

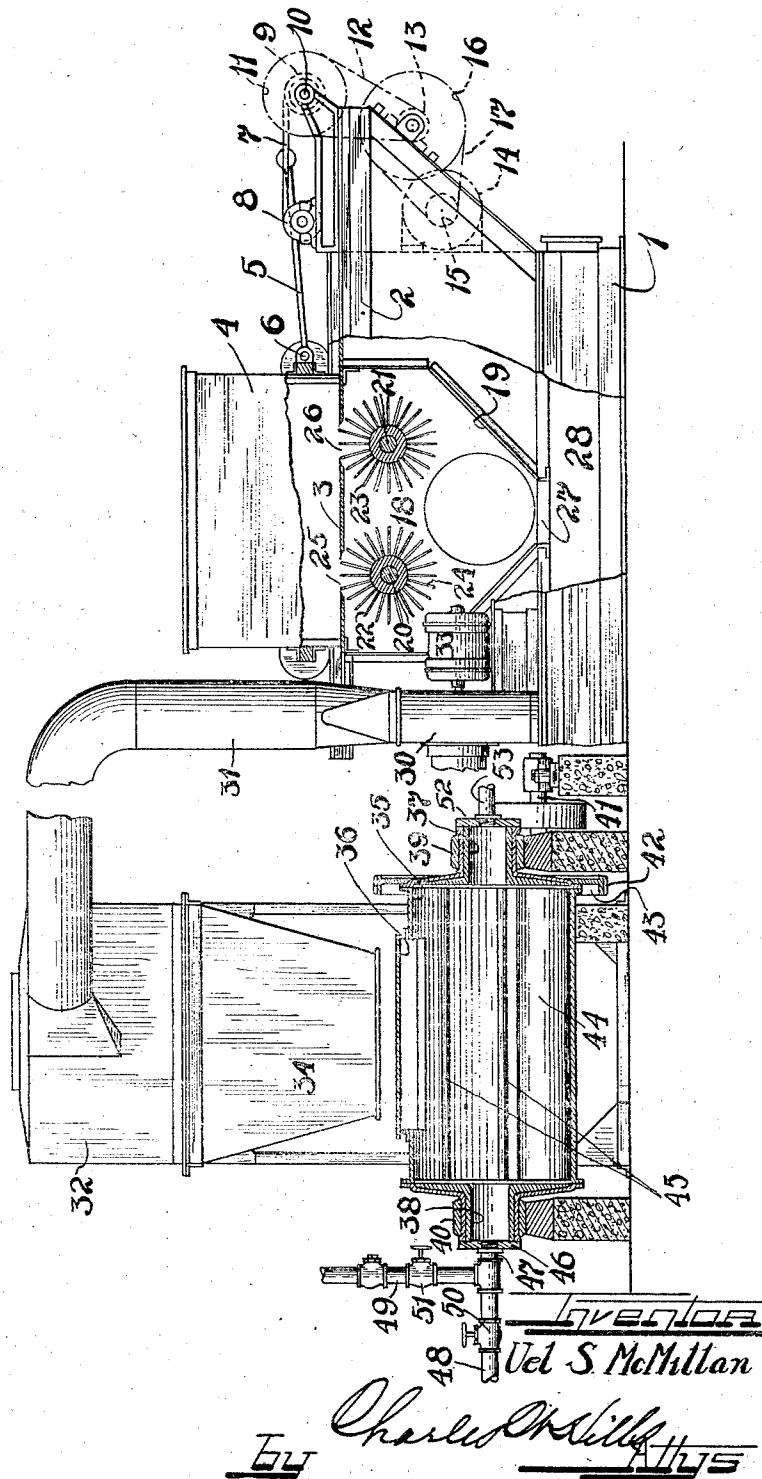
June 13, 1933.

U. S. McMILLAN

1,913,607

METHOD OF PREPARING PULP

Filed Sept. 30, 1929



UNITED STATES PATENT OFFICE

UEL S. McMILLAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO McMILLAN FIREPROOF FIBRE CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

METHOD OF PREPARING PULP

Application filed September 30, 1929. Serial No. 396,152.

This invention relates to a method of preparing pulp for the manufacture of paper and the like.

It is an object of this invention to provide a method for the preparation of pulp for use in the manufacture of paper that may be used either for the preparation of a mechanical pulp of higher quality than that of heretofore known ground wood pulp or in the preparation of a chemical pulp in a more economical manner than heretofore.

Other and further important objects of this invention will become apparent from the following description and appended claims.

The process of this invention is best illustrated in connection with the accompanying drawing in which there is shown a side elevational view of an apparatus suitable for carrying out my process, with parts in section.

The reference numeral 1 indicates a base upon which is supported a frame 2 having a top surface 3 suitably formed of metal. An open bottom receptacle 4 is mounted upon said surface 3 for reciprocating movement, said movement being effected by means of a pair of links 5 pivotally connected to one end of said receptacle 4 as at 6 and at the other end connected to a traveling belt or chain 7. Said chain 7 is trained over a pair of spaced pulleys 8 and 9, the pulley 9 being mounted upon a shaft 10 which also carries a pulley 11 driven by means of a belt 12 from another pulley 13. A motor, or other suitable driving means 14 serves to drive the pulley 13 through pulleys 15 and 16 and belt 17.

A chamber 18 having hopper-shaped bottom walls 19 is disposed beneath the surface 3 on which said receptacle 4 is reciprocated. Within said chamber 18 are mounted a pair of driven shafts 20 and 21 to which are secured revolving brushes 22 and 23. Each of said revolving brushes 22 and 23 is provided with a large number of radially extending resilient wires or combing teeth 24 suitably formed of steel and having pointed or sharpened ends which extend through apertures 25 and 26 provided in the

surface 3 for that purpose. The hopper-shaped bottom 19 opens as at 27 into a passage 28 formed in the base 1 and extending the full length thereof.

Wood or vegetable stalks is placed in the receptacle 4 lengthwise thereof, so that such wood is subjected to the combing action of the revolving brushes 22 and 23. As these brushes revolve, the combing teeth 24 extend through the openings 25 and 26 sufficiently to allow the sharp pointed teeth to engage the wood above said openings. The reciprocation of wood results in a defibering action, whereby the wood is resolved into separate fibers and bundles of fibers which are carried by the revolving brushes into the chamber 18. It should be noted that the brushes 22 and 23 are revolved at a very high rate of speed and that the combing teeth 24 yieldingly engage the wood in the direction of the length of the fibers thereof.

From the chamber 18, the fibers pass through the opening 27 into the passage 28, from which the fibers are drawn by means of a current of air induced by a fan 30 through a conduit 31 into a separator 32. The fan may suitably be driven by means of a motor 33. In the separator 32, the fibrous material is separated from the air stream and allowed to drop into a charging hopper 34.

The fibrous material is charged from the hopper 34 into a revolving drum 35 positioned beneath said hopper and provided with a manhole 36 for that purpose. Said drum 35 is provided with hollow trunnions 37 and 38 mounted in bearings 39 and 40 for revolution, as by means of a driven shaft 41 and a gear 42 acting through a gear ring 43 on said drum 35. Within said drum 35 is mounted a single roller 44 of substantially the same length as the length of the cylindrical portion of said drum and freely disposed therein. The inner surface of the cylindrical portion of the drum 35 is preferably fitted with longitudinally extending cleats or ribs 45 which, during revolution of said drum, serve to lift the roller 44 and allow it to drop again onto the fibrous material with which the drum is partially filled. The result is a rolling, kneading and spreading

apart action upon the fibers, which action serves to further disintegrate the fibrous bundles and resolve them into the ultimate cellulose fibers.

5 The drum 35 is also adapted to be partially filled with a treating liquid, which may be water or a dilute alkaline or acid solution. To facilitate the charging of the drum with the treating liquid, one of the trunnions, as
10 the hollow trunnion 38, is fitted with a non-revolving head 46, through which extends a nipple 47 connected on the outside to piping 48 and 49 provided with valves 50 and 51. The other trunnion 37 is likewise provided
15 with an end plate 52 and piping 53 connected thereto.

If hot water only is used as the treating liquid in the drum 35, merely a softening and hydrating action upon the fibers is obtained. However, my invention contem-
20 plates the use of either an alkaline or acid cooking liquor similar in composition to any of the known cooking liquors now in use for the preparation of pulp for use in the manu-
25 facture of paper and the like. Sulphite cooking acid may, for instance, be introduced into the drum 35 through the pipe 48 in an amount and of a strength sufficient to com-
30 pletely remove the lignin and incrusting matter from the fibrous material and resolve said material into the ultimate cellulose fibers. To this end, steam may be admitted
35 through the pipe 49 to bring the temperature of the contents of the drum 35 to the desired cooking temperature, say between 110 and 150° C., the steam accordingly being
40 supplied to said drum 35 at a pressure, say from 40 to 70 lbs., until the contents of said drum is brought to the desired pressure and
45 temperature to effect cooking of the pulp. The pipe 53 serves as a relief line for the steam, gases and condensate and may be suitably provided with branch pipes (not shown) for the disposition of the various relief fluids.

50 Owing to the fact that the fibrous material to be treated is in a finely divided form and particularly receptive to the action of the cooking liquor because of the method by which the fibrous material is formed, the
55 cooking process may be much milder both as regards strength of cooking liquor, temperature, pressures and length of cooking time than where chips are being cooked. In cook-
60 ing chips by the standard pulping method, penetration of the cooking liquor into the chips takes place only at the ends of the chips, which are frequently sealed as a result
65 of the crushing action of the knives used in the chipping process. The fibrous material used in the present process, on the other hand, being subjected to no cutting or compressing action, and being relatively much more finely divided and in a looser condi-
tion, is quickly penetrated by the cooking

liquor from the sides as well as from the ends.

The cooked fibrous material is discharged from the drum 35 and subjected to further treatment, such as screening, to produce a
70 pulp in every way comparable to the pulp produced by the usual cooking processes and suitable for the manufacture of various grades of paper and the like.

Although I have illustrated the drum 35
75 as being provided only with a single roller, it will be understood that a plurality of rollers or rods may be used, as in the ordinary rod mill. I have found, however, that the use of a single roller of relatively large
80 diameter gives much more satisfactory results than the use of a standard rod mill. Furthermore, my process should not be confused with the known processes for the dis-
85 integration of partially cooked chips or screenings, where the cooking is carried out in a separate operation and the chips or screenings merely subjected to mechanical disintegration in a rod mill. The use of
90 fibrous material specially prepared according to my process by subjecting the wood or vegetable stalks to a yielding combing action in the direction of the length of the fibers per-
95 mits the combination of a mild cooking process with the mechanical process of rolling, kneading and spreading apart the fibers in a single operation. The result is that a well cooked and partially hydrated pulp can be obtained more economically than hereto-
100 fore.

It will further be understood by those familiar with the art that the fibrous material used in my process cannot be employed in standard digesters due in part to the fact that it would pack too tightly in the digesters to permit the necessary degree of circulation, with the result that a part of the fibrous material would be overcooked or even burned in the cooking process. By using a revolving
105 drum and a single roller, the necessary amount of mixing of the fibrous material with the cooking liquor is obtained to insure uniform cooking. Where only hot water is used as the treating liquor, an improved quality of mechanical pulp better adapted
110 for the manufacture of high grade paper than the ground wood pulp at present supplied to the paper industry is obtained. This is due to the fact that by the usual grinding process for the production of mechanical
115 pulp, a large part of the wood is ground practically to a flour, whereas according to my process the fibers are preserved in substantially their natural length and integrity. Furthermore, the rolling, kneading and
120 spreading apart action of the drum and roller in the presence of hot water or steam, gives a softer and better hydrated pulp than can be produced by the ordinary grinding
125 processes. Mechanical pulp made in accord-
130

ance with my process may consequently be used in a larger proportion in admixture with chemically prepared pulp in the manufacture of paper than can the ordinary ground wood pulp.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. The method of preparing pulp for use in the manufacture of paper and the like, which comprises treating mechanically disintegrated fibrous material with a sulfite cooking acid at a temperature of between 110° and 150° C. and under a pressure of between 40 and 70 lbs. per sq. in. and simultaneously subjecting the fibrous material to a rolling, kneading and spreading apart action, said rolling, kneading and spreading apart action being substantially non-grinding.

2. The process of preparing pulp from mechanically disintegrated fibrous material which comprises treating said material with a liquid in a rotating drum while subjecting the material to rolling, kneading and spreading apart action between the inner surface of the rotating drum and a surface within the drum which is freely rotatable over the material by frictional contact therewith, and intermittently compacting the fibres by raising the freely rotatable surface at predetermined intervals and allowing it to drop on the material in the drum.

3. The process of conditioning prepared combed fibres which comprises heating said fibres under pressure with a cooking liquor in a rotating drum and simultaneously subjecting the fibres to a rolling, kneading, and spreading apart action between the inner surface of the rotating drum and the surface of an elongated cylinder within the drum freely rotating in frictional surface contact with the material.

In testimony whereof I have hereunto subscribed my name at Chicago, Cook County, Illinois.

UEL S. McMILLAN.