

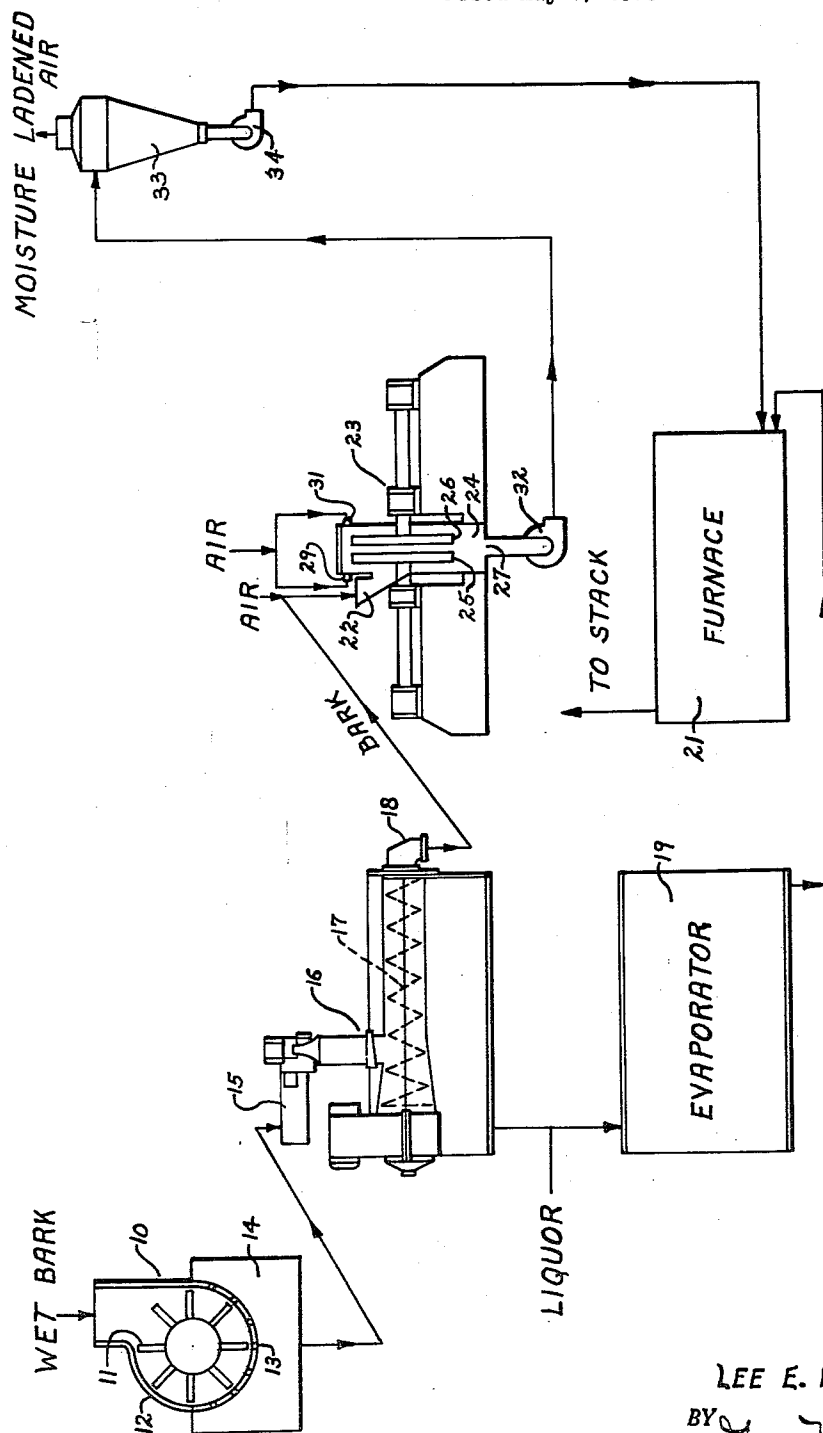
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BARK PROCESSING

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BARK PROCESSING

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This invention relates to methods of material handling and treatment, allied to the art of reducing wood plant stock to a pulp form for paper making and like purposes. More particularly, the invention is concerned with a method of treatment and utilization of by-products of the plant reduction process, especially tree bark.

In pulping processes as described, logs are stripped of their bark as a preliminary step since the essentially superficial character of the bark material prevents it from being successfully combined with the wood fibers. Through various processes of soaking, abrading and the like, most of the bark is removed before the wood is placed in process. At various points in the course of treatment of the wood, and the fibers of which it is composed, additional action is taken to cleanse or to remove from the fibrous material particles of bark which escaped the original stripping. The bark has heretofore been essentially a waste product and its handling and disposal long has posed a problem. Some effort has been made to burn it, either solely for the sake of disposal or as a fuel to produce steam useful to provide power and in the cooking of wood fibers. These efforts have had inconsistent results, however, mainly because the bark contains a high percentage of water and often will barely support its own combustion. Thus, and in spite of the fact that dry bark is known to have a high heat potential (tests having indicated that one pound of dry bark can provide seven to eight pounds of steam) there has been prior to the present invention no economically feasible system for the advantageous use of bark as a fuel.

The instant invention has in view a method of handling bark material to achieve a successful and economically sound use thereof as a fuel.

The object of the invention is to simplify the construction as well as the means and mode of operation of bark processing equipment, whereby such equipment may not only be economically manufactured, but will be more efficient and satisfactory in use, adaptable to a wide variety of applications, and be unlikely to get out of order.

A specific object of the invention is to conduct raw bark material to a furnace in a more or less continuous process in the various steps of which the bark is finally sub-divided and thoroughly dried.

Another object of the invention is to obtain a drying and sub-dividing of wet bark material through use of known refining equipment and without need for supplemental heat.

A further object of the invention is to make use of the residue of liquor extracted from wet bark material as a fuel, combined in the furnace with the dried and divided bark material whereby to utilize the known high B.t.u. content of such residue as well as to relieve stream pollution.

A further object of the invention is to provide a bark processing means possessing the advantageous structural features, the inherent meritorious characteristics and the mode of operation herein mentioned.

With the above and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations thereof, and the mode of operation as hereinafter de-

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scribed or illustrated in the accompanying drawings, or their equivalents.

The drawing is a diagram of a system in accordance with the illustrated embodiment of the invention, showing the apparatus used in the method of handling and treating the bark material and its route followed in the flow through such apparatus.

Referring to the drawing, wet bark is introduced in a raw state, as it comes from debarking and like machines, into means such as a hammer mill 10 where it undergoes an initial reduction to a divided state productive of a more readily handled mass of material. Thus, raw bark of varying shapes and sizes is fed into the mill 10 and subjected to the disintegrating action of rotary hammers 11 operable within a cylinder 12 and acting to force particles of the bark from the cylinder by way of openings 13 therein. The expelled particles, along with the liquid released or still contained therein, are confined by casing 14 and directed into a suitable conveying means which conducts them to the inlet 15 of a press refiner 16.

The device 16, known heretofore for treatment of wood fibers, is arranged to receive the discharge from the hammer mill 10, to which may be added other rejects from the plant stock. The bark and these rejects, hereinafter referred to generally as bark material, enters the device 16 at one end of a power driven feed screw like element 17 by which it is progressively advanced to an outlet 18 at the opposite end of the device. The feed screw 17 cooperates with conical and sharp edged dam formations in surrounding relation thereto to apply to the material in its progress through the press refiner a high degree of compression and powerful shearing forces, these forces of shearing and compression being alternated and progressively increased in intensity in such manner that the bark material emerges from the press refiner in a sub-divided condition and relatively dry. The liquid expressed from the bark material in its progress through the press refiner drains into the lower part thereof and then is conducted as indicated to an evaporator 19. The liquid with which the bark material normally is impregnated is in the main water. Within the press refiner 16, however, and due to the powerful forces of compression and disintegration which are exerted, the released liquid carries with it some of the essence of the bark material and so flows to the evaporator 19 as a liquor.

Within the evaporator 19, heat is applied in a suitable manner to boil off the water in the liquor directed thereto. There remains a residue which is known to have a high heat value. This residue may as indicated be connected directly to a furnace 21 and there burned as a fuel, it being understood that the furnace 21 represents a part of a steam making unit variously used in a reduction plant of the kind with which the instant invention has an allied use.

The press refiner 16 dries the bark material to a range of 50 to 70 percent of a bone dry condition and, as noted, sub-divides the material. It accordingly emerges from the outlet 18 in a relatively dry, loose form composed of comparatively small particles so that it is in a readily flowable condition. In this state, the bark material is directed to the open inlet 22 of an attrition mill 23. Within the mill 23, the bark material enters a chamber 24 within which is a pair of relatively rotatable grinding discs 25 and 26. Within the chamber 24, the bark material is compelled to pass between the discs 25 and 26 and then leave the chamber by way of an outlet 27 in the bottom thereof. In its passage between the discs, the bark material further is subdivided, being reduced therein to a fineness similar to powdered coal. The reduction of the bark material between the relatively rotating discs 25 and 26 being essentially a friction and abrading action there is a resulting heat generation raising

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the temperature of the discs and of the bark material. Also, the increased reduction of the bark material adds to the amount of surface area which the bark material presents for contact with surrounding air. As a result of this combination of circumstances a favorable condition is established for the "flashing" or yielding up of moisture from the bark material to the surrounding air. Air is free to enter the chamber 24 by way of inlet 22, and, according to a feature of the invention, additional air inlets are provided at 29 and 31 in the upper part of the chamber. The admitted air, as well as the reduced bark material are carried off by way of the outlet 27 and under the urging of an exhaust type fan 32. Operation of the fan 32, it will be understood, has the effect of rapidly and thoroughly evacuating the chamber 24 and at the same time induces a forced draft of replacement air into the chamber by way of the inlet 22 and openings 29 and 31. Thus, the heating and fine dividing of the bark material takes place in the presence of flowing air so that as the air immediately surrounding the bark material becomes saturated or moisture laden it is replaced by fresh, relatively dry air. In this connection, it further will be understood that the air supplied to the attrition mill 23 for passage through the chamber 24 may be controlled as to its source in order that it may be warmed and dried in preparation for its passage through the mill.

The bark material, now reduced to a powder-like consistency and in effect suspended in moisture laden air, is directed by the fan 32 to a cyclone separator 33. In accordance with the known operation of devices of this kind the stream of moisture laden air in which the bark material is suspended is directed into the separator 33 at the upper end thereof and travels in a helical path toward the lower or apex end thereof. During the process, the relatively light air moves toward the longitudinal axis of the device and rises for discharge from the open upper end, in the manner indicated. The heavier particles, which in this instance comprise the bark material, drop through the bottom of the separator unit, their movement being assisted by a fan 34. The fan 34 discharges as indicated into the furnace 21 so that the bark material is combined with the residue from evaporator 19 and burns to fire the furnace. The thoroughly dried and powdered bark has, like the residue from evaporator 19, a high heat value, it being calculated that a system as disclosed provides 8,000 to 10,000 B.t.u. per pound of bone dry bark or provides five to seven pounds of steam per pound of bark.

It will be understood that modifications may be made in the system as disclosed without departing materially from the invention. Thus, the wet bark material may be broken up initially in any convenient manner, as by hand or manually. In the interest of abatement of pollution, and to provide a readily combustible residue material, the evaporator 19 serves a useful purpose, but the liquor expressed from the bark material by the press refiner 16 could be discharged to waste. Also, the cyclone separator 33 results in the supplying of the bark material, to the furnace in the form of a relatively solid fuel. The air suspended bark could, however, be blown directly from the attrition mill into the furnace hearth for "flash" burning in suspension.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before

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enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A method of providing fuel for a furnace from wet bark consisting of the steps of reducing the bark to a divided state and extracting liquid therefrom by applying shearing and squeezing forces thereon, conducting the extracted liquid through an evaporator and reducing it to a combustible bark residue and further sub-dividing and drying the bark material and thereby simultaneously producing both the combustible bark residue and the dried sub-divided bark material in the form of fuel having a high heat potential.

2. A method of providing fuel for a furnace from wet bark consisting of the steps of reducing the bark to a divided state and extracting liquid therefrom in the process by applying shearing and squeezing forces thereon, conducting the extracted liquid to an evaporator and reducing it to a combustible bark residue therein, further reducing the sheared and squeezed bark material to a powder form and drying the powdered bark material in the process whereby to provide both a combustible bark residue and a dried powdered bark material having a high heat value adapting it for use as a fuel.

3. A method of processing wet bark to provide fuel including the steps of subjecting initially divided bark material to successive shearing and squeezing forces in a press refiner whereby to sub-divide and partly dry the bark material by extracting a substantial portion of the liquid therefrom in the process, subjecting the sub-divided bark material to the action of an attrition mill or the like to reduce it to a powder-like consistency and discharging the powder-like bark material from said mill in the presence of a forced draft of air in a manner to cause the powder-like bark material to yield up remaining moisture at an accelerated rate.

4. A method according to claim 3 characterized by the further step of passing the powder-like bark material and the moisture laden air resulting through a cyclone separator or the like to effect a discharge of a completely dry compressible finely divided powder-like bark material having a high heat value.

5. A method according to claim 3 characterized by converting the extracted liquid and reducing it so as to leave a combustible residue in the form of a liquor from the bark material having a high heat potential.

References Cited in the file of this patent

UNITED STATES PATENTS

425,603	Fleischman	Apr. 15, 1890
2,271,157	Badenhausen	Jan. 27, 1942
2,303,811	Badenhausen	Dec. 1, 1942
2,481,305	Fuller	Sept. 6, 1949