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METHOD OF MAKING RICE STRAW PULP AND APPARATUS THEREFOR

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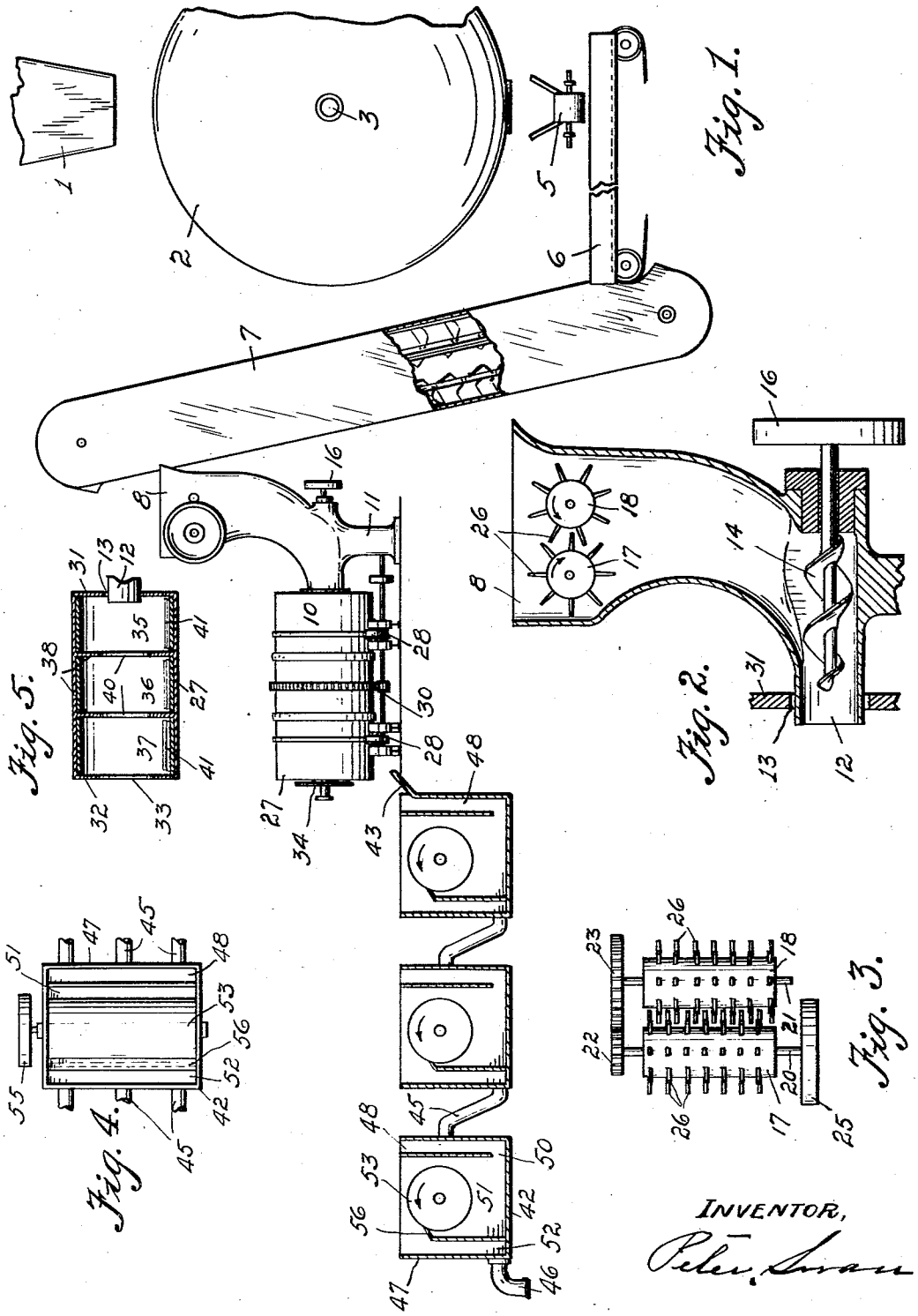


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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METHOD OF MAKING RICE STRAW PULP AND APPARATUS THEREFOR

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This invention relates to a soda process of making rice straw pulp using certain formulated treatments and providing improved apparatus for conveying, shredding and beating the material.

Among the objects of my invention is the reduction of the time required to produce the pulp and with the minimum amount of apparatus. The time-saving and simplification of the process is a direct result of much reduced period of cooking, so that the straw used in the cookers is merely cured but in no way reduced to pulp.

The apparatus and machines required in my process are shown in the following drawings, in which:—

Figure 1 is a side elevational view of the various machines employed in the process of producing pulp according to my invention shown diagrammatically with certain parts shown broken and in section.

Fig. 2 is a fragmentary side elevational view in vertical section and on an enlarged scale, of the feed hopper to the rod mill shown in Fig. 1.

Fig. 3 is a detached plan view of fibre shredding and cutting elements provided in the hopper shown in Fig. 2.

Fig. 4 is a plan view of one of the washing units shown in Fig. 1 certain intake and overflow pipes between units being shown in broken condition.

Fig. 5 is a side elevational view in vertical section of the cylinder of the rod mill shown in Fig. 1.

Referring to the above views, chutes 1 are provided for loading rotary steam cookers 2 of usual construction mounted to rotate on trunnion bearings 3. A belt 5 below the cookers serves to convey away the cured stock emptied from the cookers. This belt empties onto another cross belt 6 which empties into a bucket elevator 7 of usual design, which in turn delivers the stock into a hopper 8 for supplying stock to a rod mill 10. The hopper is supported on a base 11, and has a discharge neck 12 extending into an opening 13 in one end of the rod mill. A screw propelling shaft 14 mounted in bearings 15 and driven by a pulley 16 extends into the neck 12. Cylinders 17 and 18 mounted to rotate in spaced relation and in opposite directions in the mouth of the hopper 8 are keyed to suitable shafts 20 and 21 respectively, having bearings in the walls of the hopper and made to rotate at differentiated speeds and in opposite directions by a pair of gears 22 and 23 and a driver pulley 25. Each of the cylinders is armed with a series of radial cutting teeth 26 which are arranged to overlap and cut up and shred the stock passing between the rolls into the hopper, where water is added.

The rod mill 10 has a horizontal, cylindrical drum 27 mounted to rotate in roller cradles 28 and driven by an annular rack and pinion 30 of usual construction. The intake end of the drum 27 has a head 31 provided with the concentric opening 13, above mentioned, while the discharge end 32 has a relatively larger concentric opening 33 provided with an adjustable gate 34. The interior of the drum, see Fig. 5, is divided into three equal compartments 35, 36 and 37 by similar partitions 38 normal to the axis of the drum and having concentric openings 40 therein of a size between that of the openings 13 and 33. The inner walls of shell of the drum 27 are lined with wood and a plurality of rods 41 of suitable length and of different sizes are placed loosely in the several compartments and disposed parallel to the axis of the drum, so that the rods will be free to roll and tumble in the compartments upon rotation of the drum.

Washing units 42 for washing the pulp are arranged in series behind the rod mill so that pulp discharged from the opening 33 will fall onto an apron 43 leading into the first unit, where a supply of water, not shown, and certain chemicals later to be described, are added to the pulp, which will flow, in a manner to be presently described, from one unit to the next through connecting pipes 45 and finally out through discharge pipes 46 for delivery to the paper machines or other parts of the mill as desired. The washing units are of similar construction and working in unison, so that only one need be described. Each unit, see Figs. 1 and

4, consists of a box 47 for holding the liquid, provided with an intake compartment 48, opening near the bottom at 50 into a middle settling chamber 51 and a spillway compartment 52. A cylinder 53 extending longitudinally of the chamber 51 in its upper portion is mounted to rotate in bearings in the ends of the box and is driven by a pulley 55. The liquid is allowed to fill the box to approximately 5" below the top of the cylinder, the exposed surface of the cylinder rotating toward the spillway 52 where a wiping element 56 flexibly contacting the cylinder over the length of the box drains into the spillway, so that pulp passing from one box to the next will be washed from impurities in the chambers 51 and floating to the top of the liquid will be carried over the successive cylinders.

To prepare pulp from rice straw in the mill described, place causticized liquor, later to be described, in the cooker 2, adding 1½ pounds of salt cake for each cubic foot of liquor and fill the cooker with straw in the proportion of 169 cubic feet of liquor to the ton of straw. The contents are allowed to cook for 40 minutes. The straw then is let fall upon the belt 5 and taken in unbroken condition to the hopper 8 by way of the conveyor 7. The cooked straw is engaged by the cutting teeth 26 on the shredding cylinders 17 and 18 and is shredded and cut and carried down into the neck of the hopper where the worm 14 forces it into the compartment 35 of the rod mill where 5% volume of soda ash is admixed, in order to harden the stock, while the drum 27 is in rotation. The action of the tumbling rods reduces the straw to pulp, the pulp passing from one compartment to the next through the openings 40 and is finally spilled onto the apron 43 where a 2½% solution of bicarbonate of soda is added. The pulp entering the compartment 48 of the first washer will pass downwardly and through the opening 50 into the chamber 51 where it will be washed and rise to the liquid level and be carried over the revolving cylinder 53 and be scraped off by the scraper 56 and pass out through the spillway 52 into the next washing box and finally through the discharge pipes 46 for further refinement or directly to the paper machines.

The white liquor above referred to should have a strength reading 5 Baumé and should be causticized to approximately 86% with the addition of 5% sulphur while causticizing.

A convenient test of the causticization is to take 50 parts of the cooking liquor to 250 parts of water adding barium chloride and slackening and letting stand. Then using 25 parts with methyl orange as indicator and using iodine for Bareet's reading.

Having described my invention, I claim:

1. A method of making rice straw pulp consisting in cooking rice straw in a cooker containing causticized liquor for approximately 40 minutes, in order to impregnate the straw with the liquor, but without changing the structure of the straw, in withdrawing the straw from the cooker and conveying the straw to a hopper and there passing it between armed cylinders for cutting and shredding the fibre, in hydrating the stock thus shredded and passing it through a rod mill where preferably soda ash is added to harden said stock, and it is reduced to pulp, and in washing the pulp.

2. A method of making pulp of rice straw consisting in cooking the straw in causticized liquor for 40 minutes, the quantity of straw and liquor being in proportion of 169 cubic feet of liquor to the ton of straw, the said liquor being proportioned of 40% white liquor and 60% black liquor and containing 1½ pounds of salt cake per cubic foot of the mixed liquors, using 1¼ pounds of lime per cubic foot of liquor for causticizing to approximately 86% and adding 5% of sulphur; in conveying the unbroken straw thus impregnated with the liquor over bucket conveying elevators to fibre-shredding and cutting apparatus, in hydrating the shredded stock, adding 5% of soda ash and passing the stock through a rod mill where it is reduced to pulp and then finally washed in suitable washing boxes and delivered to screens.

3. In pulp making apparatus the combination of cookers for impregnating the raw material with causticized liquor, conveying and elevating elements, for carrying and regulating the travel of the cooked stock, fibre-shredding mechanisms, propelling means for feeding the shredded stock into a rod mill, a rod mill for reducing the stock to pulp, and washing mechanism for washing the pulp.

4. A straw-shredding and cutting machine consisting of a hopper, spaced, parallel cylinders extending through the mouth of the hopper, a plurality of cutting arms on the cylinders arranged to overlap in the space between the cylinders, means of rotating the cylinders in opposite directions and at different rates of speed, and means of delivering the stock shredded and cut by the cylinders from the neck of the hopper.

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