METHOD AND APPARATUS FOR REMOVING HEAT AND ELEMENTS FROM EXHAUST

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Related U.S. Application Data

Continuation of Ser. No. 86,592, Nov. 3, 1970, abandoned, which is a continuation of Ser. No. 842,098, July 16, 1969, abandoned, which is a continuation-in-part of Ser. No. 537,630, March 25, 1966, abandoned.

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Field of Search 55/18, 57, 80, 84, 86, 55/89-91, 93-95, 222, 223, 227, 245, 247, 256, 260, 82, 244, 220; 261/153, 161; 210/112-117, 187

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ABSTRACT

A closed container partially filled with liquid with exhaus gas inlet and outlet devices. Internal structure provides a path for the gases, particularly furnace exhaust gases, between inlet and outlet devices and, while passing along the path, the gases are passed through the liquid which absorbs heat from and removes elements from the gases. One embodiment passes the gases physically through the body of liquid whereas in an alternate, gases pass over the liquid body and are subjected to a spray which causes heat transfer and removes exhaust elements from the gases. Various devices can be used to agitate the liquid, automatic controls and operators can be used to maintain desired liquid level, and outlets, which can include automatic controls, are provided to remove collected sludges or elements. Heat exchangers using conduction, radiation and convection principles of heat transfer can be added to utilize recovered heat energy.

18 Claims, 3 Drawing Figures
METHOD AND APPARATUS FOR REMOVING
HEAT AND ELEMENTS FROM EXHAUST

RELATED APPLICATION

This application is a continuation of application Ser. No. 86,592 now abandoned filed Nov. 3, 1970, which was a continuation of application Ser. No. 842,098 filed July 16, 1969 which was a continuation-in-part of application Ser. No. 537,630 filed Mar. 25, 1966, the latter two of which are now abandoned.

BACKGROUND AND SUMMARY

The present invention relates to a method of and apparatus for use with furnaces and the like and more particularly to treatment of the smoke or combustion products exhausting from the furnaces. That exhaust contains heat and almost invariably carries with it elements which, if removed and recovered, are useful. Most elements in such exhausts create pollution of the atmosphere which should be avoided if possible.

Accordingly, a primary object of the present invention resides in the provision of novel methods and apparatus for removing or minimizing the amount of elements in exhaust gases.

Another object resides in the provision of methods and apparatus to transfer or remove as much heat from smoke and furnace exhaust gases as desired.

Another object resides in the provision of methods and apparatus for reclaiming desirable elements in furnace smoke and exhaust gases, with provisions for removal of such material at various levels or zones which the material seek in a body of collecting liquid because of different specific gravities. It is also envisaged that sensing means can be used to determine presence in certain zones of specific materials with automatic removal of the liquid and such material from that zone.

A further object resides in providing a closed liquid container with upper inlet and outlet conduits for exhaust gas and including internal baffle devices directing the gas flow down into and therethrough by the liquid to enable heat transfer to the liquid and entrainment of various material which was in the exhaust gases. This object further contemplates (1) incorporating units to agitate the liquid to disperse and break up bubbles of the exhaust gas of sizes which may be undesirable and to aid the uniform dispersion of heat throughout the liquid; (2) providing auxiliary spray devices, with make-up or recirculation connections, directed into the inlet conduit and down through gases which are over at least selected portions of the body of liquid; (3) providing mechanical apparatus such as fins or heat exchangers with secondary liquid to capture heat from the liquid and transfer it for useful purposes to other apparatus or to the surrounding area by radiation; (4) providing automatic controls for valve and pump operators to maintain proper liquid level within the container; (5) and providing removal ports with suitable control apparatus such as valves, pumps, operators and sensing devices for removal of materials collected in the liquid at the bottom or at various levels which the materials may seek because of their different specific gravities.

Still another object resides in a further embodiment which passes the gases over a body of liquid in a closed container and such gases being subjected to an intense spray of the liquid while passing above the liquid level. Other units reiterated in the previous object are contempated for use with this second embodiment as desired and it is also contemplated that a series of containers of one embodiment or including both embodiments can be used, with the exhaust gases passing serially the plurality of containers.

Further novel features and other objects of this invention will become apparent from the following detailed description, discussion and the appended claims taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

Preferred structure and embodiments are shown in the drawing, in which:

FIG. 1 is a side elevation view of one embodiment of the invention in which furnace exhaust gases are directed to pass through a body of liquid and the components of a heat exchanger;

FIG. 2 is a side elevation view of a second embodiment of the invention in which furnace exhaust gases are directed across the surface of a body of liquid and under a spray of that liquid, the heat exchanger components being immersed in that liquid; and

FIG. 3 is a diagrammatic sketch showing one unit of each embodiment with the gas outlet from one unit in fluid communication with the gas inlet to the second unit.

GENERAL DESCRIPTION

Referring first to FIG. 1, the reclaiming apparatus consists of a tank 10 containing a suitable liquid 12 such as water, or other material which is normally liquid, or liquid metal, e.g., mercury, or the like, the normal level of the liquid being indicated at 14.

Immersed within the body of liquid is a heat exchanger 16 which has an inlet pipe 18 and outlet pipe 20 leading into and out of tank 10. The heat exchanger 16 can be conventional equipment used to transfer heat from a body of liquid to some other medium such as a secondary liquid passing within the exchanger, and as is well known, means for utilizing the captured heat in the secondary liquid can be connected to the heat exchanger.

Adjacent the upper end of tank 10 near the lefthand side is an inlet pipe or conduit 22 through which smoke gases (combustion or exhaust products) exhausting from a furnace (not shown) are introduced into the upper part of tank 10. The inlet pipe 22 can extend down into the liquid to terminate a substantial distance below the top surface of the liquid or as shown the inlet pipe 22 can terminate at the entrance into tank 10, in fluid communication with a small chamber 24 formed by the chamber wall and an imperforate baffle 26 which can be secured across and to the sides of tank 10 by welding or other suitable fastening.

The top edge 28 of tank 10 is flanged and a tank cover plate 30 is secured tight to the edge flange 28 by bolts and nuts 32 providing a smoke tight container with the small side chamber 24 and a larger right hand portion 34. An exhaust pipe or conduit 36 connected adjacent the top edge of tank portion 34 provides an exit path for the hot gas.

Smoke or the like enters via conduit 22 passes down through chamber 24 to a level below the lower edge of baffle 26, which if desired can be below the heat exchanger 16 as shown by baffle 26 in FIG. 3. The outlet 34 is connected to the entire remaining space above liquid level and an exhaust pump 38 in fluid communi-
cation with conduit 36 is used to force the gases out of a chimney (not shown) or conduit extension 40. In a well known manner the pump 38 creates a lower pressure in the space above the liquid level than is present in the inlet conduit 22 and inlet chamber 24 and causes the smoke and exhaust gases to pass down through chamber 24 and then past or bubbling up through the heat exchanger 16. A perforated wall plate 42 extends across at least a portion of chamber portion 34 from the baffle plate 26 and may be located above or below the heat exchanger 16. The perforations 44 can vary in size and area, the further they are from the baffle, and the plate can extend completely across the tank if desired, and is provided to more evenly disperse the gases throughout the liquid as it passes up to the top of the tank. Heat is transferred to the liquid in the tank and is carried away by the heat exchanger system whereas the liquid separates and traps the impurities and particles from the smoke and exhaust gases. The heavier separated particles fall to the bottom of the liquid and can be removed by suitable ports or lines such as the valve conduit arrangement 50 at the bottom of tank 10, or the valve outlets 52, 54, 56 on the side of tank 10 at different levels from the bottom. As shown, the cross-section area size of the removal outlet conduits can be as desired and will depend on the nature of material, e.g., slurry or sludge, removal from the tank. Such removal conduits may project into the tank to various distances and to various levels and may be perforated in desired patterns to enhance withdrawal of the materials into and via the conduit. Removal may be to enable reclaiming of valuable elements from the smoke or exhaust or it may be only as required to clean out the tank. More than one perforated plate such as shown at 42 may be used and such plates or equivalent screen can be used in the inlet chamber 42. Such plates can be constructed to be agitated.

Many different elements are present in smoke and exhaust from furnaces, those of less density will settle out in the liquid at higher levels than those of heavier density. Thus zones of different density materials will occur within the tank and partial separate reclamation is enabled by having the removal ports at different levels.

If feasible for certain materials, removal of separated elements can be accomplished automatically as shown at the valve conduit 44. A material sensing unit 58 can be installed at a predetermined level to sense when a desired amount of specific material has settled at that level. The device 58 can sense a factor such as density or specific gravity and, when the collected material is sufficient for removal, through suitable controls and operators 50 will govern the operation of valve 62 and pump 64 to remove the collected material. When the sensed condition drops to a predetermined level, pump 64 is stopped and valve 62 is closed.

To assure a proper level of liquid within tank 10, a source of such make-up liquid under pressure will be connected to valved inlet pipe 66, and a valved overflow outlet pipe 68 is provided adjacent the top part of the tank at desired upper level of the liquid. This level can be manually maintained or can be accomplished automatically by providing a liquid level sensing device 70 connected to a control unit 72 which in turn will selectively control the operation of inlet valve operator 74 to introduce make-up liquid when low liquid levels are sensed and will valued the overflow valve operator 76 to permit draining of liquid when the level is too high. The valve overflow line is desirable to prevent escape of the smoke or exhaust gases through the overflow conduit.

Various alternate or supplement devices can be incorporated to assure dispersion of the gases throughout the body of liquid. If no specific reclamation of separated products is desired the liquid can be agitated by a recirculating motor driven pump 80 located inside the tank as shown in FIG. 1 with the motor internal or external. Another agitating device is shown in FIG. 2 as an internal vane type agitator 82 driven by an external motor 84.

Another way to disperse and break up large bubbles and globules of gas to assure maximum area contact between the liquid and the gas to wash out the materials carried by the gas is shown in chamber portion 34 of FIG. 1. A motor 86 and gear box 88 mounted on cover plate 30 drive coaxial counterrotating shafts 90 and 92 which extend down into the tank portion 34 below liquid level. The shafts 90 and 92 are suitably journalined in the gear box and pass through a bearing seal 94 in cover plate 30 and an appropriate bearing 96 in an auxiliary perforated plate 98. Plate 98 serves to brace the shafts 90 and 92 and is supported and located by locator pins 100 and angle brackets 102 and 104 secured on the inside of the tank walls or the depending baffle 26. A perforated disc 106 with depending outer flange 107 is secured to hollow shaft 92 and a smaller perforated disc 108 with depending peripheral flange 109 is secured to the lower end of inner shaft 90. The flanges can be omitted but aid in breaking up bubbles of gas which will be urged radially outward by rotation of the discs. Single or plural discs can be used and rotation of plural discs can be by dual or a single shaft.

It is further contemplated that the tank 10 may be utilized as a direct heat exchange agent, e.g., to heat the surrounding area. If so, the heat transfer from the body of liquid to the walls of the tank can be enhanced by internal fins 110, one of which is shown. Also, external fins 112 can be provided on any area of the tank to create a larger radiation surface. Preferably the internal fins 110 are vertically disposed to avoid collection of separated materials, whereas external fins 112 may be disposed either vertically or horizontally.

SECOND EMBODIMENT

This embodiment, shown in FIG. 2, is similar to that described in connection with FIG. 1 excepting for the path of gas flow through the tank.

Adjacent one end of the upper wall of tank 120 is an inlet pipe or conduit 221 through which the smoke gases (combustion products) exhausting from a furnace are introduced into the upper part of the tank, a confined space 122 across the upper level of the liquid 12. The gases, in this instance, travel across the surface of the liquid to the other end of the tank and exhaust through a pipe or conduit 36' which can be a chimney or via a pump as in FIG. 1. As the gases pass across the liquid some heat and some of the elements in the gases will be transferred to the liquid merely by surface contact. To amplify the transfer of heat and gas entrained particles to the liquid in the tank, a system is provided to pump liquid from tank 10 via pipe 124 or from make-up liquid via pipe 126 by means of a pump 128 and pipe 130 into a manifold system 132 containing a group of overhead sprays or nozzles 134 inside the
upper space 122 of the tank 10. The liquid is sprayed down across and blankets the path of the exhausting gases over the body of liquid and absorbs heat from the gases and catches and drives elements carried with the gases down into and mixes them with the liquid in the tank.

If desired, a tap-off pipe 136 from the spray liquid pipe (or a separate source) can introduce liquid to a spray manifold 138 located in the gas inlet conduit to provide a preliminary spray 140 directed onto the incoming gases to entrain a part of the heat and the elements carried by the gas.

Short baffles 142 and 144 depending from the cover plate 30 and extending across tank 120 deflect the incoming and passing gases down onto or close to the liquid surface to provide a more efficient surface contact.

The Fig. 2 embodiment can incorporate feature similar to those described for the Fig. 1 embodiment, i.e., the heat exchanger 16; exhaust pump 38; level sensing device 70' with appropriate control 72' and valve operators 74' and 76'; and the recovered material removal devices 50', 52', 54' and 56' as well as various agitation devices such as those already described in connection with both of FIGS. 1 and 2.

Moreover the spray arrangement as described for FIG. 2 can be utilized with the apparatus of FIG. 1 and a partial utilization of make-up liquid or recirculated liquid spray is shown in FIG. 1. Recirculated liquid via pipe 150 and valve 152 or make-up liquid via pipe 154 and valve 156 is pumped by a pump 158 into one or two manifolds 160 and 162 from which the liquid is sprayed into the incoming gases in the conduit 22 and small chamber 24 for the same purpose as described for the spray in the FIG. 2 embodiment. If desired a spray can be incorporated over the entire surface of the liquid body 12 of FIG. 1 as is shown in FIG. 2.

FIG. 3 illustrates one way in which the embodiments can be utilized in series. The two units 10 and 120 can be used or more than two units can be used in various combinations.

The apparatus, aforesaid, is utilized to accomplish a method of removing or minimizing heat and elements carried into the atmosphere in coal furnace smoke or other exhaust gases by causing the smoke or exhaust gases to go (1) over, or (2) through, or (3) over and through, or (4) through and over a body or bodies of water or some other liquid or melted metals or some other element or elements in a tank or a series of tanks. In such a process a spray or a stream of water or some other liquid or melted metal or some other elements or elements may also be directed at or on the smoke or exhaust gases causing the heat and impurity particles and elements to be caught or picked up by the sprayed liquid and driven down into and mixed with the body or bodies of liquid melted metal or elements. The tanks also contain heat exchanger or heat transfer devices placed in the mixed liquid and other elements so that the heat caught therein can be transferred by pipe (or by some other known method or methods to transfer heat from one place to another) and used as desired. Various smoke or combustion products elements trapped in the liquid which settles to the bottom or various levels of the tank or tanks can be removed through various ports or by some other removal device. Such elements of ingredients are thus reclaimed and may be processed and refined by known processes for further use or they can be otherwise disposed of. This method or variations thereof can be applied to exhaust products from furnaces and devices or ways in which coal and other fuels are used in shops, mills, factories and other air polluting devices.

In conjunction with the removal of materials and heat from the gas products, such gas products can otherwise treated at any stage, before, during and after the aforesaid process, nullify, neutralize or modify harmful properties or aspects before it finally is released into the atmosphere. Treatment can be accomplished through media which can be one or more other gases and materials.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

1. The method of treating combustion exhaust gas products, including smoke from furnaces and the like wherein ambient heat, foreign particles and impurities in such gas products are removed for utilization as desired, comprising the steps of: providing at least one closed container carrying a body of liquid material at temperatures lower than that of the gas products to be treated; maintaining the body of liquid material to desired levels; introducing and subjecting such exhaust gases to substantial surface areas of the liquid material and thereby transferring heat, particles and impurities from the gas products to and trapping the same in the liquid material; exhausting the treated gas products from the container; using a heat exchanging means having a portion thereof immersed in said liquid material to absorb heat transferred from the liquid material and transferring the heat via the heat exchanging means to a location exterior of the container; said gas products being passed down and up through the body of liquid material, contacting a substantial part of the body of liquid material and during such passage, passing the gas products adjacent the portion of the heat exchanging means internal of the tank so that both the gas products and the liquid material are simultaneously transferring heat into that portion of the heat exchanging means; concentrating solids transferred to the liquid material at desired locations within the container; and removing the solids from said locations for further disposition.

2. The method of treating combustion exhaust gas products as defined in claim 1, including the steps of passing the gas products closely adjacent and laterally over substantially the entire upper level surface of a second contained body of liquid material separate from the first mentioned container of liquid material and transferring heat and solids from the gas products to the second contained body of liquid material.

3. The method of treating combustion exhaust gas products as defined in claim 1, wherein a pressure lower than that at the gas products inlet to the tank is created at the gas products outlet to cause the exhaust gas products to travel down into then up through the body of liquid material.

4. The method of treating combustion exhaust gas products as defined in claim 1, including the additional
step of spraying liquid material into the gas products at confined locations above the body of liquid material.

5. The method of treating combustion exhaust gas products as defined in claim 4, wherein make-up liquid material and recirculated liquid material from the body of liquid material are used in the spraying.

6. The method of treating combustion exhaust gas products, including smoke from furnaces and the like wherein ambient heat, foreign particles and impurities in such gas products are removed for utilization as desired, comprising the steps of: providing at least one closed container carrying a body of liquid material at temperatures lower than that of the gas products to be treated; maintaining the body of liquid material at desired levels; introducing and subjecting such exhaust gases to substantial surface areas of the liquid material and thereby transferring heat, particles and impurities from the gas products to and trapping the same in the liquid material; exhausting the treated gas products from the container; using a heat exchanging means having a portion thereof immersed in said liquid material to absorb heat transferred from the liquid material and transferring the heat via the heat exchanging means to a location exterior of the container; concentrating solids transferred to the liquid material at desired locations at plural levels within the container including the bottom of the body of liquid material; removing the solids from said locations for further disposition; concentration of solids in a zone adjacent at least one of the collection levels being sensed and the sensed condition used to accomplish automatic removal of the collected solids at that one level.

7. Apparatus for treatment of combustion exhaust gas products comprising: a closed container for containing a body of liquid material; inlet conduit means connected to and entering said container adjacent the upper end of said container; outlet conduit means in fluid communication with the interior of and adjacent the upper end of said container and spaced apart from the entering location of said inlet means; means causing gas products to enter through said inlet conduit means and to take a path to said outlet means which, when a body of liquid material is in said container, will cause said gas products to make contact with surface areas of liquid material greater than the area of upper surface of the body of liquid material; a motor driven gas bubble disperser for dispersing the gas products within the body of liquid material; said motor driven disperser including means supported on said container; vertical counter-rotating coaxial shafts projecting in the space to be occupied by said body of liquid material and rotary agitating means consisting of two perforated discs, one secured to the end of each of said coaxial shafts; and each disc includes an integral depending peripheral flange; means for maintaining a predetermined level of liquid material within said container; means for removing solids collected in said container; and means at least partially within said container adapted to be located within the body of liquid material to be contained in said container for absorbing heat from the body of liquid material and transferring the absorbed heat to the exterior of said container.

8. The method of treating combustion exhaust gas products, including smoke from furnaces and the like wherein ambient heat, foreign particles and impurities in such gas products are removed for utilization as desired, comprising the steps of: providing at least one closed container carrying a body of liquid material at temperature lower than that of the gas products to be treated; maintaining the body of liquid material to desired levels; introducing and subjecting such exhaust gases to substantial surface areas of the liquid material and thereby transferring heat, particles and impurities from the gas products to and trapping the same in the liquid material; exhausting the treated gas products from the container; using a heat exchanging means having the major exchange portion thereof immersed into and thereby disposed within the said body of liquid material to absorb heat transferred from the liquid material and transferring the heat via the heat exchanging means to a location exterior of the container; causing circulation of liquid material by agitation of the liquid wholly within the body of liquid material; concentrating solids transferred to the liquid material at desired locations within the container; and removing the solids from said locations for further disposition.

9. The method of treating combustion exhaust gas products as defined in claim 8, wherein the gas products are passed through the body of liquid material and contact a substantial part of the body of liquid material during such passage.

10. The method of treating combustion exhaust gas products as defined in claim 8, wherein the gas products are directly passed laterally across substantially the entire upper level surface of the contained body of liquid material and simultaneously a portion of such liquid material is sprayed down through the laterally traveling gas products onto and into the upper level surface of the contained body of liquid material.

11. The method of treating combustion exhaust gas products as defined in claim 10, including the steps of passing the gas products down into and up through a second contained body of liquid material separate from the first mentioned container of liquid material and transferring heat and solids from the gas products to the second contained body of liquid material.

12. The method of treating combustion exhaust gas products as defined in claim 8, wherein provision is made for controlled input of make-up liquid material and controlled drainage of excess liquid material; the level of the body of liquid material is sensed and resulting indications of level used to automatically control the input and drainage of liquid material.

13. The method of treating combustion exhaust gas products as defined in claim 8, including the further step of physically dispersing the gas products in small gas globules over a substantial lateral area within the body of material by diverting the gas products to a multiplicity of vertical passages of small cross-section area.

14. The method of treating combustion exhaust gas products as defined in claim 8, further including the steps of additionally treating the gas products through media other than said liquid material.

15. Apparatus for treatment of combustion exhaust gas products comprising: a closed container for containing a body of liquid material; inlet conduit means connected to and entering said container adjacent the upper end of said container; outlet conduit means in fluid communication with the interior of and adjacent the upper end of said container; outlet conduit means including means generating a differential pressure across said inlet means and said outlet means causing gas products to enter through said inlet conduit means and to take
a path to said outlet means which, when a body of liquid material is in said container, will cause said gas products to make contact with surface areas of liquid material greater than the area of upper surface of the body of liquid material; means for maintaining a predetermined level of liquid material within said container comprising a selectively controlled valved inlet device for introducing make-up liquid material into said container and a selectively controlled valved overflow outlet device for drawing liquid material from said container and said means for maintaining a predetermined level also including a level sensing means, a control means and operating means connected to said valved devices, said control means being connected between said sensing means and said operating means to operate said valved devices to selectively introduce and remove liquid material from said container responsive to a sensed level condition; means for removing solids collected in said container; means at least partially within said container adapted to be located within the body of liquid material to be contained in said container for absorbing heat from the body of liquid material and transferring the absorbed heat to the exterior of said container, and means operable independent of flow of gas products disposed so it will be within the body of liquid material for causing agitation of the body of liquid material at least in the space adjacent said heat absorbing and transfer means.

16. Apparatus for treatment of combustion exhaust gas products comprising: a closed container for containing a body of liquid material; inlet conduit means connected to and entering said container adjacent the upper end of said container; outlet conduit means in fluid communication with the interior of and adjacent the upper end of said container and spaced apart from the entering location of said inlet means; means including means generating a differential pressure across said inlet means and said outlet means causing gas products to enter through said inlet conduit means and to take a path to said outlet means which, when a body of liquid material is in said container, will cause said gas products to make contact with surface areas of liquid material greater than the area of upper surface of the body of liquid material; means for maintaining a predetermined level of liquid material within a said container including; means to sense the presence of a zone of separated solids within said container and to control automatic removal of said sensed zone of solids; means at least partially within said container adapted to be located within the body of liquid material to be contained in said container for absorbing heat from the body of liquid material and transferring the absorbed heat to the exterior of said container, and means operable independent of flow of gas products disposed so it will be within the body of liquid material for causing agitation of the body of liquid material at least in the space adjacent said heat absorbing and transfer means.

17. Apparatus for treatment of combustion exhaust gas products comprising: a closed container for containing a body of liquid material; inlet conduit means connected to and entering said container adjacent the upper end of said container; outlet conduit means in fluid communication with the interior of and adjacent the upper end of said container and spaced apart from the entering location of said inlet means; means including means generating a differential pressure across said inlet means and said outlet means causing gas products to enter through said inlet conduit means and to take a path to said outlet means which, when a body of liquid material is in said container, will cause said gas products to make contact with surface areas of liquid material greater than the area of upper surface of the body of liquid material; means for maintaining a predetermined level of liquid material within said container; means for dispersing said gas products within the body of liquid comprising a motor driven gas bubble disperser; means for removing solids collected in said container; means at least partially within said container adapted to be located within the body of liquid material to be contained in said container for absorbing heat from the body of liquid material and transferring the absorbed heat to the exterior of said container, and means operable independent of flow of gas products disposed so it will be within the body of liquid material for causing agitation of the body of liquid material at least in the space adjacent said heat absorbing and transfer means.

18. Apparatus for treating gas products as defined in claim 17, wherein said motor driven disperser is combined with at least a portion of said means for agitating the body of liquid and includes means supported on said container, vertical shaft means projecting into the space to be occupied by said body of liquid material and rotary agitating means secured to the end of said shaft means.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,884,651
DATED : May 20, 1975
INVENTOR(S) : John L. Velezol

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 55, change "tranfer" to --transfer--.
Col. 3, line 16, change "tranferred" to --transferred--.
Col. 3, line 27, change "removal" to --removed--.
Col. 3, line 30, change "preforated" to --perforated--.
Col. 3, line 30, change "withdrawl" to --withdrawal--.
Col. 3, line 67, change "valued" to --control--.
Col. 4, line 5, change "supplement" to --supplemental--.
Col. 4, line 53, change "221" to --22'--.
Col. 6, line 63, after "into" add --and--.
Col. 7, line 29, change "adjacent" to --adjacent--.
Col. 8, line 2, change "temperature" to --temperatures--.
Col. 8, line 6, change "tranferring" to --transferring--.

Signed and Sealed this
thirtieth Day of September 1975

[SEAL]

Attest:

RUTH C. MASON
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