Nov. 8, 1932. G. S. WITHAM, JR 1,887,225

PULPING AND SHREDDING SYSTEM

Filed Sept. 1, 1927 4 Sheets-Sheet 1

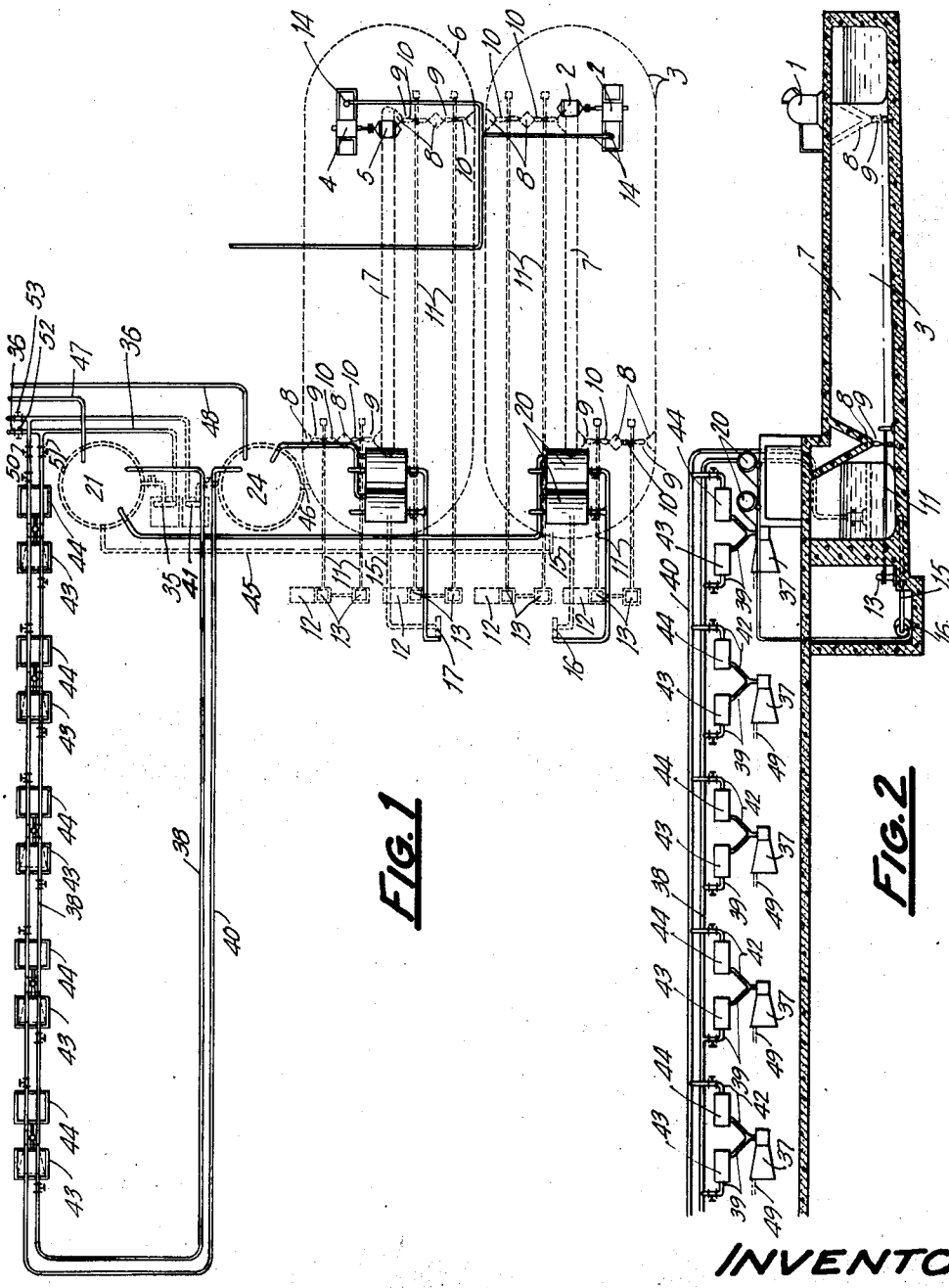


FIG. 1

FIG. 2

INVENTOR

George Stanford Witham, Jr.

By

ATTORNEY

Nov. 8, 1932. G. S. WITHAM, JR 1,887,225

PULPING AND SHREDDING SYSTEM

Filed Sept. 1, 1927 4 Sheets-Sheet 2

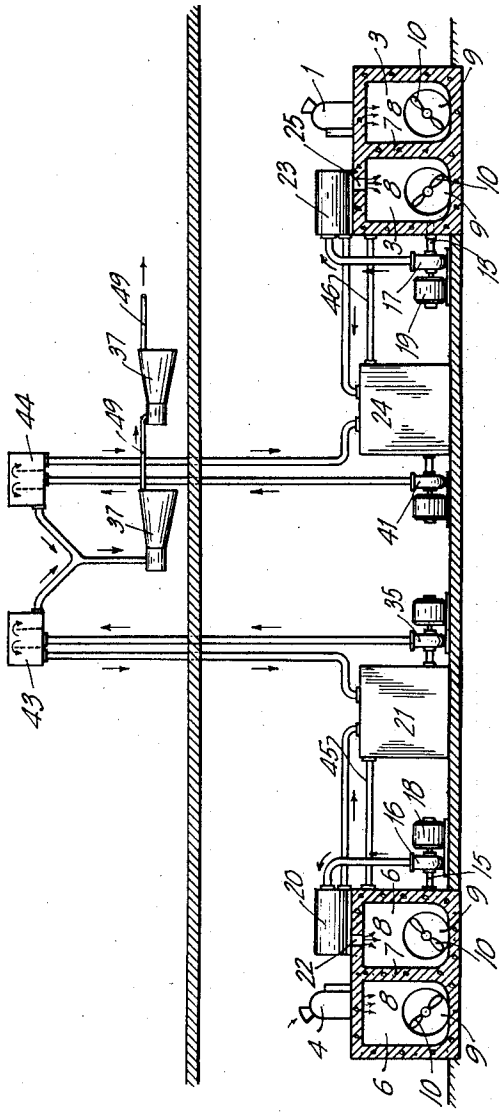


FIG. 3

INVENTOR

George Stanford Witham, Jr.

BY

ATTORNEY

Nov. 8, 1932. G. S. WITHAM, JR 1,887,225

PULPING AND SHREDDING SYSTEM

Filed Sept. 1, 1927 4 Sheets-Sheet 3

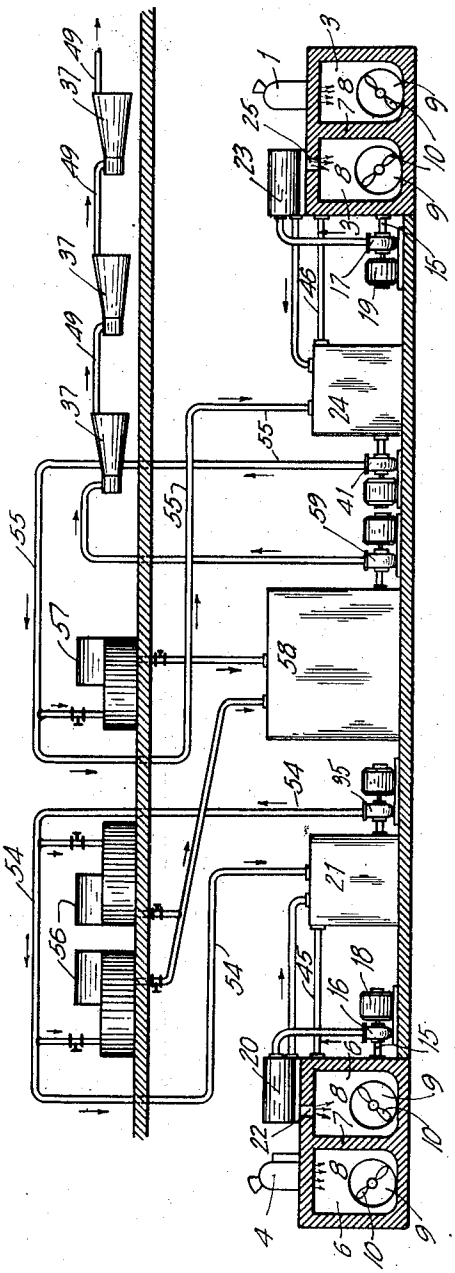


FIG. 4

INVENTOR

George Stanford Witham, Jr.

BY

ATTORNEY

Nov. 8, 1932. G. S. WITHAM, JR 1,887,225

PULPING AND SHREDDING SYSTEM

Filed Sept. 1, 1927 4 Sheets-Sheet 4

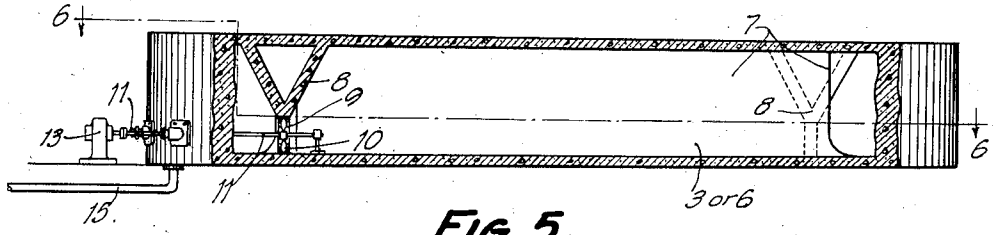


FIG. 5

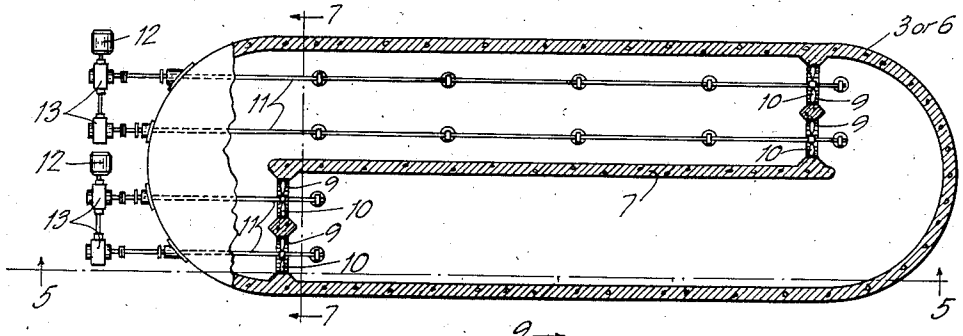


FIG. 6

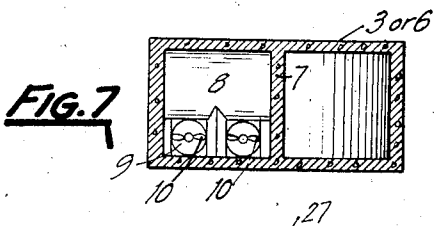


FIG. 7

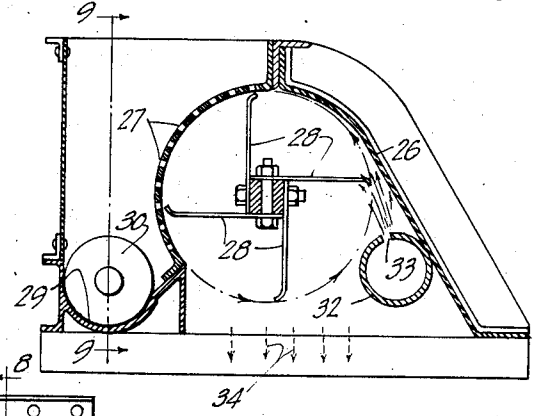


FIG. 8

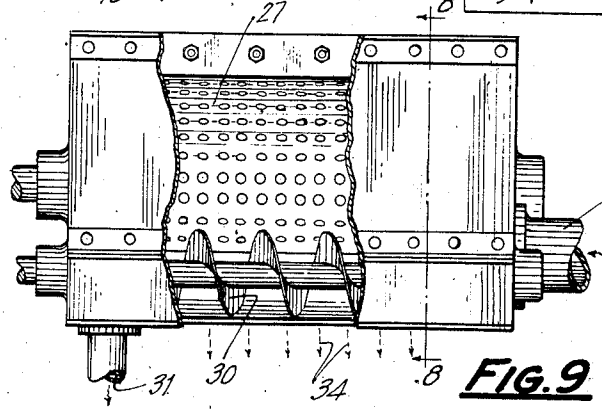


FIG. 9

INVENTOR
George Stanford Witham, Jr.
BY
ATTORNEY

Patented Nov. 8, 1932 1,887,225

UNITED STATES PATENT OFFICE

GEORGE STANFORD WITHAM, JR., OF HUDSON FALLS, NEW YORK

PULPING AND SHREDDING SYSTEM

Application filed September 1, 1927. Serial No. 216,921.

My invention relates to paper making, and particularly to the preparation of stock for delivery to the paper machine. It concerns both the method of procedure or process, the apparatus, and the arrangement of the apparatus whereby partially prepared fibrous materials are reduced or converted to the proper state or condition for use in a paper making machine, and whereby the process of reduction or conversion is carried on continuously.

In the preparation of stock for delivery to the machine, it has heretofore been necessary to subject the pulp to a beating process for the purpose of separating the elemental fibers, hydrating, and otherwise treating them to produce the desired felting or enmeshing on the paper machine. This process is performed in a beating engine and is necessarily an intermittent or batch process, whereas the paper making proper is continuous. It is usual to place in the beater a definite quantity of material including unbroken hunks, separated groups of a few fibers, and some individual fibers ready for the paper machine, and to treat the whole mass together for a definite period regardless of the fact that a constantly increasing percentage of the mixture becomes ready for the paper machine as the treatment progresses.

The action of the beater upon the pulp, or at least the resultant changes in the pulp which occur during the beating process, may be generally classed as mechanical and chemical, or physical and chemical. It is well known, for example, that the fibers are reduced in length and that this physical change takes place largely during the early stages of the beating process. As the treatment progresses, the fibers are also frayed, split, etc., either in the beater itself or in the refining engine after the beating proper has been completed. On the other hand, the chemical change, which is primarily a hydration or a combining of the cellulose fibers with water, takes place more slowly, and is induced by prolonged agitation and friction rather than by drastic mechanical treatment.

Several different systems tending to make the beating process more or less continuous as applied to limited classes of paper have been proposed by others. All of these, so far as I am aware, propose to extract particles of stock from the mass undergoing treatment in the beater. They proceed upon the theory that the fiber or particle is sufficiently treated when merely reduced to a certain degree of fineness and without substantial regard to the extent to which the chemical changes in the fiber have progressed. Inasmuch as the shortening or reduction in size of the fiber occurs largely during the early period of the beating, it follows that fibers continuously extracted from the beater while of the proper fineness may be insufficiently hydrated to form a high grade paper. Hence, it is well known, that such systems operate satisfactorily only in the production of very coarse papers such as roofing felts, leather board and the like, and for use in connection with the disintegration of broke to half-stuff which is usually circulated in the beater at a comparatively low consistency. Moreover, it has heretofore been impossible, from a practical standpoint, to separate or segregate extremely fine particles or fibers from the mass.

My present invention contemplates the substantial hydration of the fiber by agitation or circulation in water prior to any drastic mechanical action thereon tending to effect extensive changes in its physical structure, and the selection and segregation of the partially or completely hydrated fibers, to be followed, if necessary or desirable, by a mechanical treatment to effect the proper changes in physical structure. In other words, instead of producing both the chemical and physical changes in the fiber simultaneously by a beating process, I propose to effect first, a complete or substantial part of the chemical change desired, and thereafter effect such mechanical changes or structural modifications as may be necessary, depending upon the stock being treated and the characteristics sought in the final product. My invention also contemplates the continuous selection and segregation of the properly hydrated fibers which may or may not, thereafter, be subjected to a beating

process before delivery to the paper machine.

The primary object of my invention is to provide a more efficient method of procedure and means for preparing stock than have been heretofore known. Another object is to provide a method and means whereby the stock preparation process may be carried on continuously instead of intermittently or in batches. Another object is to provide a method and means whereby two or more different kinds of stock may be simultaneously and continuously prepared and blended for delivery to the paper machine. Another object is to provide a method and means of continuously preparing stock for a paper machine without subjecting it to a beating process. A further object of my invention is to provide a continuous stock-preparation system of a type adapted to prepare stock for substantially any class of paper.

With these objects in view, my invention includes the hereinafter described process, the apparatus, and the combinations and arrangements thereof which I believe are best suited to facilitate the performance of my process, and which are described below and illustrated in a more or less diagrammatic manner in the accompanying drawings, in which—

Fig. 1 is a typical floor plan showing the general layout of a mill adapted to use my system;

Fig. 2 is an elevation view, partially in longitudinal section, of Fig. 1;

Fig. 3 is a diagrammatic elevation or transverse section of my system, as illustrated in Figs. 1 and 2;

Fig. 4 is a diagrammatic elevation of a system similar to that shown in Fig. 3 and illustrating how beaters may be used in connection with the preparation of some classes of stock;

Fig. 5 is a longitudinal, vertical section of my hydration or shredder tank in the plane, 5—5 of Fig. 6;

Fig. 6 is a horizontal section of Fig. 5 in the plane, 6—6;

Fig. 7 is a transverse section of the shredder or hydration tank in the plane, 7—7, of Fig. 6;

Fig. 8 is a sectional view of my extractor in a plane normal to the impeller axis, such as plane, 8—8, of Fig. 9; and

Fig. 9 is a front elevation of my extractor with a portion of the casing broken away to show the interior construction to the rear of plane, 9—9, of Fig. 8.

In preparing stock by my process, the pulp is first shredded into a comparatively large tank, the size of which is somewhat dependent upon mill capacity but which, for example, may be about 100 feet in length, from 20 to 30 feet wide, and about 12 feet deep. The capacity of such a tank at about 4% consistency will be from 60 to 80 tons. The stock is continuously circulated and agitated in this tank, and white water and pulp are added continuously or from time to time to maintain a proper content and a consistency of about 4%.

From this tank, the stock is continuously pumped and offered to suitable stock selectors or extractors which withdraw from the offered stock such particles or fibers as have been reduced to the proper size by the hydration step. The stock is really circulated through the selectors and the particles rejected by them are returned to the hydration tank for further treatment.

The stock, properly sized and partially hydrated by the two previous steps, is then segregated in an extracted-stock chest from which it is pumped through a continuous circulation system leading back to the extracted-stock chest but having by-passes therein leading to Jordans or other refining means. The refiners draw continuously from the circulation system and deliver the refined stock to the machine chest or mixing pump on the paper machine. For some grades of paper, the extracted stock may be delivered directly to the machine without refining.

Under some circumstances and with some stocks, it may be desirable to so adjust the selectors or extractors that stock particles which have not been sufficiently hydrated or reduced in size by the treatment in the shredder or hydration tank for delivery to the machine proper, will be delivered to the extracted-stock chest. In this case, the stock may be subjected to a beating process by pumping it from the extracted-stock chest to suitable beaters from which it is dumped in the usual beater dump chest. From the dump chest, the stock may be delivered to Jordans or other suitable refiners and thence to the machine chest or mixing pump, or, it may be delivered to the machine chest or mixing pump without refining. In any event, the preliminary treatment in the hydration tank greatly reduces the time required for beating and effects a great economy in power. It eliminates the uncertainty of insufficient hydration and resolves the function of the beater into substantially its mechanical action in changing the physical structure of the fibers.

My process is particularly adapted for the preparation of stock composed of two or more different pulps, such, for example, as ground wood and sulphite, which are blended together in the final product. Each pulp is separately hydrated and extracted, and the extracted stocks are delivered to separate extracted-stock chests. From the chests, the stocks are continuously pumped or otherwise circulated through separate consistency regulators or metering boxes and the overflow returned to the respective stock chests. From

the consistency regulators, the stock is delivered to and blended in Jordans or other suitable refiners, and delivered to the mixing pump on the paper machine.

While my process is to be understood as independent of any particular form of apparatus, I have illustrated, in the accompanying drawings, in a more or less typical and diagrammatic manner, the various steps therein and the apparatus and the arrangement thereof which I believe best facilitate its performance.

In the drawings, I have illustrated the steps in my process and the apparatus as applied to the preparation of a stock comprising two different pulps, but it is to be understood that the process and apparatus may be used to prepare stock from a single pulp by simply omitting the steps and apparatus described and illustrated in connection with the second pulp.

Referring particularly to Figs. 1, 2 and 3, 1 represents a sulphite shredder driven by a suitable motor, 2, and adapted to discharge the shredded pulp into the sulphite hydration tank 3. 4 represents a ground wood shredder driven by motor, 5, and discharging into the ground wood hydration tank, 6.

The hydration tanks should be comparatively large in capacity, and are provided with centrally-disposed, longitudinal partitions, 7, similar to the mid-feather in a beating engine. Near each end of the central partition or mid-feather, but on opposite sides thereof, is a transverse partition, 8, extending from the top to the bottom of the tank and entirely closing the stock passage between the mid-feather and the side of the tank. The lower portion of each partition, 8, however, is provided with circular openings, 9, in each of which is mounted a screw propeller, 10, adapted to drive the stock about in the tank. These propellers are mounted on shafts, 11, extending longitudinally of the tanks, provided with suitable thrust bearings, and having packing glands where they extend through the ends of the tanks. The shafts, 11, are driven by motors, 12, acting through suitable gear reductions, 13. White water is supplied to the tanks through the showers, 14, and the consistency of the stock in the tanks is preferably maintained at about 4%. The tanks are provided with a slight horizontal slope along the bottom so that they may be drained and so that stock will flow readily to an outlet pipe, 15, (see Fig. 2) provided in each tank and leading to suitable pumps, 16 and 17, driven by motors, 18 and 19, respectively. The pump, 16, circulates the sulphite stock through the sulphite extractors, 20, which accept such particles thereof as are properly hydrated and reduced to the proper size, and delivers them by gravity to the extracted sulphite chest, 21. The particles which are rejected by the extractors are returned for further treatment to the sulphite hydration tank, 6, through the openings, 22, in the top thereof.

Ground wood from the ground wood hydration tank is circulated through the ground wood extractors, 23, by means of the pump, 17, and the accepted, hydrated particles of proper size are delivered to the extracted ground wood chest, 24. The particles rejected by the ground wood extractors are returned for further treatment in the hydration tank through the openings, 25, in the top thereof.

The preferred type of extractors is substantially identical with that described in my pending application for patent, Serial No. 187,333, filed April 28, 1927, and is illustrated somewhat in detail in Figs. 8 and 9 of this application. Referring particularly to these figures, my extractor comprises a casing, 26, having a perforated screen portion, 27, which is preferably cylindrical, and an impeller, 28, axially mounted within the casing to revolve with its periphery in close proximity to the screen. Stock is supplied to the extractors by pumps, 16 and 17, respectively, which force the stock through pipes, 32, and spray or project it through a slot, 33, in the side of each pipe and within the casing. The stock is preferably projected in a direction about tangential to the path of the outer edges of the impeller blades which are turned at about 400 R. P. M., by any suitable source of power. The stock particles are swept about the interior of the casing to the perforated screen, 27, where those which have been reduced to the proper size in the hydrating treatment are extruded for delivery to the extracted stock chest. Below the perforated screen portion is a trough or gutter, 29, into which fall the particles of stock extruded through the perforated screen. A screw conveyor, 30, operates in the trough and forces the accumulated particles of stock toward one end thereof where they are discharged through an opening, 31. Those particles which have not been sufficiently treated are refused by the extractor and fall back into the hydration tank through openings in the bottom of the extractor, as indicated by the arrows, 34.

Assuming that only one kind of pulp is being treated, the contents of the extracted-stock chest may, for some grades of paper, be delivered directly to the mixing pump on the paper machine without further treatment. For example, the extracted sulphite stock may be withdrawn from the chest, 21, by means of pump, 35, (see Fig. 1) and delivered to the machine through pipe, 36. In most cases, however, it will be found advisable to subject the extracted stock to a refining process by passing it through one or more Jordans or other refining engines, 37,

before delivery to the machine. In such a case, the stock is continuously circulated from the extracted-stock tank through the piping, 38, and back to the tank again (see Fig. 1), and by-passes, 39, leading to the refining engines are provided through which the refiners may draw to capacity.

Where two separate stocks are being treated which are blended in the final product, each stock is continuously circulated through a separate piping system, such as 38 and 40, by means of pumps, 35 and 41, respectively. By passes, 39 and 42, respectively, are provided in each system leading to separate consistency regulators or metering boxes, 43 and 44, respectively. From the consistency regulators, the stocks are lead through a common piping and blended and refined in one or more refining engines before delivery to the machine. In addition to refining the stock, the Jordans effect the desirable mechanical changes in the previously hydrated fibers, and the stock is run through as many refiners as may be necessary.

It will be noted that the extracted sulphite chest is provided with an overflow pipe, 45, leading back to the sulphite hydration tank, and the ground wood chest overflows to the ground wood hydration tank through pipe, 46. Return pipes, 47 and 48, (see Fig. 1) are also provided from the machines to the extracted-stock chests.

Referring particularly to Figs. 1 and 2, it will be understood that the Jordans, 37, either discharge into other Jordans, as shown in Fig. 3, and thence to the machine chest or mixing pump, or discharge directly to the machine chest or mixing pump through the pipes, 49. Valves, 50 and 51, in the pipe lines, 40 and 38, respectively, may be provided so that either the ground wood or sulphite system may be used independently of each other in connection with the refining engines; or stock from either system may be delivered direct to the machine by closing these valves and opening valves, 52 and 53.

Where it is desirable to effect the mechanical changes in the fibers by an actual beating treatment, a considerable economy of time and power is effected and a better and more uniform product is obtained by first hydrating the stock and delivering it to the beaters in the form of particles which are properly reduced in size and substantially hydrated.

Fig. 4 illustrates diagrammatically the general arrangement of the apparatus for performing my process in this slightly modified manner, and while it shows the process as applied to two different pulps which are blended in the final stock, it must be understood as applicable to the preparation of stock from a single pulp.

The arrangement of the apparatus is substantially the same as described above in connection with the process without beaters with the exception that the extracted-stock from each of the stock chests is circulated through separate piping systems, 54 and 55, to separate beaters or batteries of beaters, 56 and 57. Where ground wood and sulphite pulp are being treated for blending, or where any other pulps having natural fibers of different lengths or requiring different mechanical treatments are being prepared, it is obvious that no greater number of beaters or refiners will be used than is necessary to effect the desired results. After the stock has been treated in the beaters it may be dumped to a common dump chest, 58, and delivered from there by means of a pump, 59, to the refining engines, 37, where it is thoroughly blended and refined before delivery to the machine. Where desirable, the beaters may be dumped to separate chests, the stocks separately pumped from the dump chests to consistency regulators, and thereafter passed to the refiners for blending, substantially as described in connection with Figs. 1, 2 and 3.

In connection with the general application of my process, it is to be understood that variations and modifications in the procedure subsequent to the hydration and extraction steps will be found advisable depending, of course, upon the nature of the stock being treated or prepared and the kind of paper being made. For example, in some cases the stock may be delivered to the machine chest or mixing pump with little or no mechanical treatment of the fibers, while in other cases some mechanical treatment, such as is obtained by passing the stock through a Jordan or other refining engine will be found necessary to obtain the best results. In still other cases, the stock will require an actual beating treatment to effect the desired changes in the fiber structure. In any event, the hydration and segregation of the hydrated fibers prior to any drastic mechanical action thereon will be found to greatly reduce the time required in the preparation of stock. A great saving in power will be effected, and a marked uniformity of product with less dependence upon the personal equation of the operator will result.

It is therefore to be understood that the words which I have used in describing my invention are words of description rather than of limitation; that the drawings are merely illustrative of the apparatus and arrangements thereof which may be used to perform my process; and that changes, within the purview of the appended claims may be freely made without departing from the true scope and spirit of my invention.

What I claim is—

1. The process of preparing paper stock from two or more fibrous materials which comprises separately shredding the materials, separately hydrating by agitation in

water without effecting extensive changes in the physical structures of the fibers thereof, segregating from the hydrating materials the fibers, and particles up to a predetermined size, and thereafter blending the segregated portions.

2. The process of preparing paper stock from two or more fibrous materials which comprises separately shredding the materials, separately hydrating by agitation in water without effecting extensive changes in the physical structures of the fibers thereof, segregating from the hydrating materials the fibers and particles thereof up to a predetermined size as they become separated from the larger masses, and thereafter subjecting them together to a mechanical treatment for blending and effecting the desired changes in the physical structure of the fibers.

3. The process of preparing paper stock from two or more fibrous materials which comprises separately shredding the materials, separately hydrating by agitation in water without effecting extensive changes in the physical structures of the fibers thereof, segregating from the hydrating materials the fibers and finer particles up to a predetermined size as they approach the proper degree of hydration, separately subjecting the segregated portions to a mechanical treatment for producing the desired changes in the physical structure of the fibers, and thereafter blending the separately prepared fibers.

4. In a pulping system, a device for hydrating fibers by agitation and friction, comprising a tank having a central, longitudinal partition therein about which the pulp may be circulated, transverse partitions on opposite sides of the central partition provided with openings therein near the bottom of the tank, and screw propellers for forcing a circulation of pulp through the openings in said transverse partitions.

5. In a pulping system the combination with a tank adapted to contain hydrating pulp, of an extractor comprising a casing with a screen therein adapted to permit the passage of pulp particles of a predetermined size, and a pump adapted to withdraw pulp from said tank and spray it into the casing of said extractor.

6. In a pulping system, the combination with a tank adapted to contain hydrating pulp, of an extractor and a pump adapted to maintain a circulation of pulp between the tank and extractor and discharge a portion thereof into the extractor.

7. In a pulping system, an extractor comprising a casing, a screen adapted to permit the passage of pulp particles of a predetermined size, an impeller adapted to rotate in said casing in proximity to the screen and a pipe having an opening therein through which pulp may be sprayed into said casing in a direction substantially tangent to the impeller.

8. In a pulping system, means for hydrating pulp without effecting extensive structural changes in the fibers thereof, means for selecting from the hydrating pulp the fibers and particles up to a predetermined size as they become separated from the larger masses, means for circulating the pulp between the hydrating and selecting means, means for effecting the desired structural changes in the fibers of selected pulp and means for maintaining a flow of selected pulp to the structure changing means.

9. In a pulping system, a tank for hydrating pulp, means for selecting from the hydrating pulp particles and fibers thereof as they approach the desired degree of hydration, means for maintaining a circulation of the hydrating pulp between the hydrating and selecting means, and means for beating the selected pulp.

10. In a system for preparing paper stock, a pulp shredder, a hydration tank adapted to receive the shredded pulp and to contain a comparatively large quantity thereof at moderate consistency, means for maintaining a circulation of pulp in said tank, means for selecting and segregating fibers and particles of pulp up to a predetermined size, means for maintaining a circulation of pulp between the tank and the selecting means, a Jordan, and means for maintaining a continuous flow of pulp from the selecting means to the Jordan.

11. In a system for preparing paper stock from two or more fibrous materials, separate shredders for each material, separate hydration tanks adapted to receive the shredded pulp, separate extractors adapted to select and segregate fibers and particles of pulp up to a predetermined size, means for maintaining a circulation of pulp between each tank and an extractor, means for continuously intermixing the separately extracted pulps, means for regulating the consistency of each pulp before intermixing, and means for blending and refining the intermixed pulps.

12. In a system for the continuous preparation of paper stock, a hydration tank adapted to contain a substantial quantity of shredded pulp at moderate consistency, means for selecting and segregating pulp fibers and particles of pulp up to a predetermined size, means for maintaining a continuous circulation of pulp through the tank and the selecting means, means for regulating the consistency of the selected pulp and means for maintaining a continuous flow of selected pulp to the regulating means.

13. In a system for the continuous preparation of paper stock, a tank adapted to contain a substantial quantity of shredded pulp at moderate consistency, means for selecting and

segregating pulp fibers and particles of pulp up to a predetermined size, means for maintaining a continuous circulation of pulp through the tank and the selecting means, a main pipe line, means for maintaining a continuous circulation of selected pulp in said line, and by-passes from said line adapted to convey a continuous supply of selected pulp to refining engines.

14. In a system for the continuous preparation of paper stock from two or more different pulps, separate tanks adapted to contain a substantial quantity of each pulp at moderate consistency, means associated with each tank for selecting and segregating pulp fibers and particles of pulp up to a predetermined size, means for maintaining a continuous circulation of pulp through each tank and its associated selecting means, a separate main pipe line for each pulp, means for maintaining a continuous circulation of selected pulp in each line, by-passes from each line adapted to convey continuous supplies of pulp to separate consistency regulators, and means for continuously blending the pulps flowing from the regulators.

15. In a pulping system, a device for disintegrating and hydrating pulp without effecting extensive structural changes in the fibers thereof comprising a tank approximating a beater tub in shape, a mid-feather therein providing a continuous horizontal passage for the circulation of pulp, transverse partitions on opposite sides of the mid-feather provided with openings therein normally submerged, and screw propellers rotatively mounted in said openings for forcing a circulation of pulp in the tank.

16. In a system for preparing paper stock, the combination with a tank adapted to contain a substantial volume of water and raw stock to be disintegrated, of a plurality of screw propellers rotatably mounted therein for agitating the contents of said tank to effect a breaking up and hydration of the raw material, and means for separating the fibers and finer particles of stock from the general mass as the disintegration progresses.

17. That order of steps in the preparation of paper stock which comprises, hydrating pulp by comparatively rapid circulation in water but without drastic mechanical treatment tending to break or effect changes in the physical structure of the individual fibers, simultaneously segregating from the hydrating pulp the fibers and smaller particles thereof, and then effecting the necessary changes in the physical structure of the segregated fibers by subjecting them to mechanical treatment.

18. In a system for the preparation of paper stock, the combination with a tank of comparatively, large volume provided with screw propellers rotatively mounted therein, for disintegrating and hydrating pulp by rapid circulation in water without producing substantial changes in the physical structure of the individual fibers thereof, of means for driving said propellers, means for subsequently effecting the desired changes in physical fiber structure by mechanical action thereon, and means for maintaining a continuous flow of pulp from the hydrating tank to the structure changing means.

19. In a system for preparing paper stock, the combination with means for resolving the material substantially into its elemental fibers and hydrating to a substantial degree without extensively affecting the physical structure of the fibers and comprising a tank of comparatively large volume provided with screw propellers, rotatably mounted therein, of means for separating and segregating, as the hydrating treatment progresses, the fibers and smaller particles of stock, means for effecting the desired changes in physical structure of the segregated fibers, and means for maintaining a continuous flow of material from the hydrating means through the segregating means to the structure changing means.

20. In a pulping system adapted to prepare paper stock from two or more fibrous materials, the combination with separate tanks of large volume provided with screw propellers rotatively mounted therein for disintegrating the materials and effecting the desired chemical changes therein to a substantial degree without extensively affecting the physical structure of the fibers, of separate means for continuously withdrawing and segregating the fibers and finer particles of each material from the disintegrating tanks, means for blending the segregated portions together in the desired proportion, means for effecting the desired structural changes in the fibers of the blended stock, and means for maintaining a flow of the segregated material through the blending means to the structure changing means.

21. In a pulping system, a device for disintegrating and hydrating pulp without effecting extensive structural changes in the fibers thereof, such as take place in a beater, comprising a tank of comparatively large volume having a continuous horizontal passage therein for the circulation of pulp, a partition across said passage provided with a normally submerged opening therein of much smaller area than the normal cross sectional area of said passage, a screw propeller rotatively mounted in said opening for forcing a circulation of pulp in said passage, and means for driving said propeller to effect a rapid circulation of the pulp.

22. In a pulping system, a device for disintegrating and hydrating pulp without effecting extensive structural changes in the fibers thereof, such as take place in a beater, comprising a tank of comparatively large

volume having a continuous horizontal passage therein for the circulation of pulp, a partition in said tank extending transversely across said passage and provided with a normally submerged opening therein near the bottom, a screw propeller rotatively mounted in said opening, and means for driving said propeller to force a rapid circulation of pulp through said opening.

23. In a pulping system, a device for disintegrating and hydrating pulp without effecting extensive structural changes in the fibers thereof, such as take place in a beater, comprising a tank having a continuous horizontal passageway therein of relatively large cross sectional area and volume for the circulation of pulp, but having spaced cross sections thereof of restricted area, screw propellers rotatively mounted in said cross sections of restricted area, and means for driving said propellers to force a rapid circulation of pulp through the passageway.

24. In a pulping system, a device for disintegrating and hydrating pulp without effecting substantial structural changes in the fibers thereof, such as occur in beating, comprising a tank having a continuous horizontal passageway therein of relatively large cross section and volume for the circulation of pulp but having spaced cross sections thereof provided with a plurality of passageways of restricted area near the bottom of the tank, screw propellers rotatively mounted in said restricted passageways, and means for driving said propellers to force a rapid circulation of pulp through the tank.

25. In a pulping system, the combination with a tank, of a fiber extractor, a screw propeller for circulating the pulp through said tank to effect a hydration thereof, and independent means for maintaining a circulation of the hydrating pulp through the tank and extractor.

26. In a pulping system, a tank, screw propellers in said tank for forcing a rapid circulation of pulp therein without drastic mechanical action, such as takes place in a beater, means for selecting from the hydrating pulp the smaller particles and fibers thereof as they approach the desired degree of hydration, means for maintaining a circulation of pulp between said tank and the selecting means, means for refining the selected pulp, and means for maintaining a flow of selected pulp to the refining means.

27. A device for disintegrating and hydrating raw material for the preparation of paper stock comprising a tank adapted to contain a substantial volume of water and material, a plurality of screw propellers rotatably mounted therein for agitating the contents of said tank, a screen, and means for creating a flow of fibers and smaller particles of stock through said screen as the disintegration progresses.

28. A device for disintegrating and hydrating material for the preparation of paper stock comprising a vat-like tank adapted to contain large tonnages of water and material to be treated, a plurality of screw propellers mounted in the lower portion thereof to rotate in vertical planes entirely submerged, means for driving said propellers at a speed adapted to create a substantial agitation of the tank contents and to effect a breaking up of masses of material therein, and means extending over said propellers for restraining upthrow of material therefrom and cooperating therewith to produce a rapid circulation of stock.

GEORGE STANFORD WITHAM, JR.