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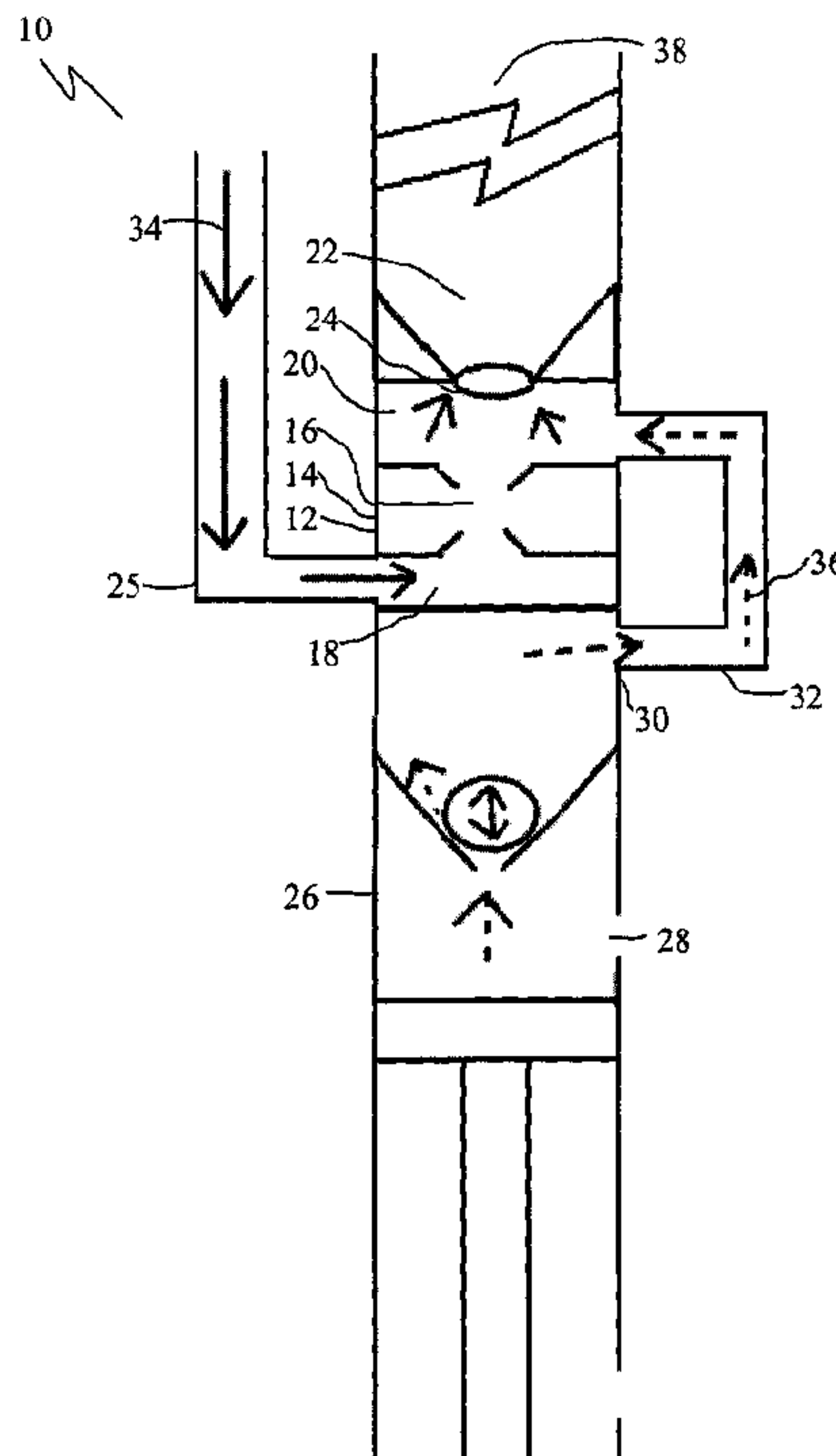
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(54) **Titre : PROCEDE ET APPAREIL DESTINE A REDUIRE L'EFFET INDESIRABLE DE LA PRESSION HYDROSTATIQUE SUR UNE POMPE DE FOND**

(54) **Title: METHOD AND APPARATUS FOR LESSENING THE ADVERSE EFFECT OF HYDROSTATIC PRESSURE ON A DOWN HOLE PUMP**



(57) **Abrégé/Abstract:**

A method and apparatus for lessening the adverse effect of hydrostatic pressure on a down hole pump. The method involves injecting gas into a column of liquid being pumped to surface by a down hole pump. The gas serves to reduce hydrostatic pressure of the column of liquid.

ABSTRACT OF THE DISCLOSURE

A method and apparatus for lessening the adverse effect of hydrostatic pressure on a down hole pump. The method involves injecting gas into a column of liquid being pumped to surface by a down hole pump. The gas serves to reduce hydrostatic pressure of the column
5 of liquid.

TITLE

[0001] Method and apparatus for lessening the adverse effect of hydrostatic pressure on a down hole pump

5 FIELD

[0002] There is described a method and associated apparatus for lessening the adverse effect that hydrostatic pressure has on the operation of a down hole pump.

BACKGROUND

10 [0003] Canadian Patent 2,453,072 (Hoffarth) is a down hole pumping apparatus that uses a reciprocating piston to lift a column of liquid to surface. As the height of the column of liquid increases, rising hydrostatic pressure makes it more difficult for the reciprocating piston to pump liquid to surface. The adverse effect of hydrostatic pressure is experienced with most, if not all, down hole pumps. What is required is a method and apparatus for lessening
15 the adverse effect of hydrostatic pressure on a down hole pump.

SUMMARY

[0004] According to one aspect there is provided a method for lessening the adverse effect of hydrostatic pressure on a down hole pump. The method involves injecting gas into a
20 column of liquid being pumped to surface by a down hole pump. The gas serves to reduce hydrostatic pressure of the column of liquid.

[0005] In explosive environments, such as hydrocarbon recovery, it is preferred that an inert gas, such as nitrogen be used.

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[0006] There are a variety of apparatus that can be used for gas injection. It is preferred that a venturi pump (sometimes referred to as a "jet pump") be used for gas injection.

[0007] According to another aspect there is provided an apparatus for lessening the
30 adverse effect of hydrostatic pressure on a down hole pump in the form of a pumping assembly. The pumping assembly includes both a venturi pump and a down hole liquid pump. The venturi pump has a body in which is positioned a venturi restriction, with a lower gas chamber below the venturi restriction and an upper mixing chamber above the venturi

restriction. A discharge conduit is in communication with the upper mixing chamber. The discharge conduit has a one way valve allowing fluids to pass from the upper mixing chamber into the discharge conduit and preventing fluids from passing from the discharge conduit into the upper mixing chamber. A gas conduit is connected to the lower gas chamber, whereby gas is fed into the lower gas chamber and through the venturi restriction. The down hole liquid pump is positioned below the venturi pump. The down hole liquid pump has an inlet for receiving well bore liquids and an outlet for discharging well bore liquids. A liquid conduit connects the outlet of the down hole liquid pump with the upper mixing chamber of the venturi. This configuration results in the liquid being aerated with gas prior to passing through the discharge conduit and becoming part of the column of liquid extending up the well toward the surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] These and other features will become more apparent from the following description in which reference is made to the appended drawings, the drawings are for the purpose of illustration only and are not intended to be in any way limiting, wherein:

FIG. 1 is a side elevation view, in section, of a well.

DETAILED DESCRIPTION

[0009] An apparatus for lessening the adverse effect of hydrostatic pressure on a down hole pump, in the form of a pumping assembly generally identified by reference numeral 10, will now be described with reference to **FIG. 1**.

Structure and Relationship of Parts:

[0010] Referring to **FIG. 1**, according to one aspect there is provided a method for lessening the adverse effect of hydrostatic pressure on a down hole pump. The method involves injecting gas 34 into a column of liquid 38 being pumped to the surface by a down hole pump 26. The gas 34 serves to reduce hydrostatic pressure of the column of liquid 38.

[0011] In explosive environments, such as hydrocarbon recovery, it is preferred that an inert gas, such as nitrogen be used.

[0012] There are a variety of apparatus that can be used for gas injection. It is preferred that a venturi pump 12 (sometimes referred to as a "jet pump") be used for gas injection.

5 [0013] Referring to **FIG. 1**, the pumping assembly 10 includes both a venturi pump 12 and a down hole liquid pump 26. The venturi pump 12 has a body 14 in which is positioned a venturi restriction 16, with a lower gas chamber 18 below the venturi restriction 16 and an upper mixing chamber 20 above the venturi restriction 16. A discharge conduit 22 is in communication with the upper mixing chamber 20. The discharge conduit 22 has a one way
10 valve 24 allowing fluids to pass from the upper mixing chamber 20 into the discharge conduit 22 and preventing fluids from passing from the discharge conduit 22 into the upper mixing chamber 20. A gas conduit 25 is connected to the lower gas chamber 18, whereby gas is fed into the lower gas chamber 18 and through the venturi restriction 16. The down hole liquid pump 26 is positioned below the venturi pump 16. The down hole liquid pump 26 has an
15 inlet 28 for receiving well bore liquids 36 and an outlet 30 for discharging well bore liquids 36. A liquid conduit 32 connects the outlet 30 of the down hole liquid pump 26 with the upper mixing chamber 20 of the venturi pump 12. This configuration results in the liquid 36 being aerated with gas 34 prior to passing through the discharge conduit 22 and becoming part of the column of liquid 38 extending up the well toward the surface.

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Operation:

[0014] Referring to **FIG. 1**, well bore liquids 36 enter the down hole liquid pump 26 via an inlet 28. The well bore liquids continue through the down hole pump 26 and through the outlet 30 which is connected with the upper mixing chamber 20 of the venturi pump 12 by a
25 liquid conduit 32. At the same time, gas 34 is injected into a gas conduit 25 which is connected to a lower gas chamber 18 of the venturi pump. The gas 34 passes through a venturi restriction 16 which is housed in the venturi body 14. The gas 34 and liquid 36 commingle in the upper mixing chamber 20 of the venturi pump 12. The gas 34 and liquid 36 mixture are allowed to flow through a one way valve 24 into a discharge conduit 22 that leads
30 to the surface. The one way valve 24 prevents the liquid from flowing out of the discharge conduit 22 back into the upper mixing chamber 20.

[0015] In this patent document, the word "comprising" is used in its non-limiting sense to mean that items following the word are included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one of the elements.

[0016] The following claims are to be understood to include what is specifically illustrated and described above, what is conceptually equivalent, and what can be obviously substituted. Those skilled in the art will appreciate that various adaptations and modifications of the described embodiments can be configured without departing from the scope of the claims. The illustrated embodiments have been set forth only as examples and should not be taken as limiting the invention. It is to be understood that, within the scope of the following claims, the invention may be practiced other than as specifically illustrated and described.

What is claimed is:

1. A method of lessening the adverse effect of hydrostatic pressure on a down hole pump, comprising:

pumping liquid into a mixing chamber with a down hole liquid pump positioned below a venturi pump;

injecting gas into the mixing chamber, with the venturi pump, wherein the gas serves to reduce hydrostatic pressure of a column of liquid being pumped to the surface.

2. The method of claim 1, the gas being an inert gas.

3. An apparatus for lessening the adverse effect of hydrostatic pressure on a down hole pump, comprising in combination:

a venturi pump having a body in which is positioned a venturi restriction, a lower gas chamber below the venturi restriction and an upper mixing chamber above the venturi restriction;

a discharge conduit in communication with the upper mixing chamber, the discharge conduit having a one way valve allowing fluids to pass from the upper mixing chamber into the discharge conduit and preventing fluids from passing from the discharge conduit into the upper mixing chamber;

a gas conduit connected to the lower gas chamber, whereby gas is fed into the lower gas chamber and through the venturi restriction;

a down hole liquid pump position below the venturi pump, the liquid pump having an inlet for receiving well bore liquids and an outlet for discharging well bore liquids;

a liquid conduit connecting the outlet of the down hole liquid pump with the upper mixing chamber of the venturi pump.

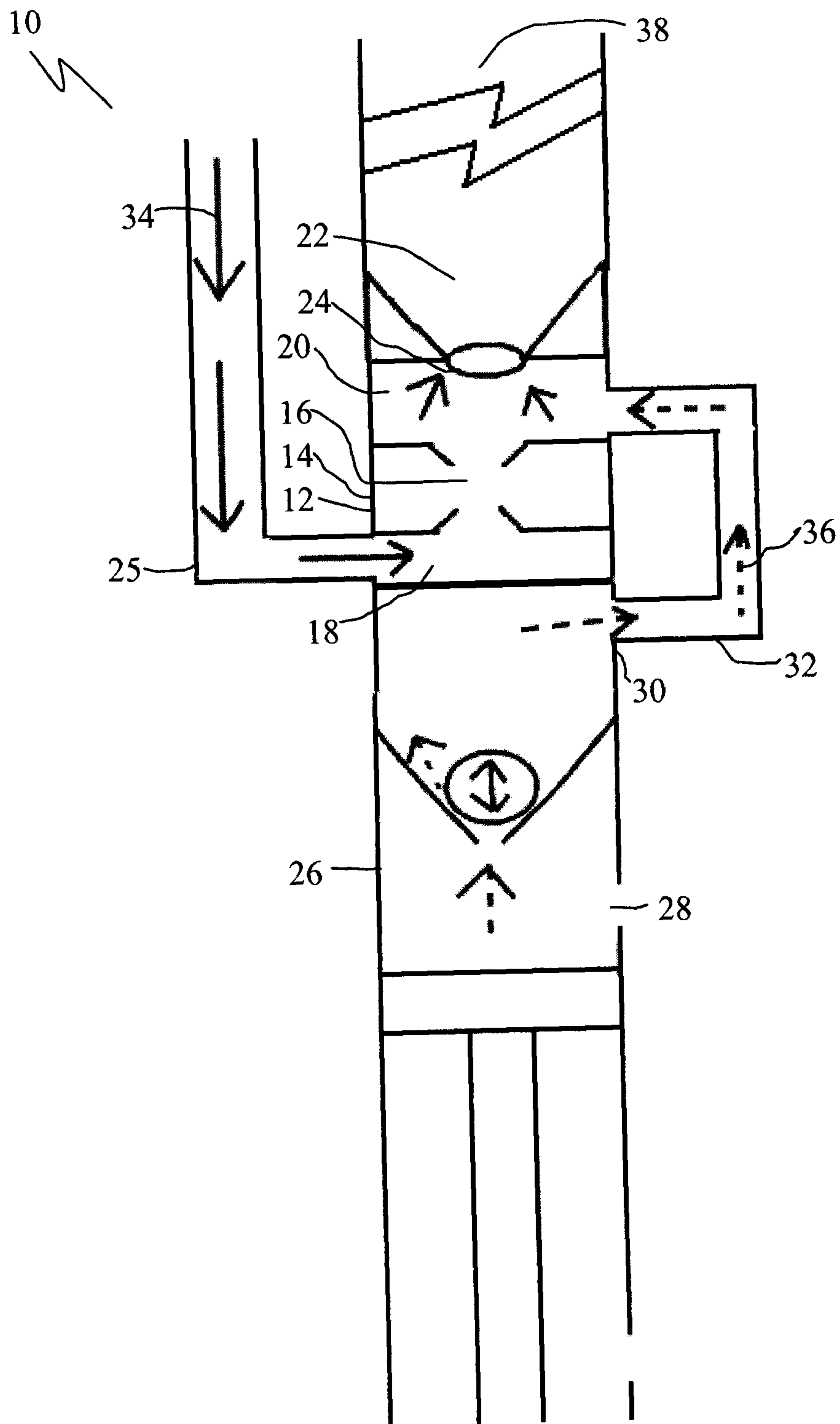


FIG. 1

