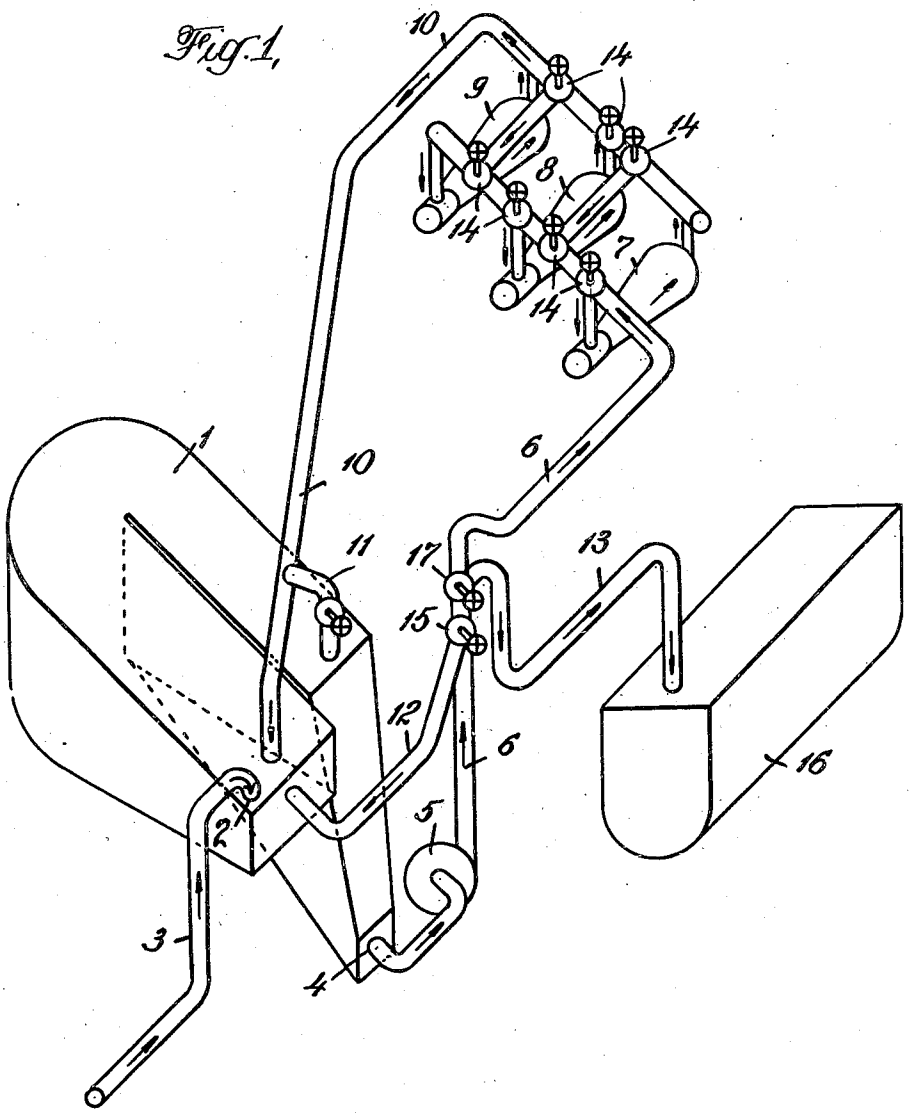
Dec. 14, 1948. G. L. BIDWELL 2,456,249

APPARATUS FOR PRODUCING VARIEGATED FIBER LENGTHS IN THE MANUFACTURE OF PAPER

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Fig. 1.



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Fig. 2.

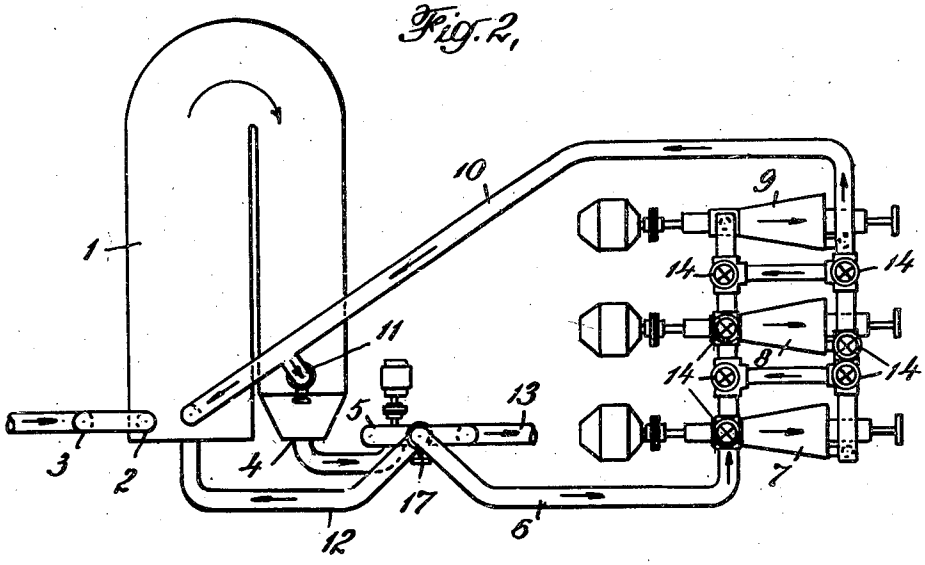
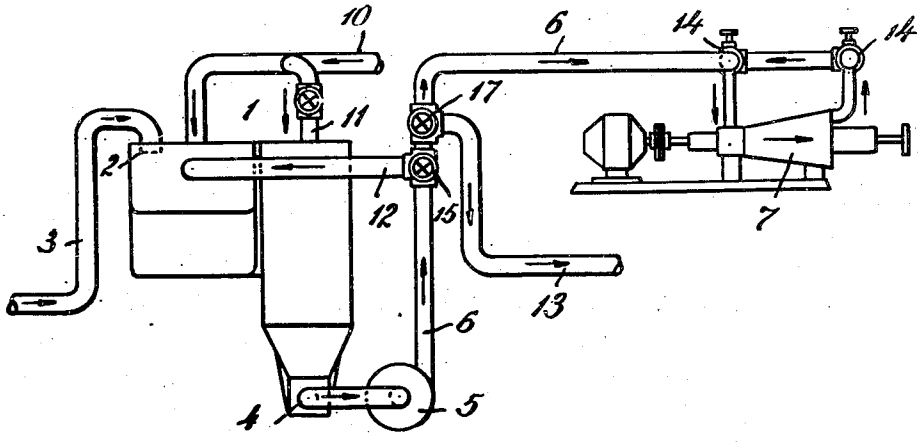


Fig. 3.



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APPARATUS FOR PRODUCING VARIEGATED FIBER LENGTHS IN THE MANUFACTURE OF PAPER

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2 Claims. (Cl. 92—20)

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This invention relates to improvements in the manufacture of paper and includes an improved apparatus for the preparation of fibers for the manufacture of paper with control of the "variegated fiber length" in such preparation.

The present invention provides an improved apparatus which will prepare the fibers for the manufacture of paper with control of variegated fiber length in which a batch of stock in a large circulating tub is pumped through refiners and returned to the circulating tub with by-passing of part of the stock so that it is returned to the tub without passing through the refiners and with by-passing of part of the stock from the refiners so that it is returned to the refiners without passing through the circulating tub.

In the manufacture of paper it is important to control the variegated fiber length in the preparation of pulp for the paper machine. A good sheet of paper is not made of fibers of uniform length but is made partly of fairly long fibers and partly of shorter fibers. The long fibers when used by themselves would make paper wild in formation and of poor quality. Therefore it is necessary to have shorter fibers varying in length to fill in the mat of long fibers which form a sort of coarse screen that holds and causes the shorter fibers to interlace with the longer ones and form a sheet of paper that closes up and gives a sheet of paper of strong physical qualities and a smooth surface which admits of a uniform finish when properly pressed and calendered.

In the Hollander beater engine the variegated fiber length is obtained by the "carry-over" caused by some of the fibers staying in the buckets formed by the cutting edges in the revolving element that grinds the stock as it passes over the bedplate. The fibers that are thrown out of the buckets by centrifugal force go back over the "back fall" of the Hollander tub or engine and when so thrown are at a higher elevation than the fibers in front of the revolving element. This causes circulation in the tub. Fibers that remain in the buckets until dumped in front of the bedplate get additional treatment on the bedplate and become shorter than the fibers thrown over the back fall. This is one feature of the Hollander engine that produces fibers of variegated lengths. Another feature which produces the same result is the fact that pulp that travels next the midfeather of the Hollander engine or tub is subjected to more treatment than pulp that travels around the outer periphery of the Hollander tub, as the length of travel around

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the midfeather is shorter than that around the outer periphery.

In order to overcome the objections incident to the use of Hollander tubs, circulating tubs of different design have been used with the revolving and stationary elements that do the grinding located outside the tub and with the pulp delivered to the grinding elements by a pump.

The present invention provides an improved apparatus for creating the desired variegated fiber length, for insuring hydration of the fibers, and for positively controlling the variegated fiber length. According to the present invention a tub of large capacity is combined with a pump, special piping and grinding elements located outside the tub so that in addition to the main circulation of pulp through the tub, piping and grinding elements with return to the tub provision is made for causing a controlled amount of fiber to be by-passed so that it is returned to the grinding elements outside the tub without making a complete circuit around the tub and provision is also made for by-passing a controlled amount of the fiber from the pump back to the tub without passing through the grinding elements.

The circulating tubs used in the apparatus and process of the present invention may vary in size and have different capacities, e. g., 2,000 pounds, 3,500 pounds, or 7,000 pounds, etc. The inlet to the tub receives the stock from the breaker and the outlet of the tub leads to the circulating pump. A by-pass piping connection permits the by-passing and return to the tub of a regulated portion of the stock without passing through the refiners. From the circulating pump piping leads to grinding or refining elements from which the stock is returned to the circulating tub and provision is made for by-passing a regulated portion of this returned stock so that it is again pumped to the refiners without passing through the circulating tank.

It is one of the important advantages of the present invention that it enables different stocks to be hydrated and refined and prepared for the manufacture of paper with control of the variegated fiber length by controlling the portion of the stock that is by-passed to the tub without passing through the refiners and the portion of the stock that is returned to the refiners without passing through the circulating tub while the main circulation is through the circulating tub and the refiners and back to the circulating tub.

The by-passing of a regulated portion of the stock from the pump back to the circulating tub without passing it through the refiners enables a

regulated proportion of longer fibers to be kept in the stock, while the return of a regulated portion of the stock from the refiners and back to the refiners enables a regulated portion of shorter fibers to be obtained at the same time that the main circulation of the stock through the circulating tub and refiners is taking place.

The invention will be further described in connection with the accompanying drawings which are somewhat conventional and diagrammatic in character and which illustrate one form of the apparatus of the invention but it is intended and will be understood that the invention is not limited thereto.

In the accompanying drawings Fig. 1 shows the apparatus in perspective and in a somewhat conventional and diagrammatic manner;

Fig. 2 is a plan view of the apparatus of Fig. 1; and

Fig. 3 is an elevational view of the apparatus of Fig. 1.

In the accompanying drawings the circulating tub 1 has its inlet at 2 where it receives the stock from the breaker through the pipe 3 and has its outlet at 4 with a pipe leading to the circulating pump 5 from which piping 6 leads to the first of three refiners 7, 8 and 9, and with connecting piping having three-way valves 14 therein to permit the circulation of the stock in series as shown by the arrows through the three refiners. Piping 10 leads from the last refiner back to the inlet end of the circulating tub 1. The piping 6 leading from the pump to the refiners should be at least double the diameter of the inlet and discharge of the refiners. Likewise the discharge pipe 10 should be preferably double the diameter of the inlet and outlet of the refiners. This discharge line 10 is also advantageously elevated, e. g., at least two feet higher than the outlet of the last refiner, thus creating back pressure and furnishing a reservoir of stock in the line 10.

A by-pass line 11 with regulating valve therein leads from the return line 10 to the outlet end of the circulating tank or to the suction side of the pump 5, thus enabling a regulated portion of the stock returning from the refiners to be by-passed and returned to the refiners admixed with other stock passing from the circulating tub to the pump and refiners. The arrangement of this by-pass 11 enables and insures a direct recirculation of a controlled quantity of fibers through the refiners, thus furnishing the necessary fines while the main portion of the pulp returning from the refiners through the return line 10 enters the inlet of the circulating tub and admixes with and is further recirculated with the stock in said tub.

On the discharge side of the pump 5 in the line 6 leading to the refiners is inserted a by-pass 12 that leads back to the inlet end of the tub 1. This by-pass permits the return of a regulated portion of the stock to the circulating tub without passing through the refiners and by regulating the amount of stock so by-passed a regulated and controlled quantity of longer fibers can be retained in the stock when the contents of the tub, at the end of the operation, are emptied to the machine chest 16 through the discharge pipe 13. A three-way valve 15 in the pipe 6 enables the amount of stock by-passed to the circulating tub to be regulated and controlled. A three-way valve 17 permits the stock to be discharged to the machine chest 16 at the end of the process.

The refiners 7, 8 and 9 are shown conventionally in the drawing and may be Jordan refining engines or other refiners such as a Mordon stock maker, a Wiener refiner, a Bauer mill, a Claflin or other type of refiner designed for producing fibers from the stock and for hydrating such fibers.

In the operation of the apparatus, in addition to the main circulation of stock through the circulating tub to the refiners and back to the inlet of the circulating tub there is a further circulation through the by-pass on the discharge side of the pump which permits a regulated quantity of fibers to be by-passed so that they do not reach the refiners as quickly as the bulk of the stock that enters the pump, with resulting production of the long fibers for the mat that is to be filled in with fines. In addition, a further circulation is provided by the by-pass in the piping leading from the discharge side of the last refiner, which by-pass connects to the outlet end of the circulating tub or to the suction side of the pump, thus causing some of the fibers to be refined many times more than the bulk of the stock entering the pump from the discharge side end of the circulating tub. The result of these combined operations is to give a well hydrated stock of variegated fiber length similar to that produced by the Hollander engine, but with less labor and with positive control of the fiber length variegation and degree of hydration.

In the process of the present invention, which is designed for operation as a batch system, different proportions of the stock can be by-passed and recycled through the different cycles to give the variegated fiber length required or desired in the paper making operation. Hydration takes place not only in the refiners but also during the circulation, the friction of the fibers in the pipe lines and in the tub, one fiber working against another, aiding in the hydration. Where the stock is by-passed from the pump back to the circulating tub and is not permitted to enter the refiner many times, longer fibers are secured. By by-passing the stock from the refiners and returning it to the refiners many times, shorter fibers are obtained. And by regulating the amounts or proportions of stock so by-passed and circulated, the desired variegated fiber length is obtained.

It is an important advantage of the present apparatus that the regulation and control of the amounts of stock by-passed is accomplished with only two valves to operate and these valves are located in the circulating system and not on the refiners. The valve in the by-pass line 11 regulates the amount of stock returning from the refiners which is by-passed to the circulating pump to be repassed through the refiners. The valve 15 in the line 6 controls the amount of stock which is by-passed from the pump back through the line 12 to the inlet end of the circulating tank without passing through the refiners.

The arrangement of the piping connected to the refiners is advantageously such, as above described, that a head of pulp is maintained in the piping 10, which with the pressure from the circulating pump causes a back pressure on the stock in the refiners which promotes the refining operation.

While the refiners have been shown in the drawing as three in number and arranged in tandem so that the stock passes successfully through the three refiners, the number and ar-

rangement of the refiners as well as the type of refiners used can be varied.

The apparatus of the present invention is simple to operate, insures thorough circulation of the pulp and removes all possibility of lodgments and is readily emptied to the stock chest when the desired variegated fiber length and hydration have been obtained.

While I do not desire to limit myself to any exact proportions of stock which is by-passed in the present apparatus, since this will vary with different stocks, I have operated with certain stocks where 50% of the stock is by-passed from the pump back to the inlet end of the tub without passing through the refiners, and where half of the stock returning from the refiners is conducted back to the inlet end of the tub, the other half of the stock returning from the refiners being by-passed into the discharge end of the tub. With such by-passed proportions, the contents of a tube of e. g., 3,500 pounds' capacity may make e. g. around 4.4 passes through the refiners with a cycle of e. g. two hours.

In carrying out the process tests may be made, known as slowness tests, on the batches and the batch emptied into the stuff chest when the desired slowness has been secured.

It will thus be seen that the present invention provides an improved apparatus for the preparation of fibers for the manufacture of paper with positive control of the variegated fiber length, and in which a circulating tub of large capacity and without circulation lodgement which may be quickly emptied without manual labor is combined with a circulating pump, refining or grinding elements independent of the circulating tub, and a system of piping with arrangement of a by-pass in the piping on the discharge side of the pump for returning a regulated portion of the stock to the circulating tub without passing to the refining or grinding elements and also a by-pass in the system of piping between the discharge side of the refining or grinding elements and the entrance to the circulating tub for by-passing a regulated portion of the stock back to the inlet of the pump and to the refining or grinding elements.

It will also be seen that the present invention provides for obtaining the desired variegated fiber length with regulation and control of longer and shorter fibers to give stock well adapted for the making of a sheet of paper of strong physical qualities and a smooth surface that admits of a uniform finish when properly pressed and calendered.

I claim:

1. Apparatus for the preparation of fibers for the manufacture of paper, including a circulating tub having an inlet and outlet, refining elements outside the circulating tub, said refining elements being arranged with feed piping and discharge piping of about double the diameter of the inlets and outlets of the refining elements, the discharge piping from the refining elements extending a distance of at least about two feet higher than the discharge outlets of the refining elements, a circulating pump for circulating the stock from the circulating tub through the refining elements and back to the inlet of the tub, in combination with a by-pass on the discharge side of the circulating pump for returning a regulated portion of the stock to the inlet of the tub and a by-pass on the discharge side of the refining elements for returning a regulated portion of the stock to the inlet of the circulating pump, said by-passes enabling a controlled amount of long fibers and short fibers to be produced in the batch of fiber being circulated, and a discharge pipe between said first by-pass and said refining elements.

2. Apparatus for the preparation of fibers for the manufacture of paper, including a circulating tub having an inlet and outlet, refining elements outside the circulating tub, said refining elements being arranged with feed piping and discharge piping of about double the diameter of the inlets and outlets of the refining elements, the discharge piping from the refining elements being higher than the discharge outlets of the refining elements, a circulating pump for circulating the stock from the circulating tub through the refining elements and back to the inlet of the tube, in combination with a by-pass on the discharge side of the circulating pump for returning a regulated portion of the stock to the inlet of the tube and a by-pass on the discharge side of the refining elements for returning a regulated portion of the stock to the inlet of the circulating pump, said by-passes enabling a controlled amount of long fibers and short fibers to be produced in the batch of fiber being circulated, and a discharge pipe between said first by-pass and said refining elements.

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