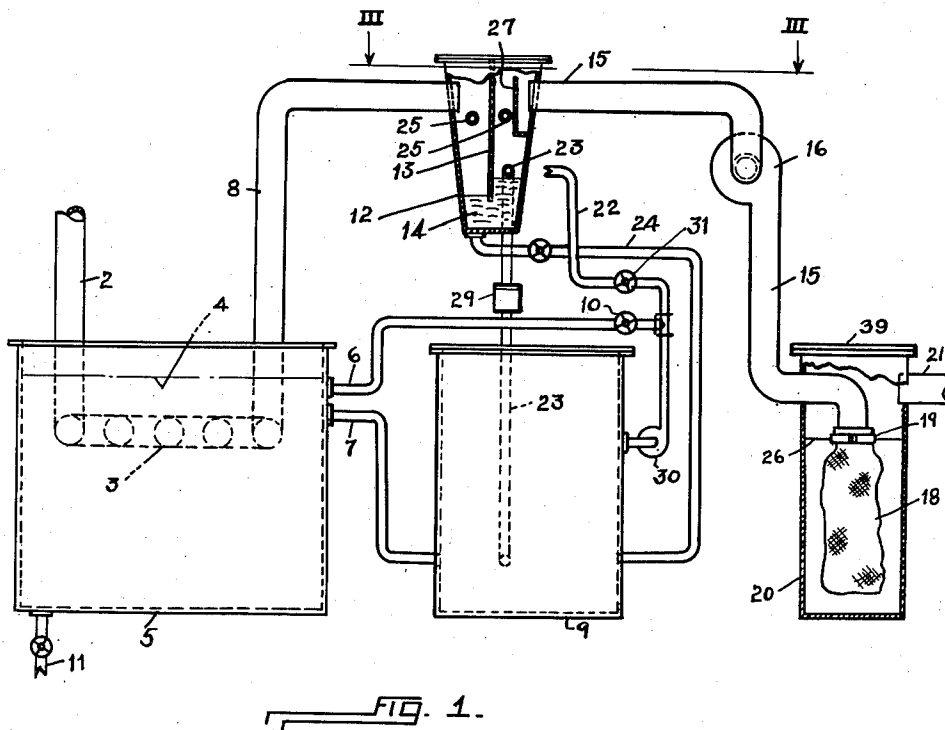


G. BUNGAS
SMOKE-ARRESTING APPARATUS
Filed Dec. 20, 1955



INVENTOR.
George Bungas
BY
Christy, Parmelee and Stridland
his attorneys

1

2,830,673

SMOKE-ARRESTING APPARATUS

George Bungas, Pittsburgh, Pa.

Application December 20, 1955, Serial No. 554,224

1 Claim. (Cl. 183—11)

This invention relates to apparatus for cleansing the hot waste gases of furnaces, boilers and industrial equipment, and the invention consists in certain new and useful improvements in the structure of such apparatus.

The primary object of the invention is to provide apparatus which is economical to construct and operate for the cooling and removing of maximum quantities of solid matter from hot, dirty gases. Other objects will appear in the following specification.

In attaining my objects the gases are first cooled, then scrubbed by passage through a substantial depth of water, and thereafter they are filtered for release into a stack or other outlet discharging into the open atmosphere.

In the accompanying drawings, illustrating an embodiment of my invention:

Fig. 1 is a view of the apparatus, partly in side elevation and partly in vertical section.

Fig. 2 is a view in plan of a gas cooler embodied in the apparatus; and

Fig. 3 is a fragmentary view, partly in plan and partly in horizontal section, showing portions of the apparatus to larger scale, as seen on the plane III—III of Fig. 1.

Referring to the drawings the reference numeral 2 represents a duct that leads the hot dirty gases from the outlet flues of a domestic or industrial furnace, say, and delivers such gases into a horizontal bank of heat exchange tubes 3 immersed in a circulating body 4 of water in an open tank 5. Cool water is fed into the tank by a water supply line 6 leading from a storage tank or stand-pipe 9, while an outlet pipe 7 returns water from the cooling tank 5 to supply tank 9 at the same rate as it is fed thereto by the supply line. While the storage tank 9 appears in Fig. 1 to be of smaller water-holding capacity than the cooling tank 5, it will be understood that in most cases the storage tank will have several times the capacity of the cooling tank. The circulating body of water in the cooling tank 5 removes heat from the hot gases flowing through the tubes 3 into a duct 8, and the rate of water flow may be adjusted by a valve 10 to proportion it to the heat to be removed from the flowing gases. It is desirable that the temperature of the gases flowing from duct 2 to the duct 8 shall be reduced to less than 212° F.

The cooled gases are delivered by duct 8 into a scrubber tank 12 which is of V-shape in vertical section. The tank 12 includes a vertical partition or baffle 13 which extends downwardly from the top of the tank to a distance of say five inches above the bottom of the tank, and a supply of water 14 is maintained at a level above the lower edge of the partition. The gases enter the scrubber tank 12 on the left-hand side of the partition, and exit from the right-hand side of the partition by way of one or more outlet ducts 15 under the effect of a suction fan 16 provided in the duct 15 and driven by an electric motor 17. Leading from the fan 16 the duct 15 ends in an outlet terminal, upon which a filter bag 18 is removably secured, as at 19, in a tank or container 20. The bag 18 is formed of a pervious cotton fabric cur-

2

rently available and known on the open market. Under the propulsion of the fan 16 the hot, dirty gases are propelled from the inlet duct 2, through the heat-exchange tubes 3, duct 8, scrubber 12, duct 15 and filter bag 18 into the container 20, whence the cooled, scrubbed and filtered gases are led by a duct 21 to a stack (not shown) or other outlet opening into the outer atmosphere. All possibility of air pollution is eliminated.

In the case of furnace installations that produce large quantities of hot, dirty gases, a plurality of the assemblies described may be employed. That is to say, the inlet ducts 2 of a plurality of the assemblies described may be connected to the waste gas flue of such a furnace installation, whereby the waste gases of the installation may be divided into a plurality of streams that are severally processed in the said assemblies.

Particular attention is directed to the scrubber 12, certain features of which are set forth in United States Letters Patent No. 2,720,385, granted to me October 11, 1955. It will be understood that the suction of the fan 16 is effective to raise the level of the water 14 on the right-hand side of the partition 13, as shown in Fig. 1, and correspondingly the level of the water on the left-hand side of the partition drops substantially to the bottom edge of the partition. Under fan suction the gases are drawn from the left-hand side of the partition, beneath the lower edge of the partition, and caused to bubble, with scrubbing or cleansing effect, upwardly through the water on the right-hand side of the partition, whence the gases are drawn into the duct 15 and forced through the filter bag 18. During such operation tar and solid particles washed from the gases rise to surface of the water. In order to prevent water or moisture from being drawn with the gases into the duct 15, a baffle 27 is arranged across and at an interval from the mouth of duct 15, and the gases rising from the water are required to steam upwardly over the top of baffle 27 and then downwardly to the mouth of said duct.

A slow flow or circulation of water enters the scrubber tank 12 by way of a supply pipe 22 and exits through a pipe 23 that leads into the lower portion of storage tank 9. The flow of water from tank 9 to the scrubber tank 12 is promoted by a motor-driven pump 30, and valves 10 and 31 in the lines 6 and 22, respectively, permits suitable apportionment of water flow to the two tanks 5 and 12. The openings of the pipes 22 and 23 in the opposite side walls of the scrubber tank are disposed at the level of the water on the right-hand side of the partition when the fan is in operation, whereby there is a slow surface flow of water between the inlet pipe 22 and outlet pipe 23 that "sweeps" the accumulation of tar and solid particles into the outlet pipe 23. The pipe 23 includes a filter or strainer 29 that removes the entrained solid particles from the discharged water before it enters the storage tank 9.

From time to time the walls of the tank 12 may be flushed by means of water sprays 25, as disclosed in my Letters Patent No. 2,720,385.

In those cases where the gases being processed contain aerosols or microscopic particles that are difficult to remove from the flowing gases, the filter bag 18 in tank 20 may be submerged in a body of water whose surface is indicated at 26 in Fig. 1. With this arrangement the gases forced through the fine fabric wall of the filter bag rise in a myriad of minute bubbles through the body of water, and, upon reaching the surface of the water, the gases flow in thoroughly cleansed condition into the outlet duct 21.

When the filter bag becomes filled with particles removed from the gases, the cover 39 of the container 20 is removed and the filled bag is replaced by a clean bag upon the outlet end of the duct 15. In the case of the

3

gases of certain furnace installations the material removed from the filter bag contains rare earth metals, such as germanium, and/or other minerals, and the recovery of these elements manifestly is of economic importance.

The conduit or tubing portions 2, 3, 8 and 15 may for purposes of definition be considered to be a duct having an inlet (the inlet of portion 2) for hot, dirty waste gases and an outlet (the terminal of pipe 15) for the cooled and cleansed gases, and it will be understood that many variations and modifications of the structure described are contemplated within the terms of the appended claim.

I claim:

In smoke-arresting apparatus comprising a flue for hot gaseous products of combustion, a heat-exchange tank containing a body of cooling water, a bank of heat-exchange tubes submerged in said body of cooling water and connected to receive hot products of combustion from said flue, whereby said products flowing through the heat-exchange tubes are partially cooled, a water storage tank, a scrubbing unit mounted above said tanks and including a pool of water, said scrubbing unit comprising a container having a partition extending downwardly into said pool, with clearance adjacent the lower end of said partition for the flow of said products through the water from one side of the partition to the other, water sprays above the pool of water in said scrubbing unit, a pump having a delivery line for effecting the flow of water from the storage tank to the water sprays, a line for returning water from the scrubbing unit pool to the storage tank, a filter in the line of return flow

4

from the scrubbing unit pool to the storage tank, said scrubbing unit having an inlet duct connected to receive on one side of said partition the products from said heat exchange-tubes, an outlet duct for leading products from said scrubbing unit on the other side of said partition, a spray-excluding baffle mounted over the mouth of said outlet duct in said scrubbing unit, a motor-driven fan for propelling the products sequentially through said inlet duct, said heat exchange tubes, said pool of water in the scrubbing unit, and said outlet duct, and a container having means therein for filtering the products flowing through the outlet duct from the scrubbing unit.

References Cited in the file of this patent

UNITED STATES PATENTS

748,432	Stanton	Dec. 29, 1903
980,977	Little	Jan. 10, 1911
1,336,905	Hunzicker	Apr. 13, 1920
1,778,988	Stiefel	Oct. 21, 1930
1,779,282	Louis	Oct. 21, 1930
1,839,582	Nordhem	Jan. 5, 1932
2,177,665	Loughrey	Oct. 31, 1939
2,239,181	Smith	Apr. 22, 1941
2,721,065	Ingram	Oct. 18, 1955
2,756,976	Jalma	July 31, 1956

FOREIGN PATENTS

412,221	Great Britain	June 22, 1934
---------	---------------	---------------