

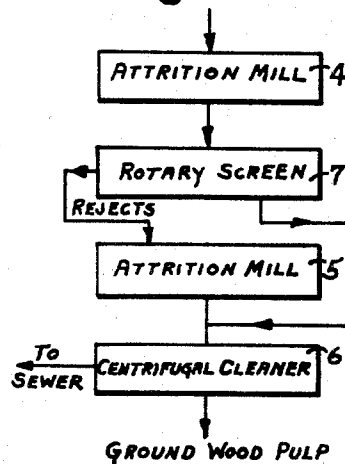
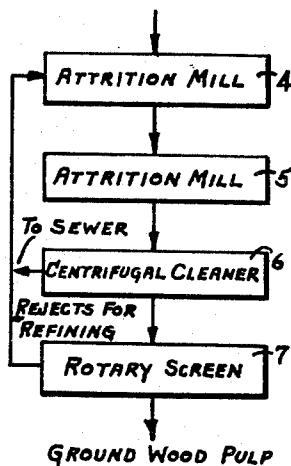
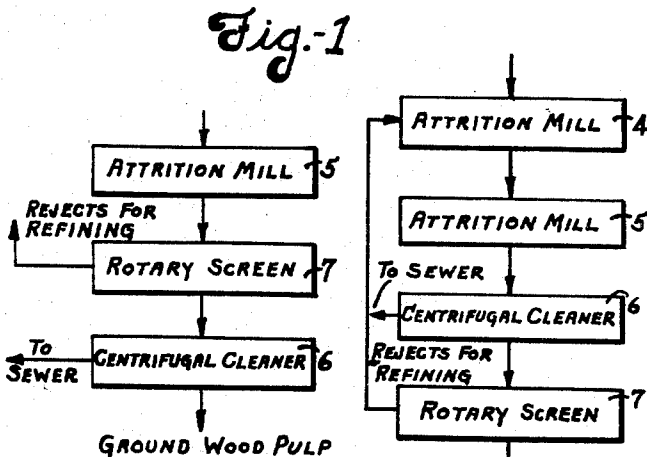
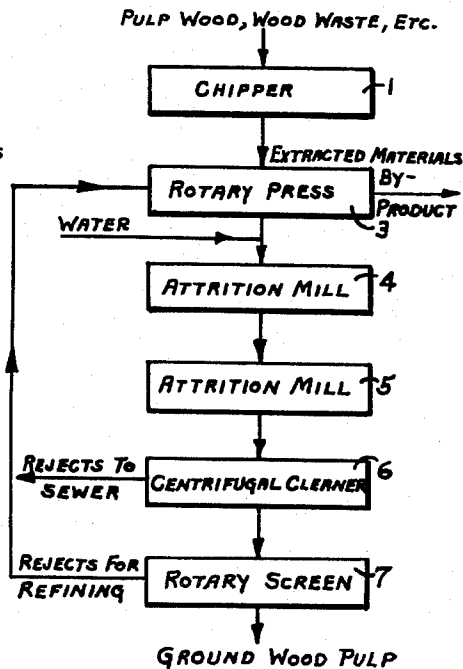
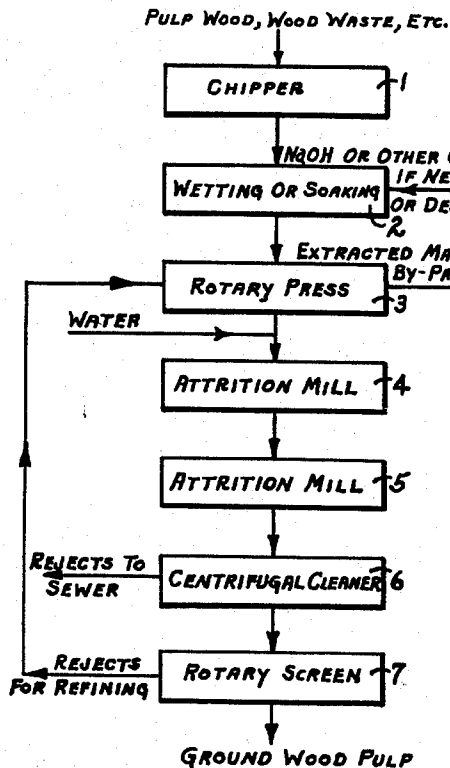
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METHOD OF PRODUCING WOOD PULP

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1

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METHOD OF PRODUCING WOOD PULP

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This invention relates to the production of wood pulp and more particularly to the apparatus and method for producing a wood pulp comparable to groundwood.

Groundwood pulp is now produced by grinding or abrading barked logs. In practice the wood is generally cut in four foot lengths, the bark removed therefrom and sorted as to straight and crooked wood. Crooked wood, for example, branches, deformed limbs, and the like, is not suitable for the production of groundwood by the normal process since it cannot be effectively or satisfactorily held in contact engagement with the face of the abrading or grinding wheel. The grinder is generally a relatively large machine having an abrasive stone with a four foot wide peripheral face, against which the logs are placed with their axes parallel to the axis of the stone. The logs, when held under pressure in contact with the moving face of the stone, are abraded to thereby produce a collection of fibers.

It has been found that a pulp comparable in quality to groundwood can be produced by making chips of the raw wood, passing these chips through a rotary press in which pressure is successively applied and removed during travel of the chips through the press, and then completing the fiberizing of the chips material in a disc mill or refiner. The quality of the pulp so produced is equal to, or in some instances better than, that produced by the conventional method and such pulp is produced at a considerable savings in power requirements.

A further advantage of the process is that it permits the use of small diameter wood, crooked wood, slabs, edgings, and other forms of wood which are either impossible or impractical to use in the conventional processing of groundwood.

The present invention involves not only a new process for the manufacture of pulp comparable to groundwood but the discovery of the adaptability and usefulness of conventional equipment for the production of a groundwood type pulp. The equipment used in the present process for the production of groundwood type pulp is entirely different than any that has heretofore been used for this purpose. It is nevertheless standard equipment in that it is well known for other applications. When used in accordance with the present process an entirely new and unexpected result is obtained. Considerable advantage is gained over the conventional methods and apparatus for producing groundwood pulp. Such advantage is three-fold, namely, first, use of conventional equipment eliminates the necessity for speciality equipment such as the grinding wheel and its associated equipment, second, considerable less power is required, and third, scrap wood and other types of wood heretofore unusable for production of groundwood are now made usable.

Thus, the object of the invention is to improve the construction as well as the means and method of operation of groundwood pulp mills as disclosed herein, whereby such groundwood pulp may not only be more economi-

2

cally manufactured but will provide more efficient utilization of power and wood supply.

A further object of the invention is to provide means whereby multipurpose equipment can be used for the manufacture of groundwood pulp.

A further object of the invention is to provide a new process by means of which groundwood pulp can be made with conventional equipment.

A further object of the invention is to provide a means and a process for producing groundwood pulp which will provide more efficient utilization of the raw wood material from which the groundwood pulp is made.

A further object of the invention is to provide a means and a process for producing groundwood pulp with less power consumption than is now normal.

A further object of the invention is to provide a means and a process whereby a complete utilization of the raw material may be achieved.

A further object of the invention is to provide a means and process for producing groundwood pulp wherein waste or lost material is relatively small.

A further object of the invention is to provide a means and process for the production of groundwood pulp which will produce desirable by-products in a form which can be utilized.

A further object of the invention is to provide a means and process for producing groundwood type pulp possessing the advantageous features, the inherent meritorious characteristics and the mode of operation herein described.

With the above primary and other incidental objects in view as will more fully appear in this specification, the invention intended to be protected by Letters Patent consists of the features, the parts and combinations thereof, and the mode of operation and process as hereinafter described or illustrated in the accompanying drawing, or their equivalents.

Referring to the accompanying drawing wherein is shown flow diagrams of the preferred but obviously not necessarily the only forms of embodiment of the invention:

Fig. 1 is a diagrammatic flow chart of one form of the invention;

Fig. 2 is a flow chart similar to Fig. 1, but having one step in the process eliminated;

Fig. 3 is a portion of the chart shown in Figs. 1 and 2 with a reversal in sequence of two of the steps;

Fig. 4 is a portion of the flow chart of Figs. 1 and 2 showing an optional return of rejects, which may be incorporated in the charts of Figs. 1 and 2 or the modification of Fig. 3; and

Fig. 5 is a diagrammatic flow chart of a further modification of the process shown in Fig. 1.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawings there is shown in Fig. 1 a flow diagram for the typical installation incorporating the present process for the production of groundwood type pulp. The raw wood, wood waste, edgings, slabs and the like are fed to a chipper 1 wherein the raw wood of whatever type, is chipped or broken into relatively small pieces. Such chippers, although possibly varying to some extent in detail construction, all operate on the same principle. The raw wood is advanced to a cutting mechanism which in effect slices from the end of the log, slab, or the like a thin slice. This slice as it falls by gravity breaks into small chips or pieces. These chips or pieces are then collected for further processing.

The chips are taken from the chipper and placed in a soaking vat where moisture is reintroduced into the chips and all chips are brought to a common level of moisture content. Depending upon the type of chips

being processed, the inclusion in this soaking vat of a wetting agent or a weak chemical solution such as a weak solution of sodium hydroxide or other softening agents may be desirable.

This soaking or wetting step is not necessary in all instances. It is, however, desirable when the wood being processed is veneer or kiln dried lumber waste which wood is extremely dry. The flow diagram for the process without the inclusion of the wetting step is shown in Fig. 2.

The chips are then taken from the wetting vat at a uniform level of moisture, and placed in a rotary press 3. In the event the soaking step is omitted (Fig. 2) the chips as they come from the chipper are at a substantially uniform moisture level and can be fully and properly processed in the press 3 the same as if they had undergone the wetting step. The rotary press 3 is of a screw type similar to that which has been heretofore used in the oil industry for extraction of oil from cotton seed, tung nuts and the like. The particular press used herein involves a succession of pressure applications and releases during travel of the wood material through the press. The material being processed is compressed by the rotation of a helical feed screw and gradually advanced through a restricted area. As the material passes the restricted area it is permitted to expand where pressure is released. As pressure is released the feed screw again picks up the material and again presses or applies pressure thereto in the advancement of the material past a further restricted area. During the pressing of the wood it is subjected not only to pressure but also to a twisting or shearing action due to the rotary motion of the feed screw. The material within the press is therefore subjected simultaneously to a squeezing and shearing action and to the successive application and release of relatively high pressures. Such treatment of the material extracts therefrom the greater part of the moisture and in addition thereto some of the natural wood fluids such as sap, rosin, and chemicals normally present in the wood. The lignin and other wood sugars are also softened during this pressing operation.

During such extraction of these materials a certain degree of heat is developed in the press which materially assists in the processing of the wood and the satisfactory extraction of these other compounds. The heat developed, however, is not comparable to that of the normal cooking operation as is generally used in the processing of fibers for pulp purposes.

The material extracted from the wood chips during the pressing operation may be later separated or classified and subsequently disposed of as by-products of the present process.

The rotary press causes a breakdown of the chipped material and an opening up of the fibrous structure thereof. A high degree of fiberizing, maceration or fibrillation is achieved by the successive application and release of pressure combined with the squeezing and shearing produced by the rotary screw member. The material, as it is discharged from the press, is in excellent condition for further refining or treatment to produce a ground wood type of pulp by conventional attrition means.

As the partially fiberized chips are discharged from rotary press the fibers thereof are immediately rewet or moistened either with water or a vapor so as to prevent damage thereto during handling. It is preferable that some wetting or moistening of the material take place at the point of final pressure release in the rotary press since at this point the material is extreme receptive to the introduction of the moisture and will readily absorb it.

The moistened material is then transferred to a conventional attrition mill. During such transfer, additional water is added thereto so as to produce a mixture suitable for further refining in the attrition mill.

The attrition mill 4 is preferably of the disc type and may be of any conventional design, i.e. a single disc mill

or a double disc mill. The partially fiberized material is subjected to a high degree of fiberizing action in the attrition mill which produces a long fibrous material generally similar in overall quality to that normally used in insulation board material. However, mixed in with the long fibers are numerous short length fibers and also probably some long shives. Shives are groups of fibers which have not been fully separated by the processing to this point.

The material as it comes from attrition mill 4 is then introduced into a second attrition mill 5 where the final fiberizing is accomplished. In this second refining stage the greater portion of the long fibers and also the greater portion of the shives are further refined and broken down. The output of the second stage refiner 5 is of the type commonly used in newsprint, lower quality book papers and the like, and constitutes a pulp which is in quality equal to or better than the normally produced ground wood pulp.

The pulp as it is discharged from the second refining stage is introduced into a centrifugal cleaner 6. The cleaner 6 effects a substantially complete removal of dirt, bark specks, short stubby fibers or short and stubby shives. Also removed by the centrifugal cleaner are all inorganic or foreign organic materials which would reduce the pulp quality. The material rejected by the centrifugal cleaner 6 is discharged to waste, as shown in Fig. 1, while the material accepted or passed by the centrifugal cleaner is conveyed to a rotary screen 7.

The rotary screen grades the pulp, separating therefrom as rejects any long shives, clusters of unseparated fibers and the like. Such material as is rejected by the rotary screen 7 is returned to the rotary press 3 (Fig. 1) for further refining where it is mixed in with the new chips being introduced to the press and proceeds through the same process as has heretofore been described. The material passed by the rotary screen as acceptable is collected and comprises the finished pulp of the groundwood type.

The finished pulp, while being of the groundwood type and equal thereto in quality, has nevertheless been produced from waste wood or wood of inferior grades, and has been produced with the expenditure of considerably less power than is normally required. Furthermore, it has been produced through the use of conventional equipment which may be used and in fact is concurrently being used for purposes other than the production of groundwood type pulp.

Referring to Fig. 2 of the drawing, this flow diagram shows substantially the same process as has heretofore been described except for the omission of the wetting or soaking vat 2. The process shown in Fig. 2 can be advantageously utilized in instances where the wood as it comes from the chipper has a reasonably high and uniform degree of moisture content. When working with woods of this type, which do not need additional softening or chemical treatment, the process of Fig. 2 is highly advantageous since it eliminates one step in the process. The processing steps shown in Fig. 2 are identical with those of Fig. 1 except for the elimination of the wetting or soaking step.

In Fig. 3 there is shown a further modification of the process of Fig. 1 involving a reversal of the last two steps in said process as shown in Fig. 1. In Fig. 3 the rotary screen 7 receives the discharge from the second stage refiner 5 and grades the pulp by separation therefrom of the long shives and clusters of unseparated fibers prior to the cleaning of the pulp. The material accepted by the screen 7 is then introduced into the cleaner 6 for the removal of dirt, bark specks and the like. The material rejected by the screen 7 is reintroduced into the process for refining while the material rejected by the cleaner 6 is directed to the sewer as waste material. This modification of the process of Fig. 1 is advantageous.

5

when using woods which are relatively hard to fibrillate or separate into individual fibers. By use of the process of Fig. 3, the long shives and undefibered material are removed prior to the cleaning of the pulp. This permits use of less cleaning capacity inasmuch as the entire volume is not passing through the cleaner.

Depending upon the amount of re-refining required to separate the long shives and clusters of undefibered material rejected by the screen 7, such rejects may be reintroduced into the rotary press 3, as shown in Fig. 1, or reintroduced into the first refining stage or mill 4, as shown in Fig. 4. Where the amount of re-refining needed is not extensive, the modification of Fig. 4 has been found quite successful. In this form of the process the rejects from the screen 7 are introduced into mill 4 along with the material discharged from the rotary press 3 and they then proceed through the process again. The reversal of the cleaner 6 and screen 7, as shown in Fig. 3, may also be made in the modification of Fig. 4. Such change in Fig. 4 would be made for the same reasons and would produce the same results as previously explained in connection with Fig. 3.

Fig. 5 shows a further modification of the basic process of Fig. 1 which may be advantageously used in certain circumstances determined primarily by the type of wood being used. In this modification, the screen or grading member 7 is interposed between the first stage refining mill 4 and the second stage refining mill 5. As previously noted, the material as it leaves the first stage mill 4 contains a certain quantity of short fibers. If it is desirable to take precautionary measures to prevent over-refining of the acceptable portion, the stock may be led directly to the centrifugal cleaner 6. In so doing the second stage refining mill 5 is completely by-passed by the acceptable portion of the stock discharged from refining mill 4. To accomplish this the grading screen 7 is interposed between the mills 4 and 5 with the long shives and clusters of unseparated fibers forming the rejects from the screen 7 being introduced into the second refining mill 5 for further refining action. The acceptable portion from the screen 7 by-passes the second mill 5 and is introduced into the cleaner 6 simultaneously with the introduction of the material thereto from the second refining mill 5. Thus, any danger of over-refining of the pulp material is obviated.

The modification of Fig. 5 is well suited for use when treating woods which are easily separated or fibrillated.

In view of the foregoing it will be appreciated that there has been evolved a completely new process for the production of groundwood type pulps utilizing machines which although conventional in design and well known for other purposes have never before been known or used for the production of groundwood type pulp. Thus, not only does the present invention include a new process for the production of groundwood type pulp but further includes a new result obtained through the use of old machines and a new product created thereby.

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 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.

6

Having thus described my invention, I claim:

1. The method of producing groundwood pulp consisting of the steps of chipping pulp wood, waste wood and the like, wetting and soaking said chips, subjecting said soaked chips to alternate continuous application and release of mechanically applied pressure for a predetermined period to effect a high degree of fiberization of said chips and extract substantially all the moisture and natural wood fluids therefrom in a single pass, introducing water to said chips upon final release of pressure, subjecting said pressed chips with water added thereto to a further fiberizing action in a disc mill, discharging said fiberized chips into a centrifugal cleaner for the removal of impurities, dirt specks and the like, the rejects from said cleaner being discharged to waste, subjecting the accepted portion of said stock to the action of a rotary screen for removal of long shives and undefibered chips, the stock removed therefrom being returned to the pressure stage of the process for further processing, the finally accepted material being acceptable groundwood pulp.

2. The method as set forth in claim 1, characterized by the addition of sodium hydroxide or its equivalent for the softening of lignin, sugars and other compositions in the chips simultaneously with the wetting or soaking of the chips.

3. The method of producing groundwood pulp comprising the steps of chipping pulp wood, waste wood and the like, wetting and soaking said chips, subjecting said soaked chips to continuous alternate application and release of mechanically applied pressure for a predetermined period to effect a high degree of fiberization of said chips and extract substantially all the moisture and natural wood fluids therefrom in a single pass, introducing water to said chips upon final release of pressure, subjecting said pressed chips with water added thereto to a fiberizing action in a disc mill, cleaning and separating said fiberized chips by use of a centrifugal cleaner and a rotary screen, the material retained after such cleaning being acceptable groundwood pulp, the rejected material from said centrifugal cleaner being waste and the rejected material from said rotary screen being reintroduced in the processing at the disc mill or prior thereto.

4. The method set forth in claim 3, characterized by a reversal of the centrifugal cleaning and rotary screening steps, whereby the material as it comes from the disc mill is subjected first to the rotary screen and then to the centrifugal cleaner.

5. A process for producing groundwood pulp from raw uncooked wood, wood waste or the like, consisting of chipping the raw wood, introducing said chips into a rotary mechanical press, subjecting said chips to a series of pressure applications, there being a complete release of pressure intermediate successive pressure applications, said treatment being effected during rotary movement of the chips through the press thereby causing a breakdown of chip structure and an opening up of the fibrous structure of the chips, the natural wood fluids and chemicals being extracted from the chips during passage through the press, immediately moistening the fiberized chips as they are discharged from the press, adding additional water thereto and subjecting the moistened fiberized chips with the additional water to a staged disc mill refining operation, and cleaning and grading the fibers after refining.

6. The process set forth in claim 5, characterized by a rotary screening of the refined fiberized chips intermediate the stages of the refining operation, material rejected in the process being further refined and the accepted material being directly introduced to cleaning equipment.

7. The process set forth in claim 5, characterized by the rejects from the grading operation being returned to the beginning of the processing in the refining operation.

8. The process set forth in claim 5, characterized by the rejects from the grading operation being re-introduced into the mechanical press.

9. A continuous flow system for the making of ground-wood pulp consisting of a wood chipper, means operatively connected thereto for wetting the chips made by said chipper, a rotary screw type press operatively connected to said chipper in following relation thereto where- in the chips are subjected to successive pressure increases and decreases during rotary and longitudinal travel of the chips through the press to produce a fibrous material substantially free of liquid, means connected for adding water to the fibrous material as it is discharged from the press, refining means operatively connected to the press for acting upon said fibrous material in successive stages, a cleaner operatively connected to said refining means to which the refined fibrous material is discharged, and a grader connected for receiving the acceptable material from the cleaner.

10. A continuous flow system for the making of groundwood pulp consisting of a wood chipper, means for wetting the chips made by said chipper connected therewith, a rotary screw type press connected to receive the wetted chips and subject them to successive pressure increases and decreases during concurrent rotary and longitudinal travel of the chips through the press to produce a fibrous material, means connected for adding water to the fibrous material as it is discharged from the press, refining means operatively connected to the press for acting upon said fibrous material in successive stages, means connected for cleaning and grading the fibrous material discharged from the refining means, and means connected with the last named means for re-intro- ducing a portion of the graded fibrous material to the refining means.

11. A continuous flow process for producing ground- wood pulp from raw uncooked wood consisting of the steps of chipping the raw wood, wetting the chips under conditions of substantially atmospheric pressure and temperature, fiberizing the chips in a rotary screw type press by successive applications and release of pressure

during continuous concurrent rotary and longitudinal travel therethrough, refining the fiberized material, and finally grading and cleaning the refined fiberized material.

12. The process set forth in claim 11, characterized by the addition of water to the fiberized material prior to the refining thereof, and the refiberation of the material rejected by the grading operation.

13. A method of producing groundwood pulp of waste wood consisting of the steps of chipping the wood, wet- ting and soaking said chips, subjecting said chips to a simultaneous rotary and longitudinal flow while effecting a squeezing and shearing thereof in successive inter- mittent fashion to extract the moisture and other liquids therefrom and add a degree of heat thereto thereby, introducing water to the partially fiberized chips result- ing, refining the chips with water added thereto in an attrition mill to further fiberize said chips to a degree suitable for insulation board material, subjecting said fiberized material to a second stage refiner fiberizing ac- tion to produce pulp usable in newsprint, and subjecting the product of the second stage refiner to a centrifugal cleaning and rotary screening action to provide a finished pulp having a high and uniform quality, the rejects being returned for further refining.

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