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[54] **VERTEX TRANSPORT**
12 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **239/11,**
46/9, 98/58, 137/604, 239/1, 239/291
[51] **Int. Cl.** **B05b 17/04**
[50] **Field of Search** 239/1, 11, 291; 137/604; 131/172, 171, 178; 98/58, 59, 60; 46/9

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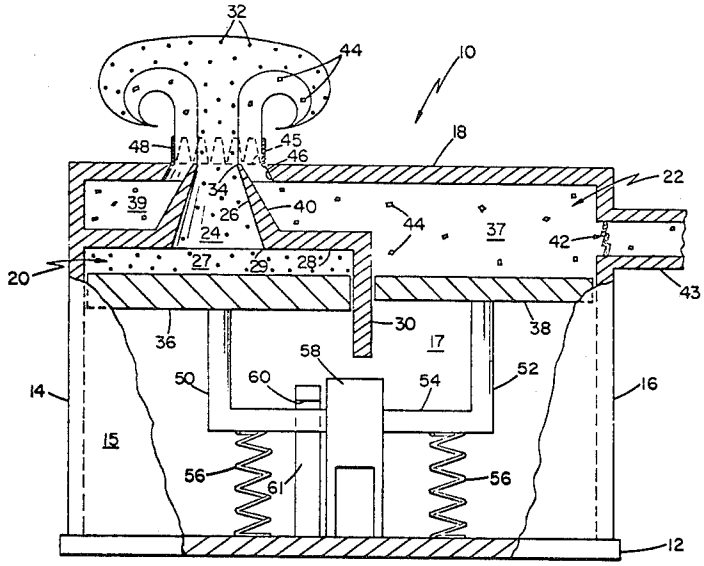
ABSTRACT: Moving a first fluid through a second fluid by incorporating the first fluid and a blanket fluid in a vortex having a surrounding outer layer of blanket fluid and impelling the vortex through the second fluid.



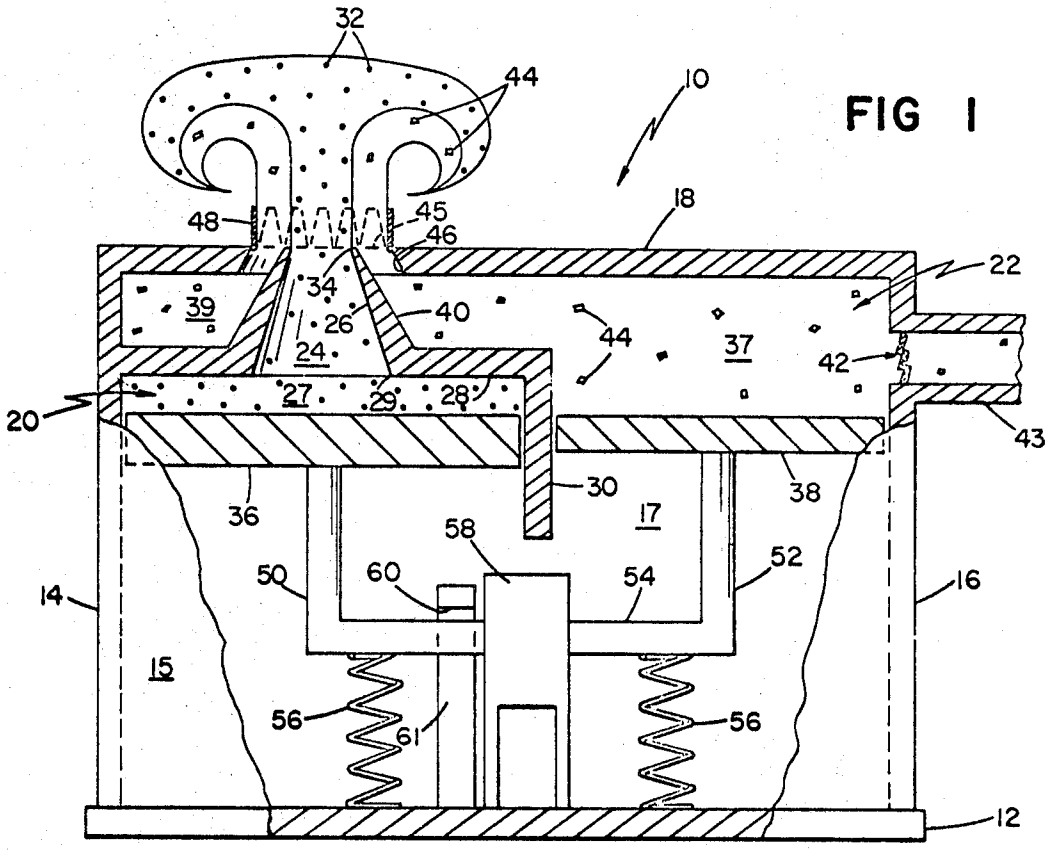

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FIG 1

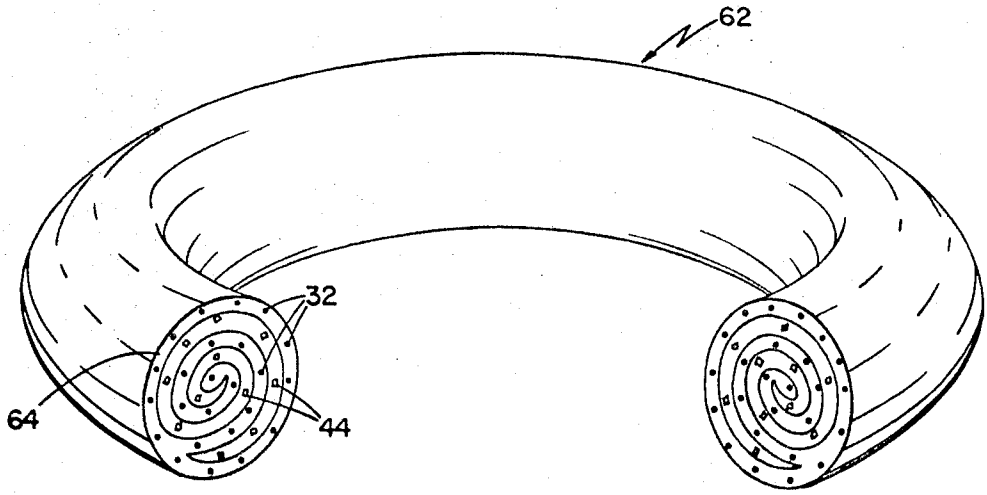
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FIG 2

VERTEX TRANSPORT

This invention relates to transport of one fluid through another fluid, such as a pollutant-bearing gas through the atmosphere, with little mixing of the fluids during transport.

It is the primary object of the invention to achieve such transport.

The invention features moving a first fluid through a second fluid by incorporating the first fluid and a surrounding outer layer of a blanket fluid in a vortex and impelling the vortex through the second fluid. In preferred embodiments, a pollutant-bearing gas is discharged in a toroidal vortex ring formed of pollutant-bearing air and a surrounding air layer; the toroidal vortex ring is formed and discharged into the atmosphere by ejecting, simultaneously, air from a circular opening and pollutant-bearing air from a concentric annular opening, closely spaced from the circular opening; and ejection is by two pistons operating in two chambers communicating, respectively, with the pollutant-bearing and blanket gases and with the two openings, the pollutant-containing chamber being open to the atmosphere and closed to the pollutant-bearing gas only during ejection.

Other objects, features, and advantages will appear from the following description of a preferred embodiment of the invention, taken together with the attached drawings thereof in which:

FIG. 1 is a view, partially in section, of a preferred embodiment of the invention, during gas discharge; and

FIG. 2 is a perspective view, partially broken away, of gases discharged in accordance with the invention. In the figures there is shown a pollutant discharge apparatus 10, having a base wall 12, exterior surrounding walls 14, 15, 16, 17 and an upper wall 18, and including a blanket gas chamber 20 and a pollutant-bearing gas chamber 22. Blanket gas chamber 20 includes a conical portion 24, formed by inner frustoconical annular surface 26, and a rectangular portion 27, formed by horizontal wall 28, which includes a circular opening 29, communicating with conical portion 24, exterior vertical walls 14, 15, 17 and an inner vertical wall 30, extending between exterior walls 15, 17. Blanket gas is provided by ambient gas (schematically illustrated by particles 32) to which blanket gas chamber 20 is open through circular opening 34 formed by an end of inner frustoconical annular surface 26. Rectangular piston 36 is sized to slide freely but closely in rectangular portion 27 of chamber 20. Pollutant-bearing gas chamber 22 includes a rectangular portion 37, beneath upper wall 18, formed by inner wall 30, and exterior walls 15, 16, 17 in which rectangular piston 38 may freely but closely slide; chamber 22 includes also a communicating annular portion 39, surrounding outer frustoconical surface 40.

Pollutant-bearing gas chamber 22 is separated by normally open shutter valve 42 (shown closed in FIG. 1) from conduit 43 which communicates with a source (not shown) of pollutant-bearing gas (schematically illustrated by particles 44) and is in communication with ambient gas by annular opening 45, defined by outer annular surface 40 and by a parallel concentric tapered bore 46 in upper wall 18 of apparatus 10. Opening 45 is normally closed by annular shutter valve 48 (shown open in FIG. 1). Pistons 36, 38 are connected, through shafts 50, 52, respectively, to a common crossarm 54, which is secured to base 12 by compression springs 56. Drive motor 58 is supported on base 12 and includes structure for intermittently engaging and lowering crossarm 54 down against springs 56, and intermittently disengaging crossarm 54 to allow it to be pulsed upwardly by springs 56. A stop 60 is secured on base 12 by supporting rod 61, and extends over crossarm 54 to limit its upward movement.

In operation, with pistons 36, 38 in their lowered position, a pollutant-bearing gas enters chamber 22 through conduit 43 and open shutter valve 42, with shutter valve 48 closed (valve 42 opening and valve 48 closing during the down stroke of the pistons). Ambient gas fills blanket gas chamber 20 through circular opening 34. Upon disengagement from drive motor 58, the pistons will be driven upwardly by the compressed force of springs 56, piston 36 ejecting blanket gas from chamber 20, while piston 38 simultaneously ejects pollutant-bearing gas from chamber 22 (valve 42 closing and valve 48 opening during this up stroke). The ejected blanket gas surrounds the ejected pollutant-bearing gas, as shown in FIG. 1, by forming a toroidal vortex ring 62 (FIG. 2), having a surface layer 64 consisting entirely of blanket gas. Since the moving pollutant-bearing gas is entirely surrounded by moving blanket or ambient gas, turbulence at the outside of the toroidal vortex ring caused by movement of the ring through the relatively stationary ambient gas will result only in mixing of moving ambient gas with stationary ambient gas, no appreciable amounts of pollutant being able to escape into the stationary ambient gas. Thus, for example, gases bearing pollutants may be transferred far up into the atmosphere before there occurs any mixing of the pollutant into the ambient air.

Other embodiments will occur to those skilled in the art and are within the following claims.

What I claim is:

1. A method for moving a parcel of a first fluid through a second fluid comprising incorporating in a toroidal vortex ring said parcel and a parcel of a blanket fluid surrounding said parcel of a first fluid and impelling said vortex through said second fluid.

2. The method of claim 1 including incorporating said first fluid in a toroidal vortex ring by ejecting, simultaneously, into said second fluid, a mass of blanket fluid from a central opening and a mass of first fluid from an opening surrounding and closely spaced from said central opening.

3. The method of claim 2 wherein said central opening is circular and said surrounding opening is annular.

4. The method of claim 2 including the step of continuing to eject said blanket fluid after complete ejection of said mass of first fluid.

5. The method of claim 1 wherein said first fluid is discharged into an ambient fluid, and said ambient fluid supplies said blanket fluid.

6. The method of claim 1 wherein all said fluids are gases.

7. The method of claim 6 wherein said first fluid is a pollutant-bearing gas and said ambient fluid is air.

8. Apparatus for enclosing a first fluid in a blanket fluid for discharge in a vortex through an outer fluid comprising

a source of said blanket fluid including a central port,

a source of said first fluid including a port surrounding and closely spaced from said central port, and

an intermittent ejector for pulsedly and simultaneously ejecting a predetermined mass of blanket fluid from said central port and a predetermined mass of first fluid from said surrounding port.

9. The apparatus of claim 8 including an interruptor for disconnecting said surrounding port from said outer fluid except during ejection of said fluid masses.

10. The apparatus of claim 9 wherein said blanket fluid source comprises a blanket fluid chamber communicating with said central port, said first fluid source comprises a first fluid chamber communicating with said surrounding port, and said ejector comprises a first piston movable in said blanket fluid chamber, a second piston movable in said first fluid chamber, and drive means for driving said pistons simultaneously into said chambers toward said ports to eject simultaneously said predetermined masses of said fluids.

11. The apparatus of claim 10 including structure for closing communication into said first fluid chamber during ejection of said fluids.

12. Apparatus for enclosing a first fluid in a blanket fluid for discharge in a vortex through a second fluid comprising

a source of first fluid,

a source of blanket fluid,

a wall carrying a flow separating edge for flow of said first fluid from said wall at the edge,

a flow directing element for directing a stream of said first fluid in a course along said wall, past said edge, and away

from said wall, said stream in its course away from said wall being contiguous with said second fluid, and

a second flow directing element for directing a discharge of said blanket fluid into a course interposed between said first and said second fluids.