July 19, 1966 H. BIDWELL 3,261,741

APPARATUS FOR PREPARING PAPER STOCKS

Original Filed May 17, 1961 4 Sheets-Sheet 1

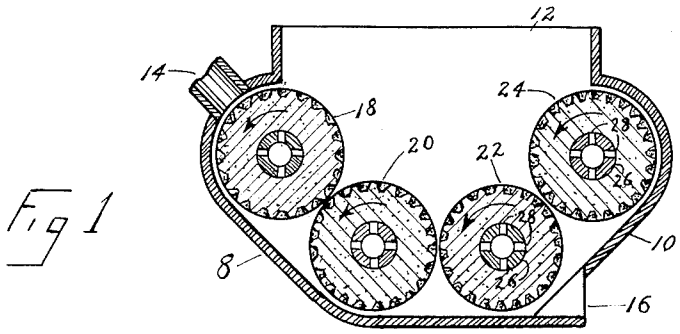


Fig 1

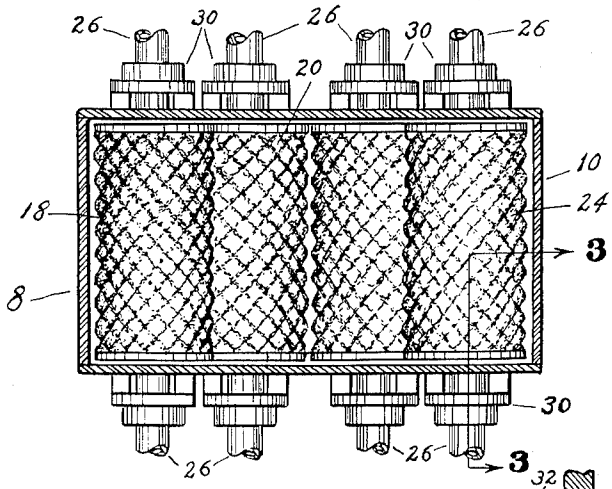


Fig 2

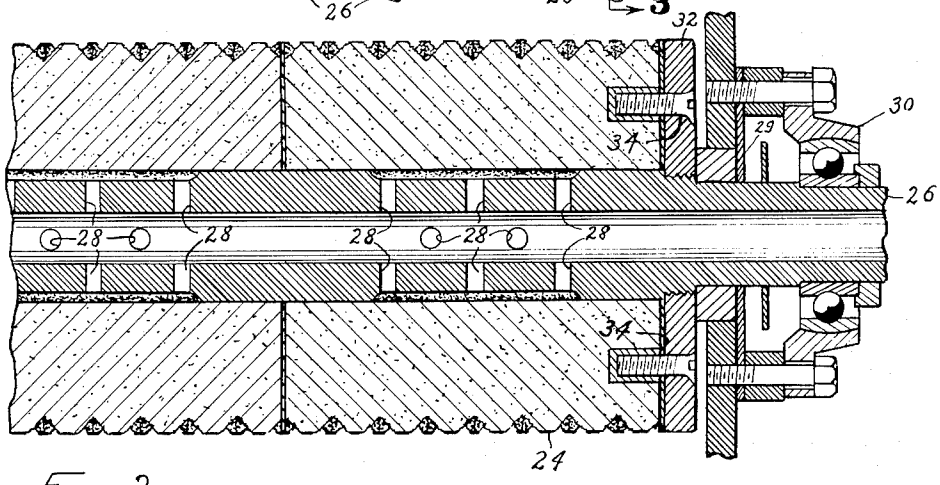


Fig 3

INVENTOR.
Howard Bidwell
BY Kenwood, Ross
Attorney

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APPARATUS FOR PREPARING PAPER STOCKS

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Fig 4

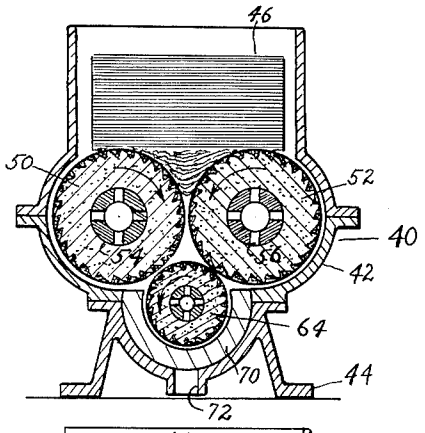


Fig 5

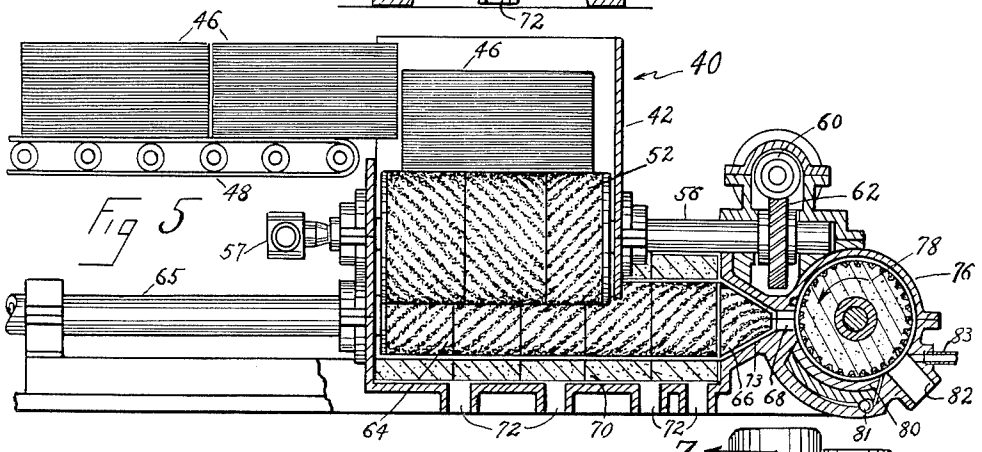


Fig 6

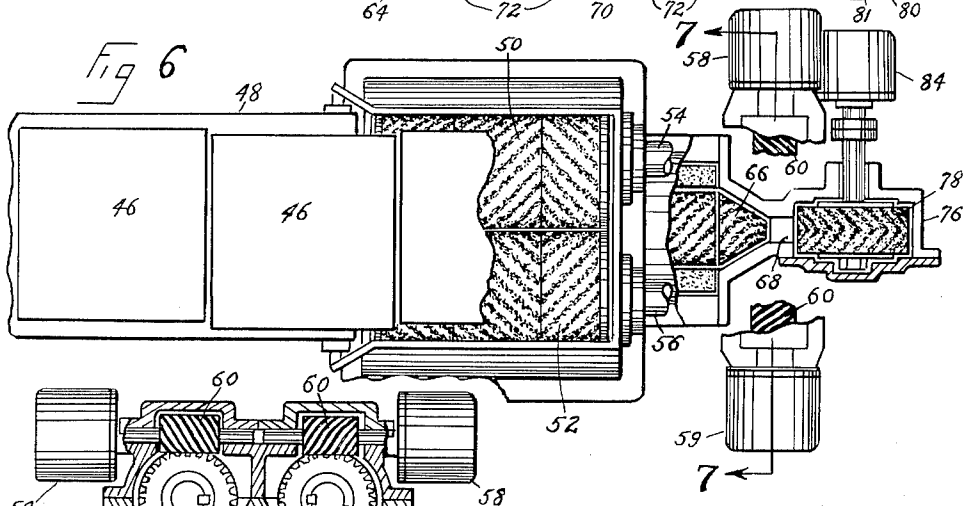
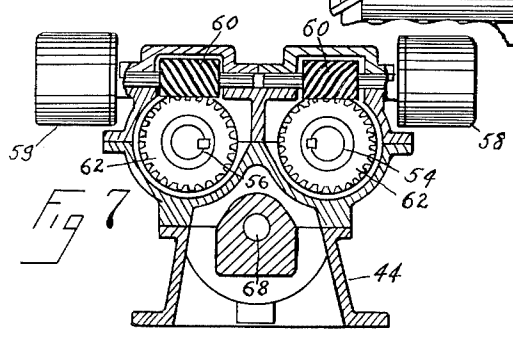


Fig 7



INVENTOR.
Howard Bidwell
BY Kenwood Ross
attorney

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APPARATUS FOR PREPARING PAPER STOCKS

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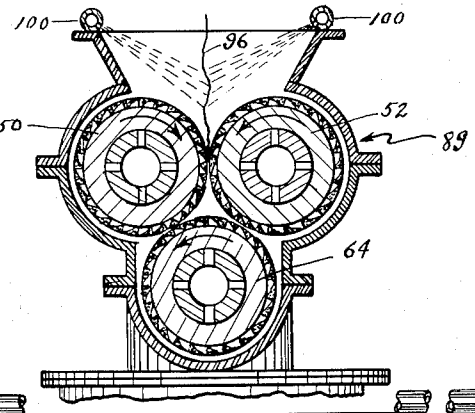


Fig. 8

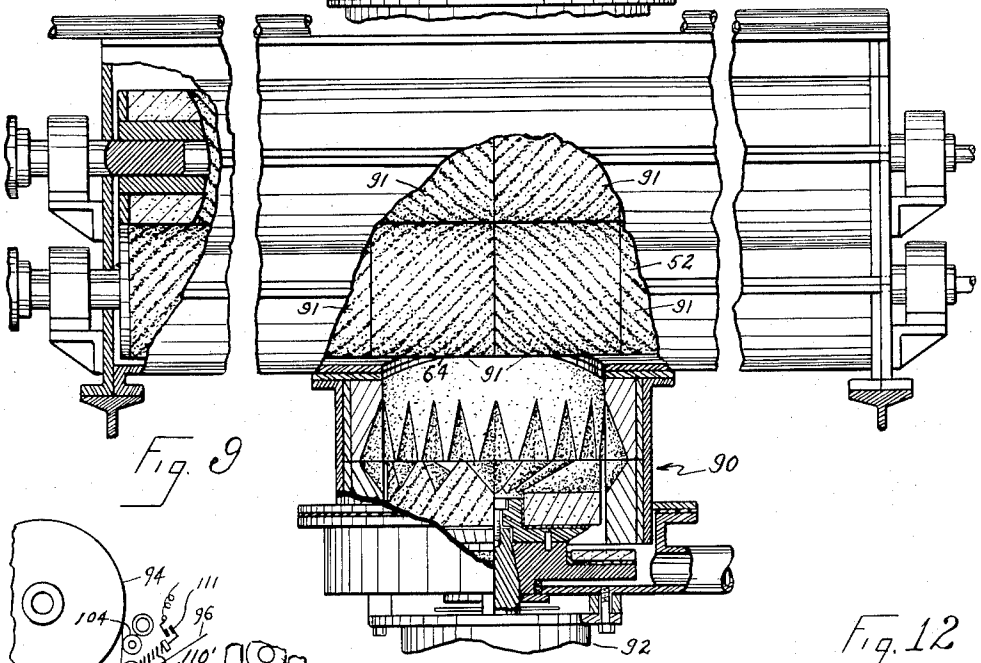


Fig. 9

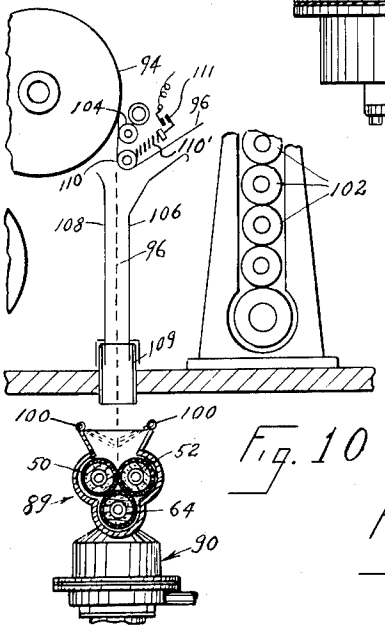


Fig. 10

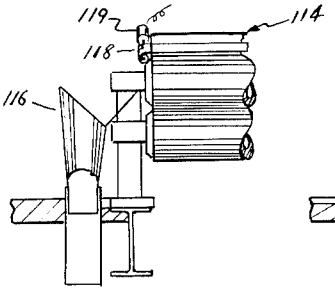


Fig. 11

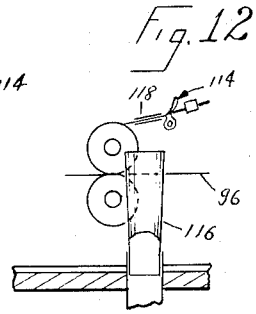


Fig. 12

INVENTOR.
Howard Bidwell
BY Kenwood Ross
Attorney

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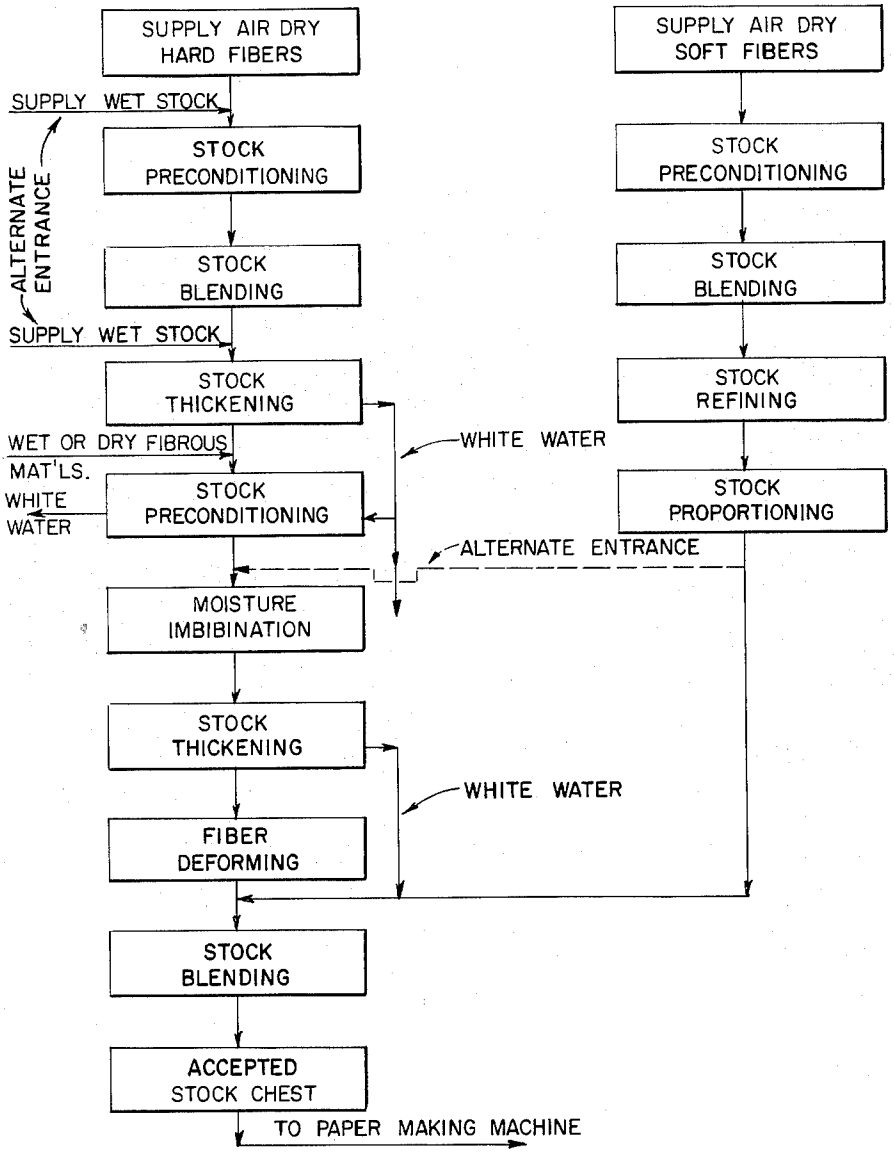


Fig. 13

INVENTOR.
Howard Bidwell
BY Kenwood Ross
Attorney

United States Patent Office

3,261,741

Patented July 19, 1966

3,261,741

APPARATUS FOR PREPARING PAPER STOCKS

Howard Bidwell, Granby, Mass., assignor of fifty percent to Rachel Bidwell, Granby, Mass.

Original application May 17, 1961, Ser. No. 118,756. Divided and this application June 30, 1964, Ser. No. 379,294

3 Claims. (Cl. 162—261)

This application is a division of my copending application Ser. No. 118,756 filed May 17, 1961.

This invention relates to methods and apparatus for preparing paper stocks for subsequent processing. More particularly it relates to methods and apparatus for the reduction or dry, raw, fibrous aggregate to a suitable condition for further processing and refining.

In general, this invention relates to apparatus comprising granular working surfaces contoured to manipulate paper stock to accomplish pulp processing and is exemplified by my Letters Patents Nos. 2,912,174 dated Nov. 10, 1959, 2,936,128 dated May 10, 1960, 3,058,678 dated Oct. 16, 1962 and 3,116,028 dated Dec. 3, 1963 and by my copending applications, Ser. No. 78,072 filed Dec. 23, 1960, Ser. No. 89,423 filed Feb. 15, 1961 and Ser. No. 93,272 filed Mar. 3, 1961.

More particularly, the invention relates to methods and aparatus for processing either wet or dry, raw, fibrous, unrefined aggregate for a reconditioned state for propagating moisture penetration through the outer primary walls of the fibers for expediting moisture absorption by the cellulose strands that comprise the several layers and zones of the inner secondary wall of the fiber to the end of promoting a more rapid fiber development to an accepted stock condition for attaining a reduction in the amount of required further processing whereby to eliminate the cutting action and other detrimental effects that consistently accompany the conventional processing techniques employing the principle of bar against bar.

In general, this invention envisions methods and apparatus comprehending a fiber reconditioning phase for more general operational use in conjunction with working surfaces contoured to manipulate paper stock over granular surfaced processing surfaces as exemplified in my aforementioned Letters Patent and copending applications.

The principal object of the invention is directed to achieving the reduction of either wet or dry unrefined raw aggregate of all types to a readjusted condition as respects stock moisture content, delineated as "stock consistency," and/or stock density and also to achieving a reconditioned state of constituent fibers as respects moisture permeability of the outer primary walls of the fibers which normally resist moisture penetration and moisture accessibility to the cellulose strands confined within the outer primary walls, which strands constitute the various layers and zones of the secondary walls.

Raw, dry, unrefined, fibrous aggregate of all types may be reduced to a flowable stock in such manner that the fiibrous characteristics of the stock, whatever its nature, are rapidly transformed from a rigid, stiff, unyielding condition, to a "tempered" condition wherein the fibers are characterized by softness, pliability and toughness.

Tempered fibers are more resistant to cutting and reduction of their length than are dry fibers. Moreover, tempered fibrous materials can be readily separated into individual fibers and readjusted as to an increased or higher stock density to facilitate their extrusion in the form of dense, compact wads so as to aid in more effectively abrading the primary walls of the constituent fibers.

Raw, wet, unrefined, fibrous chemical or semi-chemical

or other pulps, including preconditioned aggregates in flowable slurry form, may be readjusted, as to the stock density of the fiber-to-liquid ratio, to a suitable density for extruding in the form of a dense, compact, wad and also for providing an effective means for breaking down the primary fiber walls of the constituent fibers.

Additionally, it is an object of the present invention to achieve a suitable altered condition of raw, unrefined, aggregate stock as respects stock density and/or consistency pertaining to the fiber-to-liquid ratio of all types of organic fibrous materials, regardless of their origin, such as wet or dry pulps which are moisture preconditioned to a state of mobility and handleability, if need be, for stock reconditioning the physical state and condition of the primary walls of the constituent fibers from a moisture resistant state to that of a free moisture transmissible state all to the end of sufficiently promoting free moisture imbibition by the cellulose strands of the inner layers comprising the several zones, which constitute the secondary inner wall of a fiber, so as to release the cellulose strands from the restricted bonding and confinement of the outer primary wall, thereby to permit swelling action and exposure of the cellulose strands. Such swelling and exposure is essential to the development of a so-called state of "hydration" and/or to the attainment of the gelatinous effects without the fiber cutting action or other detrimental effects whereby is eliminated the necessity for the refining methods as practiced by the more conventional techniques. Such procedures as here taught produce results superior to those obtainable by conventional methods and in less time and with less expenditure of power.

Another salient object of the invention hereof is to provide means for the reduction of "paper broke" for the return thereof from the papermaking machine to its cooperant stock preparation system.

Other and further objects and advantages are made apparent in the disclosure of the accompanying drawings and in the following specification and claims:

FIG. 1 is an elevational view in cross section of one type of paper stock preconditioner embodying the invention;

FIG. 2 is a view in plan, partly in section, of the apparatus shown in FIG. 1;

FIG. 3 is a view in section, on line 3—3 of FIG. 2;

FIG. 4 is an end view in cross section showing an alternative form of preconditioner embodying the invention;

FIG. 5 is a side view in cross section of the apparatus shown in FIG. 4;

FIG. 6 is a plan view, partly in section, of the apparatus shown in FIG. 5;

FIG. 7 is a view in section, on line 7—7 of FIG. 6;

FIG. 8 is an elevational view, in cross section, of one end of a paper broke reclaiming unit;

FIG. 9 is a fragmentary side view of the unit of FIG. 8 shown as attached at its bottom center point;

FIG. 10 is a diagrammatical view showing a reclaiming apparatus oriented in relation to the dry end of a papermaking machine;

FIGS. 11 and 12 are diagrammatical views showing the application of the invention for reclaiming paper web at the wet end of a papermaking machine; and

FIG. 13 is a schematic flow line diagram showing one method of interconnecting the apparatus, exemplified and shown in FIGS. 1, 2 and 3 in my copending parent application, Ser. No. 118,756, as arranged for operating in conjunction with the apparatus shown in FIGS. 4, 5, 6 and 7 of this application, all of which are component parts of a continuous flow integrated stock blending and processing system arranged for receiving either wet or

dry aggregate materials or both wet stock and dry aggregate material for processing preparatory to subsequent processing for producing a superior quality of accepted stock, free of cut fibers and other detrimental effects characteristic of conventional refining techniques.

It has been found that superior reduction of a dry, raw, fibrous material can be obtained by moisture-penetrating or tempering a portion of the aggregate and continuously separating the so tempered or penetrated portion of the aggregate from the remainder.

In FIGS. 1–3, shown generally at **8**, is one type of apparatus for preconditioning raw paper stock prior to introduction of the stock into apparatus for carrying out subsequent phases of the pulp preparation process, such as described in my copending application, Ser. No. 93,272. The apparatus embodying the invention comprises a chamber or vessel **10** opening upwardly to permit the introduction of raw paper stock, such as shown at **12**, in FIG. 1. The vessel includes an inlet opening **14** for fluid and an opening **16** for discharging water-borne stock. Disposed within the vessel are a plurality of granular-surfaced cylindrical rolls **18**, **20**, **22** and **24**, mounted in side-by-side, spaced relation with their axes parallel. The rolls are formed of a porous, or moisture-pervious, coarse, granular material of the type described in my above-referenced patents and applications. As shown, the rolls are mounted on tubular shafts **26** which are provided with a number of radially extending holes or perforations **28** to enable fluid to be forced through the porous granular material and discharged radially from the outer surfaces of the rolls. For ease of manufacture the rolls may be, and as shown are, composed of a number of sections.

As shown, the tubular shafts extend through openings in the walls of the vessel which may be sealed by seal rings **29**. The shafts are supported by bearings **30** and may be rotated by any suitable means, not shown. The shafts **26** may be drivingly connected to the cylindrical rolls by any suitable means such as end plates **32** and bolts **34**.

In the arrangement shown, the rolls are rotated in the same direction such as indicated by the arrows in FIG. 1 with their upper surface portions moving generally toward the inlet opening **14**. The rolls are preferably rotated at relatively slow speeds so as to separate the tempered portions of the fibrous aggregate with minimum damage to the fibers, the speed of rotation of each roll being different than the speed of the adjacent rolls. In the illustrated embodiment, the roll **20** is rotated at a speed twice the speed of rotation of the roll **18**, and the roll **22** is rotated at twice the speed of rotation of the roll **20**, and the roll **24** is rotated at twice the speed of rotation of the roll **22**. The major portion of the vapor-penetrated aggregate is thus carried toward the roll **18**. The roll **18** is preferably rotated at a substantially lower rate than the other rolls and acts more or less as an anvil against which the major portion of the vapor-penetrated stock is carried and introduced into the fluid flowing into the vessel through opening **14**.

The surfaces of the rolls are deeply scored or contoured to provide efficient fiber separation and motivation with minimum damage or breakage of the individual fibers. In operation of the apparatus shown in FIGS. 1–3, the dry fibrous aggregate **12** is charged or introduced into the vessel through its top opening so that it comes to rest directly on the upper surfaces of the granular-surfaced rolls. Fluid, such as low-pressure steam, is introduced into the tubular shafts with sufficient pressure to be emitted radially from the surfaces of the rolls. The steam rapidly penetrates the fibers of the stock aggregate contiguous the roll surfaces. The steam tempers the fibers, in effect, paving the way for more rapid saturation when the stock comes into contact with fluid introduced into the vessel through pipe connection **14**. The tempered fibers of the stock are characterized by pliability, tensile strength and handleability superior to the dry fibers. Moreover, the tempered portions of the fibrous aggregate are readily separable, with minimum fiber damage, from the remainder of the aggregate composed of the dry or untempered fibers. Continuous rotation of granular-surfaced, vapor-emitting rolls acts to further separate the tempered fibers and transfer them into the fluid flowing below the rolls in such a state of wettability that they quickly become moisture-saturated.

Rotation of the granular-surfaced rolls **18**, **20** and **22** turbulently advances the water-borne pulp toward the outlet opening **16** from which the pulp may be introduced into apparatus suitable for carrying out subsequent phases in the pulp-making process.

While the conditioner, shown and described in FIGS. 1–3, is highly effective for preconditioning fibrous materials of the type considered easy to pulp, in FIGS. 4–7 is shown an apparatus **40** preferable for use in preconditioning materials considered difficult to pulp, such as hair seed fibers, which may be in sheet or bulk form, or in the form of woven fabrics.

The conditioner **40** comprises a vessel or chamber **42** supported by a base **44**. The vessel has an open top for receiving pulp **46** which may be introduced into the vessel by means of a conveyor, such as shown at **48**.

The conditioner comprises a pair of coarse, granular-surfaced rolls **50** and **52** disposed in spaced, side-by-side relation with their axes parallel and lying in a generally horizontal plane for supporting the aggregate on their upper surfaces. The rolls are of generally porous character as described above, and are mounted on tubular shafts **54** and **56**. The shafts may be provided with openings or perforations for supplying fluids such as low-pressure steam, water, or a combination of both which may be introduced into the shafts through any suitable rotary joints, such as shown at **57**. Due to the porous nature of the cylindrical rolls, the fluids will be discharged from the outer surfaces of the rolls. Means is provided for rotating the rolls **50** and **52** at different speeds and with their upper surfaces moving inwardly and downwardly for carrying the moisture-penetrated pulp downwardly toward a rotor **64** and for reducing the moisture-penetrated portions of the aggregate as it passes through the nip. The reducing action depends on the differential speeds of the rolls and their coarse surface texture and contouring. The rolls **50** and **52** comprise separate granular sections. Two of the granular sections tend to propel the aggregate in one direction, to the right as shown in FIG. 6, while the contours of the remaining sections tend to reverse this direction of movement of the aggregate. This opposing movement of the aggregate along the axes of the rolls and within the chamber **46**, increases the effectiveness of the reduction of the aggregate. In the embodiment shown, the roll drive means comprises motors **58** and **59** drivingly engaged with the tubular shafts **54** and **56** respectively by worms **60** and pinions **62**.

The rotor **64** is disposed below the rolls **50** and **52** with its axis parallel to the axes of the upper rolls and directly below the nip formed by the opposed surfaces of the upper rolls. The rotor has a coarse granular outer surface similar to the rolls **50** and **52** and is also porous in nature. The rotor is mounted on a tubular drive shaft **65** which may be perforated to supply or remove by suction fluid from the conditioning vessel through the porous rotor. In this way the amount of fluid in the vessel **42** may be effectively controlled to obtain stock having the desired characteristics. The shaft **65** may be driven by any suitable means, not shown, for rotating the shaft at a different speed and preferably faster than the upper rolls. The rotor **64** comprises a cylindrical portion and a frusto-conical portion **66** at its outer end.

The rotor **64** is spirally contoured throughout its length to impel the stock toward a discharge orifice **68**. The rotor is mounted within a coarse granular-surfaced porous shell or stator member **70** disposed in the bottom of the

conditioner, extending generally throughout the length of the cylindrical portion of the rotor. The inner surface of the stator is coaxial with and radially spaced from the outer surface of the rotor **64**. The portion of the stator underlying the upper rolls is of generally semi-cylindrical configuration, while the remainder of the stator is cylindrical, entirely surrounding the rotor.

Drain openings **72** are provided in the bottom of the vessel **42** for discharge of surplus water which passes through the walls of the porous stator **70**.

The conical end portion of the rotor **64** extends into a chamber **73** of conical cross section communicating with the orifice **68**. As the fibrous mass is forced toward the conical end of the vessel by the contoured rotor **64**, the fibrous mass is de-watered, that is, unabsorbed or surplus water is extracted from the mass. The de-watered fibers are forced through the orifice **68** into a chamber **76** in a dense, firm, compact mass or wad. Disposed within the chamber **76** is another granular-surfaced roll **78** disposed with its axis normal to the axis of the rotor **64**. Means, such as motor **84**, is provided for rotating the roll **78**. The orifice **68** is of relatively small cross sectional size terminating adjacent the periphery of the roll **78** to insure engagement of the maximum number of fibers with the coarse surface of the roll. The chamber also includes an adjustable granular-surfaced shoe **80** extending through a portion of the periphery of the roll **78**. The spacing between the opposed surfaces of the shoe **80** and the roll is adjustable by cam **81** for effective abrading action on the fibers. The chamber **76** is provided with an outlet **82** through which the preconditioned fibrous material may be supplied to subsequent apparatus employed in the pulping process.

Water for lubricating the fiber abrading action is introduced into chamber **76** just above the point where the extruded fibers contact the abrading wheel perimeter from ports provided for that purpose (not shown). Additional water may be supplied through port **83**, as required.

Operation of the apparatus shown in FIGS. 4–7 is commenced by introduction of dry, fibrous stock aggregate, through the top opening of the vessel. As shown in FIG. 4, this material is supported by the upper surfaces of the rolls **50** and **52**. The stock supporting rolls are rotated in opposite directions such as indicated by arrows in FIG. 4. The fluid, such as low-pressure steam, discharged from the rolls continuously penetrates the fibers of the aggregate, contiguous with the surface of the rolls. Rotation of the coarse, granular-surfaced rolls gently separate the vapor-penetrated portions of the aggregate from the remainder of the aggregate and carries them downwardly toward the upper surface of the rotor **64**. Rotation of the rotor acts to maintain the surfaces of the upper rolls in generally clean condition and causes further reduction of the fibrous aggregate. The surface contouring of the rotor advances the pulp toward the orifice **68**.

The conical end **66** of the rotor **64** and the orifice **68** act to compress the moisture-laden fibers extending surplus or unabsorbed water and discharging it through the porous cylindrical stator **70** and the ports **72**. The rotor **64** forces the fibers in a dense compact mass through the orifice **68**. The action of the coarse-surfaced rotor **78** on the dense wad of fibers effectively ruptures and removes the "primary wall" portions of the fibers. "Primary wall" is the name applied to the tenacious outer surface of cellulosic fibers. Unless the primary wall is broken down or ruptured sufficiently to permit full utilization of fiber affinity for moisture, extensive beating of the pulp is required. As mentioned above, the rotor **78** exerts an abrading action on the dense fibrous mass forced through the orifice **68** with the attainment of a high degree of fiber treatment such that the maximum number of fibers are subjected to rupture and at least partial removal of their primary wall. Fibers so treated are prone to rapid swelling and the formation of fibrels with a resultant increase in external fibrous surface area which enables rapid and effective fiber treatment in the following refining phase as well as high bonding ability.

While the conical end **66** of the rotor is shown as being granular surfaced, it may alternatively be of metallic construction on which spiral flutes are provided to effect discharge of the fibers through orifice **68**. The inner wall of the conical chamber **73** may also be provided with spiral flutes which will cooperate in the transmission of the fiber mass through the orifice **68**.

While the above description of the apparatus shown in FIGS. 4, 5, 6 and 7 has been made on the basis of its being operated independently for the treatment of dry fibrous materials, it is to be understood that it is not necessarily to be confined to such limited operation as it is equally effective in reconditioning wet flowable and non-flowable unrefined pulps. Additionally, it is effective in reconditioning the stock density of wet pulps to a higher or lower stock consistency as desired by reversing the flow of moisture at will through rolls **50** and **52**, hollow shafts **54** and **56**, and rotary joints **57**, by the manipulation of provided valve means, not shown, which will connect to the desired type of service, such as vacuum, for the removal of fluids as in the case of tubular drive shaft **65**.

When the apparatus of FIGS. 4, 5, 6 and 7 is used singularly and independently, with all rolls **50**, **52** and **64** operating under suction of partial vacuum, it may be used for reducing raw unrefined pulp from a flowable slurry condition to a reconditioned state as respects both the moisture content of the stock and its mobility and handleability since the apparatus may be manipulated to receive fibrous stocks in a slurry form and to discharge the so received slurry material as individualized fibers in a semi-dry fluffy non-flowable state by virtue of the allowed moisture readjustment and the abrading action of rotor **78** on the compact wad.

Additionally to the above mentioned effects resulting from the reconditioning operation performed by this apparatus is the fact that the actual physical properties of the fibers have been changed due to their undergoing a definite alteration in the tough primary outer fiber which formerly was highly resistant to moisture penetration and consequently prevented swelling of the inner cellulose strands, but which now no longer form a barrier to free moisture wherefore it may be made readily accessible to the cellulose strands constituting the fiber inner layers making up the so-called secondary fiber wall, thereby permitting moisture inbibition and swelling and greatly reducing the need for the usual customary refining techniques in the achievement of a predetermined quality of accepted stock condition, and also without the fiber cutting action which consistently accompanies conventional refining techniques.

For the reasons submitted above, the apparatus shown in FIGS. 1 to 3 may be referred to as the "preconditioner" and the apparatus shown in FIGS. 4 to 7 may be referred to as the "reconditioner." Such terminology is more accurately descriptive of the functions of the two described types of apparatus. Particularly as respects the latter type of apparatus in view of the plurality of ways in which its utility may be exploited, either separately and/or in conjunction with arrangements with other apparatus, as will be apparent by a reference to the flow line diagram (FIG. 13) which also includes a multi-stock processing arrangement.

The efficiency of the reconditioner is, of course, increased when preceded by a thickener when supplied with low consistency stocks.

It has been found that very little power input is required to precondition the fibrous aggregate from its condition of maximum fiber affinity, or resistance to separation, to a condition in which the fibers are readily separable.

The application of this invention is not confined to the preparation of raw stock but may also be suitably applied for reduction of either wet or dry paper broke such as may

occur at either the wet or dry ends of a paper making machine. Utilization of a conditioner similar to the type described may be beneficially employed for reclamation of paper broke enabling the reclaimed stock to be returned to the main stock preparation system or directly into the paper machine chest in the form of high consistency stock.

In FIGS. 8, 9 and 10 is shown apparatus for reclaiming paper broke. In general the apparatus comprises a conditioner **89** and a unit **90** for further processing of the type disclosed in my copending application, Ser. No. 99,473, filed Mar. 30, 1961, now Patent 3,116,028 of Dec. 31, 1963. The conditioner **89** is generally similar to the conditioner shown in FIG. 4, and like reference characters are used to indicate functionally similar components. The conditioner **89** comprises an upwardly opening vessel in which are disposed granular surfaced porous rolls **50** and **52** and rotor **64** which are generally of the same construction as the like numbered members shown in FIG. 4. However, since this conditioner is utilized for handling a broken web of paper, the rolls and rotor may be considerably smaller in diameter than those described above. As shown in FIG. 9, the rolls and rotor sections **91** are contoured to move the web axially toward the center of the rolls for introduction into the unit **90** to reduce the web stock to pulp and return the pulp to the machine chest or stock preparation system. As shown the conditioner is provided with sprays **100** for moistening webs of paper being processed by the unit.

The reclamation apparatus is adapted to handle a web of paper, such as shown at **96**, should the web break in its travel through a paper making machine, a portion of which is shown in FIG. 10. The machine comprises a drier roll **94**, a set of calender rolls **102** and a slitter **104**. The slitter is used to sever the web longitudinally to provide a portion of its width as a leader for threading the web into the calender. The slitter is controlled to move transversely of the web gradually increasing the width of the leader until the web's entire width is being received by the calender.

Means is provided for guiding the web into the conditioner **89** and for automatically starting the conditioner in response to breakage of the web. As shown in FIG. 10, spaced opposed members **106** and **108** are provided for guiding the web into the conditioner **89**, through an opening **109** in the floor which supports the paper machine. A roll **110** is normally biased by any suitable means such as spring **110'** toward a position closing a switch **111**. With the web properly tensioned about the roll **110** the switch **111** is kept open. However, if the web should break, the roll **110** would be moved sufficiently by spring **110'** to cause the switch **111** to be closed, thereby actuating the conditioner **89** including the sprays and roll members and the defibering unit **90**, thereby eliminating any possibility of broke accumulation.

In FIGS. 11 and 12 the working side of a press doctor is shown generally at **114**. A chute **116** is provided for receiving wet broke which collects in doctor bar **118** when the web **96** breaks. The chute introduces the broke into reclaiming apparatus as shown and described above. Means may be provided for collecting the broke from the doctor bar and introducing it into the chute **116**. As shown the collecting means comprises an endless belt **118** driven by a motor **119** in a direction so that its upper surface carries the broke toward the chute **116**.

Within the limitation that all opposed working surfaces be sufficiently spaced from each other to avoid cutting of the fibers, the relative position and spacing of the rolls to each other and of the rolls to the stators may be varied, to control the rate or volume of flow of the stock in conformity with the nature of the aggregate, its state of fiber separation, its initial or acquired water content, as attainment of the above disclosed objective teaching may suggest or require.

I claim:

1. Apparatus for altering the moisture content of fibrous material comprising in combination, a housing for a roll-enclosing material-receiving chamber and having an opening therethrough for admitting the fibrous material into the chamber and an outlet therefrom for the exiting of the altered stock from the chamber, at least four hollow coarse granular-surfaced porous moisture-pervious stock agitating rolls disposed in spaced side-by-side U-shaped relationship within the chamber of said housing, means for rotating said rolls at variable speeds respective to each other, the rotation of said rolls effecting separation of the more moisture-penetrated portions of the charged fibrous material from the remainder thereof, means for supplying fluids to the chamber of said housing through said rolls, the chamber of said housing having a fluid inlet and fluid outlet for allowing a fluid flow therethrough the moisture-penetrated portions of the fibrous being transported by the fluid flow through the chamber of said housing material.

2. Apparatus as set forth in claim **1**, in which said rolls are rotated in the same direction with their upper surface portions moving in a direction for advancing the moisture-penetrated stock generally toward said fluid inlet.

3. Apparatus for effecting abbreviated processing by the rapid break-down of the moisture-resistant outer primary wall of the constituent fibers of paper stocks without cutting action and other detrimental effects respective to fiber length preparatory to further fiber treatment and processing comprising in combination, a housing for a multi-roll enclosing chamber and having an opening for admitting the fibrous stock material into the chamber, at least four coarse granular-surfaced porous moisture-pervious rolls disposed in spaced side-by-side U-shaped formation within the chamber for supporting and agitating and defibering the fibrous stock material, means for rotating the rolls of said plurality thereof at variable speeds respective to each other the rotation of said rolls effecting separation of the more reconditioned portions of the fibrous stock material from the remainder thereof, means for impelling the altered and readjusted portions of fibrous stock material in a given direction, and means for flowing fluids through the rolls of said plurality thereof independently of each other.

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DONALL H. SYLVESTER, *Primary Examiner.*

HOWARD R. CAINE, *Examiner.*