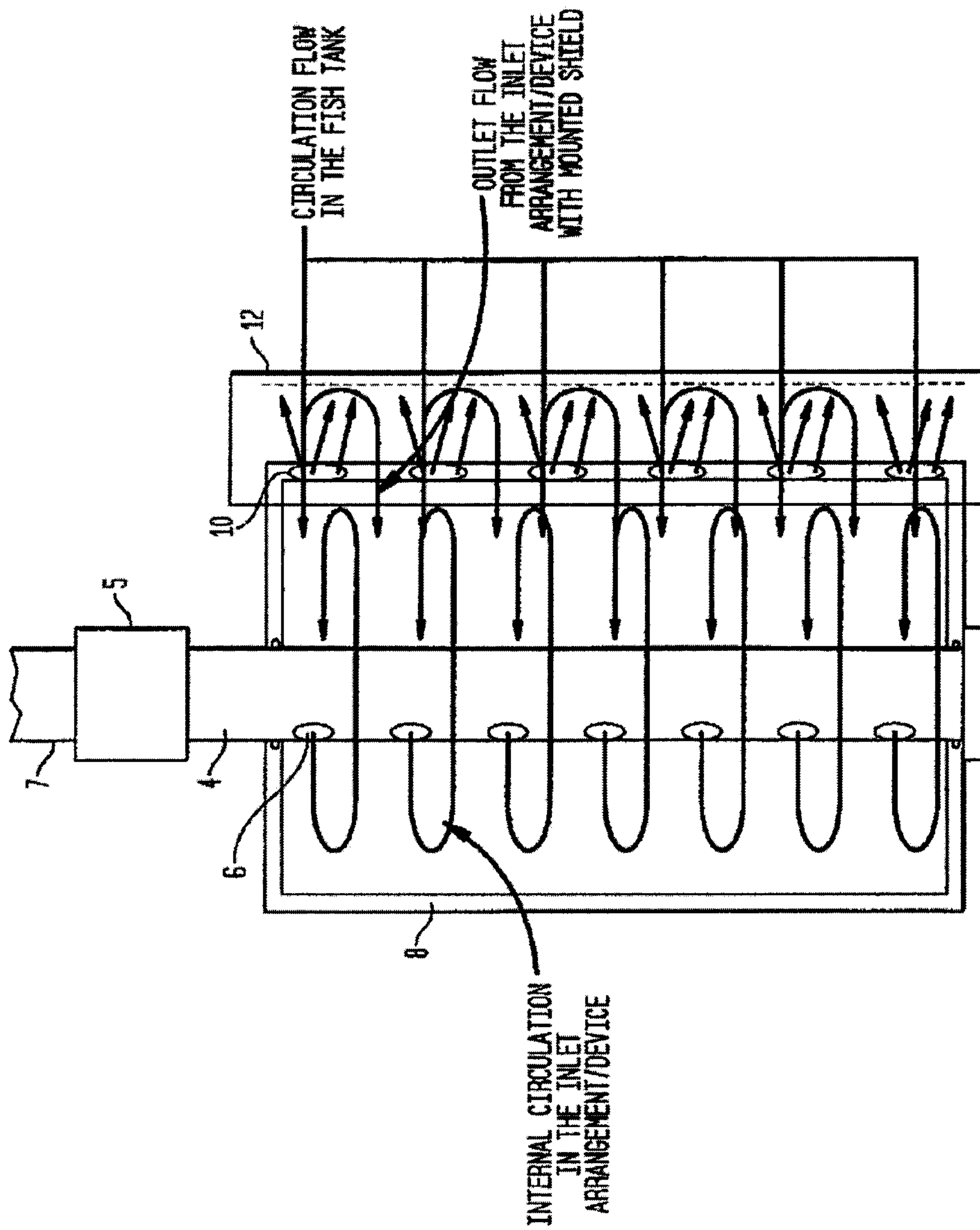


FIG. 3B

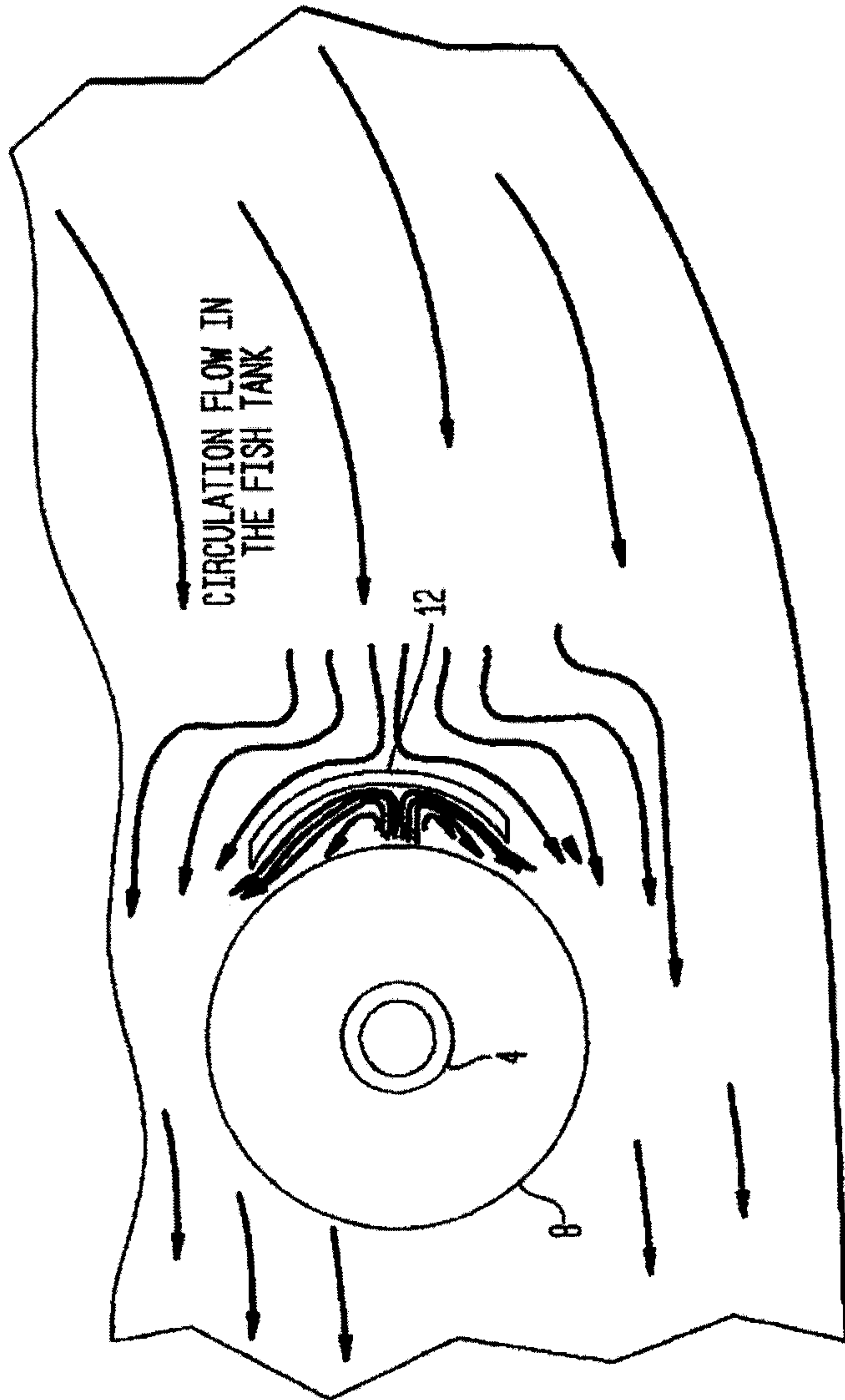


FIG. 4A

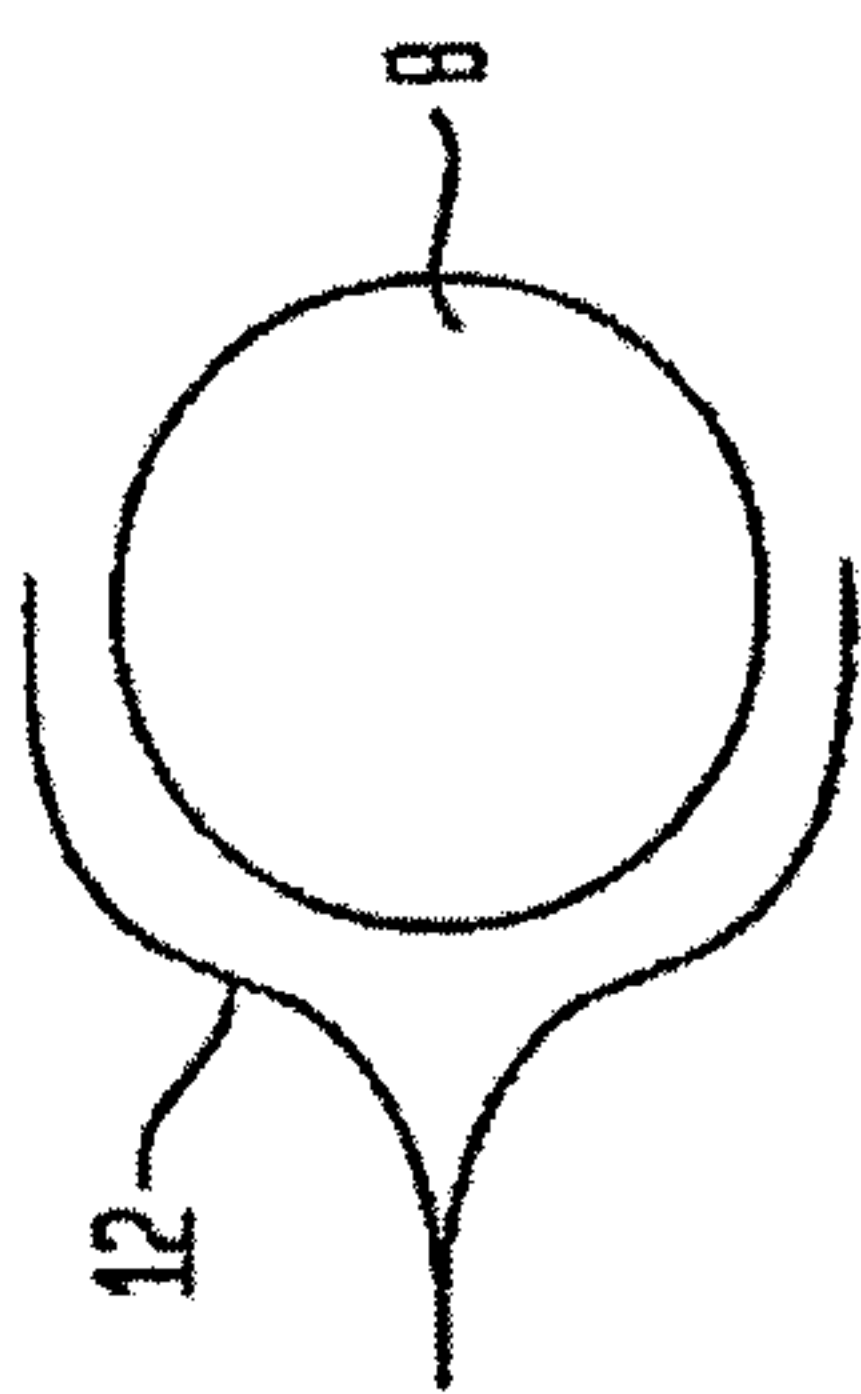


FIG. 4B

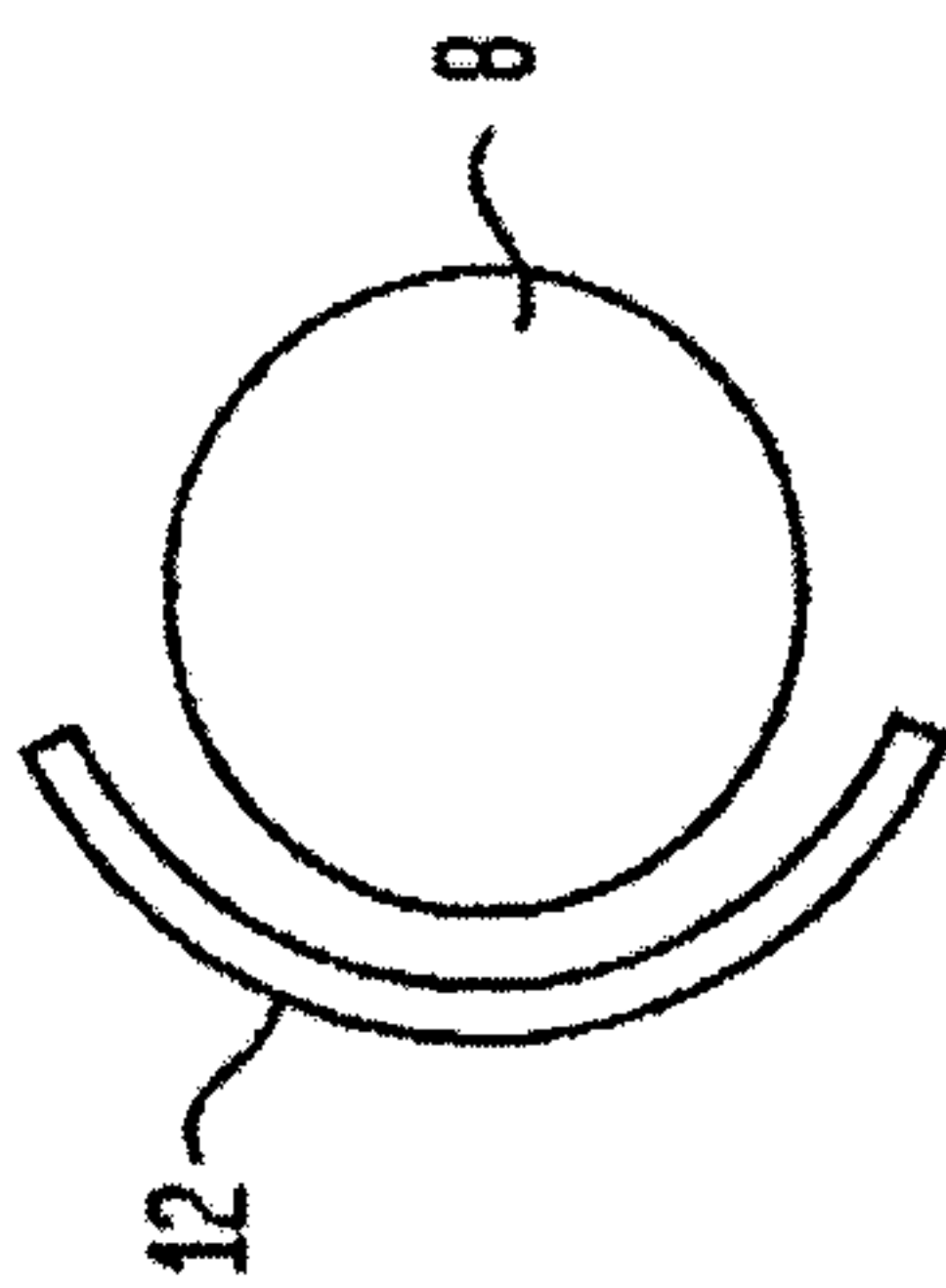


FIG. 4C

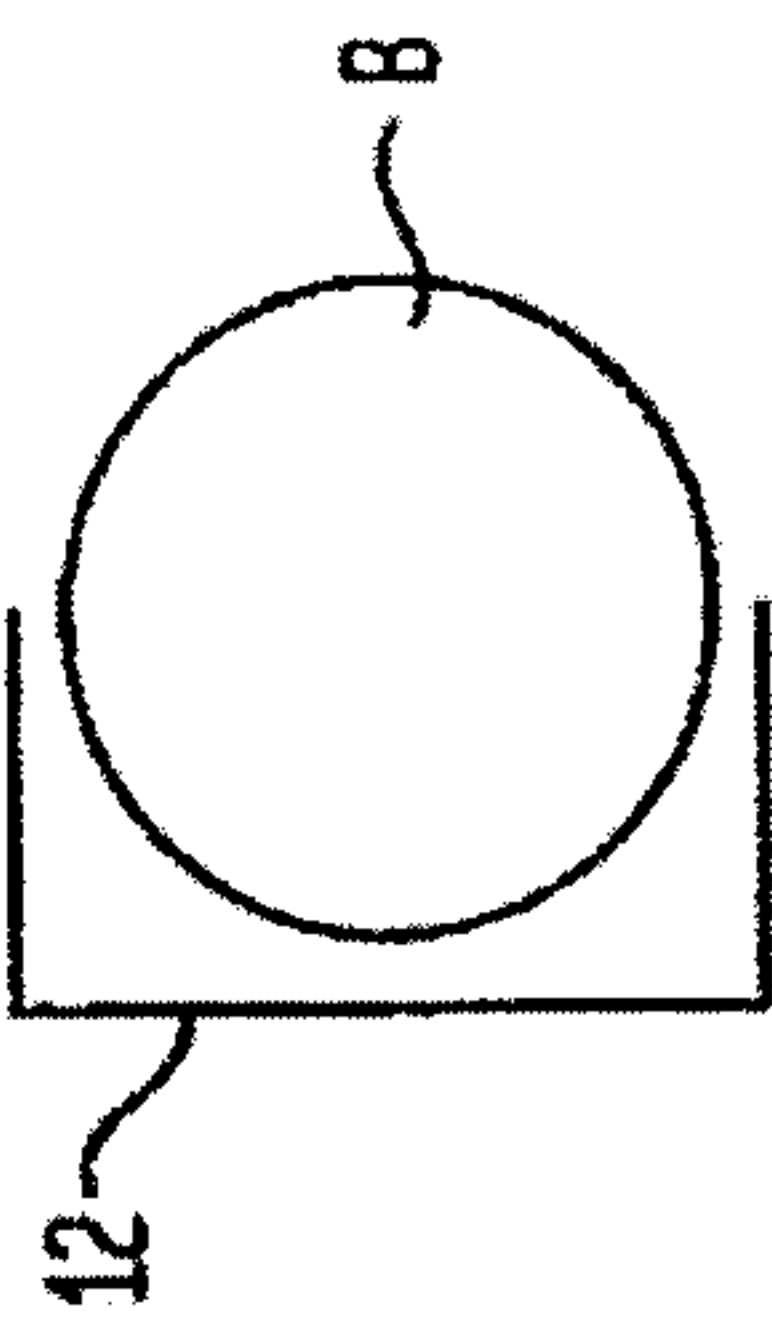


FIG. 4D

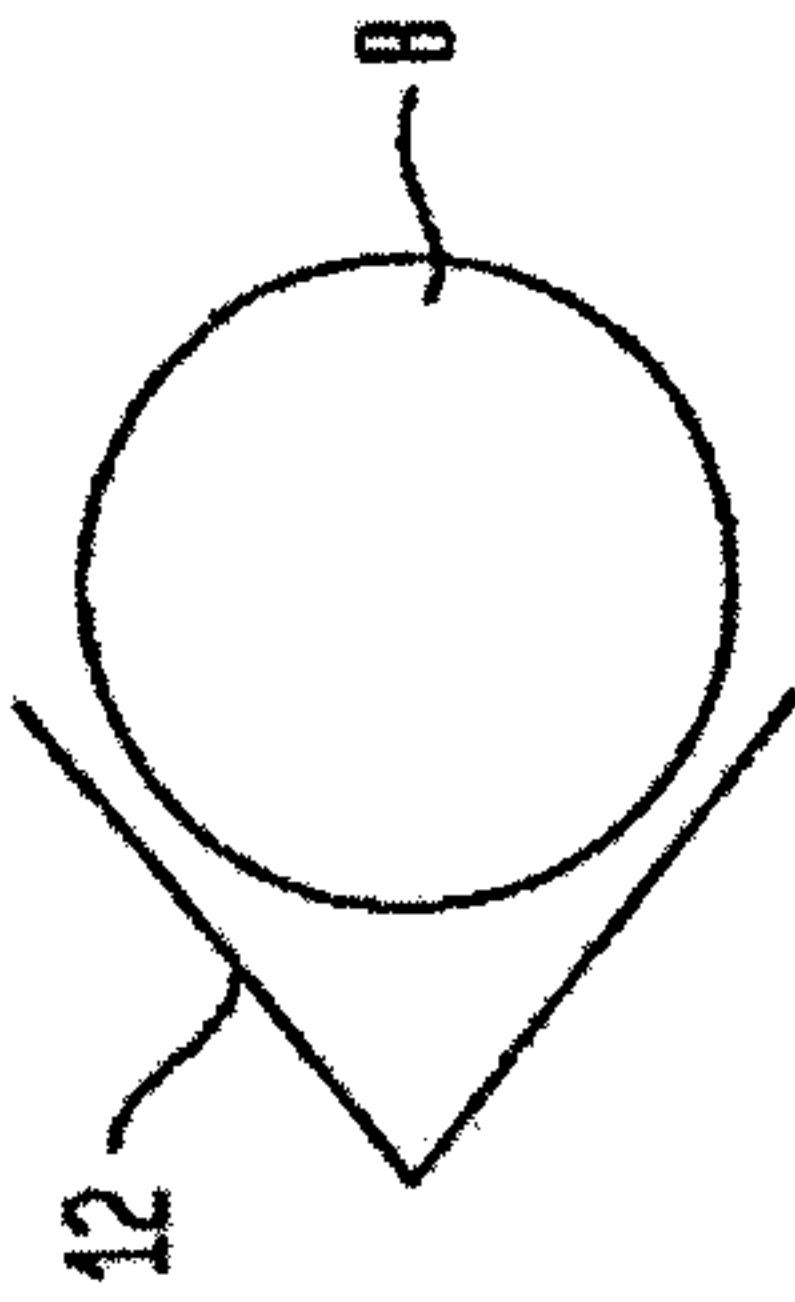


FIG. 4E

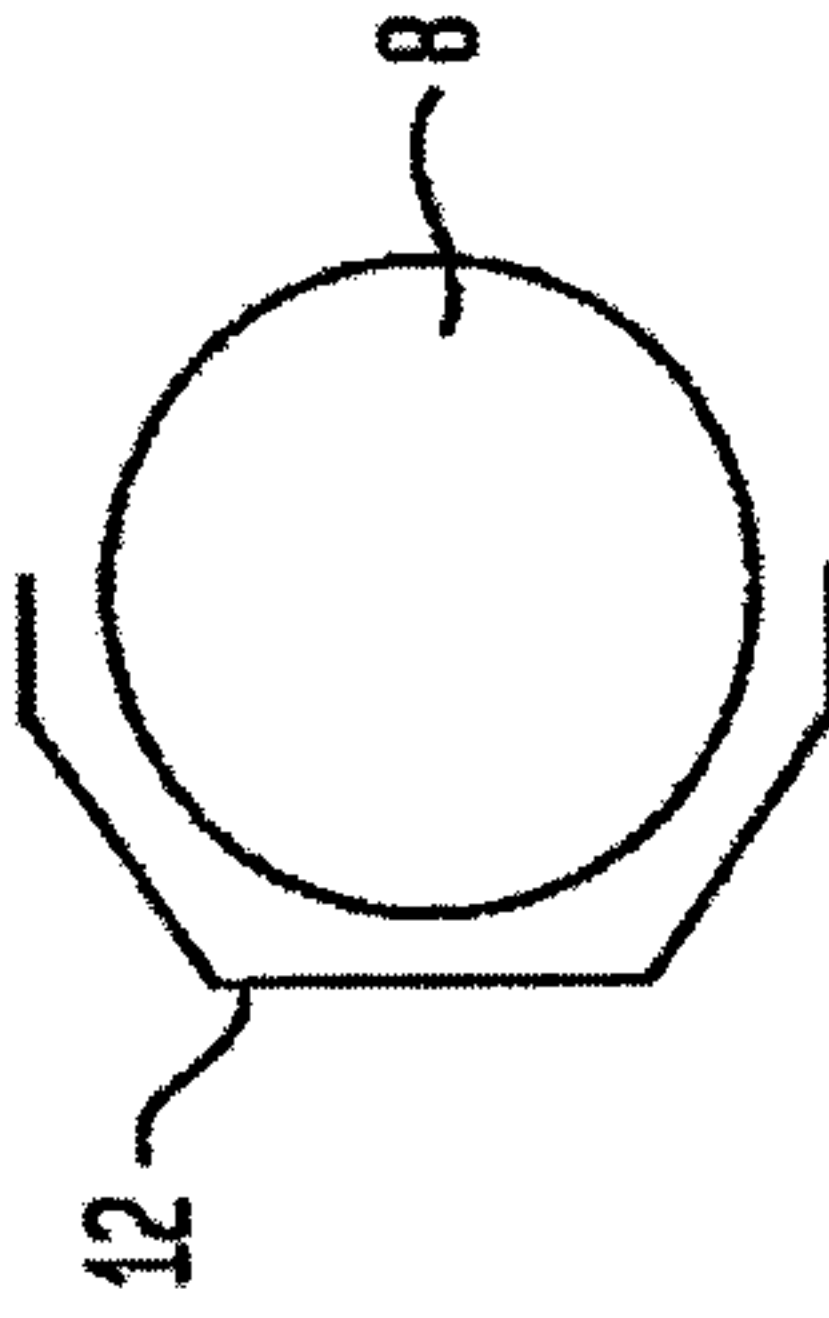


FIG. 4F

