

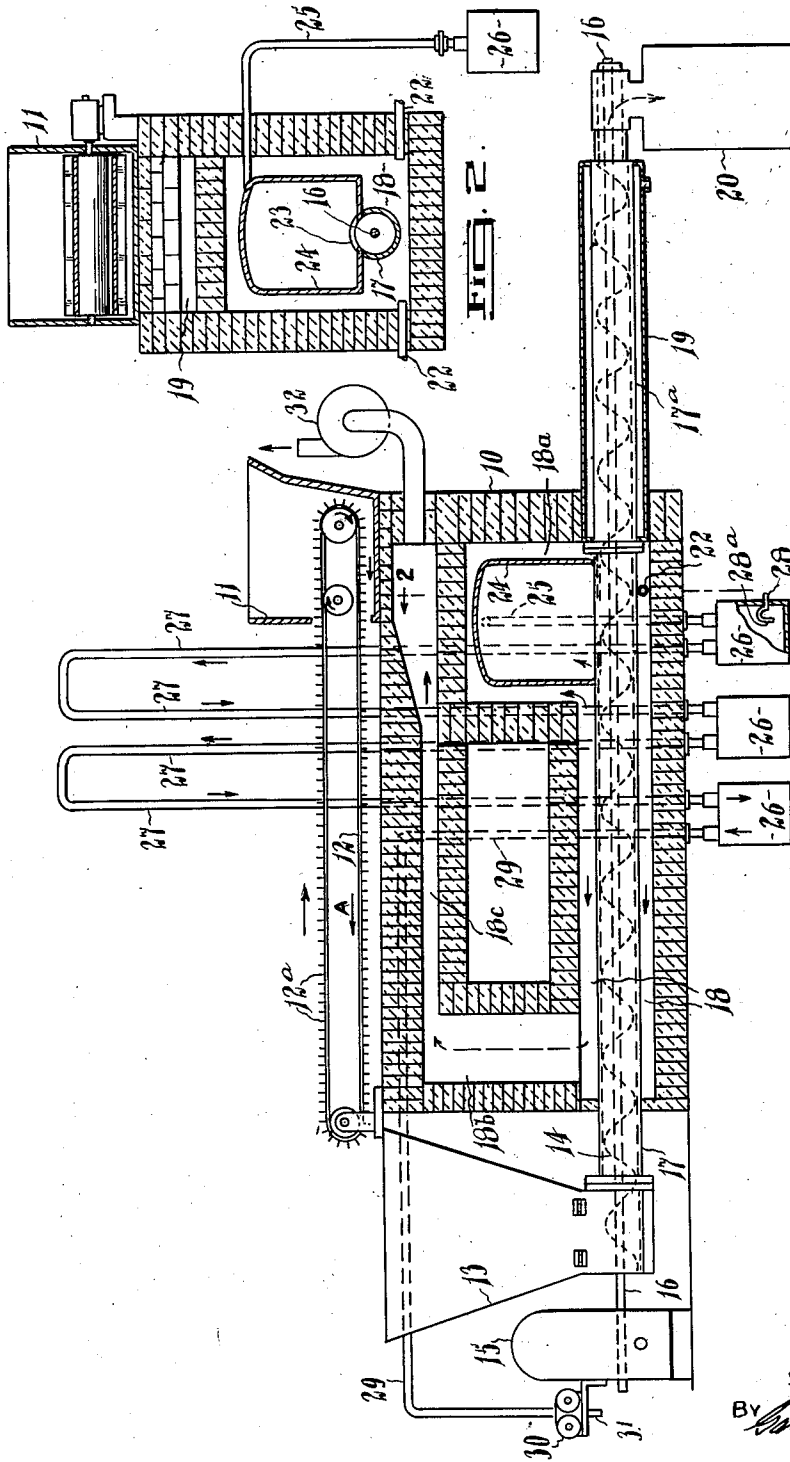
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CARBONIZING UNIT

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CARBONIZING UNIT

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2 Claims. (Cl. 202-118)

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This invention relates to apparatus for the dry distillation of waste products and to the production of carbon from waste vegetable matter such as sawdust, slash, slabs or any other like small matter.

An object of this invention is to provide a device wherein the distillation and carbonization of waste vegetable matter is carried on in a continuous process and wherein the distilled vapours are kept relatively free of small carbonized solid particles.

A further object of this invention is to provide a distillation apparatus which is efficient and thorough in the distillation and reduction of the waste material and wherein the products of distillation such as combustible gases, wood alcohol, acetic acid and tars are efficiently segregated from each other.

Describing the apparatus in general terms, the machine consists of three main parts: a retort, a cooler, and a conveying screw extending through the retort and cooler. In addition, there may be provided means for preheating the waste material which is about to be treated. The retort is externally heated by combustion of some of the gases produced during the process, and is fully enclosed by an insulated fire chamber. That is to say, the process is partly regenerative, and is rendered more efficient by the careful insulation of the retort.

The sawdust or other waste vegetable matter is conveyed from a feed vessel by means of the conveying screw, through the retort and thence through the cooler. A fire chamber is located at one end of the retort, and adjacent the point at which the fire chamber is located a vapour take-off chamber is provided through which pass all the gases which have been evolved by the heating of the waste material. By the time the waste material has passed through the retort and is about to enter the cooler, it is reduced to substantially pure carbon or charcoal, and as the process continues the charcoal is pushed by the same screw through the cooling mechanism and is discharged into a charcoal pit.

The vapour take-off chamber is connected to a system of condensers in which the various distillates are collected, and the gases remaining are drawn through a small compressor into a gasometer in which the gas is stored for use as a fuel for the process.

The features of this invention which are believed to be novel and patentable are pointed out in the appended claims, but for a better understanding of all of the foregoing, reference may

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be had to the following specification and accompanying drawings, wherein like characters of reference indicate corresponding parts throughout the several views and wherein:

Fig. 1 is a side elevation in section of the retort constructed according to this invention; and Fig. 2 is a vertical section on the line 2-2 in Fig. 1.

The carbonizing unit is built around a retort 10, many of the components of the unit being mounted directly on the retort. The waste material is fed into a hopper 11 mounted on the top of the retort, and a conveyor 12 having a plurality of spines 12^a projecting outwardly therefrom engages the sawdust in the hopper and pushes or carries it in the direction of the arrow A over the top of the retort, whence it is discharged into a feed vessel or hopper 13. It will be evident that the waste material is preheated as it is pushed along over the top of the retort. A worm 14 driven by a motor and reduction gearing 15 extends through the bottom of the hopper 13 into the retort, and is supported on a spindle 16 which extends coaxially within a tube 17. The tube 17 extends through a horizontal tubular cavity 18 in the retort and through a water jacket 19 or other suitable cooling means providing a cooling section 17^a; the tube 17 finally terminates at a charcoal discharge bin 20. The tubular cavity 18 provides a flue for hot gases of combustion produced by burner jets 22 arranged about the tube 17 near the junction of the retort and the cooling section 17^a. It will be evident that, as the worm is rotated by the motor and reduction gearing 15, the waste material is moved progressively through the tube 17 and is there subjected to the preheating effect of the flue gases within flue 18; as the waste progresses toward the cooling section 17^a it is gradually reduced to charcoal and the volatile liquid and gases are driven off.

The combustion supporting gas used to heat the retort is injected through the burner jets 22 projecting inwardly through the lower walls of the retort adjacent the junction of the retort and the cooling section 17^a in order to subject the contents of the tube to intense heat. A slot 23 is provided in the tube 17 above the jets 22, and it is through this slot that the volatile gases distilled from the waste material are withdrawn from the tube. A chamber 24 having a horizontal cross-sectional area considerably greater than that of the slot 23 covers the slot and provides a take-off chamber into which the gases produced in the tube 17 may pass. Owing to the fact that the

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cross-sectional area of chamber 24 is greatly in excess of that of slot 23, the velocities of the gases in the chamber are very much less than those in the tube 17 and in the slot 23, with the result that small solid particles of carbonized material which may be blown or otherwise carried through the slot into the chamber 24 by the velocity of the gases are no longer swept along with the flow of gases and fall to the base of the chamber from which they may be periodically removed. The take-off chamber 24 is surrounded by a fire chamber 18^a communicating with the tubular cavity or flue 18.

A conduit pipe 25 opens from the upper portion of the chamber 24 and conveys the gases therefrom to a series of distillate receiving pots 26 and interconnecting condenser pipes 27. In order to allow the operator of the still to continually withdraw the distillate from the pots 26, a side outlet 28 is provided in each of the pots above the bottom, the inner end of each of the outlets being bent downwardly as indicated in Fig. 1 at 28^a so as to form a liquid seal and maintain a constant level of distillate in the bottom of each of the pots.

A conduit pipe 29 extends from the outlet of the last of the three distillate pots 28 to a vacuum pump 33 which promotes the flow of the distillate from the tube 17 through take-off chamber 24, the condenser pipes and the receiving pots. A slight vacuum is thereby maintained in the pipe 17, preventing the distilled gases from being carried along with the charcoal into the discharge bin 20 and promoting the production of pure charcoal. The distilled gas is pumped from the pump 33 to a receiver such as a standard gasometer (not shown) through a vapour outlet pipe 31. The gas from the gasometer is carried to the jets 21 and 22 by suitable piping means not shown.

Due to the intense heat which surrounds the distillation tube 17 adjacent the chamber 24 in the region of the jets 21 and 22, the waste material is completely reduced to charcoal by the time it has entered the cooling section within water jacket 19, and the charcoal is carried through the cooling section by the action of the worm and is deposited in the receptacle 20.

In order to enhance the burning of the gases emitted by the jet 22 and to render the efficiency of the retort as high as possible, air for supporting combustion within the retort is drawn by an exhaust pump 32 through the flue 18 and suitable communicating flue passages from suitable inlets or openings in the retort 10 adjacent the cooling section 17^a. The gases of combustion first circulate in fire chamber 18^a around the chamber 24 and then are urged by the suction created by pump 32 to pass along flue 18 and thence into a vertical flue pipe 18^b which in turn opens into a second horizontal flue 18^c near the top of the retort. The centrifugal pump 32 is connected to the outlet of the flue 18^c and serves to materially increase the flow and to assure that a proper draft will at all times be obtained. It will be evident that by the conduction of the flue gases in a counter-flow direction to that of the waste material travelling in the tube 17 and by also conducting the flue gases in a portion of the retort adjacent the top over which the waste products are first conveyed by the conveyor 12, a tremendous preheating effect is achieved and the overall efficiency of the unit is greatly increased.

It is thought that the construction and use of the invention will be apparent from the above description of the various parts and their pur-

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pose. It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of the invention or the scope of the subjoined claims.

What I claim as my invention is:

1. Apparatus for dry distilling and carbonizing vegetable matter having in combination a retort having a flat top and a fire chamber, a hopper at one end of the retort adjacent the top thereof, a feed vessel at the other end of the retort, a lower preheating flue within the retort leading from the bottom of the fire chamber toward the feed vessel, a top preheating flue leading from the lower preheating flue and extending under and adjacent the top of the retort, means for conveying vegetable matter across the top of the retort and in contact therewith to the feed vessel, a tubular screw conveyor for vegetable matter and having an inlet end in the feed vessel, the conveyor extending from the feed vessel through the retort and having a discharge end beyond the retort, the conveyor extending longitudinally through the lower preheating flue and through the fire chamber, cooling means for the conveyor located between the retort and the discharge end of the conveyor, a vapour take-off chamber within the fire chamber adjacent the conveyor, the conveyor having an opening leading into the take-off chamber for the escape of volatile material and the remainder of the conveyor being closed with the exception of the inlet end, a conduit pipe leading from the take-off chamber to a receiver, a vacuum pump communicating with the conduit and creating a vacuum in the conveyor and take-off chamber to promote vapour flow from the take-off chamber to the receiver, and exhaust means connected to the top preheating flue and promoting flow of flue gases from the fire chamber through the lower preheating flue in a direction opposite to the direction of transport of the said conveyor and through the top preheating flue in a direction opposite to the direction of transport of the said conveying means.

2. Apparatus for dry distilling and carbonizing vegetable matter having in combination a retort having a flat top and a fire chamber, a hopper at one end of the retort adjacent the top thereof, a feed vessel at the other end of the retort, a lower preheating flue within the retort leading from the bottom of the fire chamber toward the feed vessel, a top preheating flue leading from the lower preheating flue and extending under and adjacent the top of the retort, means for conveying vegetable matter across the top of the retort and in contact therewith to the feed vessel, a tubular screw conveyor for vegetable matter and having an inlet end in the feed vessel, the conveyor extending from the feed vessel through the retort and having a discharge end beyond the retort, the conveyor extending longitudinally through the lower preheating flue and through the fire chamber, cooling means for the conveyor located between the retort and the discharge end of the conveyor, a vapour take-off chamber within the fire chamber adjacent the conveyor, the take-off chamber having a cross-sectional area substantially greater than the area of the opening in the conveyor, the conveyor having an opening leading into the take-off chamber for the escape of volatile material and the remainder of the conveyor being closed with

the exception of the inlet end, a conduit pipe leading from the take-off chamber to a receiver, a vacuum pump communicating with the conduit and creating a vacuum in the conveyor and take-off chamber to promote vapour flow from the take-off chamber to the receiver, and exhaust means connected to the top preheating flue and promoting flow of flue gases from the fire chamber through the lower preheating flue in a direction opposite to the direction of transport of the said conveyor and through the top preheating flue in a direction opposite to the direction of transport of the said conveying means.

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