

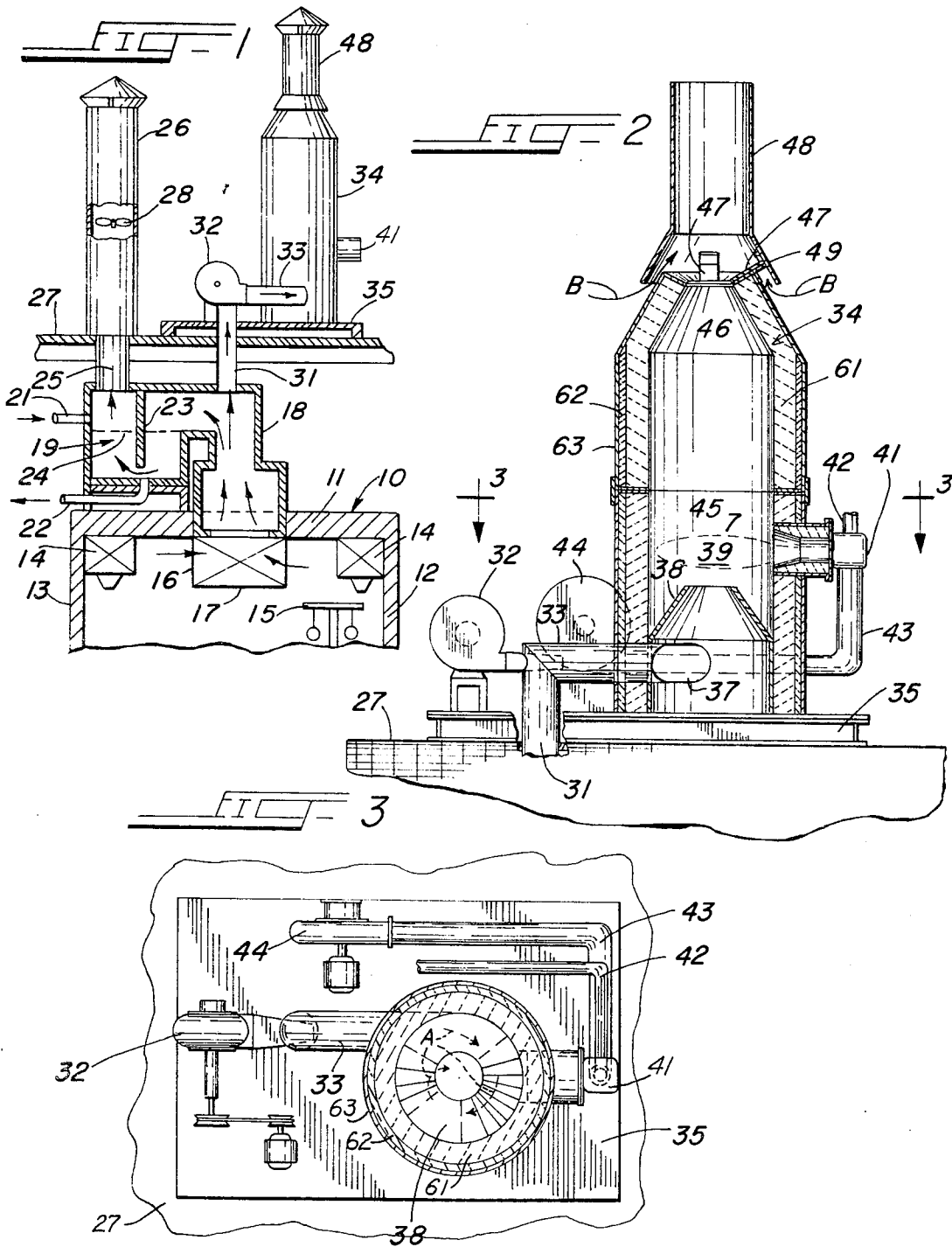
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S. R. PORWANCHER

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SMOKEHOUSE EXHAUST INCINERATOR

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INVENTOR.

SAMUEL R. PORWANCHER

BY *Kinzer, Doran & Zickert*
 ATTORNEYS

1

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SMOKEHOUSE EXHAUST INCINERATOR

Samuel R. Porwancher, Chicago, Ill., assignor to Michigan Oven Company, Romulus, Mich., a corporation of Michigan

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4 Claims

ABSTRACT OF THE DISCLOSURE

An incinerator for exhausting smoke from a food product smokehouse, including an insulated vertical cylindrical chamber tapered inwardly at the top, a deflector for directing smoke from the smokehouse, in a turbulent flow, into an intermediate combustion region in the chamber, a burner for burning the smoke in the combustion region, and means to introduce cooling air into the base of an exhaust stack extending upwardly from the top of the chamber.

In cooking and smoking meat and other food products, the product to be smoked is suspended within a smokehouse. During a part of the cycle of treatment carried out in the smokehouse, the interior of the smokehouse is flooded with a heavy dense smoke. This smoke is produced by incomplete combustion of wood chips, carried out in an oxygen-starved atmosphere to produce the desired dense form of smoke.

After the smoking operation is completed, it is necessary to remove the smoke from the smokehouse in order to permit completion of the cooking and other processing and to allow for changing of the smokehouse contents. As might be expected, the exhaust from the smokehouse is extremely dirty and presents substantial problems with respect to air pollution control ordinances and similar regulations. Incinerators have been provided, for use in the smoke exhaust systems of smokehouses, to reduce the undesirable components in the smoke exhaust by burning the smoke. But incinerators employed for this purpose tend to be rather bulky and expensive, particularly because they must handle large volumes of dense smoke within short periods of time in order to permit the smokehouse to be used efficiently. Furthermore, incinerator systems have presented substantial problems due to the fact that the heavy, dense smoke used in the smokehouse tends to foul any exhaust equipment and incinerator apparatus through which it flows.

It is an object of the present invention, therefore, to provide a new and improved compact smokehouse incinerator that is highly efficient in operation and that will permit the exhaust from a commercial smokehouse to meet anti-pollution requirements in metropolitan areas.

Another object of the invention is to provide a new and improved smokehouse exhaust incinerator that is not susceptible to becoming fouled with the materials constituting the smoke.

Another object of the invention is to provide a compact and efficient smokehouse incinerator that is relatively low in initial cost and that requires a minimum of maintenance.

A further object of the invention is to provide a new and improved smokehouse incinerator system in which the smoke exhaust is separate and independent from the main exhaust for the smokehouse.

Accordingly, the invention is directed to a smoke exhaust incinerator system incorporated in a smokehouse

2

for cooking and smoking meat or other food products, the smokehouse comprising a housing in which the product to be smoked is suspended and means for introducing a dense smoke into that housing. The incinerator system includes an insulated vertical cylindrical combustion chamber located externally of the smokehouse and having a convergent upper section terminating in an outlet opening at the top of the chamber. Smoke exhaust means are provided, connecting the interior of the smokehouse to the combustion chamber of the incinerator, for exhausting smoke from the smokehouse into the base of the combustion chamber. A deflecting means, preferably a frusto-conical baffle, is located within the combustion chamber and directs the flow of smoke from the base of that chamber upwardly past an intermediate combustion region. A burner for heating and burning the smoke is located in the combustion region of the chamber. An exhaust stack extends upwardly from the outlet opening of the combustion chamber, this exhaust stack being provided with means for introducing cooling air into the bottom of the stack.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, shows a preferred embodiment of the present invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be made as desired by those skilled in the art without departing from the present invention.

In the drawings:

FIG. 1 is a partial sectional elevation view of a smokehouse incinerator system constructed in accordance with the present invention;

FIG. 2 is a sectional elevation view of the incinerator combustion and exhaust stack; and

FIG. 3 is a detail sectional view taken approximately along line 3—3 in FIG. 2.

The smoke exhaust incinerator system illustrated in the drawings is employed in conjunction with a smokehouse 10 having a roof 11 and side walls 12 and 13. Smokehouse 10 includes two smoke inlet ducts 14 each affording a series of nozzles for introducing a dense, heavy smoke into the interior of the smokehouse. Ducts 14 are connected to a suitable smoke generator (not shown), which may be of conventional construction. In operation, the meat or other food product to be smoked in the smokehouse is suspended therein on appropriate racks such as the rack 15.

In smokehouse 10, an exhaust duct 16 is located in the center top portion of the house. Duct 16 is provided with a plurality of openings 17 into which smoke, steam, or other components of the smokehouse atmosphere can flow when it is necessary to exhaust the smokehouse as described more fully hereinafter.

Duct 16 is connected to an external exhaust duct 18 that leads into a water damper 19. Water damper 19 has an inlet 21, through which water may be introduced into the damper, and a drain or outlet 22. There is a central barrier 23 in the water damper. In operation, the water damper can be filled with water to the level indicated by the dash line 24 to close off the external exhaust duct 18 from a main exhaust outlet 25. Outlet 25 leads to a main exhaust stack 26, through the roof 27 of the building in which the smokehouse 10 is located. The main exhaust stack 26 includes an appropriate main exhaust blower 28.

The external exhaust duct 18 is also provided with a

second outlet constituting a smoke exhaust duct 31 that is independent of the main exhaust leading through the water damper 19. Duct 31 is connected to an exhaust blower 32 having an outlet duct 33 that extends into the base of a vertical cylindrical combustion chamber 34. As shown in FIGS. 1 and 2, combustion chamber 34 may be mounted upon an appropriate frame or support 35 mounted on the building roof.

Combustion chamber 34 is a principal element of a smoke exhaust incinerator that is shown in greater detail in FIGS. 2 and 3. In the preferred construction shown in those figures, blower 32 is an induction blower that forces air under pressure into duct 33 to induce a flow of smoke and air outwardly of the smokehouse from duct 31. This induction exhaust arrangement avoids passing the smoke through blower 32 and thus prevents the substantial solid content of the smoke from fouling the blower.

Duct 33 terminates within the base portion of chamber 34 at one side of the chamber, as indicated by the outlet opening 37. A deflecting means comprising a frusto-conical metal baffle 38 is located within the base of chamber 34 and directs the flow of smoke from the base of the combustion chamber circumferentially upwardly, as indicated by arrows A, into an intermediate combustion region 39 in the chamber.

The incinerator apparatus comprising combustion chamber 34 further includes a burner 41 for heating and burning the smoke as the smoke traverses the combustion region 39 within the incinerator. Preferably, burner 41 is a gas burner, provided with a gas inlet conduit 42 and an air inlet duct 43, duct 43 being connected to a blower 44. Burner 41 projects a flame into the intermediate combustion region 39 of the incinerator as generally indicated by the dash line 45 in FIG. 2.

The upper portion of combustion chamber 34 is sloped inwardly toward an outlet opening 46. A series of brackets 47 are mounted around the periphery of the outlet opening 46; these brackets support an exhaust stack 48 that extends upwardly of the combustion chamber outlet and is open to the atmosphere. The lower portion of stack 48 is a flared sleeve 49 that is spaced from the outside wall of combustion chamber 34 to permit the introduction of cooling air into the bottom of the exhaust stack as indicated by the arrows B.

In operation of the incinerator and exhaust system shown in the drawings, water damper 19 (FIG. 1) is drained and is empty when steam or other innocuous atmospheric components are exhausted from the interior of smokehouse 10. In this regard, it should be noted that for much of the operation of the smokehouse, the meat or other food products in the smokehouse are cooked in the absence of smoke, either by steam or dry heat, or both. When it is desired to evacuate the smokehouse, and there is no substantial quantity of smoke present in the house, as when a steam cooking cycle has been completed or when one charge of food product is to be removed and another substituted, the main exhaust stack 26 is employed to the exclusion of the smoke exhaust 31 and incinerator apparatus 34. This makes it possible to exhaust the smokehouse at a high rate and to reduce the cycle time for the smokehouse to a minimum.

Before the beginning of an operating cycle in which smoke is to be exhausted from smokehouse 10, and preferably even before the smokehouse is filled with smoke, water damper 19 is filled with water. This can be accomplished manually or may be effected by automatic controls controlling the operation of the smokehouse. Once the water damper is filled, air or other atmospheric constituents from the smokehouse can no longer escape from the house through main exhaust stack 26.

When it becomes necessary to clear the smokehouse of smoke, blower 44 is started in operation and burner 41 is ignited to heat incinerator chamber 34 in the intermediate region 39. Typically, the incinerator may be heated to a temperature of approximately 1500° F.

With the gas burner 41 in operation, and the incinerator heated, smoke exhaust blower 32 is started in operation. This blower induces a flow of smoke and other gases from smokehouse 10 through exhaust duct 17, external duct 18, smoke exhaust duct 31, and duct 33 into the base of incinerator chamber 34. The smoke swirls around in the lower part of the combustion chamber, as indicated by arrows A in FIG. 3, and is discharged through the top opening of baffle 38 into the intermediate combustion zone 39 in combustion chamber 34.

The smoke requires a fixed time to pass through the heat portion of the incinerator chamber. Typically, the combustion time for the smoke in chamber 34 may range from 0.3 to 0.5 minute. In a given installation, for use with an eight-cage gas-fired smokehouse, the velocity of the smoke at the 1500° temperature may be of the order of 500 to 600 feet per minute and the heater 41 may provide a heat input to the incinerator between 500,000 and 800,000 B.t.u. per hour. The foregoing exemplary data are provided on the basis of an assumed requirement of 300 s.c.f.m. in exhausting the smokehouse.

The incinerator of the invention provides effective and rapid burning of the smoke from the smokehouse and makes it possible to exhaust the smokehouse, while meeting air pollution control requirements, in a matter of a few minutes. There is little tendency for the smoke to foul the incinerator apparatus; the smoke never passes through blower 32 and is maintained continuously in movement as it passes through incinerator chamber 34. Virtually all of the smoke is thoroughly and completely burned by the time it escapes from the incinerator through exhaust stack 48.

In the preferred construction illustrated in FIGS. 2 and 3, combustion chamber 34 is provided with a refractory liner 61 and the cylindrical portion of the refractory liner is encompassed by a layer of high temperature insulation 62. The entire combustion chamber is encased in a metal housing 63 which may, in a typical installation, be formed from relatively heavy gauge aluminized steel. The provision of the flared sleeve 49 at the bottom of stack 48 and the mounting of that sleeve in spaced relation to the outer surface of the combustion chamber on the brackets 47, as shown in FIG. 2, allows a substantial influx of cooling air to the stack when the incinerator is in operation. This materially reduces the construction cost for the incinerator, because it avoids the necessity of providing a refractory liner, or the use of high temperature alloy steel for stack 48.

What is claimed is:

1. In a smokehouse for cooking and smoking meat or other food products comprising an enclosed housing in which the product to be smoked is suspended and means for introducing a dense smoke into that housing, a smoke exhaust incinerator system comprising:
 - an insulated vertical cylindrical combustion chamber located externally of the smokehouse, said combustion chamber having a convergent upper section terminating in an outlet opening at the top of the chamber;
 - smoke exhaust means, connecting the interior of the smokehouse to said combustion chamber, for exhausting smoke from said smokehouse into the base of said combustion chamber;
 - deflecting means, within said combustion chamber, for directing a flow of smoke from the base of said combustion chamber upwardly past an intermediate combustion region in said combustion chamber;
 - a burner for heating and burning the smoke as the smoke traverses said intermediate combustion region;
 - an exhaust stack extending upwardly from said outlet opening of said combustion chamber; and
 - means for introducing cooling air into the bottom of said exhaust stack.
2. A smokehouse exhaust incinerator system accord-

5

ing to claim 1 in which said deflecting means comprises a baffle of frusto-conical configuration mounted in the base of said combustion chamber.

3. A smokehouse exhaust incinerator system according to claim 2 in which said smoke exhaust means comprises a connecting duct entering said combustion chamber along one edge of the interior of said frusto-conical baffle to produce a swirling movement of the smoke upwardly through the base of said combustion chamber and into said combustion region.

4. A smokehouse exhaust incinerator system according to claim 1 and further comprising a second exhaust means, connected to said smokehouse, for exhausting said smokehouse independently of said smoke exhaust means, said smoke exhaust means and said second exhaust means including a common exhaust duct located within the smokehouse, and means comprising a water damper for

6

preventing flow of smoke through said second exhaust means.

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CHARLES J. MYHRE, Primary Examiner

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