

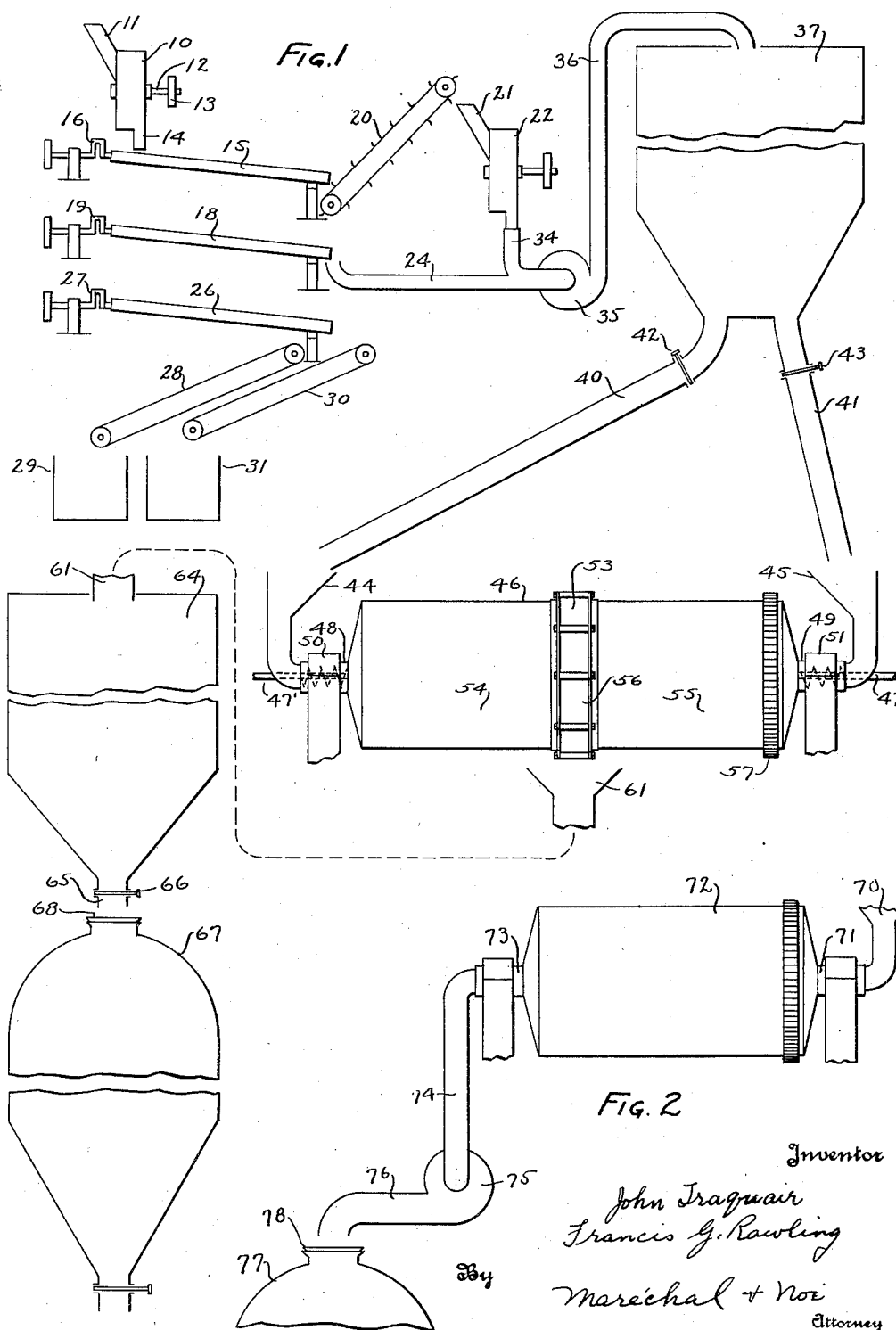
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PAPER MANUFACTURE

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PAPER MANUFACTURE

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This invention relates to the manufacture of paper, and more particularly to the preparation of pulp for use in such manufacture.

One of the principal objects of the invention is to provide a method of treating fibrous material in the pulping thereof, which is economical, highly effective, and permits increased capacity and output in the pulping operations.

Another object of the invention is to provide a method of treating fibrous material such as wood to prepare it for cooking treatment within a digester or cooking vessel, whereby a considerable increase in the amount of material which can be packed into any given space or digester volume is obtained, with resultant increase in capacity of the plant and economy in time, and a more effective and uniform cooking of the resultant material obtained.

Still another object of the invention is to provide apparatus for carrying out this method which is simple in construction, of increased capacity, and highly effective and economical in operation.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and appended claims.

In the drawing, which discloses a preferred embodiment of the invention—

Fig. 1 is a diagrammatic side elevational view of apparatus constructed for carrying out the method of this invention; and

Fig. 2 is a partial diagrammatic view of a somewhat modified form of apparatus.

Referring to the drawing, there is illustrated at 10 a chipper or other suitable cutter for the subdividing of fibrous material into pieces. Where wood is being treated, this may be a conventional chipper as is used for reducing logs to chips, having a feeding inlet 11 for the logs so that they are directed into the interior of the casing of the chipper to be acted upon by a rotary disk carrying cutting knives mounted upon a shaft 12 driven by a pulley or gear 13. The resulting chips are discharged at 14 onto a plate shaker screen 15, which is inclined from the upper feeding end to the lower discharge end, and is adapted

to be reciprocated back and forth by suitable conventional mechanism indicated generally at 16. This screen 15 is a coarse screen, having large perforations or holes generally about $1\frac{1}{2}$ inches in diameter. The chips which have been suitably subdivided by the chipper thus pass readily through this screen onto a second plate shaker screen 18 which is reciprocated back and forth by suitable mechanism 19. The screen 15 serves to remove large pieces, slivers and the like, from the chips, these pieces being discharged at the lower inclined end of the screen into a bucket elevator 20, which in turn discharges them into a hopper 21 of a rechipper or hog 22 of conventional construction.

The screen 18 is preferably a fine screen having perforations or holes of about $\frac{1}{4}$ " in diameter, so that the fine material and sawdust is permitted to pass therethrough, while the chips suitable for cooking are discharged at the lower inclined end of the screen into a suitable conveying conduit 24. The fine stuff passing through the screen 18 falls upon a still finer plate shaker screen 26 which is also reciprocated back and forth by mechanism 27. This screen has very fine holes or perforations, and serves to separate the better grade of sawdust which is retained on the screen from the finer impurities such as sand and grit and the like which pass through the screen and fall onto a downwardly inclined conveyor belt 28 which feeds this waste material into a suitable collecting vessel 29. The better grade sawdust discharged at the lower inclined end of the screen 26 falls upon the upper surface of a second inclined conveyor belt 30 and is discharged into a sawdust bin 31 for use, such as packing material for shipping or as boiler fuel.

The coarser pieces passing through the rechipper 22 are discharged into a conduit 34 and thence introduced into conduit 24 and mixed with the screen chips coming from the screen 18. The conduit 24 forms part of a conveying system for transferring the chips to a storage bin. One suitable form of conveyor is a pneumatic conveyor, such as an air suction system, which in effect blows the chips through conduits. Thus as shown, the

conduit 24 is connected to the suction side of a forced draft or blower fan 35, the discharge side of which connects with a conduit 36 leading to a storage bin 37. Operation of the fan 35 serves to draw the chips and re-chipped material through the conduits 24 and 34 respectively, and to force the mixed material through the conduit 36 into the storage bin.

In accordance with the present invention, this sub-divided and screened material is subjected to a pounding and rubbing treatment which serves to flatten and crack the chips, and to pound down and break off rough edges thereof which result from the chipping operation. This may be very satisfactorily carried out by passing the chips through a rod mill, where they are subjected to a pounding and rubbing treatment between parallel pounding surfaces of a plurality of elongate pounding elements or rods which feebly roll over each other in intermingled contact with the chips.

It is found that a much larger quantity or weight of chips which have been subjected to this character of pounding treatment can be packed in a given volume or space of a cooking vessel or digester than is the case with the chips as heretofore prepared. Such mechanical pounding and rubbing treatment smooths down the jagged broken ends or edges of the chips and rounds them off, as well as further flattening the chips so that they will pack closer together when feeding into a digester. A volume reduction of the chips of about 25% or more is readily secured; that is, a given weight of the chips will occupy only about 75% or even less of the volume which is required to hold the same weight of chips which have not been subjected to this rod milling or pounding treatment. Greater volume reductions are obtained with certain kinds of wood than with others; thus, pine chips show an exceedingly large volume reduction, as high as 35% having been frequently obtained. The net result is that a larger quantity or weight of chips can be packed into the cooking vessel for each cooking operation, thus increasing the capacity of the plant with resultant economy in time and in overhead expense.

Moreover, the pounding treatment also cracks or fractures the chips so that the cooking liquor more readily penetrates into the interior of the chips, thereby securing a more even and uniform cooking without objectionable surface cooking effects. A lesser volume of cooking liquor is required to submerge the chips which are packed more closely together leaving less voids; and a more concentrated liquor may be used, if desired. The consumption of steam in proportion to the wood is thereby reduced, due to the lesser volume of liquor required. This method

overcomes also the disadvantages inherent in the conventional alkaline cooking processes, such as the soda cook, when the chips are not ordinarily fully submerged. A better pulped product is obtained by the present method due to the uniform cooking.

As shown in the drawing, the bin 37 is provided with separate oftakes or discharge chutes 40 and 41 controlled by valves 42 and 43 respectively. These discharge chutes respectively introduce chips at a controlled and uniform rate into hoppers 44 and 45 respectively feeding opposite ends of a rod mill 46. Suitable positive feeding means, such as a short screw conveyor 47, is preferably used at each inlet of the mill to insure regular feed. A very satisfactory form of rod mill for this purpose is that disclosed in the copending application of John Traquair, Serial No. 445,336 filed April 18, 1930, which comprises a cylindrical casing 47 having hollow journals 48 and 49 at opposite ends thereof supported in suitable bearings 50 and 51 respectively, these hollow journals providing feeding inlets for the mill at opposite ends thereof through which the material introduced into hoppers 44 and 45 passes into the interior of the casing. Positioned substantially centrally between the feeding inlets 48 and 49 is a peripheral discharge portion, formed as a plurality of slots or ports 53 in the peripheral portion of the casing. As shown and described in the above mentioned application, the mill may be constructed as two cylindrical elongate casings positioned end to end in spaced relationship to provide a central common discharge of large capacity therebetween, with common rods extending through both casings.

The chips are uniformly fed in at opposite ends of the mill, and due to the agitation of the mill and the supplying of fresh material thereto, are fed to the common peripheral discharge ports 53 in downwardly converging inclined path as indicated at 54 and 55. During this travel, the chips are subjected to a pounding and rubbing treatment between a plurality of heavy metal rods 56 which extend substantially throughout the length of the casing 47 and roll and tumble freely over each other in intermingled contact with the chips as the casing is rotated, such as by a ring gear 57 fastened to the exterior of the casing and driven by a pinion (not shown) from any suitable source of power.

It is found preferable to subject the chips to only a relatively short treatment within the rod mill, generally less than 10 minutes being satisfactory, a time of about 3 to 4 minutes being usually preferred, depending upon the rate of rotation of the mill. Thus where the mill is rotated at a relatively faster rate, less time of treatment of the chips in the mill is required, and vice versa. Further-

more, it is found that better results are secured when only a relatively small quantity of chips are being treated at any one time within the mill, a more uniform treatment of the chips and a closer packing in the digester being thereby obtained. The form of rod mill above described having plural feeding inlets and an intermediate peripheral discharge is particularly suitable for this treatment, inasmuch as a short travel of the chips from the feeding inlet at one end to the centrally arranged peripheral discharge is provided, and also a relatively steep gradient of chips as they pass through the mill is maintained, so that the chips move rapidly through the mill. At the same time, a relatively small quantity of chips can be maintained within the mill to secure this more effective action as described above.

The treated chips discharging from the mill fall into a hopper 61 which feeds them into a storage bin 64. The bin 64 is provided with a discharge 65 controlled by a valve 66 adapted to feed into the neck opening of a suitable conventional digester or cooking vessel 67 when the cover 68 thereof is removed. The present invention is applicable to any suitable character of cooking treatment with a chemical cooking liquor, and any conventional cook may be given the chips thus prepared.

If desired, the apparatus illustrated in Fig. 2 may be used, thus utilizing a conventional type of rod mill. As shown, chips are adapted to be introduced into the feeding hopper 70 from a suitable supply such as the bin 37, these chips feeding through the hollow trunnion 71 into the interior of the casing of a rod mill 72. In this form of mill, the chips pass from the one feeding end 71 through the mill, while being acted upon by the tumbling rods therein, and are discharged at the opposite end through the hollow discharge trunnion 73. In order to assist the rapid travel of the chips in their natural state, or unmixed with substantial quantities of water or other liquid, through the mill, the discharge 73 may be connected to a suitable fluid pressure conveying system, such as an air suction system. Thus as shown, the discharge 73 is in communication with a conduit 74 connected to the suction side of a pneumatic conveyor fan 75. The discharge side of the fan communicates with a conduit 76 which discharges into a suitable collecting or cooking vessel 77. Operation of the fan 75 thus produces a powerful air blast which is effective adjacent the discharge 73 of the mill and assists the withdrawal of the chips from the mill. These chips are then carried by the air blast through the conduits 74—76, and then discharged by the blast with considerable force into collecting vessel 77.

The air suction blast effective at the discharge of the mill is found to rapidly draw

the chips out through the discharge, where otherwise they would tumble about several times before passing through this discharge. This decreases the length of time of the mechanical treatment, inasmuch as by moving the chips more rapidly out through the discharge, space is provided for other chips farther back in the mill and these chips will accordingly move more rapidly toward the discharge. The discharge of the fan 75 may be connected by conduit 76 so as to directly feed the chips in a powerful blast into a digester 77 when the cover 78 is removed. By thus supplying the chips in a blast of air, the chips are effectively distributed within the digester and a still better packing is secured.

While the method herein described, and the forms of apparatus for carrying this method into effect, constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to this precise method and forms of apparatus, and that changes may be made in either without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In the manufacture of pulp, the method which comprises subjecting uncooked fibrous material to a mechanical pounding and rubbing treatment, and then cooking the treated material with chemical cooking liquor.

2. In the manufacture of pulp, the method which comprises subjecting uncooked wood chips to a pounding and rubbing treatment to crack the chips and pound down and rub off rough edges thereof, and then cooking the treated chips with chemical cooking liquor.

3. In the preparation of pulp by cooking wood chips in a digester or cooking vessel, the method which comprises subjecting the chips prior to their introduction into the digester or cooking vessel to a pounding and rubbing treatment to flatten and crack the chips and pound down and break off rough edges thereof.

4. In the manufacture of pulp, the method which comprises subdividing wood into chips, screening the resulting chips, subjecting the screened chips to a pounding and rubbing treatment to crack the chips and pound down and rub off rough edges thereof, and then cooking the treated chips with chemical cooking liquor.

5. In the manufacture of pulp, the method which comprises subdividing wood into chips, coarse screening the chips to remove larger pieces therefrom, fine screening the resultant chips received from the coarse screening to remove fine particles from the chips, rechipping the larger pieces separated in the coarse screening, adding the rechipped material to the screened chips, subjecting the mixture of screened chips and rechipped material to a pounding and rub-

bing treatment, and cooking the treated chips with chemical cooking liquor.

6. In the manufacture of pulp, the method which comprises continuously subjecting fibrous material in its natural state to a
5 pounding and rubbing treatment, and withdrawing treated material by a fluid blast from the pounding and rubbing zone.

7. In the manufacture of pulp, the method which comprises continuously subjecting
10 fibrous material in its natural state to a pounding and rubbing treatment, withdrawing treated material by a pneumatic blast from the pounding-zone and forcing the withdrawn treated material into a cooking
15 vessel, and then cooking the treated material with chemical cooking liquor.

8. In the preparation of pulp by cooking chips in a digester or cooking vessel, the method which comprises pounding and rubbing
20 uncooked chips between parallel pounding surfaces of a plurality of elongate pounding elements which freely roll over each other in intermingled contact with the
25 chips, then introducing the treated chips into the digester, and cooking the treated chips therein with a chemical cooking liquor.

9. In the preparation of pulp by cooking chips in a digester or cooking vessel, the method which comprises pounding and rubbing
30 uncooked chips between parallel pounding surfaces of a plurality of elongate pounding elements which freely roll over each other in intermingled contact with the
35 chips for less than ten minutes, a relatively small quantity of chips being treated at any one time, then introducing the treated chips into the digester, and cooking the treated chips therein with a chemical cooking liquor.

10. Apparatus of the character described for preparing fibrous material for cooking treatment in the manufacture of pulp, comprising in combination, a device for subdividing the fibrous material into pieces, and
40 a mill for pounding and rubbing the pieces.

11. Apparatus of the character described for preparing wood for cooking treatment in the manufacture of pulp, comprising in combination, a chipper for subdividing the
50 wood into chips, screening means for the chips, and a rod mill for pounding and rubbing the chips.

12. Apparatus of the character described for preparing wood for cooking treatment
55 in the manufacture of pulp, comprising in combination, a chipper for subdividing wood into chips, a plurality of screens for separating both the coarser and finer material from the chips, a rechipper for the coarser
60 material, means for adding the rechipped material to the chips, and a rod mill for pounding and rubbing the mixed chips and rechipped material.

13. Apparatus of the character described
65 for the treatment of fibrous material in the

preparation of pulp, comprising in combination, a mill for pounding and rubbing the fibrous material, a cooking vessel, and means for supplying the pounded and rubbed fibrous material received from the mill to said cooking vessel.

14. Apparatus of the character described for the treatment of wood in the preparation of pulp, comprising in combination, a
75 chipper for subdividing wood into chips, a rod mill for pounding and cracking the chips and for rubbing off and pounding down the rough edges thereof, and a digester for cooking the rod milled chips.

15. In apparatus of the character described for the treatment of fibrous material in the preparation of pulp, a disintegrating mill having a plurality of pounding elements therein for subjecting the fibrous material to a pounding and flattening treatment, a feeding inlet for said mill, means for introducing fibrous material therein, a discharge for said mill, and pneumatic conveying means effective to assist withdrawal of fibrous material
90 through said discharge.

16. In apparatus of the character described for the treatment of fibrous material in the preparation of pulp, a rod mill, means for continuously feeding fibrous material to said rod mill, a discharge for said mill, a collecting vessel, a conduit communicating with said discharge and leading to said collecting vessel, and a fan blower within said conduit, said fan serving to produce a fluid blast effective adjacent the discharge of said mill to assist in withdrawing treated fibrous material from said rod mill, and for forcing the withdrawn fibrous material into said collecting vessel.

17. Apparatus of the character described for the treatment of fibrous material in the preparation of pulp, comprising in combination, a mill for pounding and rubbing the fibrous material, a cooking vessel, and means for supplying the pounded material from said mill to said cooking vessel including a conduit leading from said mill, and a fan blower within said conduit.

18. Apparatus of the character described for the treatment of wood in the preparation
115 of pulp, comprising in combination, a chipper for subdividing the wood into chips, a rod mill having a discharge, means for continuously feeding chips from said chipper to said rod mill, a collecting vessel, a conduit communicating with the discharge of said rod mill and leading to said collecting vessel, and a fan blower within said conduit.

In testimony whereof we hereto affix our
125 signatures.

JOHN TRAQUAIR.
FRANCIS G. RAWLING.