United States Patent

Leonard

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[54] JACKETED PRECIPITATOR APPARATUS

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Related U.S. Application Data

[63] Continuation of Ser. No. 607,839, Jan. 6, 1967, abandoned.

[52] **U.S. Cl.** **55/135,** 55/146, 55/DIG. 38

[51] **Int. Cl.** **B03c 3/01**

[58] **Field of Search** 55/146

[56] **References Cited**

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[57] **ABSTRACT**

An improved electrostatic precipitator having a temperature regulated precipitator chamber for the treatment of particle-laden gases.

1 Claim, 2 Drawing Figures

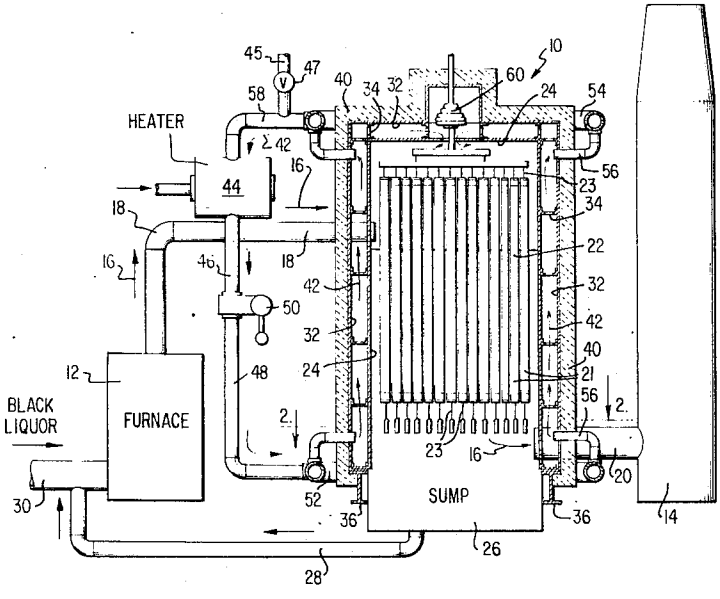
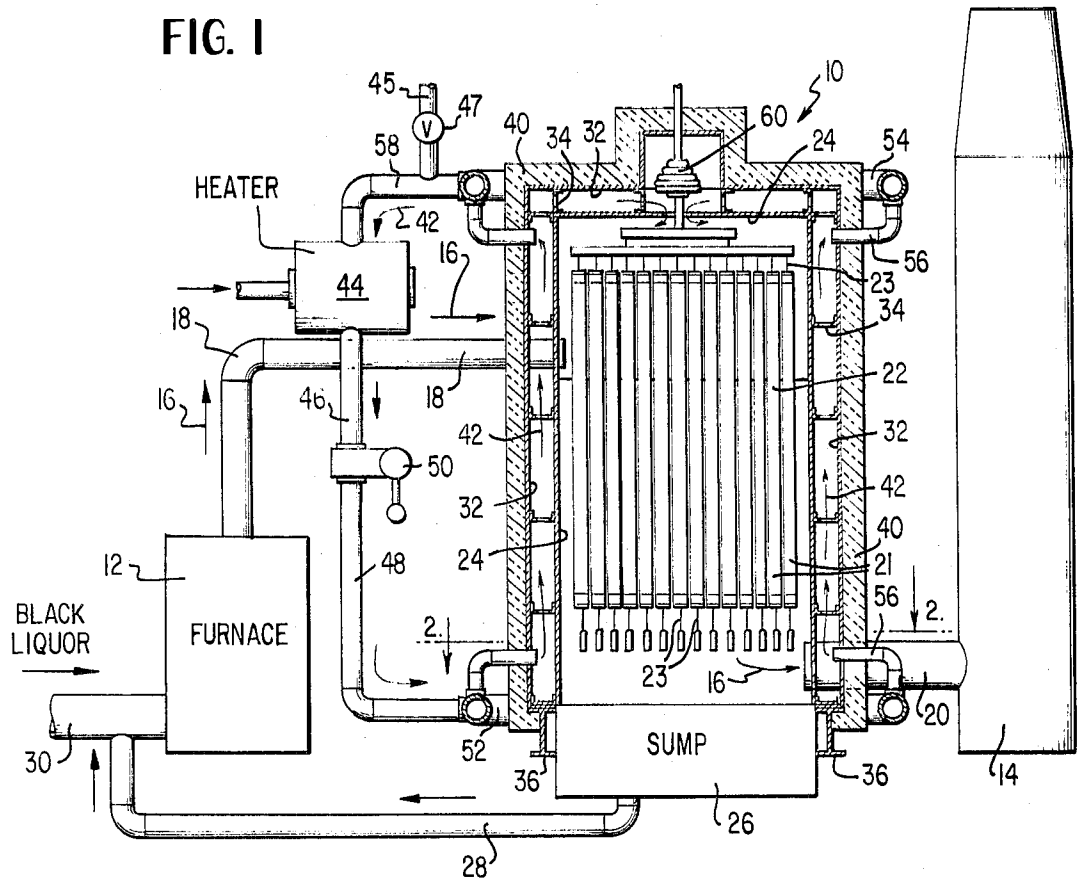


FIG. 1



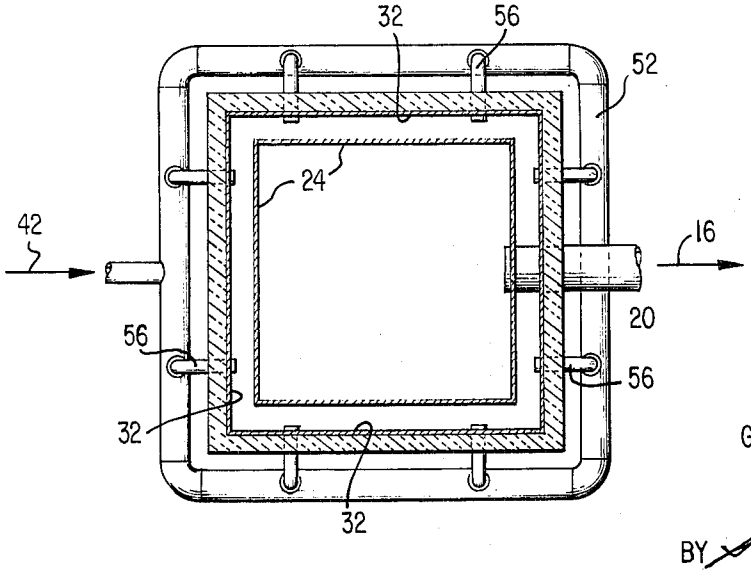


FIG. 2

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JACKETED PRECIPITATOR APPARATUS

This is a continuation application of Ser. No. 607,839, filed Jan. 6, 1967, now abandoned.

In a preferred form the present invention relates to a hollow-jacketed electrostatic precipitator gas treatment chamber provided with means for passing a flow of a heated gas through such jacket to prevent or reduce the condensation of the gas under treatment onto the interior walls of the chamber.

An excessive temperature differential between the particle-laden gases under treatment and the walls of a gas treatment precipitator chamber through which such gases flow will cause condensation of moisture from the gas stream upon the chamber walls, with the deposition of gas products and suspended particulate matter carried within the gases.

Such deposition upon the chamber walls is undesirable in that deleterious condensation products may build up which may reduce the precipitator efficiency and also act to corrode and erode the chamber walls, particularly when the gases contain matter such as phosphorous, sulphur, nitrates, or the like.

It is accordingly an object of the present invention to prevent undesirable condensation upon the interior walls of an electrostatic precipitator chamber.

A more specific object of this invention is to prevent undue temperature fall of the precipitator chamber walls by providing an external jacket over the same; passing a heated gas through such jacket; and/or supplementing such a flow of temperature-regulating heated gas by a flow of heated gas over the internal chamber walls.

The above and further objects and advantages of the invention will become apparent upon consideration of the detailed description of a preferred embodiment of the invention which follows, when taken with the accompanying drawings wherein:

FIG. **1** is a diagrammatic representation showing in elevation and partial section a system for treating particle-laden gases utilizing the present invention; and

FIG. **2** is a view taken on line **2** — **2** of a portion of FIG. **1**.

In the drawings reference numeral **10** generally designates an electrostatic precipitator through which hot particle-laden gases from a furnace **12** flow for ultimate discharge through vertical stack **14**.

Arrows **16** indicate the gas flow from furnace to stack, which is by way of the furnace-outlet to precipitator-inlet flue **18**; through precipitator **10**; and then through the precipitator-outlet to stack-inlet flue **20**.

The precipitator **10** includes treatment electrode sets **22** consisting of tubular ground potential collecting electrodes **21** and fine wire discharge electrodes **23** which pass axially through each of the collector tubes **21**. The discharge electrodes **23** are suspended by an insulator and bus arrangement **60**, and charged from the usual voltage source (not shown). Electrodes **22** occupy the major area within treatment chamber **24**. The gas cleaner illustrated in FIG. **1** may be utilized in treating paper mill gases, for example, and to this end precipitator **10** is shown with a sump **26**; a return flow conduit **28** leading to a black liquor inlet **30** to the recovery boiler (not shown) within furnace **12**.

While tubular collecting electrodes have been specifically shown in the drawings any form of electrodes may be employed with the jacketed housing without changing the basic objects of the invention.

The walls of treatment chamber **24** are preferably formed of mild steel for ease of manufacture and assembly. However, for example, in the treatment of paper mill gases corrosion of the chamber walls due to condensation of sodium sulphite gases from the recovery boiler is to be avoided. Rather than form the chamber walls of a more expensive and less workable corrosion-resistant metal the present invention proposes to regulate the temperature on both sides of chamber walls **24**.

To this end a spaced jacket **32**, which also may be formed of mild steel, is provided which surrounds chamber walls **24**. It is spaced from walls **24** by means of plurality of channel members **34**. Support members **36** bear the weight of precipitator **10**, and an outer insulation shield **40** may be optionally provided to maintain a more uniform temperature within treatment chamber **24**.

The channel spacer members **34** have openings therein, as illustrated, to provide a closed jacket surrounding the treatment chamber; through which jacket heated air flows as indicated by the arrows **42**.

A heater **44** maybe located adjacent the precipitator in order to heat the fresh temperature-regulating air for the jacket formed by precipitator walls **24** and jacket walls **32**. Heated air from the heater outlet duct **46** is circulated through the jacket by means of a blower fan **50** and a supply duct **48**. The temperature-regulating air enters the jacket via a peripheral input manifold **52**; passes along the outer surface of walls **24**; and exits via output manifold **54**. A plurality of branch ducts **56** interconnect the manifolds with the jacket.

A closed recirculating system is illustrated for the temperature-regulating air; the output manifold **54** being connected back to the heater by the return duct **58**. In accordance with known practice the several ducts **46**, **48** and **58** should be graduated in cross-section; and the several branch ducts **56**, either entry, or exit, or both, should be provided with adjustable throttling valves (not shown); in order that a uniform flow of the jacketing air is achieved.

Further in accordance with known practice make-up air may be introduced into the recirculating temperature-regulating system, for example, by means of inlet duct **45** having a damper-controlled means **47** positioned ahead of blower fan **50**. Heater **44** may be provided with suitable temperature regulator control means.

In FIG. **1** it will be noted that the suspension means for the gas treatment electrodes **22** enters the chamber roof panel **24** through an opening below insulator **60**. Bleed air from the jacket flows into the interior of the precipitator at this point as indicated by the curved arrows.

Such bleed air serves to prohibit condensation upon the insulator and the gas treatment electrodes, as well as the chamber roof and side panels **24**.

The heater **44** may be of any conventional design and may be gas or oil fired or electrically or steam heated. In general the heater **44** for the air would not comprise a flue gas type heat exchanger as with a flue gas heated heat exchanger the incoming air temperature to the jacket would be lower than the flue gas temperature and may not therefore prevent condensation from the gas stream upon the chamber walls of the precipitator.

EXAMPLE

In an installation for a paper mill precipitator the following operating values were found to eliminate unwanted condensation upon the interior precipitator walls:

Heater **44** output temperature:		340° F.
Blower fan **50**:	5400 cfm.	
Input manifold **52**:	5400 cfm.	at 300° F.
Output manifold **54**:	4800 cfm.	at 250–300° F.
Bleed air into chamber:	600 cfm.	at 300° F.
Make-up air into system:	600 cfm. — Ambient	

Operation of the hollow-jacketed electrostatic precipitator should be apparent from the foregoing description and example, although certain modifications, equivalents and changes may occur to those skilled in the art. Accordingly, the invention is only to be limited as defined by the appended claims.

What is claimed is:

1. A gas treatment electrostatic precipitator comprising a double wall vertical shell having inner and outer spacedly arranged tubular side walls, said inner wall circumscribingly defining a gas treatment chamber, means at the lower end of the shell for supporting the shell and closing off the treatment chamber and the space between the side walls, a double wall top housing arrangement at the top of the shell closing off the shell and constituting transverse top projections of the side walls, said top wall arrangement defining an insulator chamber disposed in free and open communication with the space between the side walls, said insulator chamber being closed off from the treatment chamber with only a bleed passage

between the insulator chamber and the treatment chamber, spacedly arranged discharge and collecting electrodes positioned in said treatment chamber, electrical conductor means passing through the insulator chamber and into the treatment chamber for energizing the electrodes, inlet conduit means directingly conveying particle laden gas to be treated into the treatment chamber to flow between the spacedly arranged discharge and collecting electrodes, outlet conduit means in communication with the treatment chamber for conveying the treated gas out from the treatment chamber, heater means for heating a clean gas that is distinct from the treated gas, inlet means communicated between the heater means and the space between the walls of the shell for conveying the heated clean gas into said space so that the gas comes in intimate contact with the exterior surface of the inner wall of the shell, outlet means communicated with said space at a point remote from the inlet means for withdrawing the heated gas from the space between the walls and being connected with the heater means for returning the withdrawn gas to the heater means, said heater means being in substantially closed fluid path with said gas inlet means and said gas outlet means, said bleed passage between the insulator chamber and the treatment chamber permitting a portion of the heated clean gas to enter from the insulator chamber into the treatment chamber around the electrodes and into contact with the interior of the shell walls, conduit means for conveying a make up gas to the closed fluid path of the heater means in advance of the heater means to replace the bleed portion of said gas, spacer members connected between the inner and outer side walls of the shell for spacing the walls apart and having openings therethrough through which the heated clean gas passes in a controlled manner and means for forcefully moving the heated clean gas from said gas outlet to said gas inlet means.

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