

[54] JET AGITATOR ASSEMBLY

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[58] Field of Search 259/4, 95, 96; 137/563, 137/604; 417/198, 151, 431; 239/142, 432, 487, 568

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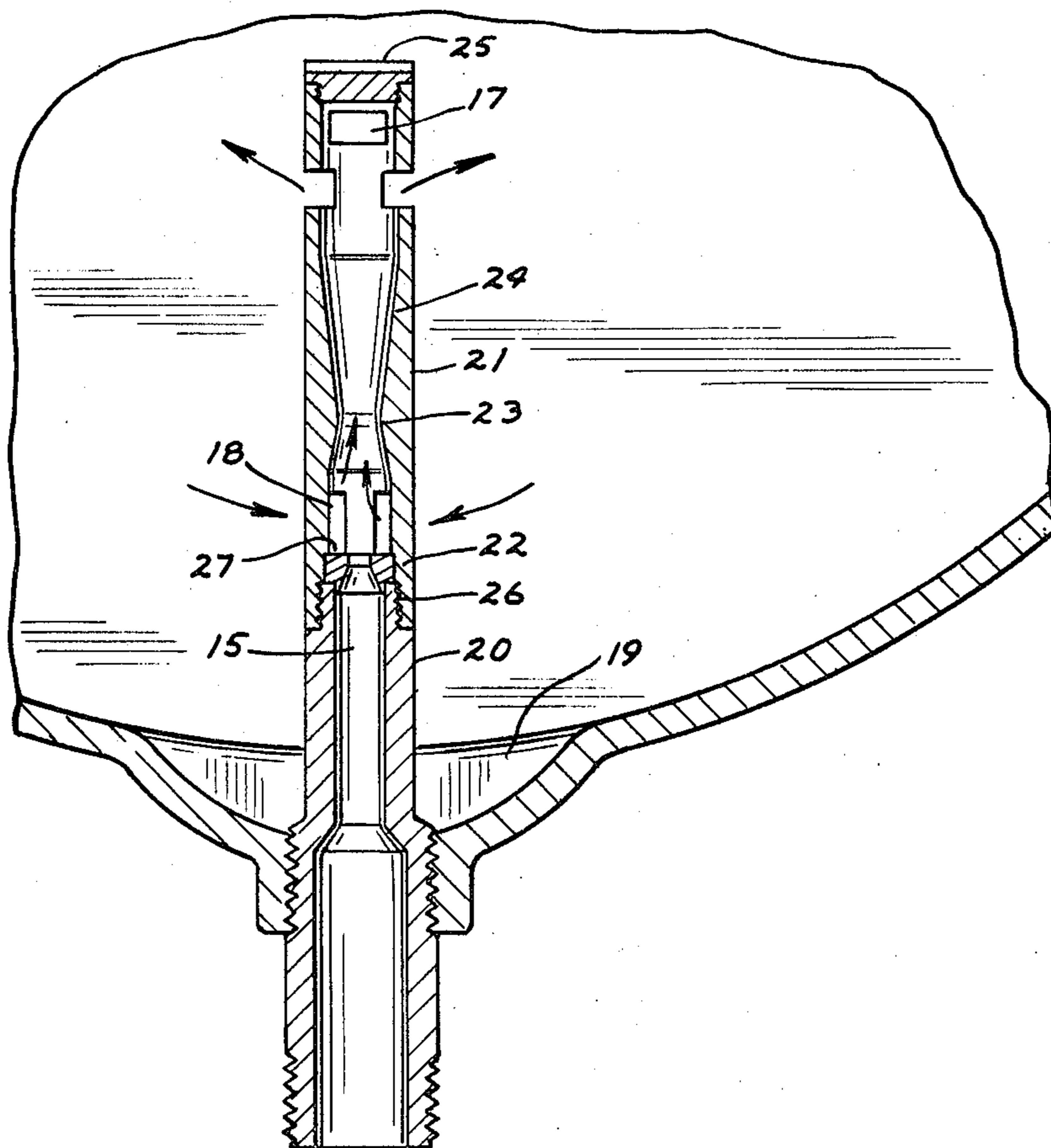
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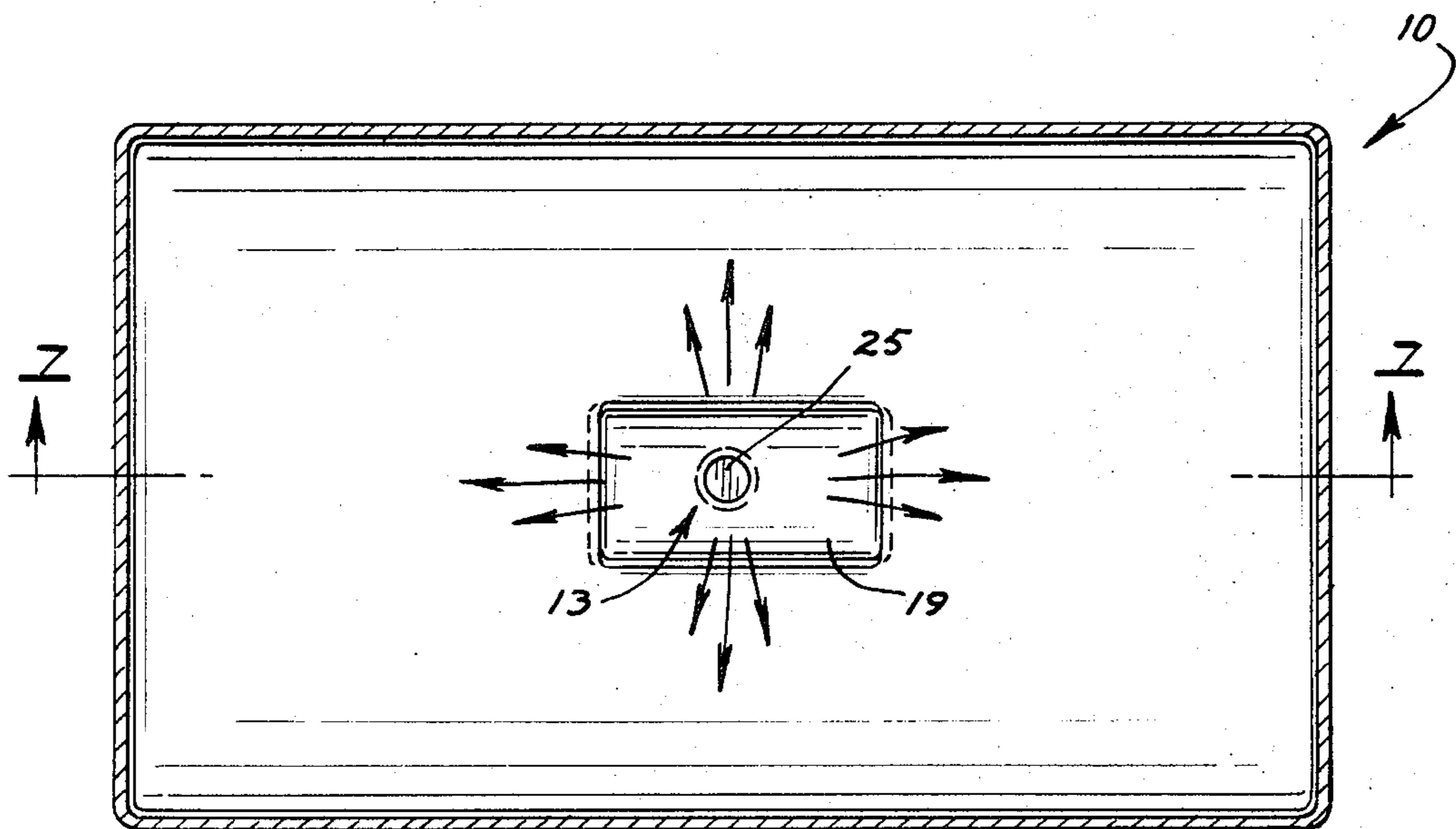
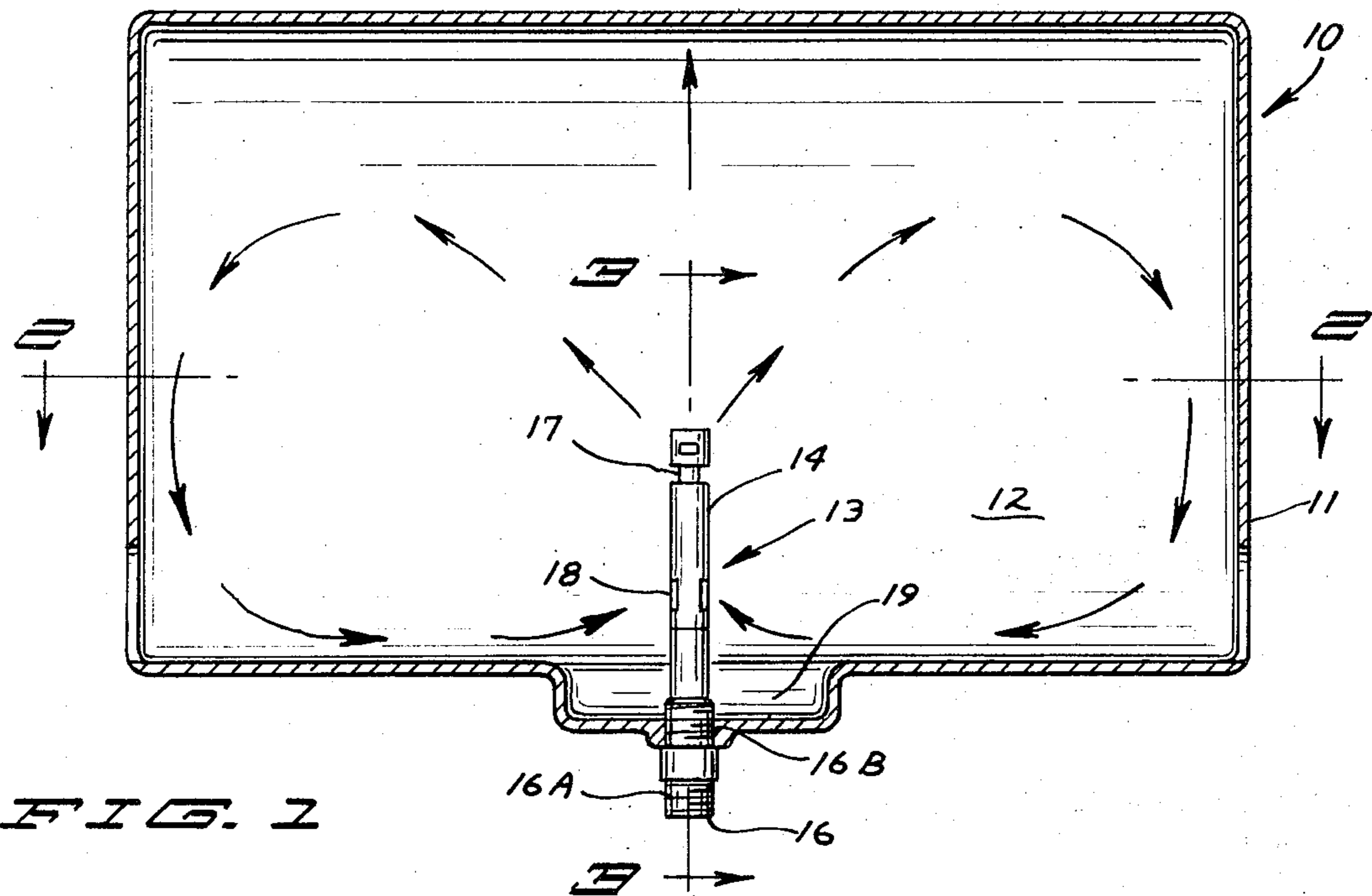
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ABSTRACT

Venturi mixer means comprising a hollow cylindrical body with a rearward inlet port and a forward outlet port, and with replaceable orifice means being disposed rearwardly adjacent said inlet port. Venturi throat means having a throat area greater than the area of the orifice means are disposed forwardly of the orifice, with a plurality of radially disposed inlet openings being formed within said body between the orifice and the throat. The forward outlet port is preferably formed of a plurality of radially disposed openings for enhancing fluid agitation.

5 Claims, 4 Drawing Figures





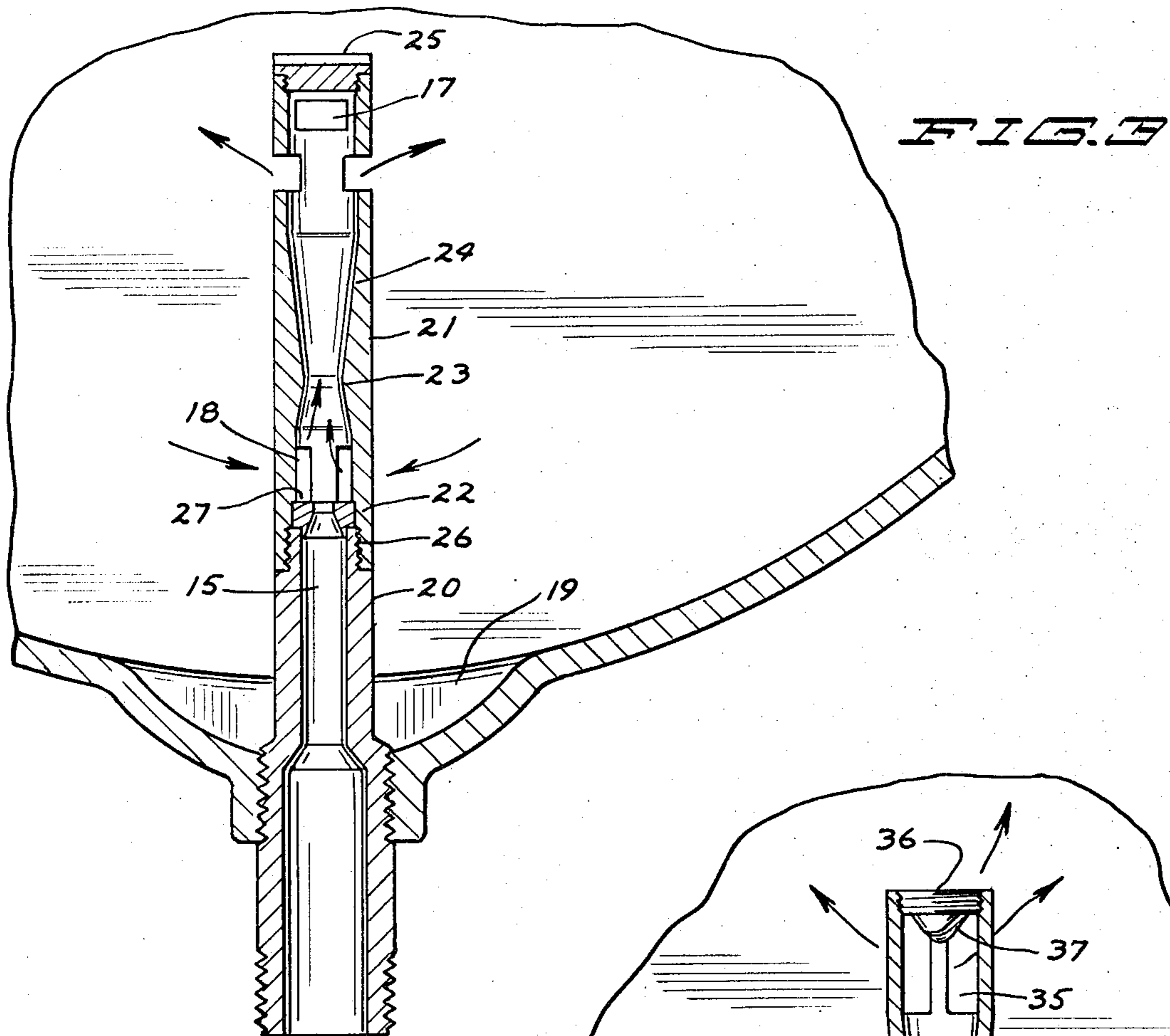
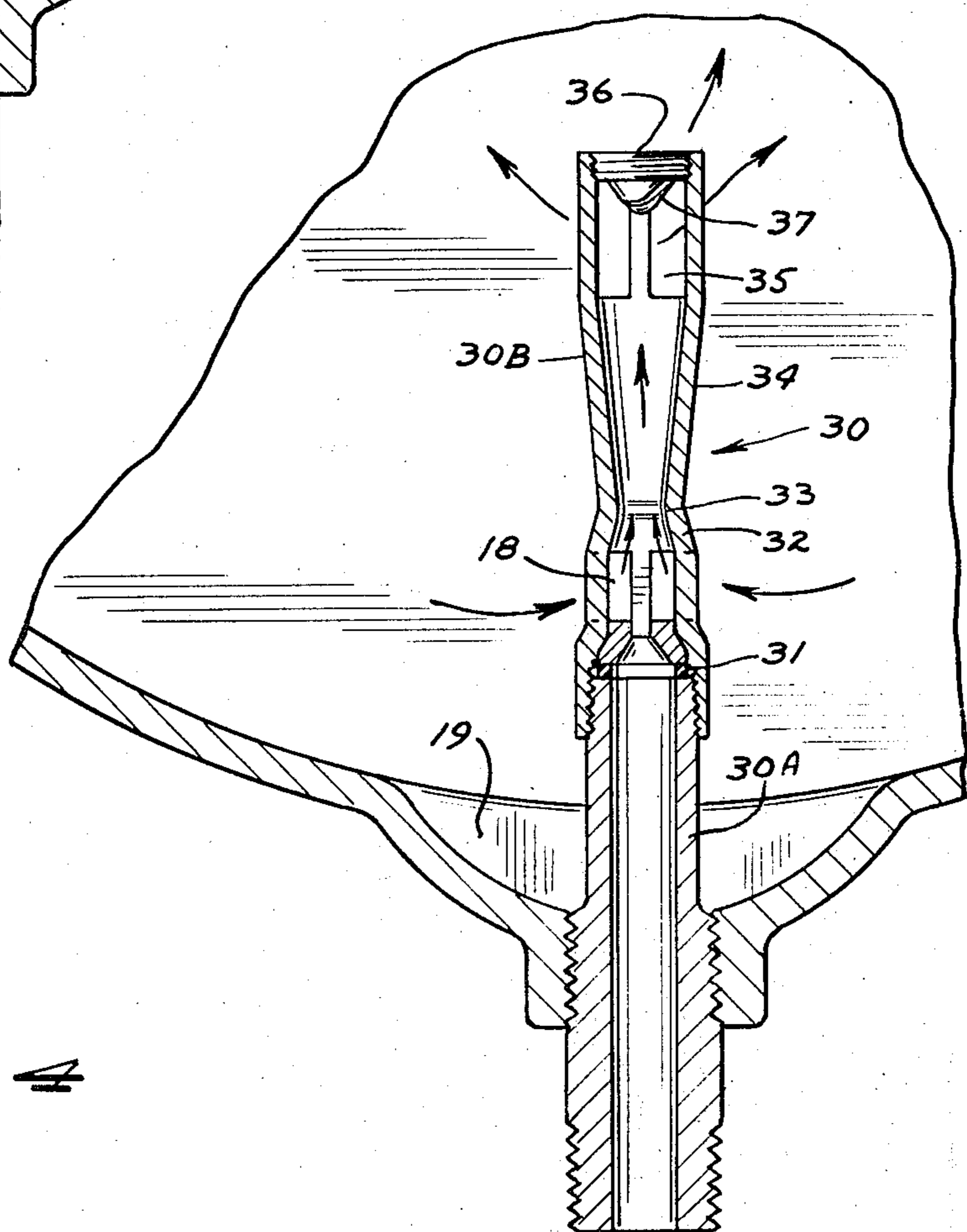


FIG. 4



JET AGITATOR ASSEMBLY

BACKGROUND OF THE INVENTION

The present invention relates generally to Venturi mixer nozzles, and more particularly to Venturi mixer nozzles utilized to provide agitation within a fluid storage tank. Venturi-type mixer nozzles of the present invention are normally employed as bypass mixer nozzles in fluid systems.

Wettable powders are frequently employed for use as active ingredients for a variety of applications, including, for example, agricultural herbicides, insecticides or fungicides, as well as other industrial uses. Whenever wettable or water soluble powders are mixed into solution, there is a tendency for certain of the dissolved or suspended solid particles to settle out from the solution and collect at the bottom of the tank or container. In order to enhance the accuracy and predictability of the application, these wettable powders or water soluble powders should be maintained in substantially homogeneous suspension at all times. In order to accomplish this result, the solution should be constantly agitated.

In a typical application, a sprayer is mounted on a vehicle, with a pump being utilized to transfer the fluid from the storage tank or vessel to the spray nozzles. Normally, agitation is provided through a bypass of a portion of the solution being pumped from the tank to the spray nozzles to allow the bypass solution to return to the vessel or tank where it is discharged through a Venturi nozzle. The Venturi nozzle will normally be positioned near the bottom of the container to assist in drawing the settling or precipitating particles and surrounding liquid into the Venturi whereupon it is discharged with force sufficient to accomplish the desired agitation.

At the present time, these Venturi nozzles normally are formed of a single self-contained Venturi unit with a bore extending through the body thereof, thus providing an inlet and an outlet. Inlet openings or "windows" are provided adjacent the Venturi throat in order to permit the surrounding fluid to enter the agitator nozzle and pass through the system, thus enhancing the agitation capability of the structure. Thus, the Venturi mixer nozzles are provided with a pressure inlet which derives its pressure from the bypass of the system pump, an aspirating inlet which is in communication with the fluid being agitated, and an outlet which accommodates flow from the combined inlets.

In order to assure the flow of liquid from that portion retained within the tank, an orifice is provided which controls the fluid flow from the pressure source.

While these systems have been generally acceptable and widely used in the past, it has been found that, pursuant to the present invention, the outlet openings in the mixer nozzle should be radially disposed, thus enhancing the agitation of the fluid within the tank, and reducing the tendency toward stratification. Furthermore, the area of the outlet ports is sufficiently large so as to accommodate the flow of fluids entering the nozzle from the pressure source as well as the aspiration source.

SUMMARY OF THE INVENTION

In the structure of the present invention, the nozzle body is preferably formed in two axially elongated seg-

ments, with the orifice being retained in position against the shoulders of a counterbore formed in one of the segments.

Therefore, it is a primary object of the present invention to provide an improved hollow cylindrical Venturi mixer nozzle having an inlet at one end, an outlet at the other end, and an aspirating inlet therebetween, with the outlet being formed of a plurality of radially spaced openings.

It is a further object of the present invention to provide an improved elongated cylindrical Venturi mixer nozzle having a body formed of a pair of mating segments having a bore extending therethrough, and with counterbore means being formed adjacent the ends of one of the segments for providing retention shoulders to receive and retain a flow controlling orifice therein, and with the outlet from the system being in the form of radially spaced openings.

It is yet a further object of the present invention to provide an improved Venturi mixer means which is adapted to be received within a storage tank or vessel, and when in operation, provide agitation for the system to avoid stratification of the retained liquid.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the improved Venturi mixer nozzle means of the present invention, with the nozzle means being shown mounted within a typical storage vessel, and with the storage vessel being illustrated in section, the section being taken along the line and in the direction of the arrows 1—1 of FIG. 2;

FIG. 2 is a horizontal sectional view taken along the line and in the direction of the arrows 2—2 of FIG. 1;

FIG. 3 is a detail sectional view of the nozzle structure illustrated in FIG. 1, and on a slightly enlarged scale, with a portion of the storage tank being broken away; and

FIG. 4 is a view similar to FIG. 3, and illustrating a slightly modified form of the Venturi mixer nozzle means of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With attention being directed to FIGS. 1 and 2 of the drawings, the agitation system generally designated 10 is disposed within the tank 11, the interior of which is shown at 12. The Venturi mixer nozzle means generally designated 13 is shown mounted within the tank 11, the nozzle means including a body 14 with a through-bore 15 extending therethrough. Bore 15 is in communication with inlet 16 and each pair of arcuately and axially spaced outlet ports 17—17. A plurality of inlet openings 18—18 are arranged along the body 14 of the Venturi mixer nozzle means 13, with the details of these openings being discussed more fully hereinafter. A sump dish 19 may be provided, as indicated.

As is illustrated in FIGS. 1 and 3, pipe-to-hose coupling threads are provided as at 16A, and a threaded shank portion is provided at 16B in order to threadedly engage the body 14 of Venturi mixer nozzle means 13 within the threaded opening formed in the wall of tank 11. A spacer collar area is disposed between the two

threaded portions in order to assist in the mounting of the nozzle 13 within the tank.

Attention is now directed to FIG. 3 of the drawings for a more complete description of the interior of Venturi mixer nozzle means 13. In this connection, the body 14 consists of a pair of individual axially aligned and coupled segments 20 and 21, with orifice 22 being disposed adjacent the juncture point of the segments 20 and 21. Venturi throat 23 is disposed forwardly of orifice 22, with expansion zone 24 extending between throat 23 and each pair of arcuately and axially spaced outlet ports 17—17. Plug 25 is threadedly engaged within the forward tip end portion of segment 21, as is illustrated in FIG. 3.

It is appreciated, therefore, that body 14 provides an elongated hollow cylindrical body with bore 15 extending therethrough. Orifice 22 has a certain first predetermined area which is small relative to the area of Venturi throat 23. The Venturi throat is of larger area in order to accommodate the greater flow which will pass through throat area 23, this flow including the main pressure flow entering inlet 16, as well as the aspiration flow entering inlet openings 18—18.

In a typical operational embodiment for agricultural spray systems, the orifice 22 will have an area suitable for accommodating flow of 7 gallons per minute, with the throat 23 having an area suitable for accommodating flows of from 17 to 20 gallons per minute. The additional 10 to 13 gallons per minute is obtained for the system through inlet openings 18—18, with the outlet openings 17—17 having an area suitably larger than the area of throat 23 for readily accommodating the total outlet flow of 17 to 20 gallons per minute. With continued attention being directed to FIG. 3 of the drawings, it will be seen that segments 20 and 21 are threadedly engaged with each other in and along mating threads 26. Orifice 22 is appropriately received within counterbore 27 formed within segment 21.

In this manner, orifice 22 may be readily removable from the system, and retained in place by the shoulders of counterbore 27 and the forward tip end of segment 20. If it is desired to change orifices so as to accommodate other flow volumes, this can be accomplished without significant difficulty.

Attention is now directed to FIG. 4 of the drawings wherein a modified Venturi mixer nozzle means is illustrated. Accordingly, the nozzle means generally designated 30 has a pair of body segments 30A and 30B, coupled together as indicated, and having a fluid transmitting bore extending therethrough. Orifice 31 is interposed in the bore adjacent the junction between segments 30A and 30B, with a Venturi being formed in the bore forwardly of orifice 31. The Venturi means includes a contraction or compression zone 32, a throat zone 33, and an expansion zone 34. As is indicated, inlet ports 18—18 communicate with the main bore through the walls of segment 30B, the inlet openings being disposed between the orifice 31 and the Venturi throat 33. Outlet ports, radially disposed, are provided as at 35, with the through-bore being closed by means of threaded plug member 36. It will be observed that plug member 36 has a plurality of generally helically arranged slots or grooves 37 formed therewithin, these slots or grooves extending radially in a direction which is counter to that of the threads for plug 36 in order that the force which the fluid exerts on plug 36 will tend to tighten the plug member within the confines of

the segment 30B. This groove has been found to enhance the swirling effect of the fluid as it leaves the nozzle through outlet openings 35—35, the swirling effect enhancing agitation and reducing the tendency toward stratification.

In a typical operational environment, for agricultural spray purposes, a pump is provided which delivers approximately 12.5 gallons per minute at 50 psi. Total capacity for all of the nozzles on the spray boom is recommended at 9 gallons per minute, with the extra output from the pump being available for agitation. With 40 psi spraying pressure, a 5/32 inch orifice will be employed, while if 30 psi spraying pressure is utilized, a 3/16 inch orifice will be utilized. In the system illustrated, the area of the inlet openings 18—18 is preferably approximately 0.38 square inch, with the area of the outlet openings 17—17 totalling approximately 0.56 square inch. The diameter of the Venturi throat, such as throat 23, is preferably approximately 1 1/32 inch in the example given.

In the example given, sufficient agitation is available to accommodate storage tanks or vessels having capacities up to about 100 gallons, it being recommended that additional Venturi mixer nozzle means be employed for large volume tanks.

I claim:

1. Venturi mixer means comprising:

- a. an elongated hollow cylindrical body with an axial bore formed therewithin and having rearwardly disposed inlet port means and forwardly disposed outlet port means with said axial bore terminating in a generally closed forward end;
- b. orifice means of predetermined area, and seating means within said body for positioning said orifice means rearwardly within said bore and adjacent said inlet port;
- c. throat means of area greater than said predetermined area mounted within said hollow cylindrical body and disposed within said bore and providing a restriction for flow, and including a forward expansion chamber between said throat means and said outlet port;
- d. a plurality of radially disposed inlet openings formed through said hollow cylindrical body and being positioned between said orifice means and said throat means and communicating with said bore;
- e. said forward outlet port means being a plurality of radially disposed openings through the wall of said hollow cylindrical body, with the combined area of said radially disposed openings forming said forward outlet port being greater than that of said throat means.

2. The Venturi mixer nozzle means as defined in claim 1 being particularly characterized in that said orifice means is a disc removably secured within said hollow cylindrical body.

3. The Venturi mixer nozzle means as defined in claim 1 being particularly characterized in that said hollow cylindrical body comprises mating forward and rearward segments.

4. Venturi mixer means comprising:

- a. an elongated hollow cylindrical body with an axial bore formed therewithin and having rearwardly disposed inlet port means and forwardly disposed outlet port means;

- b. orifice means of predetermined area, and seating means within said body for positioning said orifice means rearwardly within said bore and adjacent said inlet port;
 - c. throat means of area greater than said predetermined area mounted within said hollow cylindrical body and disposed within said bore and providing a restriction for flow, and including a forward expansion chamber between said throat means and said outlet port;
 - d. a plurality of radially disposed inlet openings formed through said hollow cylindrical body and being positioned between said orifice means and said throat means and communicating with said bore;
 - e. said forward outlet port means being a plurality of radially disposed openings through the wall of said hollow cylindrical body, and including arcuately and axially spaced openings.
5. Venturi mixer means comprising:
- a. an elongated hollow cylindrical body with an axial bore formed therewithin and having rearwardly disposed inlet port means and forwardly disposed outlet port means, said bore terminating in a for-

- wardly disposed plug, said plug having a rearwardly directed conical projection extending into said bore to an axial position adjacent said forward outlet port means, said conical projection having a helical groove formed within the surface thereof;
 - b. orifice means of predetermined area, and seating means within said body for positioning said orifice means rearwardly within said bore and adjacent said inlet port;
 - c. throat means of area greater than said predetermined area mounted within said hollow cylindrical body and disposed within said bore and providing a restriction for flow, and including a forward expansion chamber between said throat means and said outlet port;
 - d. a plurality of radially disposed inlet openings formed through said hollow cylindrical body and being positioned between said orifice means and said throat means and communicating with said bore;
 - e. said forward outlet port means being a plurality of radially disposed openings through the wall of said hollow cylindrical body.
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