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TOMIZO SAITO

2,734,685

TWO STAGE PULVERIZING APPARATUS FOR KNOT  
OR PULP OF WOOD, FOR MAKING PAPER STOCK

Filed July 16, 1952

3 Sheets-Sheet 1

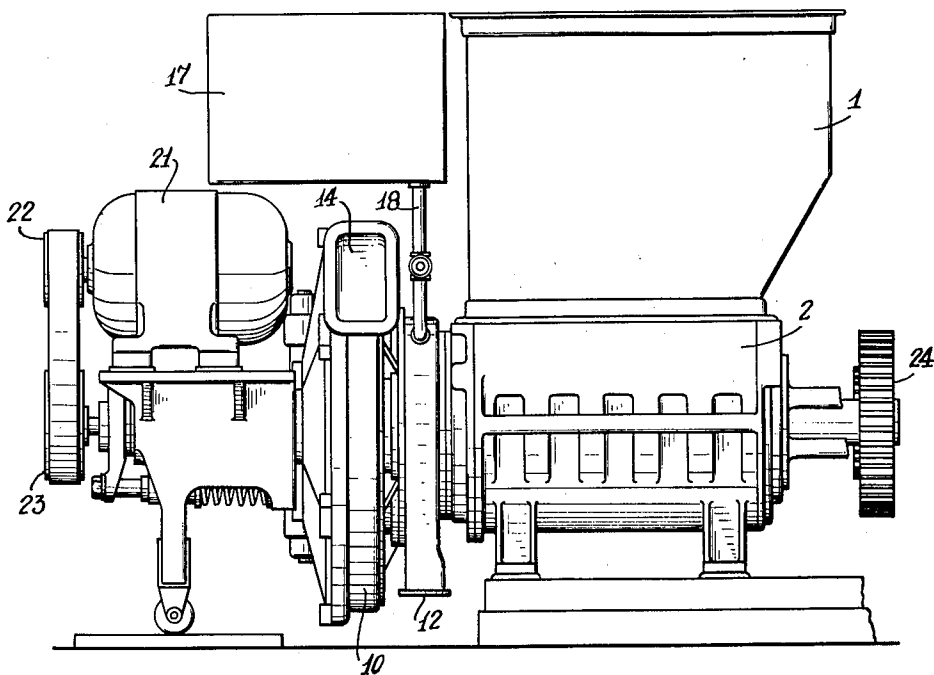


FIG. 1.

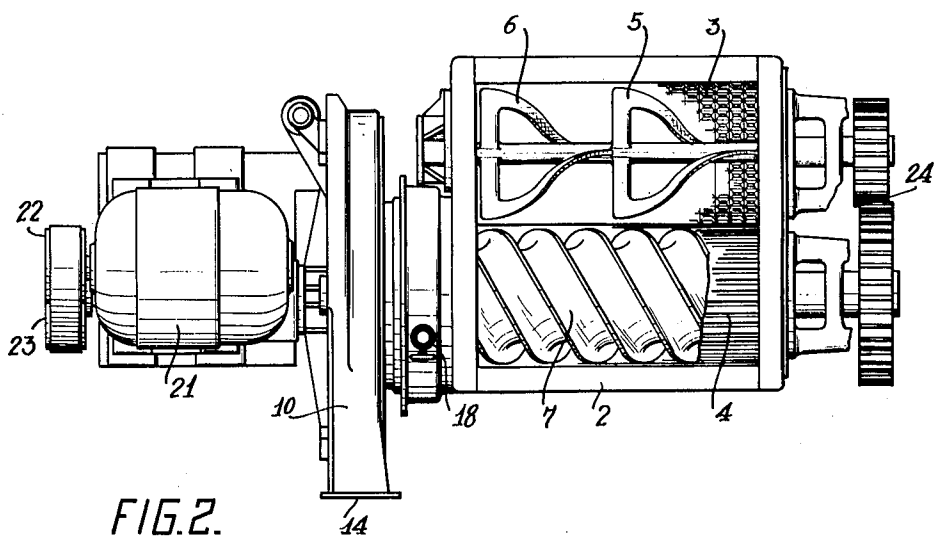


FIG. 2.

BY

INVENTOR.  
TOMIZO SAITO  
*Hans Winter*

ATTORNEY.

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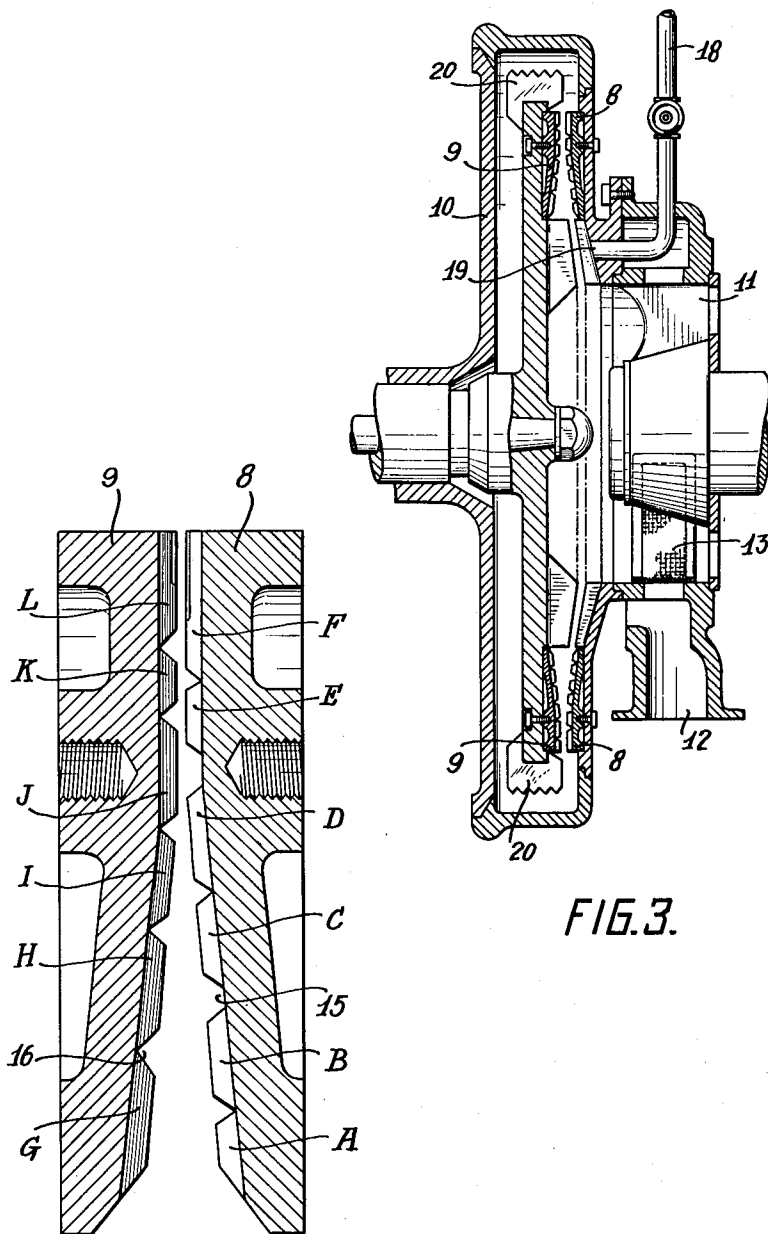


FIG. 3.

FIG. 6.

BY

INVENTOR.  
TOMIZO SAITO  
*Hans Meister*  
ATTORNEY.

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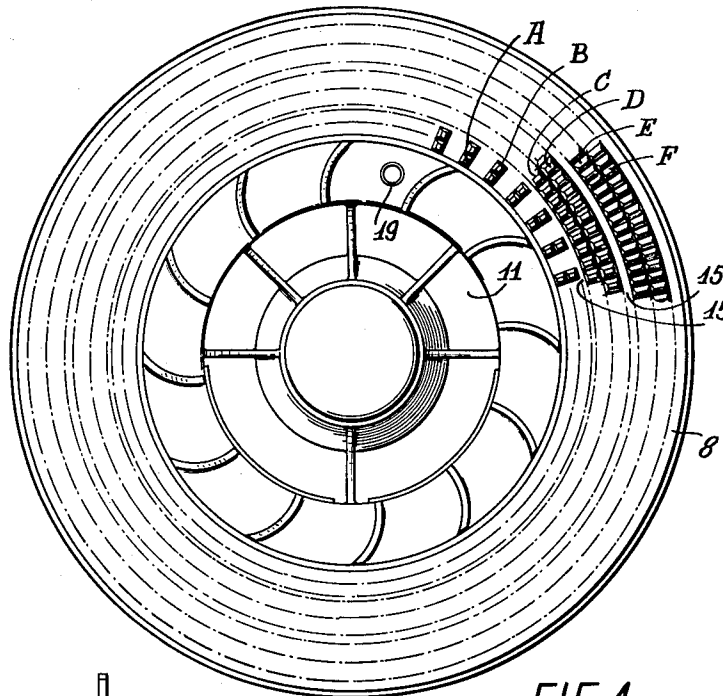


FIG. 4.

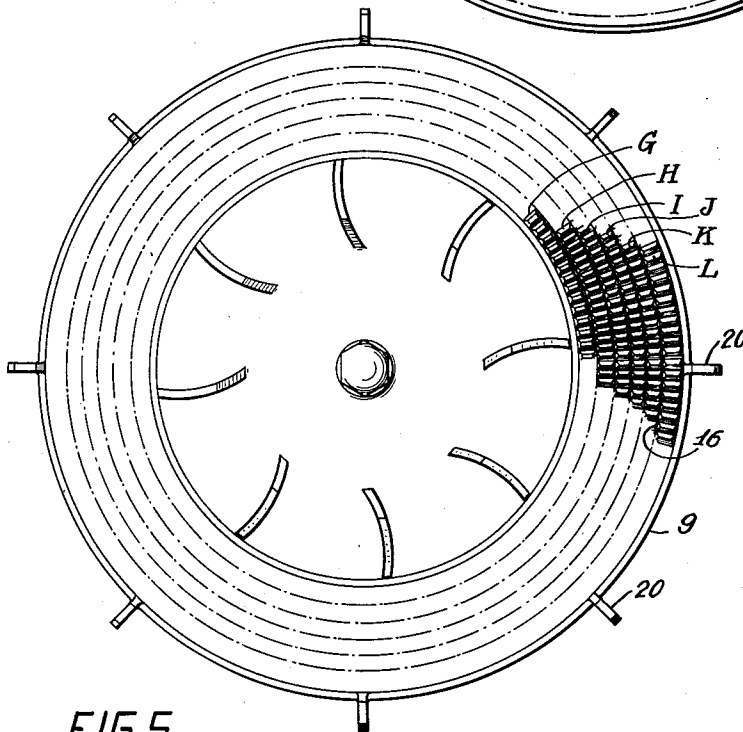


FIG. 5.

BY

INVENTOR.  
TOMIZO SAITO  
*Hans Meister*  
ATTORNEY.

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## TWO STAGE PULVERIZING APPARATUS FOR KNOT OR PULP OF WOOD, FOR MAKING PAPER STOCK

Tomizo Saito, Tokyo, Japan

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3 Claims. (Cl. 241—46)

The present invention relates to a pulverizing apparatus for knot or pulp in which knot or pulp can be pulverized in two stages, the one coarse-crushing and the other fine pulverization.

The principal object of this invention is to provide an efficient pulverizing mill, wherein knot may be treated just as ordinary pulp, which is highly advantageous for the pulp industry, because the knot has usually been cast away as useless or merely used as material for low grade papers.

For attaining the above mentioned object, the pulverizing mill for knot incorporates a rotary crusher and includes means therein for effecting the coarse-crushing of knot or pulp and the feeding of the coarsely crushed knot or pulp to a second rotary crusher internally directly in open communication with said tank and so adapted to receive the coarse crushed knot or pulp in direct spill therefrom, said second rotary crusher including means therein adapted to pulverize the thus spilled coarsely crushed material into a more finely divided form and to discharge the final pulverized material from the mill, there being a water feed tube leading to the second rotary crusher.

Further, the present invention as another feature involves the provision of a transmission screw and of rotatable crushing blades, with said screw mounted rotatably on one of two parallel horizontal shafts journaled in the crusher tank and with said crushing blades mounted rotatably on the other of said two parallel shafts.

A further feature of this invention is to provide in said second rotary crusher a pair of stationary and rotatable discs characterized in that the grinding means on said discs and formed in relief in arcuately extended groups of projections thereon have annular or ring clearances therebetween. In order to obtain a smooth running of the second rotary crusher, said annular or ring clearances on the two discs are arranged in such way that said clearance of the stationary disc is always mismatched with said clearance of the rotatable disc.

Still another feature of this invention resides in the provision of several rows of said arcuately extending groups of projections, with the groups arranged concentrically and separated by ring clearances between the consecutive rows.

Further objects and characteristics of the present invention will be understood more clearly from the following description relating to the embodiment of the present invention illustrated in the accompanying drawings, of which

Figure 1 is a side view of the said embodiment;

Figure 2 is a plan view;

Figure 3 is a longitudinal section of the rotary crusher;

Figure 4 is a front view of the stationary disc of the said rotary crusher;

Figure 5 is a rear view of the rotatable disc of the said rotary crusher; and

Figure 6 is an enlarged detail sectional view showing groups of said projections as carried by said disc.

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The following description is given with reference to the accompanying drawings.

Numerous projections 3 and parallel relief-stripes 4 are provided on the internal wall of the bottom of the crusher tank 2 provided with a hopper 1. Rotating crusher blades 6 include portions 5 which constitute crushing instrumentalities by coaction with said projections 3, and said blades 6 and said screw 7 and rotating transmission screws 7 are rotatably mounted on a different one of two parallel shafts above the said projections 3 and the said parallel relief stripes 4 respectively. Said relief-stripes, it will be noted, are in the nature of corrugations extended parallel with the axis of rotation of the screws 7 thereby at said corrugations to provide an auxiliary crushing means in the tank 2 and one functioning incidental to operation of the screws as conveyors.

As illustrated in Figure 3, a casing 10 for the rotary crusher is provided by the side of the crusher tank 2, the said casing 10 embracing a stationary crusher disc 8 and a rotatable crushing disc 9 these discs facing each another. A transmitting passage 11 which leads to the central portion of crusher tank 2 and also to the rotary crusher casing 10, is provided around the one end of the shaft of the said rotating transmission screw 7. Over the lower half of the periphery of the said transmitting passage 11, a ventilating mesh plate 13 is stretched, which is connected with a vent 12. A delivery hole 14 opens in the external periphery of the rotary crusher casing 10 in the tangential direction thereof (see Figure 2). Two groups consisting of many grinding devices such as in the shape of teeth, A, B, C, D, E, F and G, H, I, J, K, L are concentrically provided but mismatched or out of registry with one another on the stationary 8 and the rotatable crushing discs respectively, as shown in Figure 6. Ring clearances 15, 16 between two consecutive groups of crushing projections are arranged in such a manner that ring clearances 15 and 16 will come in mismatching relation with each other, when the two crushing discs are brought face to face. Further, one end 19 of the feed pipe 18 for the liquid from a liquid tank 17 opens in the stationary crushing disc 9 and a few discharging blades 20 are also provided on the external circumference of the rotatable crushing disc.

Next, the function of the above-mentioned embodiment will be described, as follows: Knot or pulp, raw material for crushing, is first charged in the crusher tank 2. The rotary crusher and thus the rotating transmission screw 7 are then driven by an electric motor 21, through pulleys 22, 23, and the rotating crushing blades 6 are both rotated by way of transmission gears 24. The raw material in the crusher tank 2 is then roughly crushed amidst the rotating crushing blades 6, the rotating transmission screw 7, the projections 3 of the inner bottom surface and the relief stripes 4. The crushed material thus obtained is transferred in one direction to the rotating transmission screw 7 and carried gradually toward the middle portion of the rotary crusher 8, 9 automatically along the inlet passage 11. The roughly crushed material fed in such a manner as above is pulverized between the stationary and rotatable crushing discs 8, 9. In this case, the air is sucked automatically from the vent 12, with the rotation of the crushing disc 9, through the ventilating mesh plate 13. Thus obtained pulverized material is delivered from the exit opening 14 by means of the discharging blades 20 provided on the external periphery of the rotatable crushing disc 9. In handling knot, an appropriate quantity of water is fed from the liquid tank 17, between the two crushing plates 8 and 9, while in the case of pulp to the contrary caustic soda solution is fed.

According to the present invention, a rotary crusher 8, 9 is provided as described above, in direct continuation

of a crusher tank 2, whereby raw material is first roughly crushed in the crusher tank 2 and the thus obtained crushed material is fed to the rotary crusher 8, 9, where it is pulverized and then delivered. Therefore, a continuous and highly efficient pulverization is enabled at a low horse power. Further, because the ring clearances 15, 16 as arranged between the crushing-projection groups for the two crushing discs 8, 9 in the rotary crusher arranged mismatchingly with one another, a high crushing efficiency is obtainable contrarily to the case, where the ring clearances 15, 16, are arranged face to face or in matched relation, and where stuffing with material usually occurring decreases the crushing efficiency. Moreover, one end 19 of the feed pipe 18 from the liquid tank 17 opens between the crushing clearances of the second rotary crusher, while in the case with knot, the pulverizing efficiency is increased by controlling the flow of water through the crushing part by adjusting water supply in accordance with the water content of the knot and consequently by adjusting the grain size of material subjected to the final pulverization. And in the case with pulp, caustic soda solution is fed, while the pulp is being pulverized, so as to impregnate it uniformly with the caustic soda solution. Besides, liquid is supplied by the rotary crusher to the pulverized material, while it is pulverized. The fiber of knot or pulp is, therefore, free from being injured excessively. As described heretofore the pulverizing mill according to the present invention, wherein raw material is first crushed down roughly and the crushed material is gradually and continuously pulverized, makes it possible to obtain an extraordinarily high pulverizing efficiency at low horse-power.

What I claim is:

1. A pulverizing mill for knot or pulp comprising a crusher tank, a device provided therein for the coarse-crushing of knot and feeding of the coarsely crushed knot to further pulverizing stage, a second rotary crusher internally connected with said crusher tank and adapted to receive crushed knot therefrom, and a device provided in the said second crusher and adapted to pulverize the said coarsely crushed material into a more finely divided condition and to discharge the final pulverized material, a water feed tube being provided immediately before the second crusher, said first-named device incorporating a transmission screw, rotatable crushing blades, and two parallel, horizontal shafts journaled in the said crusher tank, said screw being rotatably mounted on one of said shafts and said blades being rotatably mounted on the other of said shafts.

2. A pulverizing mill for knot or pulp comprising a crusher tank, a device therein adapted to effect the coarse-crushing of knot and to move the coarsely crushed knot in a predetermined direction, said device including a rotary structure which, with said tank, constitutes a first rotary crusher, a second rotary crusher permanently disposed for direct end to end communication with said crusher tank and hence always adapted to receive by direct spill thereinto from said tank crushed knot moved in said direction, and a device in said second crusher adapted to reduce the coarsely crushed knot to a finely pulverized condition incidental to discharge of finely pulverized knot

from the mill, said first-named device incorporating two parallel spaced shafts in the tank, both extended toward the part of the tank in direct communication with said second rotary crusher, a screw-conveyor means fixed on one of said shafts, a plurality of crushing blades having spirally extended crushing edges fixedly carried by the other of said shafts, there being in the tank at its interior adjacent to the field of travel of said spirally extended crushing edges a multiplicity of closely spaced crushing teeth for coacting with said crushing edges to break down the knot, as said edges move relative to said teeth.

3. A pulverizing mill for knot or pulp comprising a crusher tank, a device therein adapted to effect the coarse-crushing of knot and to move the coarsely crushed knot in a predetermined direction, said device including a rotary structure which, with said tank, constitutes a first rotary crusher, a second rotary crusher permanently disposed for direct end to end communication with said crusher tank and hence always adapted to receive by direct spill thereinto from said tank crushed knot moved in said direction, and a device in said second crusher adapted to reduce the coarsely crushed knot to a finely pulverized condition incidental to discharge of finely pulverized knot from the mill, said first-named device incorporating two parallel spaced shafts in the tank both extended toward the part of the tank in direct communication with said second rotary crusher, a screw-conveyor means fixed on one of said shafts, a plurality of crushing blades having spirally extended crushing edges fixedly carried by the other of said shafts, there being in the tank at its interior adjacent to the field of travel of said spirally extended crushing edges a multiplicity of closely spaced crushing teeth for coacting with said crushing edges to break down the knot, as said edges move relative to said teeth, and there also being in the tank at its interior adjacent to the path of travel of said screw-conveyor means, a plurality of corrugations the crests and troughs of which extend parallel to the axis of rotation of said means thereby to provide with the latter and in the tank an auxiliary crusher and one functioning incidental to operation of said means, in acting on knot entering the field of operation of said means because previously sufficiently broken down by said first rotary crusher, for advancing coarsely crushed knot in said predetermined direction.

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