May 2, 1944. S. A. STAEGE 2,347,850

PAPER MACHINERY

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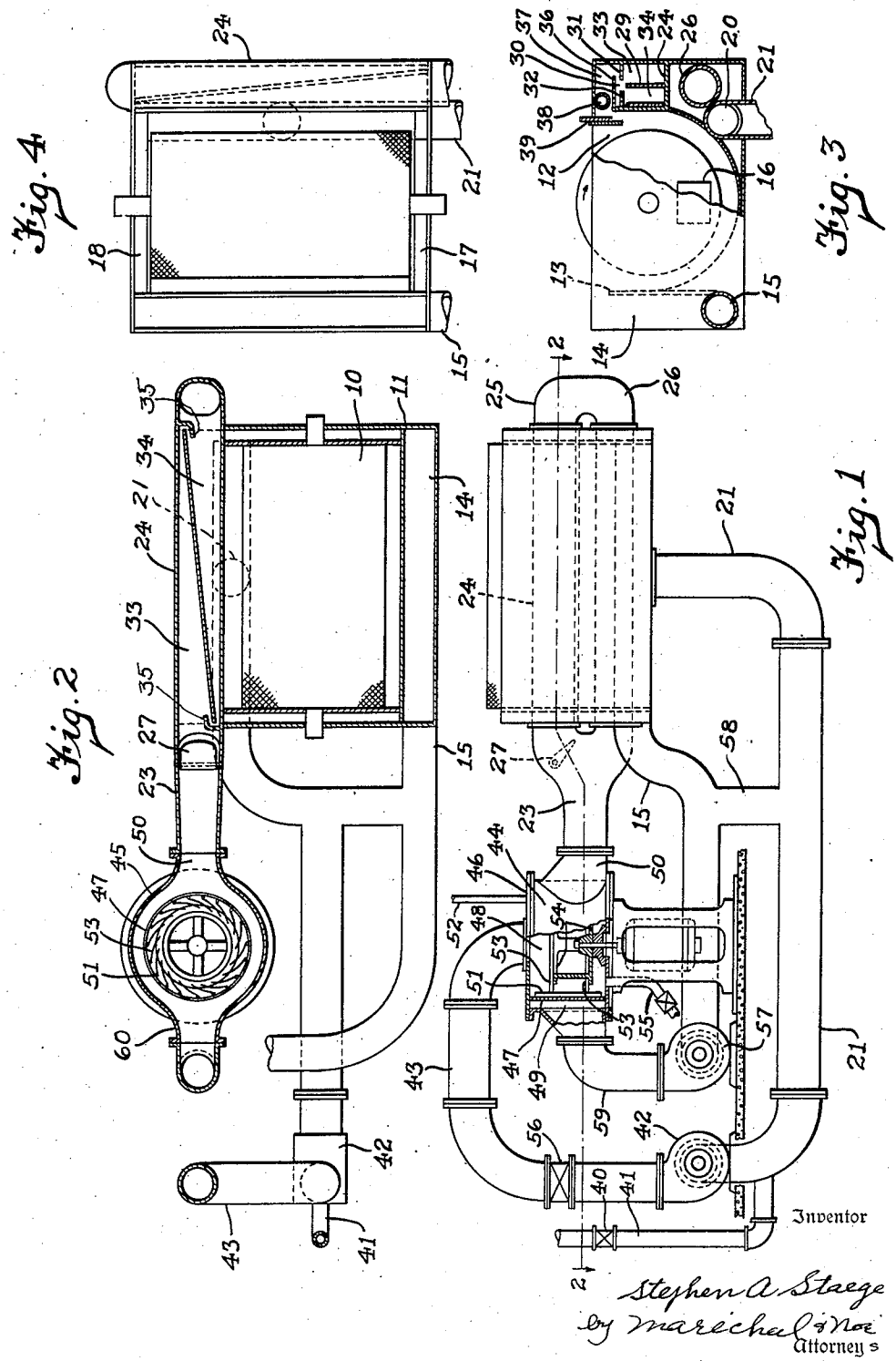


Fig. 4

Fig. 3

Fig. 2

Fig. 1

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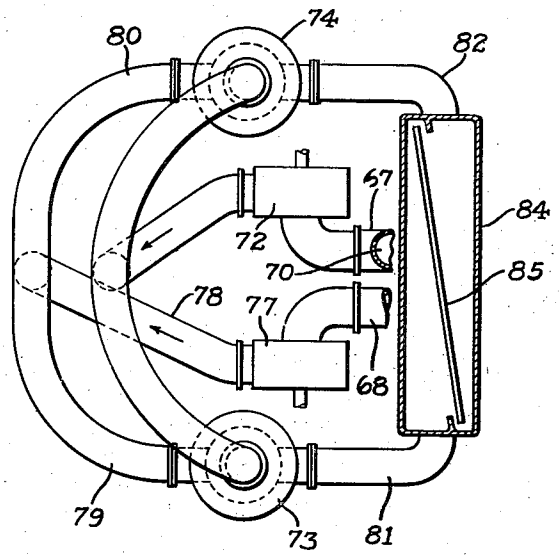


Fig. 6

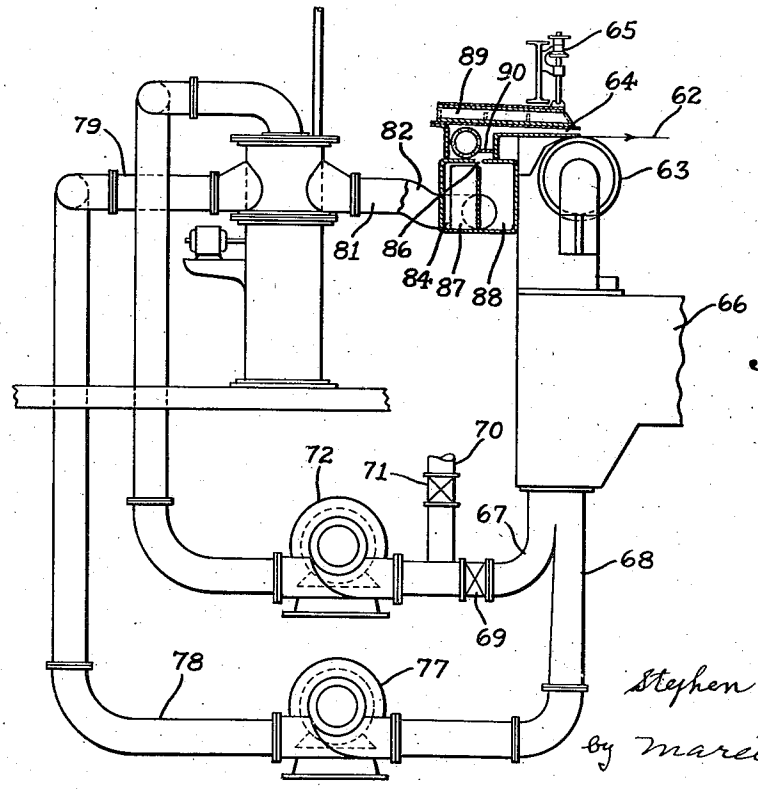


Fig. 5

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PAPER MACHINERY

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Application May 25, 1940, Serial No. 337,230

2 Claims. (Cl. 92—38)

This invention relates to the art of paper making.

One object of the invention resides in the process, in the manufacture of paper, in which paper pulp, after the pulping operation has been completed, is screened and supplied at the required pressure and required rate of flow directly from the screen to a making wire.

Another object resides in the process of making paper in which paper pulp is screened and then immediately mixed with white water returned from the forming wire, the mixing action taking place in the screening apparatus to obtain a consistency suitable for application to the forming wire without further change.

Another object resides in the process of making paper in which the paper pulp together with white water returned from the cylinder mold of a paper making machine is supplied to a screen and the screening action takes place at a consistency above that required at the cylinder mold, some of the white water passing through the cylinder mold being returned together with the vat overflow stock and mixing with the screened stock to reduce the consistency to the value required at the cylinder mold.

Another object is the provision of apparatus adapted to carry out the process referred to.

Further objects and advantages of the invention will be apparent from the following description, the appended claims and the accompanying drawings, in which

Fig. 1 is a side elevation of paper making apparatus embodying and for practicing the present invention, a portion of the screen being shown in central vertical section;

Fig. 2 is a horizontal section on the line 2—2 of Fig. 1;

Fig. 3 is an end view of the cylinder mold vat, a portion being shown in central vertical section;

Fig. 4 is a top plan view of the vat;

Fig. 5 is a side elevation of a portion of a paper making apparatus of the Fourdrinier type, embodying and for practicing the invention, a portion of the flow passage being shown in section; and

Fig. 6 is a top plan view corresponding to Fig. 5 but showing a portion of the flow passage in horizontal section.

Referring more particularly to the drawings by reference numerals, like parts being designated with the same reference numerals in the several views, Figs. 1 to 4, inclusive, show the preferred embodiment of the invention as embodied in a paper making apparatus of the cylinder mold type in which paper pulp is supplied to the cylinder mold vat at a rate in excess of that required for paper formation so that an excess overflow of pulp is provided. The cylinder mold, which is shown at 10, operates in the vat 11, the direction of turn of the cylinder mold being clockwise as shown in Fig. 3, and the pulp being supplied to the pulp passage 12 adjacent the downturning side of the forming wire, excess pulp overflowing the dam 13 into an excess pulp chamber 14. The excess pulp flow is conducted from the chamber 14 by a pipe 15. As the forming wire rotates in the vat, the fibers are deposited on it, and water passes through the wire and flows out through lateral openings 16 into the white water chambers 17 and 18. A longitudinally extending conduit 20 connects the two white water chambers 17 and 18 to the white water withdrawal pipe 21.

Paper pulp is supplied to the vat through pipe 23 which connects directly to one end of the distributing conduit 24, the opposite end 25 of this conduit being connected to a supply pipe 26 which extends across the vat below the distributing conduit and connects to the pipe 23 so that a flow of pulp takes place into the conduit 24 from opposite ends of the vat. A manually controllable valve 27 may be operated to adjustably restrict flow from pipe 23 into the adjacent end of the conduit 24 in order that the axial rate of flow toward the center of the vat from the opposite ends of the conduit 24 may be equalized.

The conduit 24 is provided with a diagonally extending baffle wall 29 the upper end of which is located adjacent a diagonally extending orifice 30 provided between the ends of the upper wall portions 31 and 32 of conduit 24 so that pulp entering the two tapered passages 33 and 34 from opposite ends of those passages will be mixed together at the top of the wall 29 and flow through the elongated orifice 30 with a velocity that is equalized throughout the length of the conduit 24. This flow of pulp is deflected by a horizontally extending wall 36 so that any stock bundles or groups will be effectively broken up as the streams issuing from the two passages 33 and 34 engage one another and then strike the wall 36. The pulp entering the covered compartment 37 above the wall portions 31 and 32 is preferably vibrated or agitated, as by flowing through a perforated slowly rotating hollow cylinder 38 to maintain the fibers in a dispersed condition in the water and break up any fiber groups, and enters the passage 12 of the vat,

preferably in a downward direction. An adjustable wall 39 capable of being adjusted as to height affords a control of the direction of pulp flow adjacent the downturning side of the forming wire and prevents the pulp from being driven into the meshes of the wire.

The opposite ends of the wall 29 are spaced a small distance from the side walls of the conduit 24 to insure some small flow past these ends and around baffle 35 to the larger ends of the adjacent passages, thus avoiding the retention of any bodies of slowly moving pulp at the narrow ends of these passages.

The supply of pulp to the system comes in through a controllable valve 40 and the pulp supply pipe 41 which leads to the white water pipe 21. The pipe 21 conducts the white water coming from the white water compartments 17 and 18 to a pump 42 which returns the white water together with the pulp added through pipe 41 through a pipe 43 to the supply end of a screening machine 44. This screening machine includes a substantially cylindrical casing wall 45 enclosed at its top by the plate 46 which has a passage through which the pulp to be screened is supplied from the pipe 43. Within the wall 45 is a stationary cylindrical screen 47 through which the pulp must travel in passing from the supply chamber 48 of the screen to the annular discharge chamber 49 which is between the screen and the wall 45. The screened pulp is discharged from the chamber 49 at one side of the screen through the outlet 50 into the pipe 23.

Passage of the pulp through the screen 47 is greatly facilitated by a large number of scraping blades 51 having a construction as more fully disclosed in my prior application Serial No. 285,362 filed July 19, 1939. These blades extend along the inner surface of the screen and are carried yieldingly by springs 53 mounted on carrying rings 54 of a rotatable spider which is connected to a motor driven shaft and turned at a comparatively slow rate of speed of the order of about one turn per second so that the creation of any large centrifugal force on the fluid in the screen is avoided. The blades provide an effective scraping action on the inner surface of the screen, and in view of the comparatively slow rate of speed and the comparatively large number of blades, each screen opening will be cleaned many times per second without causing the mass of pulp within the screen to rotate to such extent as to provide substantial centrifugal force. The rate of flow through the screen is dependent upon the pressure of the stock supply to the inlet chamber 48, as the blades keep the screen openings from clogging, and the pump 42 is of such character as to give a flow rate and produce the required pressure on the pulp to provide the required rate of flow to the vat. The rate of flow through the pump 42 is controlled, preferably by a suitable control valve 56 in the white water pipe 43.

Any lighter impurities, foam, etc., that may tend to collect at the top of the screen, at its inlet side, flow up through the upwardly extending pipe 52 which extends high enough so that these impurities may be retained and periodically discharged. The heavy impurities that settle down, due to gravity effect, in the lower portion of the inlet chamber 48 may be periodically withdrawn through a pipe 55 which extends down from the bottom of the screening chamber. The screening machine thus cleans as well as screens the pulp, and as it thoroughly mixes the screened pulp with the returning white water and overflow pulp there is no need for the usual mix box. The screen is adapted to handle very large quantities of pulp and supply the pulp under pressure so as to give a direct flow from the screen to the cylinder mold through a closed passage of comparatively short length. Inasmuch as the circuit from the vat back to and through the screen and to the vat again is closed there is little chance for foam to develop.

The overflow pulp from the vat, which enters the compartment 14, is carried back to the screening machine, together with such quantities of the white water as is not required to be mixed with the new pulp coming in through the pipe 41. This overflow stock, which passes through the pipe 15, travels to return pump 57, the pipe 15 communicating with the white water source as by means of a pipe connection 58. The white water, in excess of that required to reduce the new pulp entering the system to the consistency desired for screening, is forced by pump 57 through a pipe 59 which leads to an outwardly flaring passage 60 preferably formed as a part of the wall 45 of the screening machine. Some of the white water and the excess overflow pulp from the vat is thus returned to the discharge side of the screen, so that the previously screened pulp of the vat overflow will not be rescreened, although, if desired, some or all of the white water is returned through pump 57 while the returning excess overflow stock may be returned through the pipe 21 to the inside of the screen and pass again through the screen so as to be thoroughly deflocculated before passing to the vat again. The returned excess pulp and the white water is very intimately mixed with the screened pulp emerging from the screen openings as the returned white water passes around on opposite sides of the screen in its flow to the discharge passage 50.

The consistency of the pulp required at the vat may be of the order of a few tenths of one per cent, or even considerably less than one-tenth of one per cent. The consistency of the new pulp added to the system through the pipe 41 may be of the order of three or four per cent or more. It is quite desirable to screen the pulp, in a screen of the character described, at a consistenecy higher than that required by the vat and much less than the consistency of the new pulp supply. The described arrangement gives great flexibility to the screening action as the amount of white water returned through the pump 42 and mixed by the pump itself with the incoming higher consistency pulp entering through pipe 41 may be controlled to provide a screening operation that takes place at a desired consistency, say of the order of one-half per cent, or at a higher consistency of one or two per cent if required to provide a higher screening capacity. The consistency of the pulp being screened should be such as to provide an effective screening and cleaning action, lower consistencies permitting the heavy particles or impurities to settle more readily provided the rate of flow out to the screening surface is not so rapid as to carry the heavy particles along with it. The other white water entering the cylinder mold and not returned through the pump 42, is returned through the pipe 15 and mixed with the vat overflow pulp and this mixture is supplied to the discharge side of the screen and intimately mixed with the screened pulp at the screening zone. This reduces the consistency of the pulp supplied,

through the screen openings to the low value desired at the vat. The pulp travels under the required pressure directly from the screening machine to the vat, the point of screening being located so close to the point of distribution of the pulp in the vat that the thorough dispersion of the fibers at the point where they leave the screen will be maintained until the pulp reaches the forming wire, there being insufficient time or length of travel for the stock fibers to collect or group together. If there should be any lack of uniformity in the pulp consistency in the short length of travel of the fibers to the tapered passages 33 and 34 of the distributing conduit, the merging action of the streams from these passages as the stock flows through the orifice 30, and the further agitating action produced as the stock flows through the holes of the perforated cylinder 38 will provide a very uniform distribution and deflocculation of the fibers at the point where they enter the vat.

Figs. 5 and 6 of the drawings show a modification of the invention as applied to a Fourdrinier type of paper making machine. The forming wire 62, in this construction, travels over the breast roll 63, stock being supplied through the slice or orifice 64 the width of which may be adjusted by an adjusting device designated 65. The white water which flows through the wire as the fibers are deposited, is conducted down to a receiver 66 and is withdrawn through pipes 67 and 68, the former being provided with an adjustable valve 69 which governs the rate of flow through pipe 67. Pulp is supplied to the system through a pipe 70 having a control valve 71 and is mixed with the white water flowing through pipe 67 and pumped by the pump 72 to the inlet side of the screening machines 73 and 74 which are similar in construction to the screening machine of Figs. 1 to 4. A suitable number of these screens are provided to take care of the requirements of the wire. Pulp may be supplied to the system at a consistency of several per cent through the pipe 70, and sufficient white water is returned to the screen through the pipe 67 and pump 72 to provide a screening action at a suitable consistency preferably of the order of about one-half per cent. The remaining quantities of white water passing to the receiver 66 from the wire is returned to the system through pipe 68, pump 77, pipe 78 and branch pipes 79 and 80 which lead to the sides of the screening machines and conduct this white water to the discharge side of the screens to flow around the outside of the screens and mix with the screened pulp emerging from the screen openings, reducing the consistency of the pulp in the discharge chamber of the screens to some suitable consistency less than that obtaining at the supply side of the screens, and suitable for supply to the Fourdrinier wire. The pulp, at suitable low consistency, is conducted through pipes 81 and 82 to opposite sides of the distributing conduit 84, which is provided with a diagonally extending baffle 85 extending from a point closely adjacent one corner of the conduit to a point closely adjacent a diagonally opposite corner. The top of this wall 85 is slightly below a mixing orifice 86 so that the pulp discharges from the two tapered passages 87 and 88, passes through the diagonally extending orifice 86, and emerges with a uniform velocity throughout the total length of the conduit 84. The stock then passes through the holes of a perforated rotatable cylinder 89 towards which it is deflected by the baffle wall 90 arranged above the orifice 86, and then flows to the slice or orifice 64. As will be apparent, the flow path from the screen to the slice 64 is quite short and the fibers will be maintained in the thoroughly distributed and dispersed condition in which they leave the screen until they reach the forming wire, although if there should be any tendency for the fibers to group together they will be effectively broken up as they pass through the mixing orifice 86 and through the holes in the rotatable perforated cylinder 89. The pulp will be supplied through the slice 64 at the required pressure necessary to give the desired rate of flow of the stock at that point, this pressure being produced by the pumps 72 and 77 which return the white water under a required pressure head.

While the forms of apparatus and the processes herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus and processes, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In a paper making apparatus, an enclosing screen casing, an annular screen within said casing and spaced from the walls of the casing, means for supplying pulp to the inside of the screen under pressure to submerge the screen and fill said casing leaving no liquid-air surface therein, the space between the screen and the casing defining an annular discharge chamber for stock flowing through the screen, said casing having an outlet opening at one side thereof and a supply opening at the other side thereof and in direct communication with the discharge chamber but remote from the outlet opening, a forming wire, a closed supply passage leading from the outlet opening of the casing to the forming wire, a receiver for water flowing through the wire, means for returning water from said receiver to the inside of the screen, and means for supplying some of the water from the receiver to the supply opening of the casing to flow around the screen and mix with the screened pulp.

2. In a paper making apparatus, a forming wire, a closed screen casing having a pulp screen and having inlet and discharge chambers, a pressure tight passage leading from the discharge chamber of the screen casing to the forming wire, a receiver for water flowing through the wire, a water return pipe connected to said receiver, a water pump connected to said pipe and to the inlet chamber of the screen casing for returning water to the screen under pressure to maintain the screen chambers filled with liquid, a pulp supply passage connected to the water pipe ahead of the water pump for supplying pulp to the apparatus, and means for supplying some of the water from the receiver to the discharge chamber of the screen casing to mix in the discharge chamber with the screened pulp.

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