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GAS SCRUBBING APPARATUS

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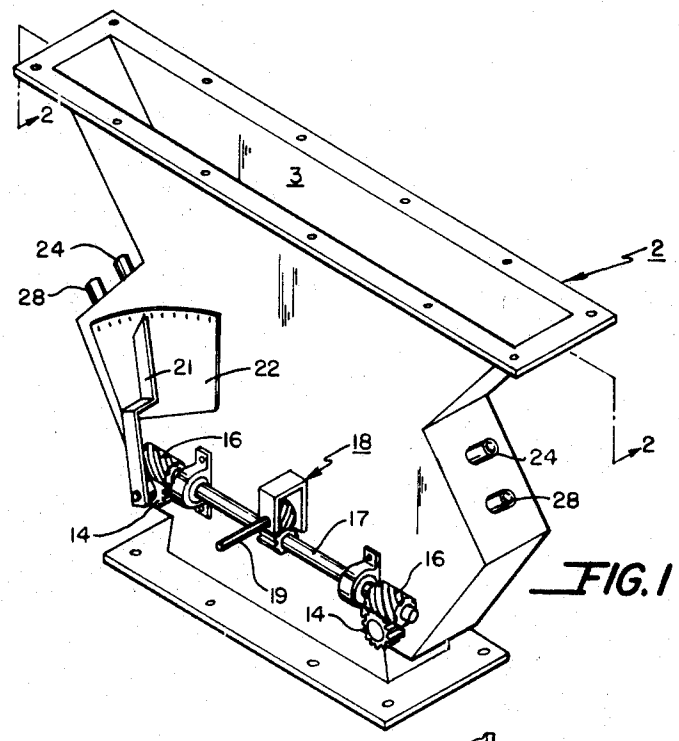

FIG. 1

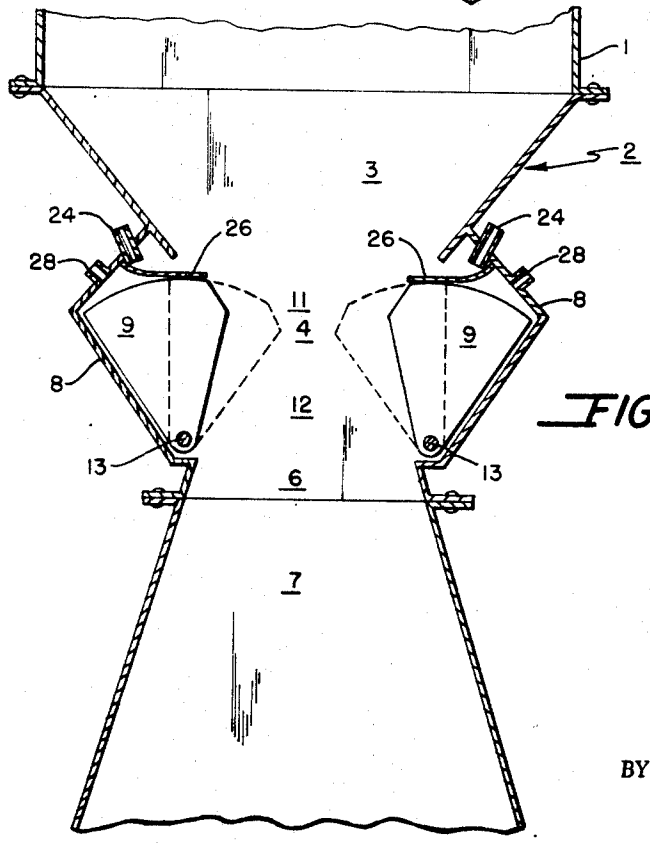

FIG. 2

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GAS SCRUBBING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A venturi-type gas scrubbing apparatus including a contraction section, an intermediate throat section, and an expansion section, the throat section having adjusting means independently operative of the contraction and expansion section, and means to introduce washing liquid in opposed paths normal to the gas stream to be treated at a location upstream the throat section immediately adjacent the adjusting means in such throat section.

The present invention relates to gas scrubbing apparatus and more particularly to improved gas scrubbing apparatus of venturi shape utilized to remove finely divided suspended matter from dirty waste gases.

The utilization of venturi-shaped gas scrubbers for removing fine dusts and for eliminating noxious smoke particles, fogs, and fumes discharged by industrial processes has long been known in the art. In a number of industrial processes where venturi-shaped gas scrubbers are employed there are frequent and considerable variations in the amounts of dust-laden gases introduced into the scrubbers. For example, in the oxygen process of making steel, the volumes of dirty gas emitted in the process increase substantially during oxygen lancing operations. To accommodate for the fluctuating gas volumes delivered to a scrubber and the concomitant variations in scrubber and blower efficiencies, some attempts have been made in the past to provide arrangements which maintain uniform gas velocities. For the most part, these past arrangements have not proven satisfactory. The apparatus employed has been complex, cumbersome, and uneconomical, requiring frequent adjustments of an over-all system and creating alignment and gas resistance problems with each incremental change made to such system. straightforward structural arrangement which permits ad-

The present invention provides an economical and straightforward structural arrangement which permits adjustments to be made quickly and efficiently to obtain uniform gas velocities in a venturi-shaped scrubber in accordance with changing gas volumes delivered thereto. In addition, the present invention provides a structural arrangement which permits adjustments to be accomplished in a symmetrical fashion with a minimum of geometrical contour change to the over-all structure and with a minimum of operating steps and movement of parts.

Various other features of the present invention will become obvious to one skilled in the art upon reading the disclosure set forth hereinafter.

More particularly, the present invention provides gas scrubbing apparatus comprising: a venturi-shaped gas defining passage including a contraction section, an intermediate throat section, and an expansion section; means for introducing washing liquid into the gas defining passage upstream the throat section; adjusting means to vary the cross-sectional area of the throat section independently of the upstream contraction section and the downstream expansion section, the adjusting means including a pair of spaced, relatively movable dampers with spaced opposed faces thereof defining the throat section; and means to move the dampers relative each other to vary the cross-sectional area of such throat section.

It is to be understood that various changes can be made in the arrangement, form and construction of the apparatus disclosed hereinafter without departing from the scope or spirit of the present invention.

Referring to the drawing which discloses one advantageous embodiment of the present invention:

FIGURE 1 is an isometric view of a gas scrubbing apparatus incorporating the novel features of the present invention; and

FIGURE 2 is a vertical, cross-sectional view taken in the plane passing through line 2—2 of FIGURE 1, this figure further disclosing the manner in which the apparatus of FIGURE 1 is incorporated into duct work connected to a source of dirty gas from an industrial process (not shown).

Referring to the drawing, the gas stream to be scrubbed of finely suspended contaminant matter is conducted from a process source (not shown) by duct **1** to the novel venturi-shaped gas scrubbing apparatus, broadly designated by reference numeral **2**.

Gas scrubbing apparatus **2**, which advantageously is of varying cross-sectional area of rectangular configuration, includes upstream converging contraction section **3**, intermediate throat section **4**, and downstream diverging expansion section **6**. The upstream converging contraction section **3** can be connected to duct **1** by bolting or by some other suitable means. In similar fashion, downstream diverging expansion section **6** can be connected to an outlet duct **7**. It is to be noted that outlet duct **7** also can be diverging, the amount and extent of divergence in both the contraction and expansion sections depending upon the nature of the installation and the results desired.

Positioned intermediate upstream contraction section **3** and downstream expansion section **6** adjacent throat section **4** so as to be equally spaced from a plane passing through the central longitudinal axis of flow of the gas scrubber is a pair of damper boxes **8**. Pivotally mounted within damper boxes **8** to nest therein when in "full" or "open" position is a pair of spaced dampers **9**. Dampers **9** are so contoured that the spaced, opposed mirror-image faces thereof are successively inwardly and outwardly inclined about the central longitudinal passage of the scrubber to provide successive upstream converging and downstream diverging passages **11** and **12** respectively. It is to be noted that the inclination of the faces of the dampers is such that when the dampers are in "full" or "open" position, the upstream faces of the passage **11** are substantially aligned with opposed walls of the converging contraction section **3**, and the downstream faces of passages **12** are substantially aligned with opposed walls of diverging expansion section **6**.

To pivot dampers **9** into various positions in a symmetrical fashion about a plane extending through the central longitudinal axis of the scrubber **2**, each damper is fixed to a shaft **13** which, in turn, is rotatably journaled in the sidewalls of damper box **8**. Each shaft **13** extends through a sidewall of its damper box and has fixed to its extended end a worm wheel **14**. Worm wheels **14** are designed to mesh with worms **16** mounted at the extremities of driven shaft **17**. Shaft **17** can be rotated through a suitable worm and gear arrangement **18** by means of drive shaft **19** connected to a suitable source of power (not shown). It is to be noted that one of shafts **13** is provided with a suitable pointer **21**, pointer **21** cooperating with plate **22** mounted on a sidewall of scrubber **2**. Plate **22** is provided with a graduated scale thereon so that the position of the pointer relative the scale indicates the positioning of the dampers **9** in the scrubber apparatus.

Positioned in mirror-image fashion immediately above dampers **9** in extended relationship from the walls of

damper boxes **8** is a pair of spaced, inclined liquid baffles **26**, each liquid baffle **26** having a discharge nozzle **24** located thereabove to cooperate therewith. Discharge nozzles **24**, which extend through damper boxes **8**, are connected to a suitable source of liquid (not shown) and can be controlled in any one of a number of ways to adjust the amount of liquid delivered to the system in accordance with the amount of gas treated. In addition to nozzles **24** aforedescribed, a further pair of nozzles **28** are provided to cooperate with each of damper boxes **8** to flush the dampers **9** whenever necessary to maintain the dampers in efficient operating condition.

From the above description, it can be seen that a straightforward and efficient gas washing apparatus is provided wherein the velocity of the gases passing through the gas scrubber can be adjusted to compensate for changes in the rate of gas flow entering into the system without gas cleaning interruptions and without major changes in the over-all system.

The invention claimed is:

1. Gas scrubbing apparatus comprising: a venturi-shaped gas defining passage including an upstream contraction section, an intermediate throat section, and a downstream expansion section; spaced opposed baffle means fixedly mounted and extending normally to the gas defining passage upstream said throat for introducing washing liquid from opposite sides of said gas defining passage in opposed sheet-like paths normal to the direction of gas flow and into said gas defining passage upstream said throat section to increase the gas liquid contact at said throat section; adjusting means positioned immediately below said baffle means for introducing washing liquid to vary the cross-sectional area of said throat section independently of said contraction section and said expansion section; said adjusting means including a pair of spaced, relatively movable dampers the top portions of which, when in fully open position, are positioned immediately below said baffle means, said dampers having spaced opposed side faces thereof defining a portion of said throat section; and means to move said dampers relative to each other and relative to said baffle means to carry the cross-sectional area of said throat section, the top portions of said dampers serving as extensions of said baffle means when said dampers are moved from fully open position.

2. The apparatus of claim **1**, said means to move said dampers including damper drive means coupled to both of said dampers to move said dampers toward and away from each other about a longtudinally extending plane passing through the center line of said throat section to vary the cross-sectional area of said throat section in a symmetrical fashion.

3. The apparatus of claim **1**, said side faces of said dampers including opposed inclined cutaway sections along opposed upstream and downstream faces thereof alignable with the opposed converging ends of said contraction section and expansion section respectively when said dampers are in "fully open" position.

4. Gas scrubbing apparatus comprising: a venturi-shaped gas defining passage including an upstream contraction section, an intermediate throat section, and a downstream expansion section; spaced opposed baffle means fixedly mounted and extending normally to the gas defining passage upstream said throat for introducing washing liquid from opposed sides of said gas defining passage in opposed paths normal to the direction of gas flow into said gas defining passage upstream said throat section to increase gas-liquid contact at said throat section; a pair of damper boxes adjacent said throat section; a pair of spaced, relatively movable dampers the top portions of which when in fully open position are positioned immediately below said baffle means for introducing washing liquid and disposed within said boxes, said dampers having spaced opposed faces defining a portion of said throat section; means to move said dampers relative to each other and relative to said baffle means to vary the cross-sectional area of said throat section independently of said contraction section and said expansion section, the top portions of said dampers serving as extensions of said baffle means when said dampers are moved from fully open position, and means for introducing a flushing liquid into said damper boxes to clean the same.

5. Gas scrubbing apparatus comprising; a venturi-shaped gas defining passage having a varying cross-sectional area of rectangular configuration and including a converging upstream contraction section, an intermediate throat section, and a diverging downstream expansion section; a pair of damper boxes adjacent said throat section, a pair of spaced dampers pivotally disposed within said boxes, said dampers having inclined cutaway sections along the opposed upstream and downstream faces thereof alignable with the opposed converging walls of said contraction section and expansion section respectively when said dampers are pivoted to "fully open" position; damper drive means coupled to both of said dampers to pivotally move said dampers simultaneously toward and away from each other about a longitudinally extending plane passing through the center line of said throat section to vary the cross-sectional area of said throat section in a symmetrical fashion; means for introducing a flushing liquid into said damper boxes to clean the same; and means for introducing washing liquid into said gas defining passage upstream said throat section including a pair of oppositely disposed inclined baffles disposed within said damper box upstream said dampers and extending inwardly toward said gas passage and a plurality of liquid inlets communicating with said throat section to direct jets of liquid against said baffles to form liquid sheets introduced transversely into said gas passage.

References Cited

UNITED STATES PATENTS

3,069,146	12/1962	MacNeill	261—62 X
3,138,647	6/1964	Krantz.	

FOREIGN PATENTS

925,711	5/1963	Great Britain.
1,381,961	11/1964	France.
1,381,962	11/1964	France.
1,381,963	11/1964	France.

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