July 27, 1943. J. T. COGHILL 2,325,159

APPARATUS FOR SEPARATING FIBERS

Filed March 14, 1940 3 Sheets-Sheet 1

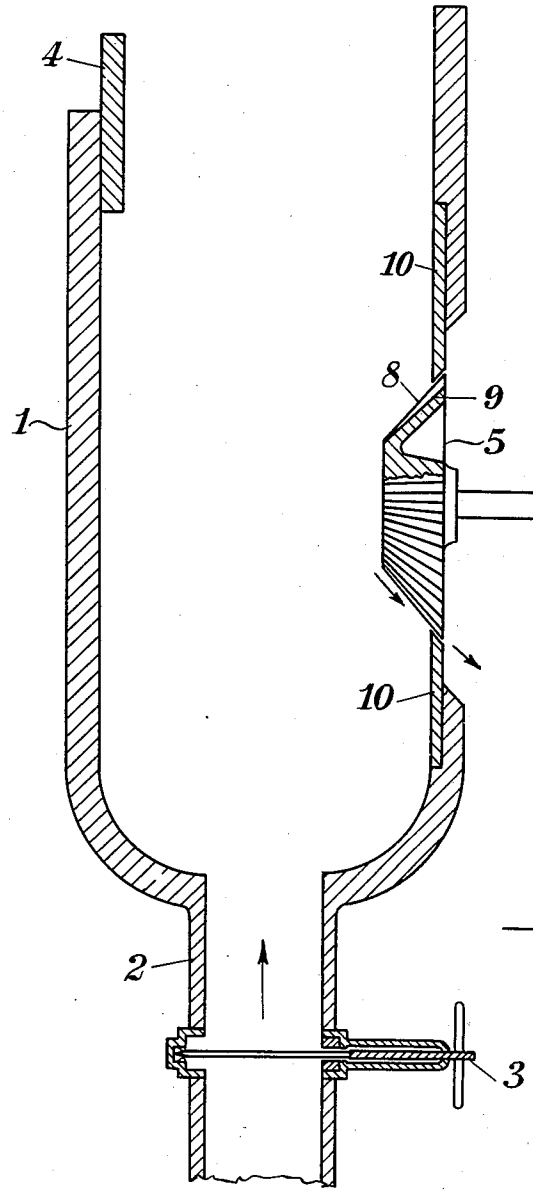

Fig. 1

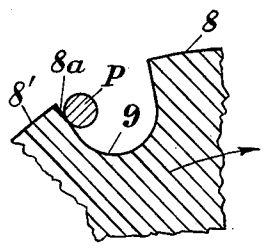

Fig. 2

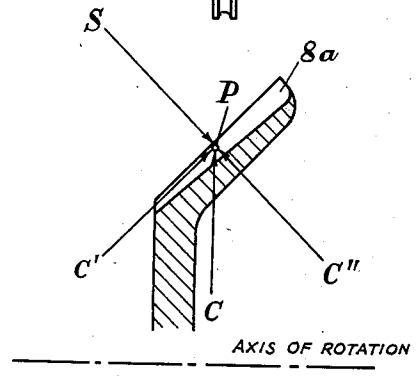

Fig. 3

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APPARATUS FOR SEPARATING FIBERS

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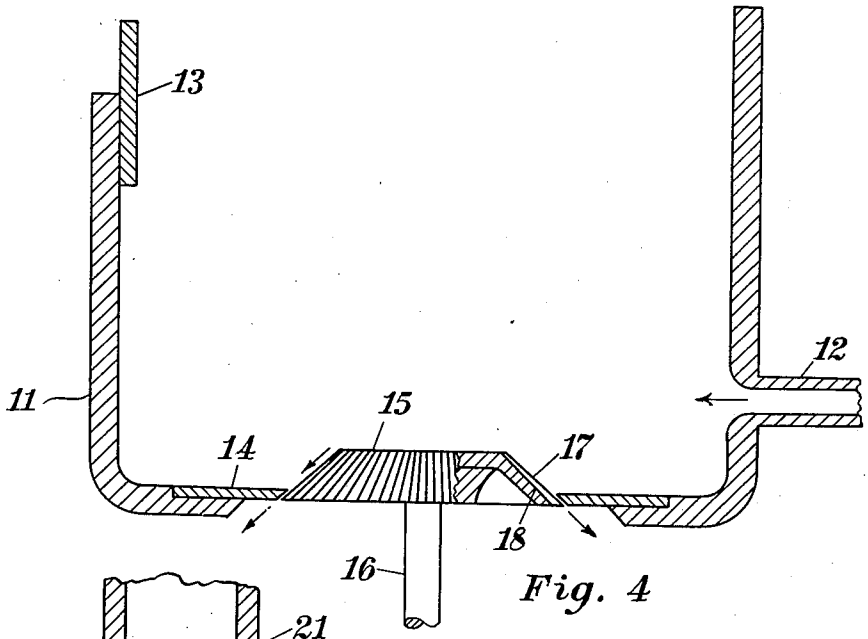

Fig. 4

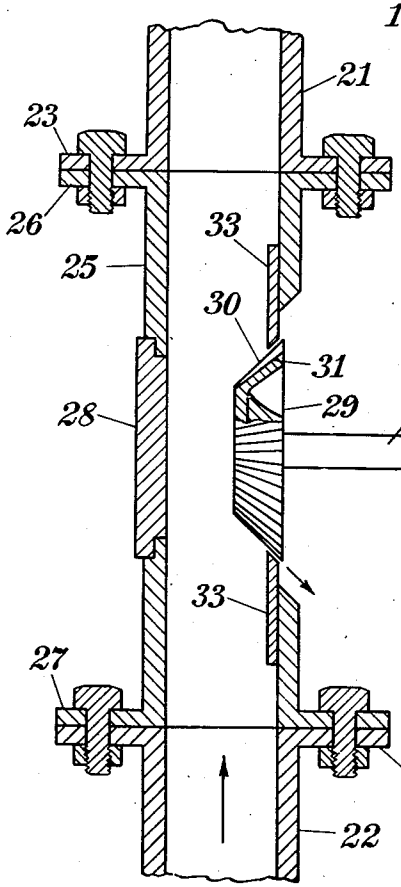

Fig. 5

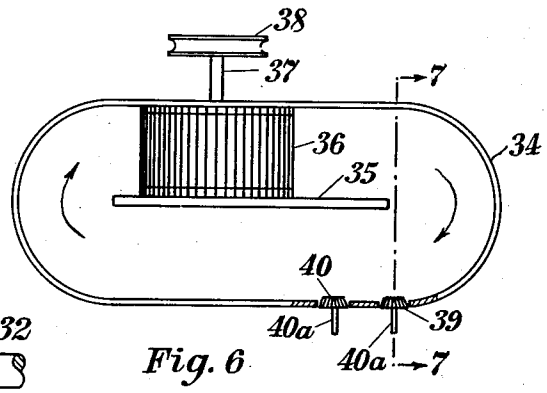

Fig. 6

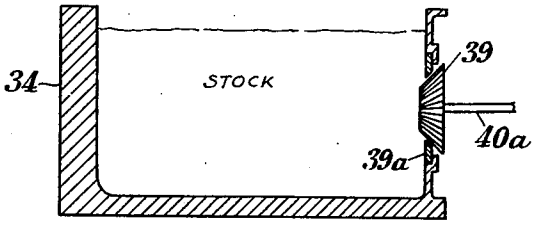

Fig. 7

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APPARATUS FOR SEPARATING FIBERS

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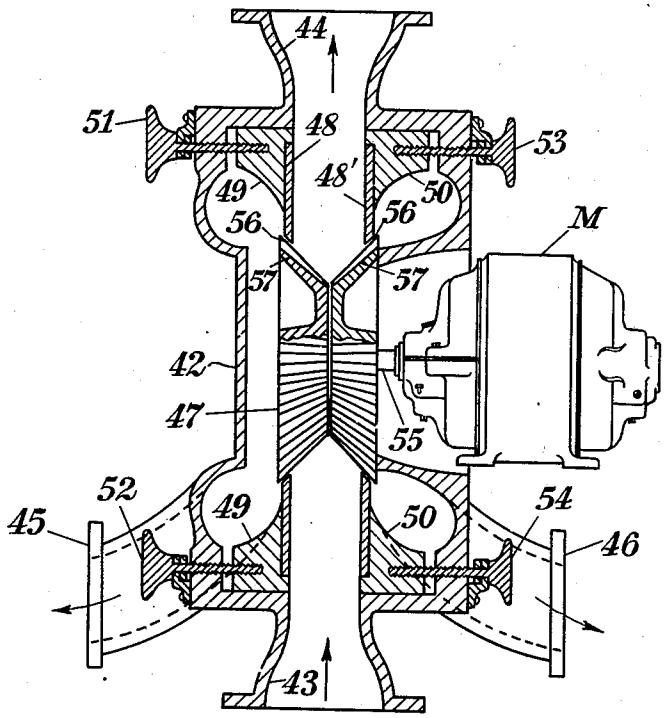

Fig. 8

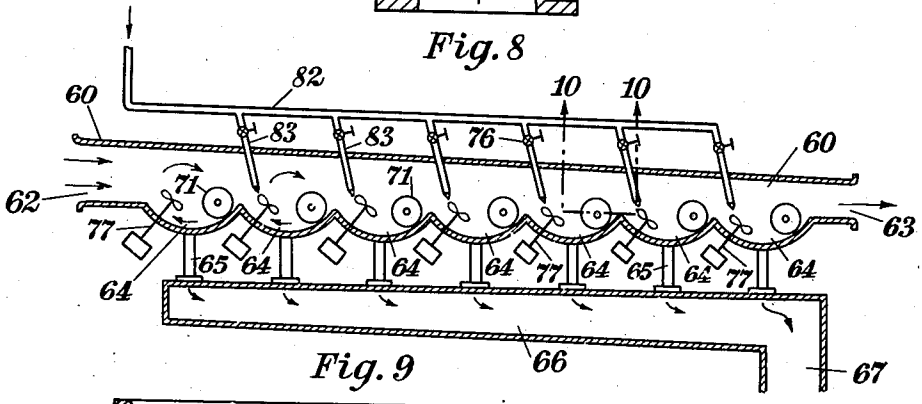

Fig. 9

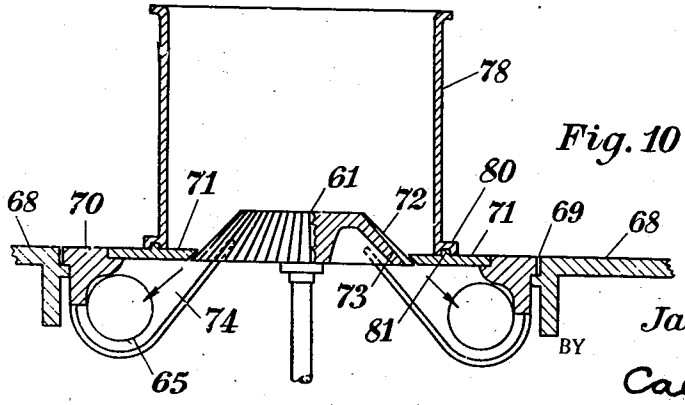

Fig. 10

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Patented July 27, 1943 2,325,159

UNITED STATES PATENT OFFICE

2,325,159

APPARATUS FOR SEPARATING FIBERS

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Application March 14, 1940, Serial No. 323,955

11 Claims. (Cl. 92—29)

This invention relates to apparatuses for separating fibers, and has particular reference to apparatuses for separating the fine fibers from masses containing such fibers in admixture with other materials such as water, coarse fibers, fiber bundles, scraps of undefibered material, foreign materials, etc.

The invention is applicable to various industries involving wet processes such as canning, the manufacture of paint, and the preparation of pulp and paper, as well as the treatment of sewage. The invention may also be applied to certain dry processes such as the separation of dust or lint from textile fibers.

One of the most promising applications of the invention is in the art of papermaking, an application which lends itself admirably for the specific disclosure of the invention such as is required by the patent statutes. The invention will, therefore, be described with particular reference to the papermaking art, and it is to be understood that the present disclosure is illustrative rather than restrictive, and that no limitations are to be imported which are not required by the language of the claims and the state of the prior art.

As applied to the art of papermaking, the invention is particularly concerned with that phase of the art which has to do with the treatment of pulps to render them suitable for formation or fabrication into sheets or webs.

In order to produce a sheet or web of paper having desired properties, it is necessary to start with a papermaking pulp of a required quality. For reasons with which this invention is not concerned, not all of the pulp produced by any particular process is of the required quality for a particular purpose. If the pulp is produced by mechanical processes, it comes from the grinder pit as a mass of separated wood fibers of varying size mixed with water and varying amounts of wood slivers, unground slabs, and foreign materials such as dirt, sand, and stone. If it is produced by chemical processes, the pulp comes from the washing tanks mixed with knots and partially cooked chips together with foreign materials such as dirt, cement and digester brick. If the papermaking material is made from waste papers, it generally contains more or less undefibered stock and foreign materials such as dirt, sand, grit, pieces of string, etc. In many cases, before the pulp can be made into paper, the coarse fibers and undefibered material must be separated from the fine or majority fibers, and the dirt and other foreign matter must be removed.

Prior to this invention, the customary way to separate the coarse fibers and other undesirable materials from papermaking pulps was by means of a machine called "a screen," the process being generally referred to as "screening." The separation by means of screens as practiced prior to the present invention has many disadvantages and shortcomings as will now be pointed out.

Effective screening generally requires the use of both coarse and fine screens, and in order to obtain optimum results it is often necessary to use very large settling tanks or rifflers between the two types of screens. In some cases, particularly in the ground wood process, rifflers may be employed after the fine screens. The screens and rifflers require a large amount of floor space, and the cost of installation, operation, upkeep and repair is relatively high especially in the case of the screens. Furthermore, the pulp must be prepared for screening by being diluted with very large quantities of water, which serves as a conveyor for the pulp through the system. The stock (mixture of pulp and water) is, as a general rule, pumped through the system at a consistency of from .4% to 1.25% B. D. The large amount of added water renders necessary the use of pumps of large capacity and results in the expenditure of large amounts of power.

Most of the added water must be removed after the screening operation. The process of removing the water, which is often referred to as slushing, thickening, deckering or concentrating, requires additional equipment and labor. Thickening equipment is expensive, costing about $300 per ton of capacity in a groundwood mill for the machinery alone; installation is costly; large floor space is required, and maintenance is high. Furthermore, thickeners due to their intricate construction are gathering points for dirt and slime. It is also to be noted that in the case of groundwood pulp, the stock cannot be pumped until the coarsest material such as slivers and slabs are first removed. This operation is an additional item of expense and constitutes another disadvantage in the screening of mechanical pulps.

A further drawback to prior art methods of pulp-separation by screening resides in the fact that screens are of necessity very sensitive to changes in the quantity and density of the stock being handled, and hence do not give uniform or dependable results when operated under different or changing conditions. Relatively small changes in the quantity or density of the stock generally produce sharp variations in the capacity

and effectiveness of the screen, and unless the screening conditions are carefully controlled, poor results will be obtained. It is to be noted that proper control of screening consistency is inherently very difficult. There is no consistency regulator on the market that will do the job, and hence manual operation of the valves must be relied upon. The screening operation requires a great deal of attention; otherwise the screens will be clogged, or good papermaking fibers will escape with the tailings or rejects. Because of the many disadvantages of screening, prior to the present invention, the screening operation was generally omitted in the preparation of pulp in certain types of plants such as board mills.

The primary object of this invention is to overcome and eliminate the many shortcomings and disadvantages inherent in prior art methods and apparatuses for separating the coarse fibers and foreign materials from papermaking pulps.

Another important object is to provide a pulp-separating process, which is relatively simple and effective in operation, and which entirely obviates the use of prior art screening devices with their many defects.

Another object of importance is to provide a pulp-separating process, which is particularly well adapted to be carried out by means of relatively simple, compact and inexpensive equipment.

Another object of importance is to provide a relatively simple, compact and inexpensive form of apparatus for performing the steps of the process of the present invention.

Another important object is to provide a pulp-separating process and apparatus, which render wholly unnecessary the prior art operations of preliminarily diluting the pulp and subsequently concentrating the stock as well as the often-practiced intermediate riffling operation.

Another important object is to provide a pulp-separating process and apparatus, particularly suitable for application to the processing of a wide variety of types and qualities of cellulosic or vegetable pulps as well as animal (leather) and mineral (asbestos) pulps intended for the fabrication of a wide range of papers, boards and specialties.

A further object is to provide a pulp-separating process and apparatus, which can be applied very readily and economically to the processing of pulps, which vary widely in quality and quantity as well as in density or consistency.

Still another object is to provide a pulp-separating device having a relatively high capacity per unit and requiring small power consumption, thereby rendering it possible to process a larger quantity of a given stock with a smaller number of units, less floor space, and a smaller expenditure of power.

Other objects and advantages of the invention will be set forth as the detailed description proceeds or else will become apparent from such description.

Before discussing the invention in detail, it should be pointed out that the invention is based upon the discovery or observation that if an edge, either sharp or rounded, is moved at a relatively high rate of speed through a fairly dense mass or slurry of pulp containing both fine and coarse fibers, the edge will gather out of the stock the relatively fine individual fibers and leave behind the coarse fibers. If the pulp mass also contains shives, fiber bundles, scraps of undefibered pulp or foreign materials such as dirt, sand, grit, stone, pieces of string, metal, rubber, etc., these material will also be left behind by the moving edge. The materials that are left behind are either too large to remain in front of the rapidly moving edge or are too much entangled in the mass of pulp to be caught up and carried along by the edge.

In its broadest aspect, the present invention consists in totally immersing an edge into a mass or slurry of pulp containing fine fibers admixed with other materials such as coarse fibers, shives, fiber bundles, scraps of undefibered pulp and foreign materials such as those previously mentioned and moving the edge while so immersed at a relatively high rate of speed through the mass or slurry. The moving edge gathers up the fine fibers from the mass or slurry of pulp, leaving behind the undesired materials. The fine fibers are then removed or conveyed away from the moving edge. Experimental data indicate that in order to obtain an effective separation of the fine fibers, the speed with which the edge is moved through the mass of pulp must be in the order of 4,000 feet per minute. Greater speeds than 4,000 feet per minute have been found preferable in carrying out the process of the invention on a practical industrial scale. Speeds between 6,000 and 12,000 feet per minute have been found to be particularly advantageous from the standpoint of maximum performance.

The process of the invention is susceptible of being practiced by means of various forms of apparatus, it being essential that the apparatus, whatever its specific form of construction, be provided with one or more edges adapted to be moved at a relatively high rate of speed through a mass or slurry of pulp to gather up the fine fibers from said mass, and adapted to carry the separated fibers away from the working zone.

In a preferred form of construction, the pulp-separating edges, to which frequent reference has been made, are embodied in a rotor of either cylindrical or frusto-conical form. The rotor is provided on its circumferential surface with a plurality of alternating ribs and grooves. The ribs and grooves are preferably disposed substantially transversely of the rotor, but they may be disposed at a pronounced angle to the axis of the rotor. It is, therefore, to be understood that the term "substantially transversely of the rotor" is intended to mean "transversely of the rotor" or "at a pronounced angle to the axis of the rotor." The rotor may advantageously be mounted in proximity to an opening in a suitable form of stock channel, flow box or other vessel containing the pulp with its axis substantially perpendicular to the plane of the opening. When the rotor is moved at a high rate of speed while totally immersed in a body of pulp, the forward edges of the ribs on the surface of the rotor function to gather up the fine fibers of pulp, and the grooves serve to convey the separated fine fibers out through the opening in the vessel in a manner to be hereinafter described in greater detail.

Referring briefly to the drawings,

Figure 1 is a vertical sectional view through an illustrative form of pulp-separating apparatus embodying the inventive concept;

Figure 2 is a fragmentary sectional view of the rotor on an enlarged scale showing the manner in which a bead of pulp is snatched out of a pulp mass or slurry;

Figure 3 is a diagram showing the forces acting on a bead of pulp as it is separated out of the mass;

Figure 4 is a vertical section through a modified form of pulp-separating apparatus in which the rotor is disposed at the bottom instead of at the side of the vessel;

Figure 5 is a vertical section through a modified form of pulp-separating apparatus applied to a pipe-line;

Figure 6 is a plan view of a beating or pulping engine having incorporated therein several fiber or pulp separating devices constructed in accordance with the present invention;

Figure 7 is a vertical cross-section taken along line 7—7 of Figure 6;

Figure 8 is a modified form of pulp-separating apparatus in which the rotor is in the form of a double cone;

Figure 9 is a plan view of an illustrative form of pulp-separating apparatus utilizing a series of rotors; and

Figure 10 is a vertical cross-section on line 10—10 of Figure 9, and showing a cylinder that may be used to render any one of the rotors ineffective.

Referring to the drawings in greater detail and more particularly to Figure 1 thereof, the numeral 1 designates a suitable form of tank or vessel adapted to contain the pulp to be treated in accordance with the process of the invention. The vessel may advantageously be provided at or near its bottom with a pipe connection 2 for introducing the pulp into the vessel. A suitable form of valve 3 may be provided in the pipe connection in order to render it possible to control or regulate the flow of pulp into the vessel 1. The vessel may be open at its top, and may be provided at one side with an adjustable gate or dam 4 for a purpose to be hereinafter pointed out.

At the side opposite the gate or dam 4, the tank 1 is shown provided with an opening for accommodating the rotor 5. The rotor is illustrated as being frusto-conical in form and is provided with a horizontal shaft 6, which may be provided with a pulley 7 for connection to a suitable form of driving means (not shown) for the rotor. The rotor is provided about its circumferential periphery with a large number of alternating ribs 8 and grooves 9. The numeral 10 indicates an annular doctor plate secured about the opening in the wall of the tank 1, said plate having a conical bore to cooperate with the conical surface of the rotor 5 as will hereinafter be pointed out.

Before proceeding further with the description, it will be helpful to consider what happens when the rotor 5 is rotated rapidly through a mass of unscreened stock as the stock is caused to flow into the vessel 1 through the pipe line 2. Assuming that the level of the pulp slurry is above the rotor so that the rotor is completely immersed therein, the forward edges of the ribs 8 will each catch up a tiny bead or particle of pulp as they move rapidly through the mass.

Referring now to Figure 2, wherein is shown a fragment of the rotor 5 on an enlarged scale, 8 and 8′ are two successive ribs, 9 is the intervening groove, 8*a* is the forward or effective edge of the rib 8, and *p* is the tiny bead or particle of pulp which has been caught up by the edge 8*a*.

The forces acting on the bead of pulp are indicated in Figure 3. In this figure, *p* is again the bead of pulp, and 8*a* is the edge that has caught up the bead. The line *s* represents the static head of the slurry or pulp which tends to force the particle *p* into the groove. As soon as the particle *p* has been forced into the groove, the particle must necessarily travel at the velocity of the rotor surface and the centrifugal force tends to throw the particle out radially. The line *c* represents this centrifugal force, and lines *c′* and *c″* represent the two components of this force, the component *c′* being parallel to the face of the rotor and the component *c″* being perpendicular to the face of the rotor.

It is thought to be clear that if sufficient time is allowed for the stock to enter the groove, enough stock will enter so that the force *c″* will be exactly equal to force *s*. The force *c′* is an accelerating force and tends to move the separated pulp particles axially along the groove between the doctor plate and the rotor, where they are discharged as separated fiber. In actual practice, it has been found that a time interval of between $\frac{1}{1000}$ and $\frac{1}{200}$ of a second is sufficient to allow the separated pulp to feed at maximum capacity. It has also been found that the rotor will not accept the coarse fibers, shives, fiber bundles, scraps of undefibered pulp and other undesirable material of the type previously mentioned. These materials will either pass on with the stock over the adjustable gate or dam 4, or will tend to settle in the tank 1.

It is thought to be clear from the foregoing explanation that the process of the present invention is simply a matter of snatching out the fine fibers from the stock and discharging them. There are several factors that apparently control the cross-section of the beads of stock that will be separated. The factors include the number, width and length of the grooves, the angle of cone of the rotor, the diameter of the doctor plate, the stock depth, and the speed of the rotor. For any given installation, the number, width and length of the grooves, the angle of cone of the rotor, and the diameter of the doctor are constants, while means may be provided to regulate the stock depth and the speed of the rotor. In the apparatus shown in Figure 1, the adjustable gate or dam 4 constitutes the means for regulating the stock depth. It will be understood that the stock depth governs the static head, and that the angle of cone governs the component of the centrifugal force that moves the separated pulp to the discharge end of the rotor.

It is preferable to have the grooves as narrow as possible, for at least two reasons. The narrower the grooves the greater the number of edges that can be provided on a rotor of a given size, and hence the greater the capacity or output that can be obtained with a given installation. Furthermore, the narrower the grooves the smaller will be the largest pulp particle that will be accepted by the rotor. However, the grooves must be large enough to receive and carry the tiny bead of pulp which begins to form at the narrow end of the rotor, and which increases in size until it reaches the doctor plate. The depth of the grooves apparently has no effect on the performance of the apparatus, provided the grooves meet the foregoing requirement.

From what has been said, it is thought to be clear that by selecting a suitably dimensioned rotor and doctor plate, and by adjusting the other factors, the apparatus of the invention may be readily adapted for the separation of the finer

fibers or particles of pulp from any kind of fibrous material including vegetable fibers such as cellulose, animal fibers such as leather, and mineral fibers such as asbestos or a mixture of two or more of these materials. For the pulp-separation process of the invention is wholly independent of the type of fibrous material to be subjected to the treatment, and in so far as the procedure is concerned, it is immaterial whether the pulp has been prepared by mechanical or chemical methods from virgin cellulose or from waste material such as rags and waste papers. In any event, the process is preferably carried out with stock taken directly from the pulp-making process or storage tanks without any preliminary addition of water as has always been considered necessary in prior art screening processes. In other words, the method of the present invention is preferably, but not necessarily, carried out on high density stock in contradistinction to prior art methods of screening at low densities or consistencies. It is thought to be clear, therefore, that the apparatus of the invention does its work at a sufficiently high density so that subsequent thickening is not required.

By way of example, it may be stated that in a commercial form of apparatus constructed in accordance with the invention, the rotor was twelve inches in diameter at the doctor plate and had three hundred grooves, each $\frac{1}{16}$" wide and $\frac{1}{16}$" deep. The ribs or lands between the grooves were also $\frac{1}{16}$" wide. The doctor plate was adjustable in reference to the rotor, and the normal clearance between the two elements was in the order of .001 of an inch. The clearance may vary from .001 to .004 of an inch without appreciably affecting the results, the larger clearances being preferable from the operating standpoint. In this connection, it is to be noted that there are no engaging grooves of any sort on the doctor plate, and that the sole function of this plate is to prevent the discharge of any stock except that which is snatched up by the ribs on the rotor and forced out through the grooves.

A permissible variation in the form of construction illustrated in Figure 1 consists in omitting the overflow. Such a construction requires occasional washing out of the undesirable materials, which necessarily accumulate in the tank. For this reason, this form of construction finds its chief use in the case of paper stocks such as board machine liners, where the amount of undesirable materials is relatively small.

Another permissible variation is to have the discharge opening for the separated stock at the bottom instead of at the side. Such a form of construction is illustrated in Figure 4. Referring to this figure, the vessel containing the pulp to be processed is denoted by **11**, the stock inlet which is at one side is indicated by **12** and the adjustable gate or dam, which controls the overflow and hence the stock level and static head, is designated by **13**. As has already been stated, the discharge opening for the separated stock is at the bottom. Adjustably secured about the discharge opening is the doctor plate **14**, and mounted in the opening with a very small clearance is the frusto-conical rotor **15**, which may be rotated by means of the shaft **16**. The rotor may be provided with a plurality of axially or transversely extending ribs **17** and grooves **18**, as has been described in connection with the form of construction shown in Figure 1.

Still another variation is to have the discharge opening and the rotor at the top of a casing instead of at the side or bottom. In such embodiment, the stock may be fed in at the side or bottom, and the rotor will start to function when the pulp has completely filled the casing. A suitable form of outlet for the unaccepted stock may be provided.

The forms of apparatus which have been described may be embodied in a pipe line. Referring to Figure 5 wherein is illustrated such an application, the reference numerals **21** and **22** designate two separated pipe sections of a pipe line provided with the flanges **23** and **24**. Interposed between the two pipe sections is the casing **25**, which contains the essential elements of the pulp-separating device. The casing has the two flanges **26** and **27**, by means of which the casing is connected to the two pipe sections to form a continuous passage for stock. The casing **25** may advantageously be provided with a hand hole and cover plate **28** to facilitate access to the interior, and is also shown provided with a discharge opening for stock, within which is mounted the rotor **29**. The rotor **29** has the axially or transversely extending ribs **30** and grooves **31**, and is provided with a shaft **32** to enable it to be rotated at a predetermined rate of speed. The numeral **33** denotes the adjustable doctor plate, which prevents all but the separated pulp from leaving the system.

In the embodiment illustrated in Figure 5, the pipe sections are shown as being vertically disposed and the rotor is shown mounted in a side wall of the interposed casing, the direction of flow of stock being upward. It will be understood that as the mass of stock passes the rapidly moving rotor **29**, the fine particles will be snatched out by the forward edges of the ribs **30** and discharged from the system through the grooves **31** under the doctor plate **33**.

The pulp-separating device may also be applied to a horizontal pipe line, in which case the discharge opening and the rotor may be disposed at the bottom or top instead of the side of the casing **25**. In such construction, the shaft would be vertical and the rotor may be disposed with its narrower end either up or down.

The process of the present invention lends itself particularly for incorporation in any process involving a defiberizing or refining operation, and the device of the invention may readily be embodied or incorporated in a system containing one or more defiberizers or refiners. The device of the invention may be disposed between two defiberizers or refiners to remove from the stock, which has already been acted upon by the first defiberizer, the finer fibers, or the device may be disposed in a channel or passage-way of a defiberizer or refiner along the path of travel of the recirculated stock, so as to remove the finer fibers from the stock before the stock is again presented to the beater roll or other defiberizing element. The apparatus may also be embodied in a pulping engine or other form of device for breaking up and reducing cellulosic materials such as old or waste papers. In such a device the rotor may be disposed within an opening in one side of the device or in the bottom thereof. Such a form of construction is illustrated more or less diagrammatically in Figures 6 and 7.

Referring specifically to Figures 6 and 7, the numeral **34** denotes a breaker beater, which may be of the Hollander or conventional type. The numeral **35** denotes the midfeather, **36** is the beater roll, **37** is the spindle or shaft, and **38** is the pulley by means of which the beater roll is

operated. Two rotors 39 and 40 of the type previously described are shown as being disposed in suitably formed apertures in one of the sidewalls of the beater. Each of the apertures is provided with a doctor plate 39a similar to those previously described, and each rotor is provided with an operating shaft 40a as shown.

The manner of operation of the form of construction illustrated in Figures 6 and 7 is thought to follow from the foregoing description. Water and cellulosic material such as waste papers, broke, etc. are placed in the tub of the beater, and the beater roll set into operation to reduce the cellulosic material to a defibered or pulpy condition.

One or both of the rotors are set into operation, and as the stock circulates in the tub, the finer fibers are gathered up in the grooves of the rotors and discharged through the clearance spaces between the rotors and the doctor plates. The coarser fibers keep on going through the beating process until they are finally fine enough to be accepted by the rotors.

The capacity of the pulp-separating device of the invention may be increased by combining two frusto-conical rotors either with their wide or narrow ends together. In Figure 8 is illustrated a form of device, in which the rotor consists of two frusto-conical sections secured with their narrow ends together, so that the fine particles are snatched up at the V-shaped central portion of the rotor and discharged in both directions from said central portion.

Referring to this figure of the drawings, the device is shown embodied in a hollow casing 42 provided with a central lower flanged opening 43, an upper flanged opening 44 in vertical alinement therewith, and two additional lower openings 45 and 46 which may advantageously be provided at the sides of the casing. The two alined openings 43 and 44 provide a vertical passageway, in which is mounted the double frusto-conical rotor 47 and the two doctor plates 48 and 48', which cooperate therewith. These doctor plates are mounted on the two annular adjusting blocks 49 and 50. The handwheels 51, 52, 53, and 54 provide means for adjusting the doctor plates to provide a predetermined clearance. The numeral 55 is the shaft which is shown as connecting the rotor to a suitable motor M. Each of the two frusto-conical sections of the rotor is provided with a plurality of axially or transversely extending ribs 56 and grooves 57.

In this form of apparatus, the stock enters at the bottom through the opening 42 and passes up through the central passage about the rotor 47. The fine fibers are separated out at the V-shaped central portion of the rotor and are forced outwardly between the doctor plates and the wide ends of the rotor, being finally discharged through the two openings 45 and 46. The rejected stock leaves the device through the upper opening 44.

The pulp-separating devices thus far described are much more flexible in operation than conventional screens, in that they can be operated more economically over a wider range of conditions. The flexibility of the device of the invention can, of course, be increased by using a number of devices of small capacity instead of one of large capacity. Another way to increase flexibility is by providing each device with a number of rotors, any one or more of which may be shut off or rendered inoperative whenever desired. An illustrative form of such construction is shown in Figures 9 and 10.

Referring to Figure 9, the numeral 60 designates a casing, which may be of suitable form of construction, and is preferably open at the top as shown to provide for convenient access thereto. The casing has an inlet opening 62 at one end and an outlet opening 63 at the opposite end. The casing is shown as being divided into a number of communicating compartments 64, each of which has a separate outlet 65 to a chamber or trough 66, which runs the entire length of the apparatus and which has an outlet 67 at the same end as the outlet opening 63.

Referring now to Figure 10, which shows a vertical section through one compartment, it will be noted that the floor 68 of each compartment is provided with an opening 69. Mounted in the opening is an annular block 70, which carries an annular doctor plate 71. Mounted in the opening 69 is the rotor 61, which may advantageously be of frusto-conical shape and which is provided with the ribs 72 and grooves 73. The grooves in the successive compartments may be progressively narrower, since the rejected stock as it passes through the casing toward the exit is increasing in concentration. As shown in Figure 9, there is a suitable form of passageway 74 from the periphery of each rotor to the corresponding outlet 65, so that the discharged stock from each of the rotors empties into the same chamber or trough 66 which runs the length of the apparatus.

As thus far described, it is thought to be clear that the pulp to be processed enters through the inlet 62 and passes through the entire length of the casing to the exit 63 at the other end of the casing. As it passes through each of the compartments, the finer particles of stock are snatched out of the main body by the corresponding rotor and discharged into the chamber or trough 66 through the separate outlets 65. From the chamber or trough 66, the accepted stock passes on to the next operation in the mill, while the rejects leave the device through the exit 63 and may be subjected to further processing, such as defibering in a suitable form of apparatus. It may be advantageous to dispose each successive compartment somewhat lower than its predecessor so that the entire apparatus will slope sufficiently to insure travel of the high density stock. For the same reason, the chamber or trough 66 may be provided with a sloping bottom toward the outlet 67.

In the illustrative form of multi-stage device shown in Figure 9, means are provided to add shower water as may be desired in any or all of the compartments. The means consists of a pipe line 82, which runs the length of the casing 61, and which is provided with a number of branch pipes 83, each of which extends into a compartment 64. A valve 76 of conventional construction may be provided on each of the branch pipes 83 to regulate the amount of added water or to shut the supply off entirely. The purpose of the shower water is to wash the fine fibers out of engagement with the rejects and into the extracted stock.

The apparatus of Figure 9 is also shown provided with a number of propeller agitators 77 to keep the stock in constant motion so that the rotor will contact and extract the maximum number of fine fibers. Means may also be provided to render any particular rotor ineffective. This may consist simply of a cylinder 78 adapted to be

slipped over the rotor to be rendered ineffective. The cylinder may be provided with a flanged lower end 80 formed with an annular groove, and each of the doctor plates may be formed with an annular ridge 81 to prevent the cylinder from shifting position.

I claim:

1. An apparatus for separating the fine fibers from a mass containing such fibers in admixture with other materials, said apparatus consisting of a chamber for containing the mass to be treated, said chamber having an aperture in a wall thereof, and a rotor disposed in said chamber in proximity to the aperture with its axis substantially perpendicular to the plane of the aperture, said rotor being provided with a plurality of alternating ribs and grooves, the body and ribs of said rotor defining a closure for said aperture and the grooves of said rotor constituting the only substantial communication between the interior and the exterior of said chamber, and means to rotate said rotor at a rapid rate of speed.

2. The device defined in claim 1, the rotor being frusto-conical in form and having its narrow end disposed within the chamber and its wide end disposed within said aperture in close proximity to the wall of the aperture.

3. An apparatus for separating the fine fibers from a mass containing such fibers in admixture with other materials, said apparatus consisting of a chamber for containing the mass to be treated, means to supply material to said chamber, means to adjust the static head of said material, an aperture in a wall of said chamber, a rotor of frusto-conical form with its small end disposed within said chamber and with a portion of its circumferential surface in close proximity to the aperture, said rotor being provided on its circumferential surface with a plurality of alternating ribs and grooves extending through said aperture, and means to rotate said rotor at a rapid rate of speed.

4. A pulp-separating device comprising a casing, two vertical partitions in said casing to divide the casing into three compartments, each of said partitions being provided with an aperture, said apertures being in alinement, a double-coned rotor mounted in the middle compartment with the wide end portions thereof in proximity to the apertures, said rotor being provided on its circumferential surface with a plurality of alternating ribs and grooves extending through said apertures, means to rotate said rotor at a rapid rate of speed, and means to feed pulp into the casing.

5. An apparatus for separating the fine fibers from a mass containing such fibers in admixture with other materials, said apparatus consisting of a chamber for containing the mass to be treated, said chamber having an aperture in a wall thereof, a rotor having its axis substantially perpendicular to the plane of the aperture, one end of said rotor being disposed within said aperture with its circumferential surface in close proximity to the wall of the aperture, the remainder of said rotor being disposed within the chamber with its circumferential surface spaced a substantial distance from the walls of the chamber, said rotor being provided on its circumferential surface with a plurality of alternating ribs and grooves extending through said aperture, and means for rotating said rotor at a rapid rate of speed.

6. The device defined in claim 5, the rotor being frusto-conical in form, the narrow end of said rotor being disposed within the chamber.

7. A pulp separating device consisting of a chamber having both an inlet and an outlet, said chamber being provided with an aperture disposed between said inlet and said outlet, a rotor having its axis substantially perpendicular to the plane of the aperture, one end of said rotor being disposed within said aperture with its circumferential surface in close proximity to the wall of the aperture, the remainder of said rotor being disposed within the chamber with its circumferential surface spaced a substantial distance from the walls of the chamber, said rotor being provided on its circumferential surface with a plurality of alternating ribs and grooves extending through said aperture, and means for rotating said rotor at a rapid rate of speed.

8. The device defined in claim 7, the rotor being frusto-conical in form, the narrow end of said rotor being disposed within the chamber.

9. Apparatus for selecting and separating fine fibers from a liquid suspension containing such fine fibers as well as objectionable matter such as larger fibers, fiber bundles and foreign materials, said apparatus comprising a chamber containing the liquid suspension, said chamber having an aperture in the wall thereof below the level of the suspension, a revoluble rotor projecting through said aperture into the suspension within the chamber and constituting a closure for said aperture, means for revolving said rotor at a high speed, said rotor having on its periphery a plurality of spaced passages the inner ends of which are disposed interiorly of the chamber and the outer ends of which are disposed exteriorly of the chamber, whereby a portion of the suspension is caused to enter each passage by the force of the static head of the suspension and is there subjected to centrifugal force, the disposition of said passages with respect to the axis of rotation of the rotor being such that said portion of the suspension which has entered the passages is caused to move along the passages and be discharged exteriorly of said chamber.

10. The apparatus of claim 9, said passages being in the form of alternating ribs and grooves on the surface of said rotor, the ends of said passages exteriorly of said chamber being exposed to atmosphere and the depth of said passages being such that in the presence of atmosphere at their exterior ends the balance between the force of the static head of the suspension and the centrifugal force of that portion of the suspension which has entered the passages determines the quantity of the suspension in each passage.

11. The apparatus of claim 9, the portion of said rotor containing said passages being substantially frusto-conical and having its small end disposed within said chamber, said passages being in the form of alternating ribs and grooves on its surface, the ends of said passages exteriorly of said chamber being exposed to atmosphere and the depth of said passages being such that in the presence of atmosphere at their exterior ends the balance between the force of the static head of the suspension and the centrifugal force of that portion of the suspension which has entered the passages determines the quantity of the suspension in each passage.

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