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2,709,580

SMOKE WASHER

Filed Nov. 21, 1952

2 Sheets-Sheet 1

Fig. 1.

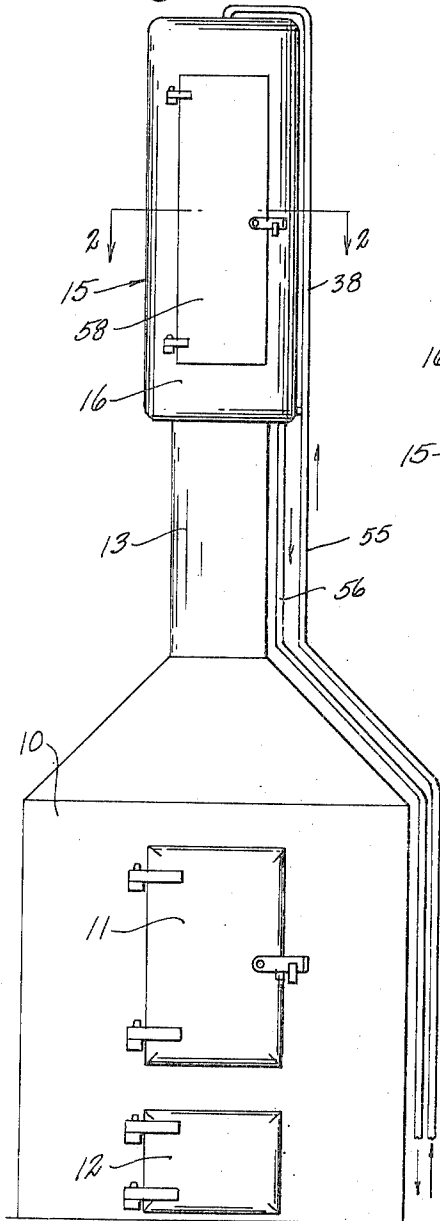
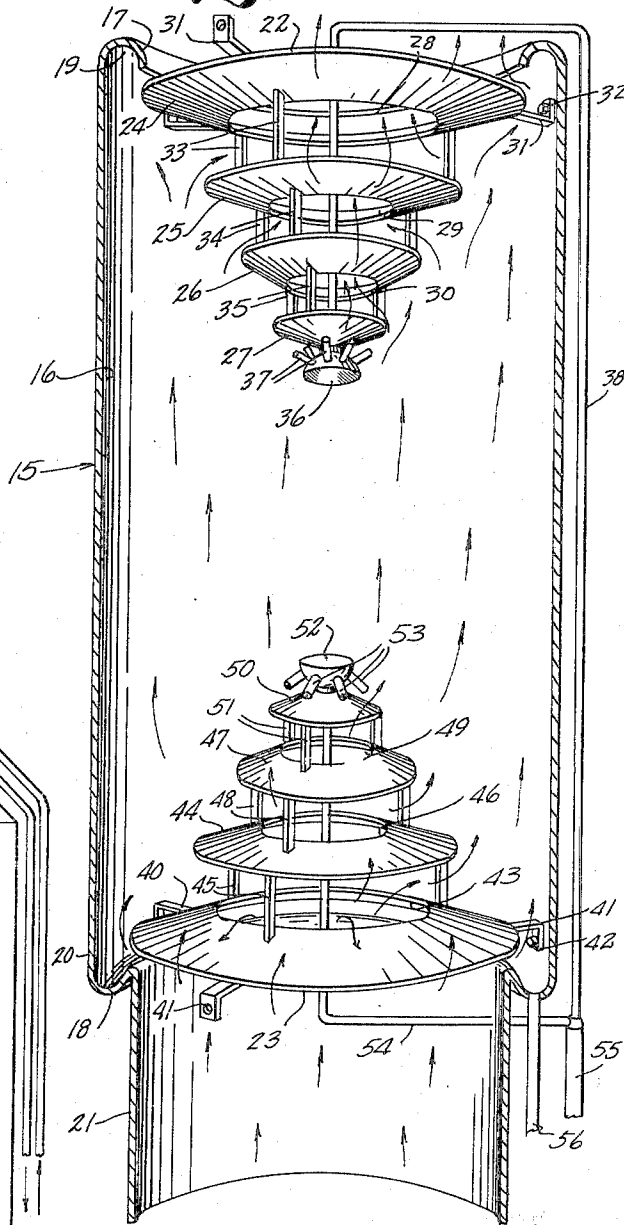


Fig. 4.



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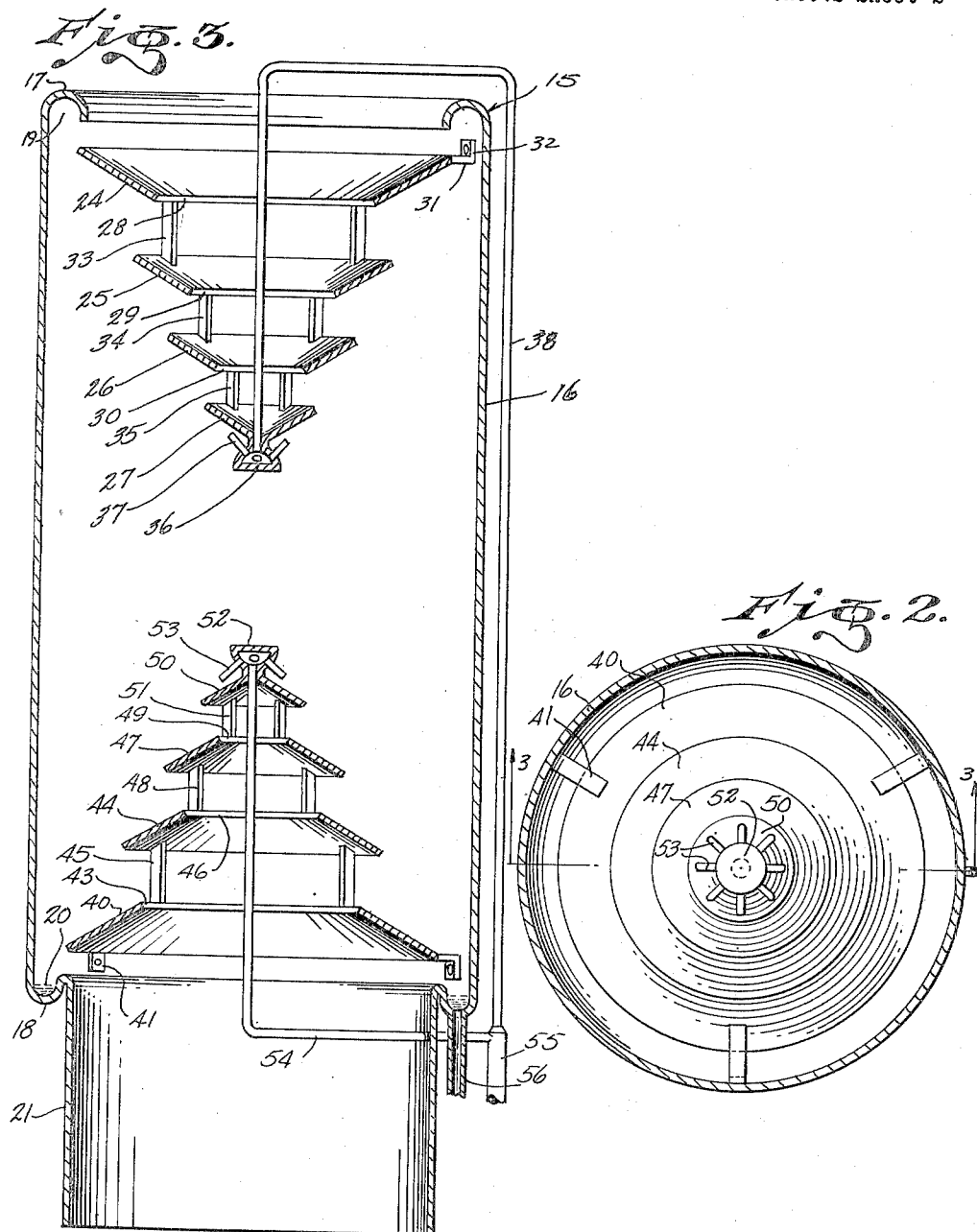
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SMOKE WASHER

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2 Claims. (Cl. 261—111)

This invention relates to apparatus for removing soot and other undesirable components from furnace or incinerator smoke and more particularly to apparatus for washing the soot and other components, such as acid-forming compounds, out of smoke as the smoke issues from a furnace or smoke stack.

It is among the objects of the invention to provide improved smoke cleansing apparatus which can be applied as an attachment to a smoke stack or disposed as a unit between a furnace smoke outlet and an associated stack or chimney; which thoroughly washes the smoke issuing from the smoke stack or furnace to remove from the smoke such components as soot, ash, tar and sulphur compounds and leave a substantially clear and non-acid forming flue gas to be discharged into the atmosphere; which, if desirable for economy of operation, may recirculate the same water through the washing apparatus with only a small quantity of make up water added; which does not materially reduce the draft of the associated smoke stack or chimney; and which is simple and durable in construction, economical to manufacture, easy to install and service, and effective and efficient in operation.

Other objects and advantages will become apparent from a consideration of the following description and the appended claims in conjunction with the accompanying drawings, wherein:

Figure 1 is a front elevational view of an incinerator having an upwardly extending smoke stack with smoke washing apparatus illustrative of the invention installed on the upper end of the smoke stack;

Figure 2 is a transverse cross sectional view on the line 2—2 of Figure 1;

Figure 3 is a longitudinal cross sectional view on the line 3—3 of Figure 2; and

Figure 4 is a cross sectional view similar to Figure 3 but with certain internal parts of the apparatus shown in elevation to better illustrate the construction of the apparatus.

In the installation illustrated in Figure 1 the numeral 10 indicates an incinerator furnace having a door 11 through which material to be burned is placed in the furnace and a door 12 below the door 11 through which ash and non-combustible materials are removed from the incinerator. A smoke stack 13 extends upwardly from the upper end of the furnace 10 and a smoke cleansing apparatus or device, generally indicated at 15, is mounted in upright position on the upper end of the smoke stack 13.

While the smoke cleansing apparatus 15 has been shown as mounted on the upper end of an incinerator smoke stack, it is to be understood that it may be mounted on the top of any type of smoke stack or chimney or may be installed as a unit between a furnace smoke outlet structure and an associated smoke stack or chimney, without in any way exceeding the scope of the invention.

The smoke cleanser 15 comprises a hollow housing 16 of elongated and preferably cylindrical shape having inwardly rolled end portions 17 and 18 to provide annular

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troughs 19 and 20 extending around the inside of the housing 16 one trough at each end of the housing. An adaptor 21 of cylindrical shape and of smaller diameter than the housing 16 is disposed coaxially of the housing 16 and secured at one end to the inner edge of the rolled trough formation 18 at one end of the housing and projects longitudinally from the housing for reception in the upper end of a smoke stack or chimney or in a smoke discharge structure of a furnace.

Smoke washing assemblies 22 and 23 are disposed in the housing 16 one assembly adjacent each end of the housing and both of these assemblies are substantially identical in construction except that one is inverted relative to the other.

The upper assembly 22 near the top end of the housing 16 comprises dished, annular plates 24, 25 and 26 disposed substantially parallel to each other and coaxially of each other and of the cylindrical housing 16 with their concave sides facing the adjacent upper end of the housing, and a dished, solid plate 27 spaced from and disposed coaxially of and substantially parallel to the plate 26.

The plates 24 to 27 inclusive are circular in shape and decrease progressively in diameter from the plate 24 disposed adjacent the inwardly rolled upper end portion 17 of the housing to the plate 27 most remote from the upper end of the housing. The larger plate 27 has a diameter such that it slightly overlies the inner edge of the upper trough 19 of the housing and has a central aperture 28 therein somewhat smaller in diameter than the plate 25 nearest the plate 24. The plate 25 has a central aperture 29 somewhat smaller than the plate 26 and this plate 26 has a central aperture or opening 30 somewhat smaller than the plate 27.

The plate 24 is secured to the housing 16 by angle brackets 31 projecting radially from the concave side of this plate at substantially equal angular intervals therearound and secured to the housing 16 adjacent the upper trough formation 17 of the housing by suitable means such as the bolts or rivets 32 extending through registering apertures in the angle brackets 31 and in the housing wall. The plate 25 is secured to the plate 24 by struts 33 disposed substantially parallel to the longitudinal center line of the housing 16 and extending from the convex side of the plate 24 adjacent the central opening 28 in this plate to the concave side of the plate 25 near the outer edge of the latter plate, these struts being spaced at substantially equal angular intervals around the central aperture 28 of the plate 24. The plate 26 is secured to the plate 25 by struts 34 similar to the struts 33 and the plate 27 is secured to the plate 26 by struts 35 similar to the struts 33 and 34.

A spray head 36 comprising a hollow body of substantially hemispherical shape is mounted on the plate 27 at the convex side of this plate and substantially centrally thereof and a plurality of spray nozzles 37 project from the spray head 36 at substantially equal angular intervals around the spray head and are directed toward the outer edge of the plate 27 to direct sprays of water past the outer edges of the several plates 27, 26, 25 and 24, the water passing the outer edge of the plate 24 being directed into the trough 17 at the upper end of the housing and deflected by this trough to the inner surface of the housing wall and flowing down the housing wall into the trough 20 at the bottom end of the housing.

A water supply pipe 38 leads over the upper end of the housing 16 and downwardly through the central apertures in the several deflector plates to the spray head 36 to carry water under pressure to the spray nozzles 37.

The lower washer assembly 23 comprises a dished annular plate 40 having its concave side facing the lower or bottom end of the housing 16 and supported on the housing by angle brackets 41 which project radially from

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the plate 40 at substantially equal angular intervals around the plate and are secured to the housing by suitable means, such as the bolts or rivets 42 extending through registering apertures in the angle brackets and the housing wall. The plate 40 is spaced from and substantially parallel to the inner edge of the bottom trough 20 of the housing 16 and has a diameter slightly greater than the diameter of the inner edge of the trough 20 so that water flowing past the outer edge of this plate will flow into the trough and not downwardly through the adaptor 21. The plate 40 is provided with a concentric circular opening 43 of circular shape and a dished, circular plate 44 is disposed above and spaced from the plate 40 with its concave side facing the convex side of the plate 40. The plate 44 is supported on the plate 40 by struts 45 disposed substantially perpendicular to the longitudinal center line of the housing 16 and at substantially equal angular intervals around the center opening 43 in the plate 40. The plate 44 has a diameter somewhat greater than the diameter of the central opening 43 in the plate 40 and is itself provided with a concentric central opening 46 of circular shape.

A third dished, annular plate 47 is disposed above the plate 44 with its concave side facing the convex, upper side of the plate 44 and is held in spaced and substantially parallel relationship to the plate 44 by struts 48, similar to the struts 45, extending from the plate 44 to the plate 47. The plate 47 has a diameter somewhat greater than the diameter of the central opening 46 in the plate 44 and is provided with a concentric central opening 49 of circular shape.

A dished, solid plate 50 is disposed above the plate 47 with its concave side facing the upper, convex side of the plate 47 and is held in spaced and substantially parallel relationship to the plate 47 by struts 51, similar to the struts 45 and 48, extending from the plate 47 to the plate 50.

The plates 40, 44, 47 and 50 are all disposed substantially coaxially of the housing 16 and of each other and are preferably uniformly spaced apart with the planes of their outer or peripheral edges substantially perpendicular to the longitudinal center line of the housing and these plates decrease progressively in diameter from the lower plate 40 to the upper plate 50.

A hollow spray head 52 of substantially hemispherical shape is mounted on the upper, convex side of the plate 50 centrally of this plate and a plurality of spray nozzles 53 project radially from the spray 52 at substantially equal angular intervals therearound and are directed toward the outer edge of the plate 50 for directing sprays of water over the outer edge of the plate 50 and causing the water to flow downwardly over the outer edges of the successively lower plates 47, 44 and 40 and over the outer edge of the bottom plate 40 into the bottom annular trough 20.

A water supply pipe 54 extends upwardly through the central openings in the plates 40, 44 and 47 and is connected at one end to the spray head 52, the end of the supply pipe 38 remote from the spray head 36 and the end of the supply pipe 54 remote from the spray head 52 being both connected to a main water supply pipe 55. A drain pipe 56 is connected at its upper end to the bottom trough 20 of the housing to conduct the used water from the washing apparatus to a sewer or other discharge or to return the water to a suitable settling tank from which it may be pumped into the main supply pipe 55 for recirculation through the washing apparatus.

The smoke passing upwardly through the adaptor 21 may pass through the space between the plate 40 and the inner edge of the trough 20 or through any of the spaces between the plates 40, 44, 47 and 50 and will be subjected to a spray of water at each passage through adjacent plates. After leaving the unit 23 the smoke

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passes upwardly through the housing 16 and then through the upper unit 22, being free to pass through any of the passages between the plates 27, 26, 25 and 24 or the space between the plate 24 and the inner edge of the upper trough formation 17 and out of the top of the housing.

The combustion gases issuing from the top of the washer housing will be in a clear and non-acid condition having been washed free of objectionable components, such as soot, ash, tar and sulphur compounds.

When the washer apparatus is of sufficient size the housing 16 will be provided in its cylindrical wall with an access opening closed by a hinged mounted door 58 which can be opened to provide access to the interior of the washer for servicing the washing assemblies.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment, is therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the 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.

What is claimed is:

1. Smoke cleaning apparatus comprising an upright open ended hollow housing and having the lower end adapted for mounting upon a smoke outlet structure, and a pair of washer assemblies disposed within said housing one adjacent each of the open ends of the housing, each assembly comprising a plurality of dished plates arranged in substantially parallel and coaxial relationship to each other and spaced apart longitudinally of said housing with the plates decreasing progressively in size, the plate of the greatest size of each assembly being nearest the adjacent open end of the housing and the plate of the shortest size being farthest from such associated open end, the plates of each assembly having their concave faces facing toward the adjacent open end of the housing, and a spray head on the plate of the shortest size of each assembly for directing streams of water over the associated plate and toward the other plates of the assembly.

2. Smoke cleaning apparatus comprising an upright open ended hollow housing and having the lower end adapted for mounting upon a smoke outlet structure, a pair of washer assemblies disposed within said housing one adjacent each of the open ends of the housing, each assembly comprising a plurality of dished plates arranged in substantially parallel and coaxial relationship to each other and spaced apart longitudinally of said housing with the plates decreasing progressively in size, the plate of the greatest size of each assembly being nearest the adjacent open end of the housing and the plate of the shortest size being farthest from such associated open end, the plates of each assembly having their concave faces facing toward the adjacent open end of the housing, and a spray head on the plate of the shortest size of each assembly for directing streams of water over the associated plate and toward the other plates of the assembly, and an annular trough on the lower end of said housing for receiving the water from said assemblies.

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