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METHOD AND APPARATUS FOR BRINGING GASES, LIQUIDS
AND/OR PULVERIZED SOLID BODIES INTO
INTIMATE CONTACT WITH EACH OTHER

Filed March 15, 1966

2 Sheets-Sheet 2

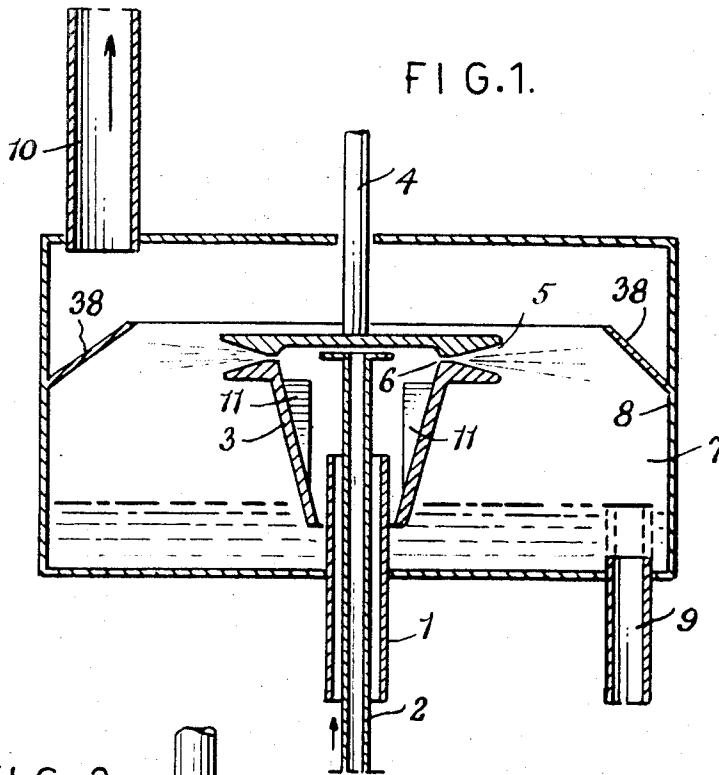


FIG. 2.

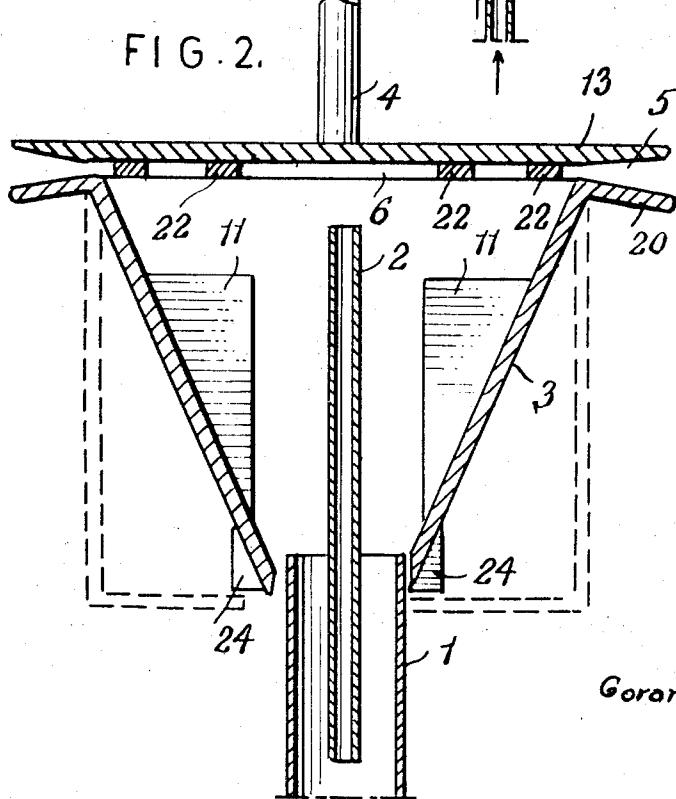
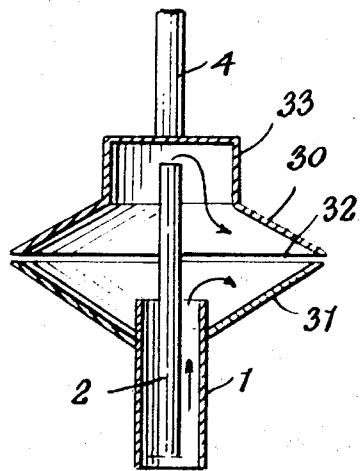


FIG. 3.



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FIG. 4.

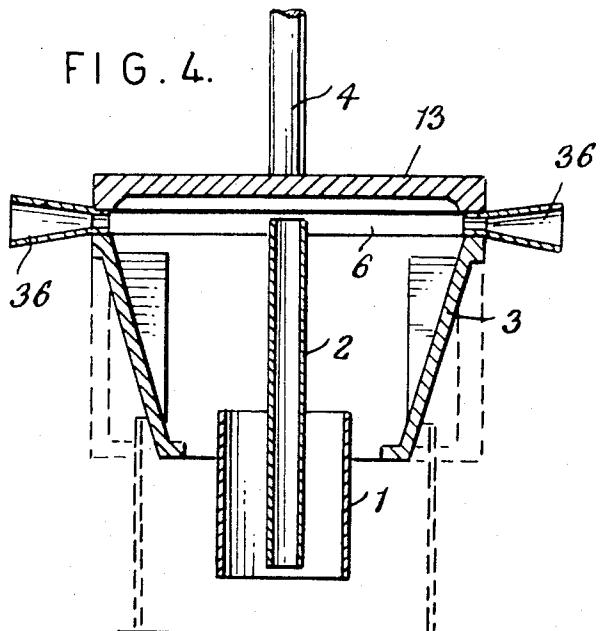
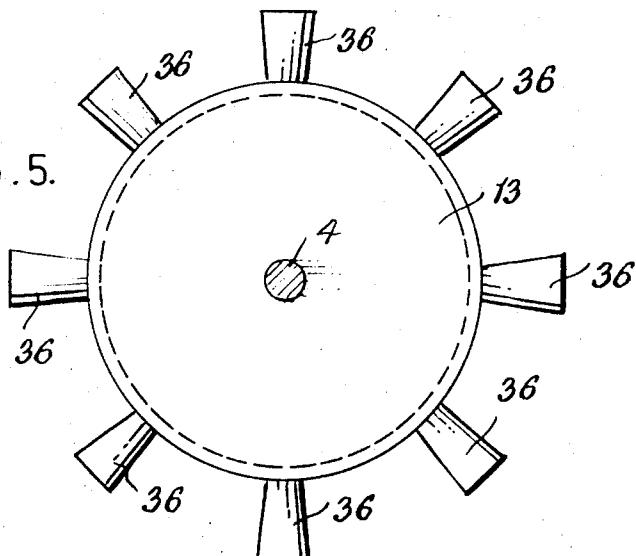


FIG. 5.



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7 Claims

ABSTRACT OF THE DISCLOSURE

Method and apparatus for bringing a gaseous medium and a liquid medium into intimate contact with each other by introducing them into a centrifuging drum which rotates within a chamber wherein it is whirled about and forced out through slots in the drum into a chamber wherein the pressure is lower than that generated by the centrifuging drum, causing the liquid and gas components to become separated by the pressure drop upon entry into the chamber.

The invention involves a method and apparatus for the removal of contamination, odors, etc. from liquids, gases and solids and it comprises a rapidly rotating centrifugal drum such as one of conical formation into which the mixture is delivered and which whirls it about within the drum. The drum is provided with a peripheral outlet slot which is regulatable as to its width and the mixture after being centrifuged is forced out through the slot and into a chamber disposed around the drum and in which it drains to reach an outlet pipe. The pressure within the chamber is less than the centrifugal pressure generated within the drum. The outlet slot in the drum can, if desired, be divided into a plurality of separate outlets and each of the outlets can be provided with a flared outlet nozzle.

It is an object of the invention to provide a purification device of this kind or a mixing system by which the mixture of different reactive components with one another will be secured. For example, it has been found very desirable to secure the intimate mixture of liquor vapour condensate from evaporation plants in sulphate mills with the stack gas from black liquor combustion. When an apparatus made in accordance with the present invention is employed, the condensate leaving the device is found to be wholly free from malodorous and poisonous sulphurous compounds. In the accompanying drawings, wherein an illustrative embodiment of the invention is disclosed,

FIG. 1 is a vertical sectional view of an apparatus constructed according to the invention;

FIG. 2 shows a slightly modified construction;

FIG. 3 shows an embodiment in which the centrifuge is in the form of two opposed frusto-conical sections;

FIG. 4 shows a structure in which a plurality of flared expansion nozzles is used, and

FIG. 5 is a top plan view of the structure of FIG. 4.

Referring to the drawings, there is therein shown in FIG. 1, a centrifugal drum 3 of frusto-conical shape, borne by a rotated shaft 4 driven by suitable drive means to thereby rotate the drum. A pipe 2 leads into the interior of the drum 3 and through said pipe the liquor-vapor-condensate or other material to be treated is sprayed into the interior of the centrifugal drum. The drum 3 is rapidly rotated and the mixture of gas and liquids in the drum is forced outwardly toward the peripheral outlet 5 of the drum. The outlet 5 is in the form of a slot shown at 6 and this slot may be regulatable as to its width so that by the adjustment of the width of the slot the pressure in the drum, generated by the centrifugal force developed therein, can be maintained to a required degree.

By the rotation of the drum 3, aided by the force generated therein, the gas and liquid mixture will be forced out through the slot 6 to reach the interior of the chamber 7 that is arranged around the drum and in which a pressure lower than that in the drum, prevails. During the passage through the slot 6 and after such passage and intimate mixture of the liquid and gas takes place, consisting partly in the evaporation of the liquid and the expansion of the gas and the result of this is that the different reacting components become very finely divided and come into practically molecular contact with one another. This permits for short reaction periods and when the mixture contacts the wall 8 of the chamber 7, the desired reaction is completed.

15 The liquor which contacts the wall 8 is deflected by the baffle 38 and it drains down the wall to the lower portion of the chamber 7 to flow therefrom through an outlet pipe 9 to a suitable location. The gas is evacuated through the outlet pipe 10.

20 To increase the working capacity of the centrifugal drum 3 the same may be provided on its interior wall surface with a plurality of radial blades 11. Also, if desired, the outlet pipe 9 can have its upper end elevated so that said upper end will be located higher in the chamber 7 than the lower end of the frusto-conical drum 3. The liquid in the chamber 7 will then be sucked up into the drum 3 and as a result the liquid can be circulated numerous times through the slot 6.

25 It is also possible to embody the present invention in 30 a device usable for the purification of stack gases. Stack gas such as emanates from a lime sludge re-burning kiln, contains large quantities of dust. If such dust reaches the atmosphere the surrounding area becomes coated with a fine whitish dust. According to the present invention, the 35 stack gases can be directed into the centrifugal drum 3 through a pipe 1 shown encircling the pipe 2 and the liquid enters the drum 3 through the pipe 2. As previously described, the mixture of gas, liquid and the solid dust is 40 whirled about within the drum 3 and emerges through the slot 6 of the drum. Due to the liquid being partly evaporated and developed into a mist form, it moistens even the finest particles of the dust and separates them from the gas. The dust particles are thereupon conveyed out of the chamber 7 by means of the pipe 9.

45 Another example of the use of the described device is 50 as follows: The centrifugal drum 3 is rapidly rotated as heretofore described by the driving of the shaft 4 and fuel oil is forced into the interior of the drum 3 in desired quantity through the pipe 2. Air is sucked into the 55 drum through the pipe 1 and when the air and oil mixture passes through the slot 6 an extremely good mixture takes place. The mixture may thereupon be ignited by a suitable circular burner arranged around the drum. In this case the centrifugal drum is used as an oil burner and one having efficiency primarily because of the finely divided nature of the fuel oil and because of which the burning can take place with a minimum excess of air.

60 In FIG. 2 of the drawings, the centrifugal drum 3 has a radial flange 20 at its larger end and above which is arranged a horizontal plate 13 forming the upper closure or cover for the drum, said plate or cover member 13 being connected to the driving shaft 4. A flared outlet slot 65 is provided between the marginal edge portions of the plate 13 and flange 20. The slot between the plate 13 and the flange 20 is divided into a plurality of outlets by means of the separated spacers 22. Also radial wings 24 may be provided at the lower or smaller end of the centrifugal drum 3 for preventing air from entering through any space between the inlet pipe 1 and the lower end of the centrifugal drum.

In the embodiment of the invention shown in FIG. 3, the centrifugal drum consists of two half sections indicated respectively at 30 and 31 which sections have their wider ends facing one another and define the outlet slot 32 between them. In this embodiment the pipe 2 has its upper end terminating in a turret 33 at the upper end of the part 30 of the centrifugal drum.

In FIGS. 4 and 5 the therein disclosed structure is generally similar to that of FIG. 1 except that the outlet from the centrifugal drum consists of a plurality of flared expansion nozzles 36 projecting radially from the drum as distinguished from a continuous slot as disclosed in FIG. 1.

Having thus described embodiments of the invention, it is obvious that the same is not to be restricted thereto, but is broad enough to cover all structures and methods coming within the scope of the annexed claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are as follows:

1. The method of treating a mixture of liquid and gases by intimate contact between the component parts of the mixture in a centrifuging drum having annular diverging side walls conically shaped which is circumferentially slotted about the widest portion thereof, and which rotates within a chamber under substantially atmospheric pressure, said method comprising:

- (a) injecting the mixture into the rotating drum;
- (b) ejecting the gas and liquid components through the slots of the drum into the chamber under pressure created by the centrifugal force, and
- (c) causing the gas and the liquid components to become separated by the pressure drop upon entry of the mixture of gas and liquid components into the chamber.

2. The method according to claim 1 in which the mixture comprises fuel oil and air and the foamed fuel oil and air is ignited upon its ejection from the slotted drum.

3. The method of bringing a gaseous medium and a liquid medium in intimate contact with each other by introducing them into a centrifuging drum having annular diverging side walls conically shaped which is circumferentially slotted at the widest portion thereof, and which rotates within a chamber under substantially atmospheric pressure, said method comprising:

- (a) driving the drum with such a speed that at the slots inside the drum a pressure is maintained that is substantially higher than that in said chamber,
- (b) injecting the mixture into the rotating drum,
- (c) ejecting the mixture of the gas and the liquid components through the slots of the drum into the chamber under pressure created by the centrifugal force, and

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(d) causing the gas and the liquid components to become separated by the pressure drop upon entry of the gas and liquid components into the chamber.

4. An apparatus for treating a mixture of liquids and gases by intimate contact between the component parts of the mixture, comprising:

- (a) a chamber under substantially atmospheric pressure,
- (b) a centrifuging drum having diverging annular side walls mounted for rotation within said chamber,
- (c) a drive shaft for said drum;
- (d) means concentric with said shaft for injecting the mixture into said drum,
- (e) said drum having flared expansion nozzles about the widest portion thereof in a plane perpendicular to the axis of rotation to permit ejection of the liquid and gas components therethrough into said chamber under pressure created by the centrifugal force.

5. An apparatus for treating a mixture of liquids and gases by intimate contact between the component parts of the mixture, comprising:

- (a) a chamber under substantially atmospheric pressure;
- (b) a centrifuging drum having diverging annular side walls mounted for rotation within said chamber;
- (c) said drum having flared expansion nozzles about the widest portion thereof in a plane perpendicular to the axis of rotation to permit ejection of the liquid and gas components therethrough into said chamber under pressure created by the centrifugal force.

6. Apparatus according to claim 5 wherein the centrifugal drum consists of two frusto-conical sections having their wider ends facing each other and with a narrow outlet slot disposed between said facing ends.

7. An apparatus according to claim 6 wherein one of the frusto-conical sections is provided with a central turret at the top and a fluid inlet pipe enters into and terminates within the turret.

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