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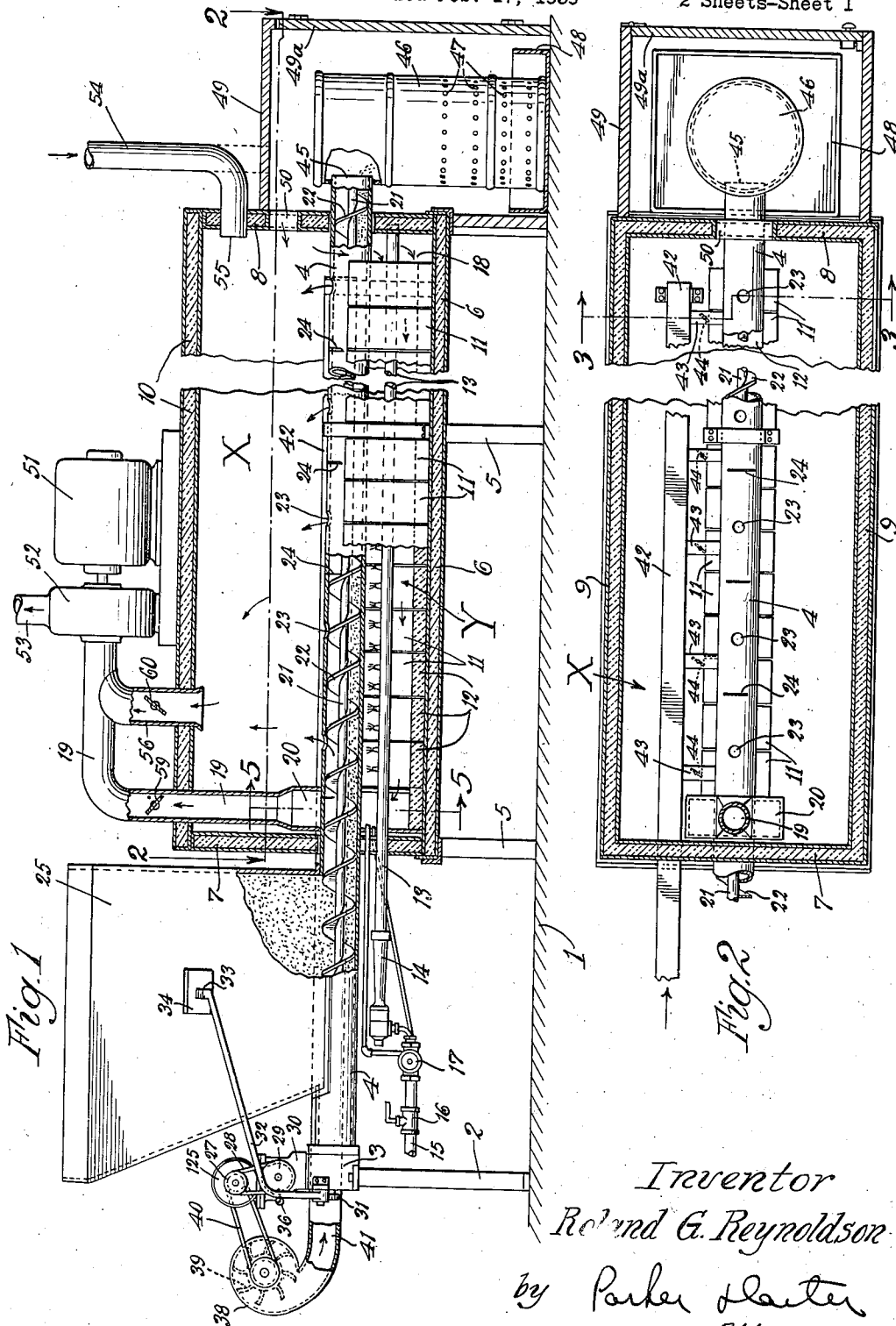
R. G. REYNOLDSON

2,265,857

APPARATUS FOR TREATING MATERIALS

Filed Feb. 17, 1939

2 Sheets-Sheet 1



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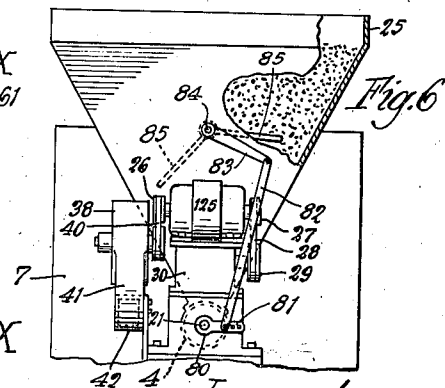
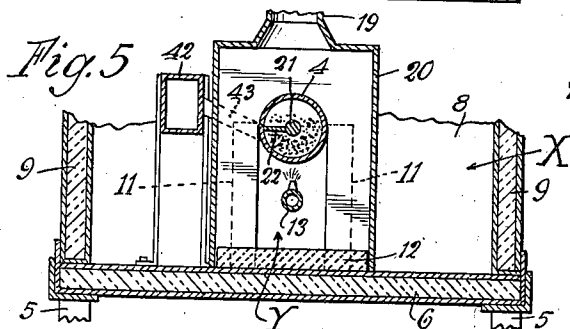
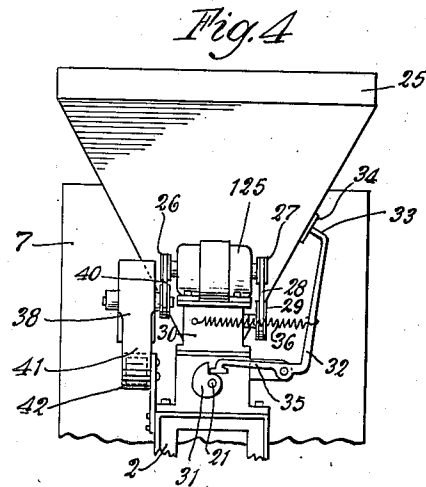
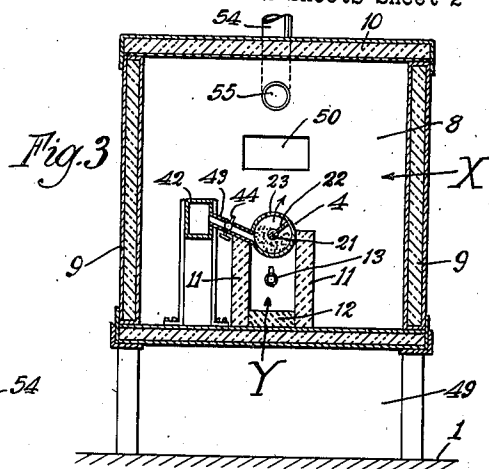
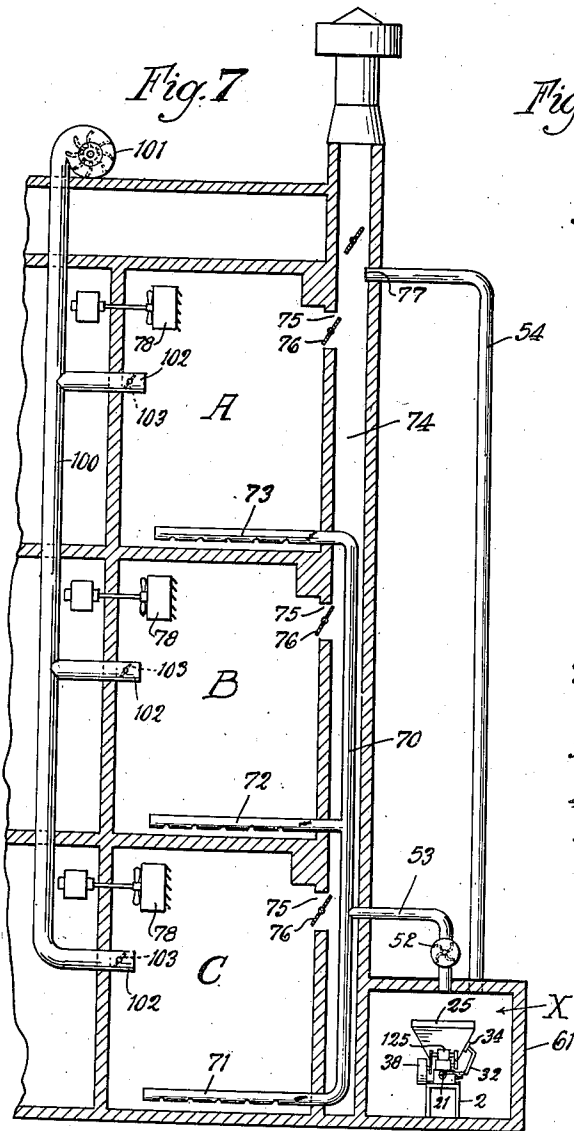
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UNITED STATES PATENT OFFICE

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APPARATUS FOR TREATING MATERIALS

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4 Claims. (Cl. 126—59.5)

My invention relates to an improvement in methods of and apparatus for wood distillation and has for one purpose the provision of an improved method of subjecting wood to destructive distillation.

Another purpose is the provision of an improved method of and apparatus for smoking meats or other foods or substances.

Another purpose is the provision of an improved means for subjecting wood to destructive distillation and for smoking foods or other substances with the products of such distillation.

Another purpose is the provision of improved means for obtaining the uniform feed of finely divided wood or sawdust during the process of distillation.

Another purpose is an improved system for maintaining and supplying smoke to one or more smoke zones separate from the zone of smoke production.

Another purpose is the provision of improved means for supplying air to the wood or sawdust during distillation.

Another purpose is the provision of improved means for economizing heat.

Other purposes will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings wherein:

Fig. 1 is a vertical section;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 2;

Fig. 4 is an end elevation of the structure shown in Fig. 1;

Fig. 5 is a section on an enlarged scale at 5—5 of Fig. 1;

Fig. 6 is a view similar to Fig. 4 illustrating a variant form of my device; and

Fig. 7 is a vertical section through a smoke-house installation.

Like parts are indicated by like characters throughout the specification and drawings.

Referring to the drawings, I generally indicate any suitable surface, floor or the like, upon which my smoking installation may be positioned. 2 illustrates an end bracket, pair of legs or the like, secured at the upper end to any suitable sleeve or member 3 from which extends a conveyor tube 4. The conveyor tube may be supported by additional legs or supporting brackets 5, 5 upon which is mounted a heat insulating chamber which may have a bottom 6 of cork or the like, an end member 7, an opposite end member 8, sides 9, 9 and a top 10. These various wall

members may be formed of any suitable heat insulant, cork or the like, but preferably the upper wall or top 10 is of a heat resisting material, magnesia or the like.

Mounted in any suitable manner on the bottom member 6 are a plurality of fire bricks or equivalent members 11 shown as positioned on edge to define with the additional bricks 12 a closed chamber, the top of which is completed by the conveyor tube 4.

13 is any suitable heating element, gas pipe or the like, which may be supplied from any suitable gas injector 14 in communication with the gas supply line 15 controlled by its valve 16 and any suitable pilot-stat valve 17, the details of which do not form part of the present invention. The chamber in which the heating member 13 is located is provided with an air inlet at one end, as at 18, and has an outlet passage 19 at its opposite end in communication with an outlet housing 20.

Mounted for rotation within the tube 4 is a shaft 21 carrying the conveyor screw 22. 23 are outlet holes spaced along the top of the tube 4 to permit the volatiles to escape. The tube 4 may also be transversely slotted as at 24 in order to compensate for the expansion and contraction due to changes in temperature. 25 is a sawdust hopper, preferably secured to the tube 4 sufficiently solidly, as by bolts, welding or the like, to permit the tube 4 to constitute the sole support for the hopper, for a purpose which will later appear.

125 indicates any suitable motor shown as having drive pulleys 26, 27 at each end of its armature. The drive pulley 27 through a belt 28 drives the pulley 29 associated with any suitable transmission or gear reducing mechanism 30, the details of which form no part of themselves of the present invention. It will be understood, however, that thereby the shaft 21 and screw 22 may be rotated in response to rotation of the motor at a plurality of different speeds. In practice I employ five different speeds whereby the speed of travel of the material through the tube 4 may be controlled to suit the particular smoking job under way.

31 indicates a snail shell cam mounted on or rotating in unison with the shaft 21. Opposed to it is the lever 32 which terminates at one end in a contact member 33 opposed to a wear plate 34 welded or otherwise secured to one side of the hopper 25. The opposite arm 35 of the lever is held opposed to the snail shell cam 31, for example by the spring 36. Thus as the shaft 21

rotates the contact member 33 is caused to tap or hammer against the side of the hopper 25. The mounting of the hopper on the tube 4 permits it to vibrate substantially in response to the tapping or hammering action and the result is a settling of the sawdust in the hopper, resulting in an even and uniform feed or delivery of the sawdust in the hopper to the space within the tube 4 and thus to the conveyor screw 22.

38 generally indicates any suitable blower having a fan 39 which may be driven from the pulley 26 as by the belt 40. The blower 38 exhausts through the outlet 41 to a longitudinally extending duct or passage 42 which may be connected by transverse ducts 43 with the interior of the tube 4. These ducts are spaced along and are each provided with any suitable valve or gate means 44 whereby the supply of air may be varied or controlled in relation to the movement of the sawdust along the tube 4.

It will be understood that under many circumstances, and perhaps usually, the air duct 42 need not be employed at all. Thus for destructive distillation, as below set out, I may prefer to dispense with the employment of the fan 39 and may supply no additional outside air to the interior of the tube 4.

The tube 4 delivers its solid by-products through an open end 45 to a drum 46 which may be vented or apertured as at 47 to permit air to flow therein. 48 is any suitable pan or surrounding outside sleeve which serves to catch any ash which may escape through the apertures 47. Any suitable means may be employed to admit air to a housing 49 surrounding the drum 46, or the drum may be left in the open. In either event, air heated by the combustion of the charcoal may pass inwardly along the passage 50 to the space which receives the smoke or volatiles through the apertures 23. The employment of this heat assists in maintaining the smoke or volatiles at relatively high temperature and preventing condensation and in effect substantially increases the efficiency of my device and method.

It will be understood that I may employ my invention with the tube located in the hollow interior of a smokehouse. In such case, it is not necessary to employ the closed housing, including the top 10, the side members 9, or the end members 7 and 8. In such event, volatiles are exhausted through the apertures 23 directly to the zone of treatment of meat or the like which may be suspended in any suitable manner not herein indicated.

I find it desirable, however, under many circumstances to position the tube 4 and the smoke generating device at a distance from the zone of treatment. Thus I illustrate in Fig. 7 a plurality of smoke chambers A, B and C. It will be understood of course that a single chamber may be employed or any suitable number of chambers. Assuming the existence for example of a single distant smoke chamber, I may supply to it the smoke generated in the chamber X of Fig. 1 by employing a motor 51 actuating any suitable blower mechanism 52 to exhaust smoke or volatiles along a supply passage 53 which may extend to any suitable zone or chamber of treatment. 54 indicates a return passage from such zone of treatment which delivers the returned gases, air and the like as at 55 to the chamber X adjacent the discharge end of the conveyor. Thus the cold return circulation of smoke and air is delivered to the hottest por-

tion of the chamber X and an economizing effect is obtained as the cold gases move in opposite direction to the direction of movement of the sawdust undergoing heating and distillation.

A certain amount of the return circulation will pass downwardly through the passage 18 in order to scavenge the lower chamber around the burner 13, which chamber is indicated as at Y. The gases so scavenged travel upwardly along the passage 19 to the blower 52. The main circulation of the volatiles, however, is upwardly through the outlet 56 adjacent the feed end of the conveyor, and thence with the passage 19 to the blower 52. The valves or gates 59 and 60 may be employed to control the mixture of gases and the circulation downwardly through the passage 18. It will be understood also that if desired the passage 54, as shown in dotted line in Fig. 1, may be directed to the chamber 49 so that the return gases are heated by the combustion of the charcoal in the drum 46 and arrive in the chamber X already partially heated.

Referring to Fig. 7, the system therein shown includes the above mentioned separate smokehouses or smoke chambers A, B and C. In Fig. 7 I illustrate the delivery passage 53 in communication with a larger housing 61 which may take the place of the smaller housing formed of the members 7, 8, 9 and 10. In other words, the size of the housing and the amount of the installation surrounded by it are a matter of choice. In supplying sawdust and in removing ash there is a certain advantage, especially in smaller installations, in having the hopper and the ash chamber exterior to the housing. In any event, I illustrate the passage 53 as in communication with a general supply duct 70 having individual supply or smoke delivery passages 71, 72 and 73 for the chambers A, B and C.

74 is a general outlet duct or chimney or exhaust passage in communication with each of the chambers as through the apertures 75, with the control valves or gates 76. It will be realized, of course, that individual outlet or return ducts may be employed if desired. In the form of Fig. 7, the return passage 54 connects with the outlet duct 74 as at 77 and maintains a return circuit to the interior of the chamber 61 and thus to the smoke generating unit. Any suitable additional heating means may be employed as at 78 for the individual smokehouses.

Referring to Fig. 6, I may substitute for the hopper vibrating structure of Fig. 4 an actual agitator located in the hopper. I illustrate for example a crank disc 80 mounted on or driven from the shaft 21 which includes an adjustable crank arm 81 to which may be adjustably secured a link 82 pivoted to a lever 83 on the agitator shaft 84 which carries any suitable agitator member or members 85 located within the hopper.

It will be realized that whereas I have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative, rather than as limiting me to my precise showing.

The use and operation of my invention are as follows:

I provide means for smoking meats and the like which is available for plants of various size and in particular is adapted to reduce labor and ma-

terial costs and increase operating efficiencies. For example, I have so designated my machine that one filling of the hopper 25 is sufficient to carry out the normal full-time smoking operation. Therefore, it will not be necessary for an attendant to stay by the smoke houses and feed the sawdust as is now necessary in the old method of spreading sawdust on the smokehouse floor.

I preferably employ a five-speed transmission whereby the amount of sawdust fed to the smokehouse can be adjusted at five rates. In other words, I provide a flexible arrangement in which five densities of smoke are available by merely controlling the speed reduction or transmission.

Ash is collected in the closed container 46 and at the end of the smoking period the ash is all accumulated in the container which, if desired, can be kept sealed. To clean away the ashes it is merely necessary for an attendant to remove the container 46 from the smokehouse, it being understood that any suitable means such as the door 49a are provided to give access to the container 46, the container being preferably freely removable from the end of the tube 4. Thus there will be no fly ash and no dirt carried up onto the meat and the walls of the smokehouse or smoke chamber. This reduces the cleaning necessary and is a further factor of labor saving. Concentrating all of the ash in a single container also reduces fire hazard.

I may obtain a further advantage by employing the apertures 47 which permit the ash or residual charcoal to smolder and glow and create heat which may be carried into the chamber X through the passage 50. This heat keeps the smoke hot and prevents condensation, for example in the passages 19 and 53.

I find it desirable to employ my conveyor in connection with a separate generation chamber X as shown for example in Fig. 1. From this chamber or from the corresponding chamber 61 of Fig. 7, smoke can be directed to a single smokehouse or smokechamber or to a number of smoke chambers. With further relation to fire hazard, the generation unit may be entirely outside of the main building and may be located for example in a supplemental chamber 61, as shown in Fig. 7. A single fireproof chamber further prevents fire risks.

In the operation of the generating means, I find it useful to vibrate or tap the hopper in order to insure an even and constant delivery of sawdust to the screw 22. I illustrate alternative means in Figs. 4 and 6, in the first instance employing an external hammer 33 and in the second an internal agitator 85.

I find the employment of an enclosed circuit circulation highly advantageous and employ the warm air from the smokehouse or smoke chamber as a conveyor and thereby reduce the use of fresh air to a minimum. This cuts down smoke loss, saves fuel, and increases efficiency. A certain amount of smoke, of course, is exhausted upwardly through the flue 74, but a substantial proportion is returned along the return duct 54 and this return air acts as a conveyor for the smoke and reduces the amount of fresh air. I find for example that the normal leakage of the system is enough to provide for whatever additional supply of fresh air is necessary.

Under some circumstances it may be desirable to supply additional outside air directly to the sawdust undergoing distillation. I do this by employing the fan 39 to deliver air along the duct

42, whence it reaches the interior of the tube 4 through the side passages 43, which may be individually adjusted as by valves 44 to vary the supply of air at different points along the conveyor path. Under normal circulation, however, I find it advisable to cut off the outside air supply.

One advantage of employing the system as shown for example in Fig. 7 is that I can independently vary the smoke density of a plurality of chambers A, B and C. I may employ for example an air conduit 100 which if necessary may be supplied with air by any suitable fan means 101. An air inlet 102 may be provided for each of the chambers A, B and C, these air inlets being valved as at 103 whereby they may be entirely closed or set at any desired opening. The result is the practical and rapid varying of the lightness of the smoke in any particular smokehouse or chamber.

Where the entire unit is housed in the chamber 61, or where the passage 54 communicates with the chamber 49, as in Fig. 1, the heat of combustion of the charcoal is employed in keeping the smoke hotter than it otherwise would be. This prevents condensation in the delivery pipes. It will be noted further, as in Fig. 1, that the return air along the passage 54 is delivered at the hot end of the conveyor, whereas the smoke is delivered from the cold end of the conveyor. The movement of the smoke being in great part along the path of the conveyor and in the opposite direction, a heat economizing effect is obtained.

The intermittent operation of the screw 22 is effective to permit the sawdust to be at rest a substantial part of the time, a condition preferable for heat transmission. However, the sawdust is moved often enough and far enough to obtain a thorough agitating effect and thus to promote even distillation.

The supports 2 and 5 constitute, with the passage 4, a self-contained unit which can be bodily moved or removed. This is advantageous in small plants and in modification or reconstruction plants.

I claim:

1. In an apparatus for smoking articles, a conveyor, means for feeding finely divided wood particles thereto, means for heating the particles while on said conveyor, and for thereby driving off volatiles therefrom, means for receiving the end solids left after the volatiles have been driven off, means for delivering oxygen to said end solids and for thereby causing their combustion, and means for directing heat from said combustion to the zone of treatment of the articles undergoing smoking.

2. In an apparatus for smoking meats and the like, a plurality of walls defining a primary smoke chamber, a generally tubular smoke producing conduit extending through said smoke chamber and through opposite walls thereof, the length of said tubular member substantially exceeding its diameter, said tubular member being provided with aperture means longitudinally extending along the upper surface thereof, a screw conveyor located in said tubular member, a sawdust container exterior to said primary smoke chamber in communication with one end of said screw conveyor, an ash container exterior to said smoke chamber in communication with the opposite end of the screw conveyor, and additional walls located within said primary smoke chamber and defining, with said tubular member, a heating space, heating means located within said heating space and adapted to subject the wall of said

tubular member to sufficient heat to cause a distillation of the sawdust passing thereover, without creating full combustion, motor means for rotating said screw conveyor substantially continuously during the process of distillation and for thereby conveying sawdust, during distillation, from the sawdust container and through the primary smoke chamber, and means for supplying air to said ash container and for thereby causing combustion of the ash thereto delivered.

3. In an apparatus for smoking meats and the like, a plurality of walls defining a primary smoke chamber, a generally tubular smoke producing conduit extending through said smoke chamber and through opposite walls thereof, the length of said tubular member substantially exceeding its diameter, said tubular member being provided with aperture means longitudinally extending along the upper surface thereof, a screw conveyor located in said tubular member, a sawdust container exterior to said primary smoke chamber in communication with one end of said screw conveyor, an ash container exterior to said smoke chamber in communication with the opposite end of the screw conveyor, and additional walls located within said primary smoke chamber and defining, with said tubular member, a heating space, heating means located within said heating space and adapted to subject the wall of said tubular member to sufficient heat to cause a distillation of the sawdust passing thereover, without creating full combustion, motor means for rotating said screw conveyor substantially con-

tinuously during the process of distillation and for thereby conveying sawdust, during distillation, from the sawdust container and through the primary smoke chamber, means for supplying air to said ash container and for thereby causing combustion of the ash thereto delivered, and means for delivering air heated by the combustion of said ash to the primary smoke chamber.

4. In an apparatus for smoking meats and the like, a generally tubular smoke producing conduit, the length of the conduit substantially exceeding its diameter, the conduit being provided with aperture means longitudinally extending along the upper wall thereof, a screw conveyor located in said tubular conduit, means for delivering sawdust for distillation to said tubular conduit, means for heating the exterior of said conduit sufficiently to cause distillation of sawdust passing therethrough, without creating full combustion of the sawdust, motor means for rotating said screw conveyor substantially continuously during the process of distillation and for thereby conveying the sawdust, during distillation, along and beneath the longitudinally extending aperture means, and means for delivering air to said conduit at a plurality of points along the length thereof, including a plurality of ducts in connection with the interior of said conduit, and individually controllable valve means for said ducts.

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