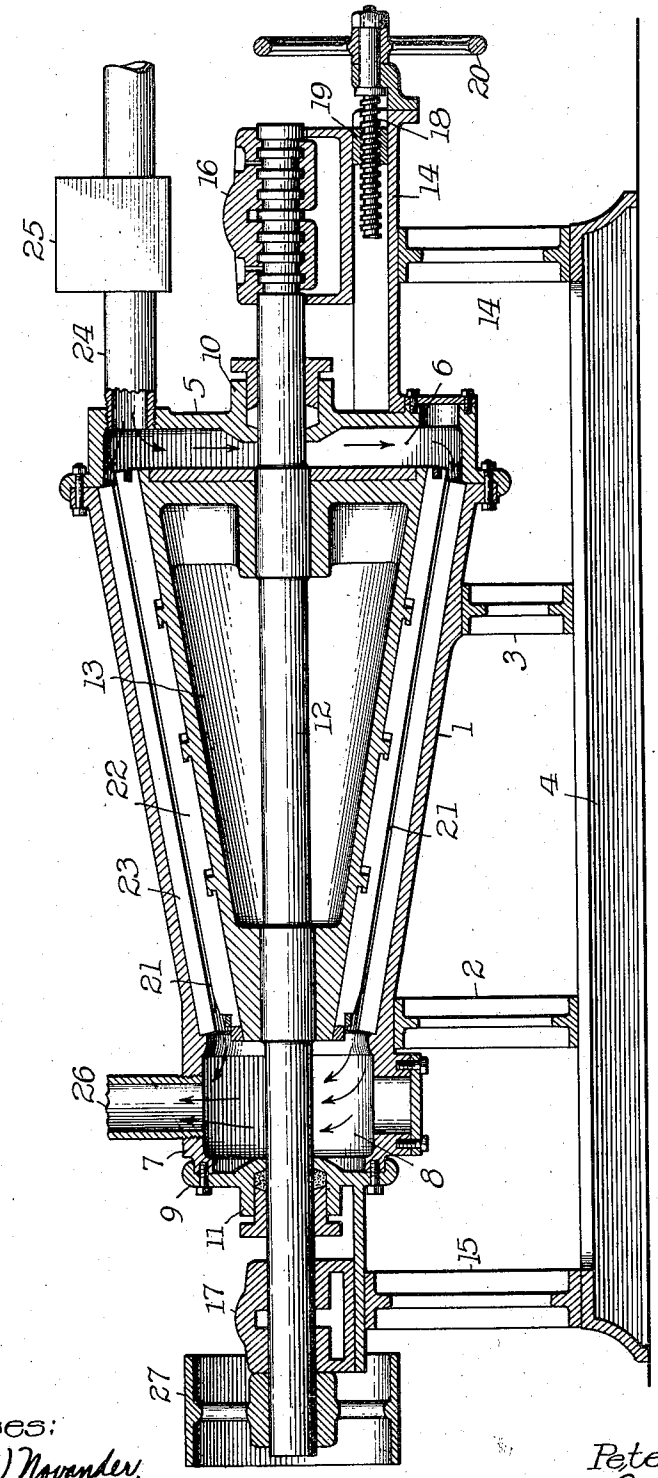
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MEANS AND PROCESS FOR REFINING PAPER STOCK.

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1,217,528. Patented Feb. 27, 1917.



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MEANS AND PROCESS FOR REFINING PAPER-STOCK.

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To all whom it may concern:

Be it known that I, PETER R. THOM, a citizen of the United States, and a resident of Appleton, in the county of Outagamie and State of Wisconsin, have invented certain new and useful Improvements in Means and Processes for Refining Paper-Stock, of which the following is a specification.

My invention relates to improved means and process for refining paper stock.

In the manufacture of paper it is customary to put the stock through a final refining process before feeding of the stock to the belt, as for example a Fourdrinier belt, the aim of the refining treatment being to separate, reduce and arrange the fibers to produce paper of uniform consistency and thickness.

For giving this refining treatment a machine known as the "Jordan" machine has been in almost universal use. This machine comprises a conical drum within which is a conical core or plug, the outer surface of which and the inner surface of the drum are lined with bars, provision being made to effect relative rotation between the drum and plug, and provision being also made to effect relative adjustment between these parts whereby to adjust the distance between the opposed bars. In operating these Jordan machines it has heretofore always been the practice to feed the paper stock into the drum at the small end thereof and to depend upon the centrifugal action to force the stock between the relative rotating parts and into and through the outlet extending from the large end of the drum, the rate of rotation being something like 350 revolutions per minute, which in large diameter machines would produce a high speed particularly at the large end of the plug. The paper stock fed into the machine comprises only about from two and one-half to three per cent. of pulp, the remainder being water, and the depth of the film of stock flowing between the members would therefore be very thin, and it was therefore necessary to effect adjustment to bring the bars very close together, and in fact touching, in order that the stock would be properly acted upon. The action on the stock is thus very drastic, being practically a grinding of the stock between hard relatively moving surfaces. The delicate fibers of the stock are therefore apt to be mutilated, torn and destroyed, and not in the best condition for the efficient manufacture of high class paper.

Another disadvantage of this old refining process is that, on account of the very high speed and the grinding action of the stock between the touching grinding surfaces, it is impossible to keep down the temperature at the large end of the conical members, the temperature sometimes reaching as high as 125 to 130 degrees Fahrenheit. To overcome this temperature effect it is necessary to use much larger quantities of size and alum in the pulp to make the quality thereof equal to that of pulp made when the temperature of the water is much lower, as in winter time. This increase in the quantity of size and alum is not only expensive but is also detrimental to the quality of the paper and also affects the color.

The object of my invention is therefore to provide an improved process for less drastically and more efficiently refining paper stock, and to provide improved means and arrangement for carrying out such process. Instead of depending upon centrifugal action to force the stock to pass between the revolving members and thus requiring close adjustment and contact of the grinding surfaces with the stock of the thin film between such surfaces, I cause the stock to be positively forced through the machine by the action of pressure, this alone causing a thicker film of stock to flow and permitting adjustment for a wider gap between the relatively moving bars and consequently less drastic action. When a machine is used in which the relatively revolving elements are conical, I also cause the stock to flow between the surfaces in a direction contrary to that which centrifugal action would tend to cause it to flow, in other words, I cause the positive pressure applied to the stock to force it through the machine against the centrifugal action, this putting the stock between the moving surfaces under considerable pressure, and instead of having the surfaces close together I am enabled to separate them a considerable distance, say as much as $\frac{1}{8}$ of an inch. With this procedure the stock passes through a machine in compact and uniform condition and instead of having the fibers worked against and between hard grinding surfaces, the fibers are worked against each other to a smooth and silky texture and to uniform length and di-

ameter. I find that paper made from stock thus refined is much stronger and more durable, of more uniform strength both ways of the sheet, and less likely to break than if the refining had been done in the old way, and on water marked papers it greatly facilitates water marking. I also find that with my process rising of temperature is avoided, this being due to the pronounced separation of the relatively traveling surfaces and the comparatively large volume of stock which passes between the surfaces, the result of such avoidance of temperature increase being a saving in size and alum and consequently in a better quality of paper.

By re-arranging a Jordan machine my improved process could be readily practised therewith. Such parts would involve the feeding of the stock under pressure into the drum at the large end thereof and pronounced separation of the drum and core.

On the accompanying drawing I have shown a well known type of Jordan machine together with my improved arrangement for adapting such machine for efficiently carrying out the steps of my improved process.

The figure of the drawing is a longitudinal diametral sectional view of a machine involving my invention.

The conical drum or shell 1 is supported on standards 2 and 3 mounted on a bed frame 4. A cap 5 is detachably secured to the drum at its large end and forms an inlet chamber 6, while the small end of the drum has integral therewith the section 7 forming the outlet chamber 8 whose outer end is closed by a cap 9. The caps 5 and 9 provide axial journal boxes 10 and 11 respectively for journaling a shaft 12 on which is mounted the conical core or plug 13 within the drum in registration with the conical part thereof, as is well understood. Standards 14 and 15 rising from the bed 4 support journal boxes 16 and 17 for the outer ends of the shaft. The journal box 16 forms a step bearing for the one end of the shaft and is slidable on the frame 14 which mounts a screw 18 engaging the lug 19 on the bearing and controlled by a hand wheel 20. With this arrangement the plug 13 can be shifted with reference to the drum 1 to adjust the gap 21 between the bars 22 on the exterior of the plug and the bars 23 on the interior of the drum. A paper stock inlet pipe 24 connects with chamber 6 at the large end of the drum and the stock is forced in under pressure by means of a pump 25 or by other means. An outlet pipe 26 extends from chamber 8 to deliver the refined stock where desired, usually to the belt.

The shaft with the plug thereon is rapidly rotated by means of a suitable pulley 27, or a motor could be directly connected to the shaft. When the structure is in operation the direct pressure action on the stock will tend to force it to flow between the drum and plug from chamber 6 to chamber 8, while centrifugal action will oppose such travel. The direct pressure being, however, in excess of the centrifugal action the stock will flow from the larger to the smaller end of the conical drum and will be under compression between the direct pressure and the pressure caused by the centrifugal action. The bars 22 and 23 will never contact with each other but there will always be a pronounced gap which may be anywhere from $\frac{1}{64}$ to $\frac{1}{8}$ of an inch, according to the fineness of the pulp desired. As the plug rapidly rotates there will be a uniform layer of stock under compression traveling through the machine between the opposed bars, and the bars being separated by a substantial gap there will be no grinding thereby on the stock but the fibers will be worked over, against and around each other and gradually brought to uniform arrangement and to a smooth silky texture. The fibers will not be mutilated or shredded but will retain their form and strength. The fineness of the pulp will depend upon the size of the gap, the smaller the gap the finer the delivered pulp will be.

The greater part of the material flowing through the machine is of course water, and on account of the pronounced gap the large volume of water will tend to prevent rise of temperature and the stock will be kept cool, and additional quantities of size and alum will not be required. This of course results in saving and also in better quality of paper and does not affect the color.

The shape of the drum and core need not necessarily be conical. They could be cylindrical. When thus cylindrical the pressure opposing the feeding-in pressure could be obtained by a spiral or diagonal arrangement of the bars to give a screw action which would tend to force the stock toward the inlet end to thus generate pressure on the stock in opposition to the direct feeding-in pressure thereon. The diagonal or spiral bars could also be applied to the drum and plug when they are conical and the direction of the bars and the direction of rotation of the plug could be such that the bars would assist or oppose the feeding-in pressure.

I do not of course desire to be limited to the exact arrangement and procedure disclosed as there may be changes and modifications which will still come within the scope and spirit of my invention, and I claim as follows:

In a machine for refining pulp stock for making bond or analogous papers, the combination of a conical casing, a conical core rotatable in said casing and slightly spaced therefrom to form a passage annular in cross-section, means for feeding unrefined stock under pressure directly to the large

end of said passage, means for effecting relative rotation of said core and casing and thereby causing the centrifugal action to exert a counter pressure on said stock effective throughout the length of the passage, and a discharge conduit communicating with the small end of said conical passage for receiving and delivering the treated stock, the first-mentioned or feeding pressure being sufficient to cause the stock to travel from the large to the small end of said passage.

In witness whereof I hereunto subscribe my name this 29th day of Jan'y, A. D., 1915.

PETER R. THOM.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."