

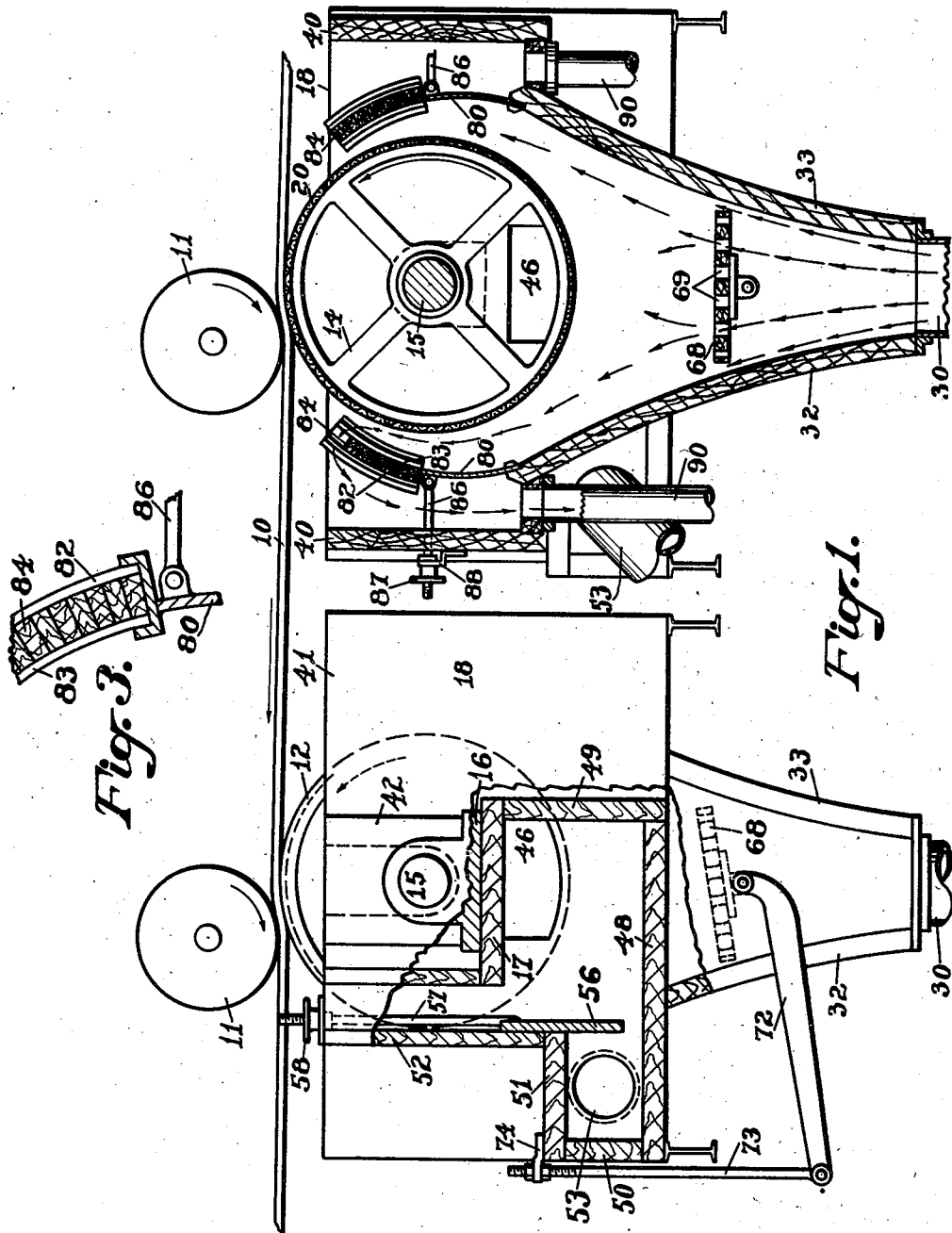
Jan. 18, 1944.

D. V. LOWE ET AL
PAPER MAKING MACHINE

2,339,711

Filed April 4, 1940

4 Sheets-Sheet 1



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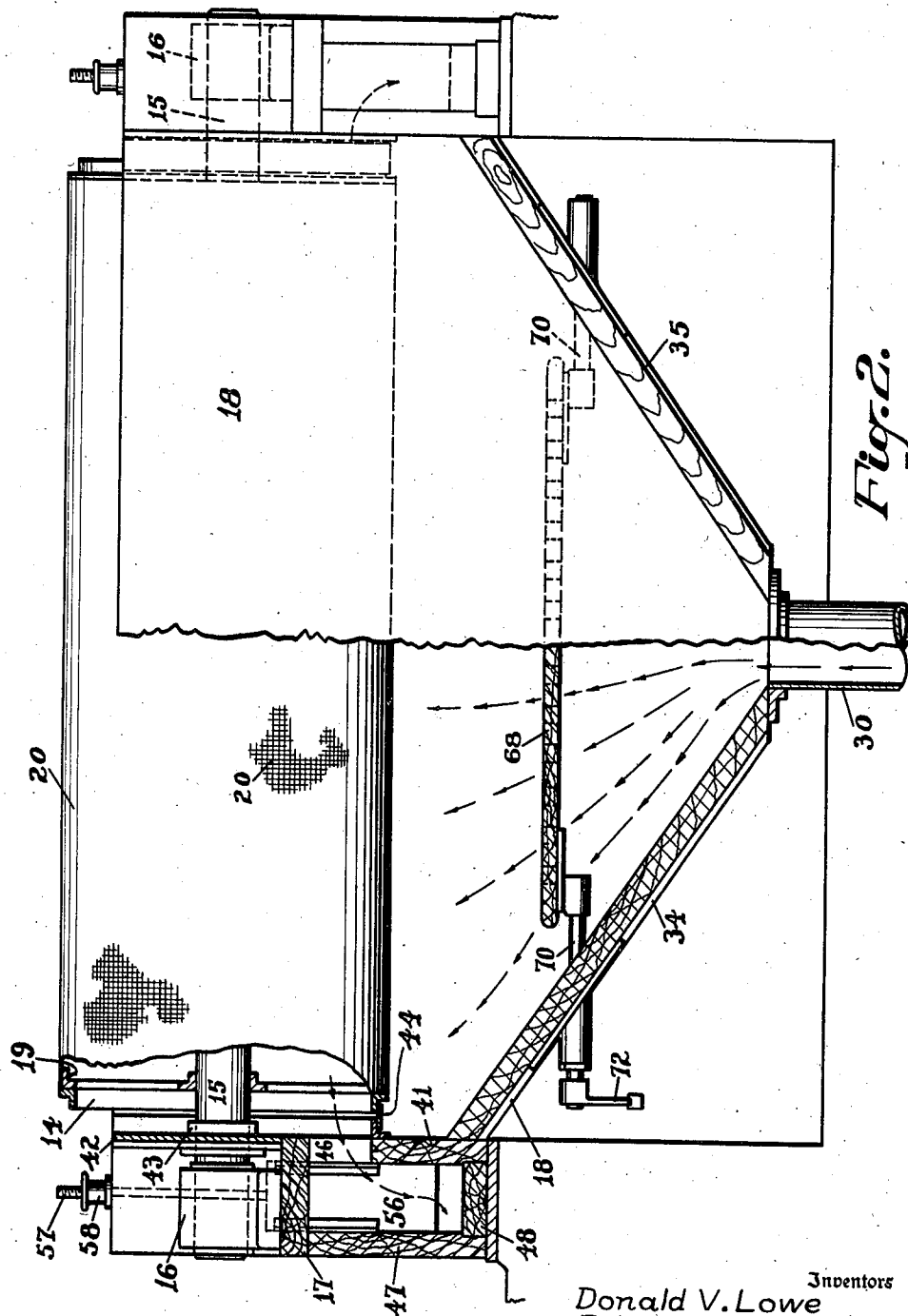
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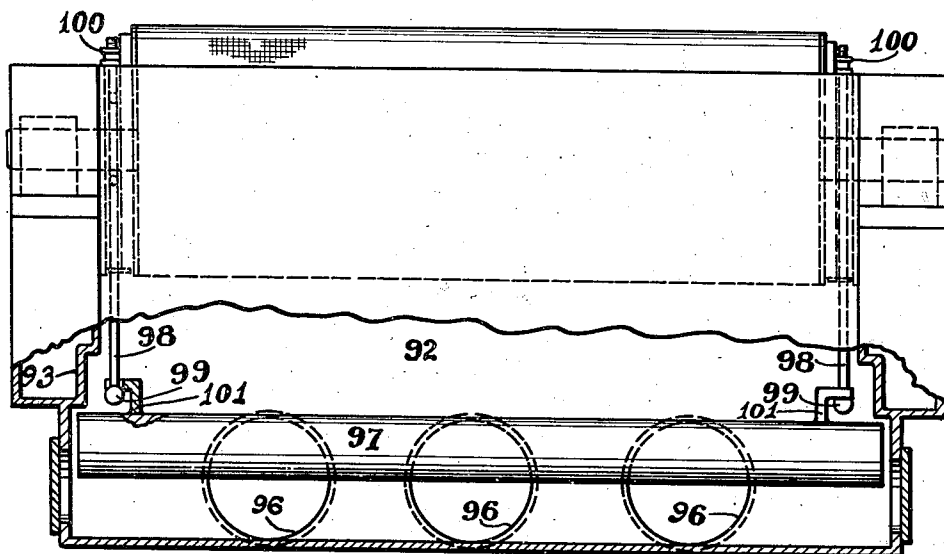
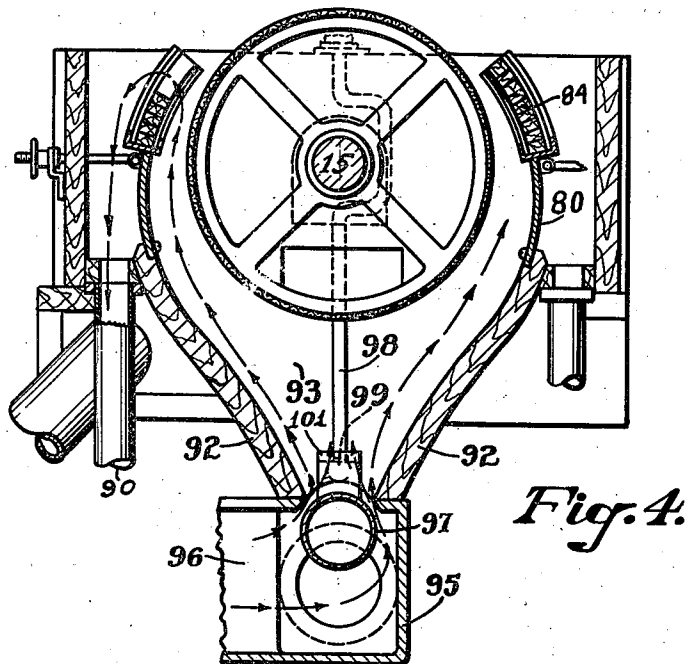
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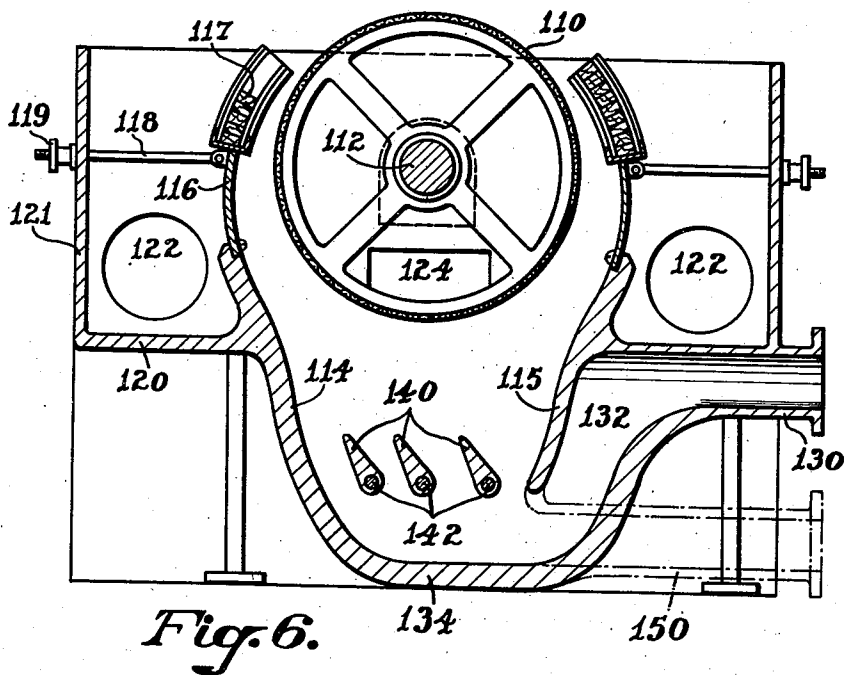


Fig. 6.

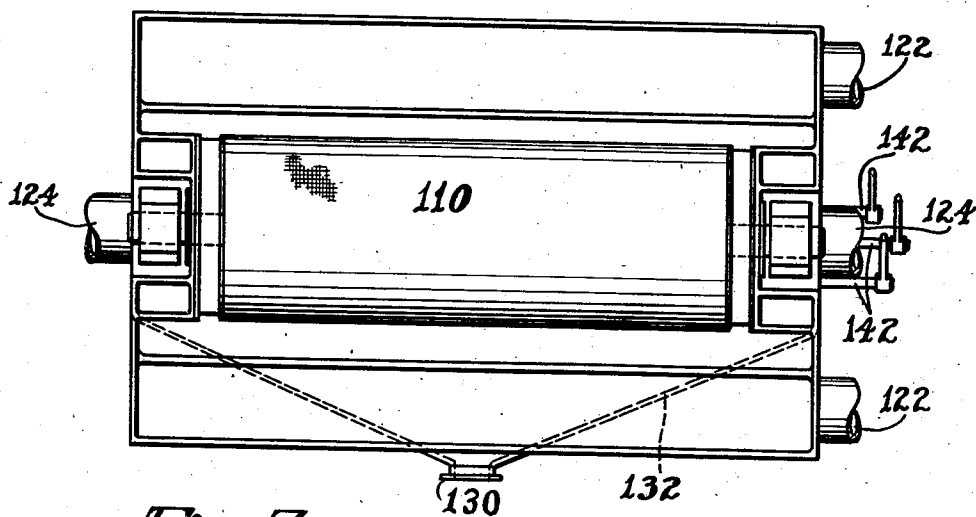


Fig. 7.

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UNITED STATES PATENT OFFICE

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PAPERMAKING MACHINE

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Application April 4, 1940, Serial No. 327,856

4 Claims. (Cl. 92—43)

This invention relates to the manufacture of paper and more particularly to the construction of a paper making machine comprising a cylinder mold which has a rotatable cylindrical screen arranged to receive a coating of wood pulp and transfer it to an endless felt.

A cylinder mold of standard construction comprises a rotatable cylinder having a wire screen surface on which the paper fibres are laid as a removable web. The stock of water and suspended pulp usually flows into the top of the mold vat by passing over a weir or dam located at one side or the other of the cylinder. The white water which passes through the cylinder escapes from the ends thereof at a controlled rate.

Such cylinder mold constructions have been operated in various ways depending upon the type of pulp used and the desired characteristics of the paper, as well as the many varied theories of web formation held by the different paper makers. Each constructional arrangement as heretofore used has had certain disadvantages in the formation of the paper web, and the machines have not always had such universality of operation as would make it feasible to lay the pulp on the cylinder to the best of advantage and in accordance with the paper maker's wishes. The vat walls have been located close to the cylinder mold and the stock has flowed around the cylinder at a comparatively rapid rate and often with turbulence or the formation of currents in the water which have affected the lay of the fibres on the screen. It is desirable to have the stock move quietly adjacent the cylinder so that the fibres may be laid uniformly as the web is formed. It is also often desirable to control the consistency of the stock for the production of some types of paper, and to control the flow of the stock past or towards different portions of the cylinder. This flow should be capable of local regulation, if desired.

The primary objects of this invention are to overcome such prior art problems and to satisfy the above requirements, and particularly to provide a paper making apparatus of this type wherein the stock flows quietly and uniformly to the cylinder mold.

A further object is to provide apparatus which may be adjusted to obtain various methods of operation, and particularly to cause the stock to flow either countercurrent or with the rotating cylinder, or both, and otherwise to meet the needs of the paper maker at any time.

Another object is to provide a way of regulating the direction of flow of the stock to the cyl-

inder and to control the lay of the web locally.

With these and other objects in view, we have provided an apparatus capable of being operated in many ways and of satisfying various requirements of paper formation.

In accordance with this invention, we rotate the wire screen cylinder mold within a comparatively large vat having the pulp in water suspension flowing quietly towards the cylinder and in a non-turbulent condition. To this end, we introduce the stock into the bottom portion of the vat and beneath the cylinder and in such a direction as to avoid setting up localized currents within the vat which would interfere materially with a proper laying of the web. The stock is preferably introduced at the bottom of the vat in a vertical direction, and the vat is so shaped and constructed as to insure an even distribution of stock to the cylinder or, if desired, to provide a definite current flow towards one side or the other of the rotating cylinder. Moreover, weirs may be provided at one or both sides of the cylinder which may be adjusted to provide an overflow for the excess of stock so that, if desired, the stock may flow definitely in either direction or both directions, in relation to the rotating cylinder, as well as towards its wire mesh, and the excess of stock that escapes from the vat may be returned.

We have illustrated in the drawings several constructions which embody all of these various features, and some of which may be used with or without the other features as will be described.

In the drawings:

Fig. 1 is a longitudinal elevation, partly in section, of two cylinder molds associated with the endless felt to which the paper pulp is transferred;

Fig. 2 is a side view of a mold taken at right angles to that of Fig. 1, which is partly in section to show the water flow;

Fig. 3 is a fragmentary detail of the weir construction;

Fig. 4 is a sectional view showing a modified construction adapted for controlling the in-flow of the stock;

Fig. 5 is a side elevation, partly in section, of the form shown in Fig. 4;

Fig. 6 is a central section of a further modification; and

Fig. 7 is a plan view thereof.

Referring first to Figs. 1, 2 and 3, we have there shown two cylinder molds in their association with the endless felt 10 held thereagainst by the rollers 11 to insure transfer of the pulp web.

Each cylinder mold comprises a cylinder 12 of standard construction comprising a series of supporting spiders 14 mounted on a shaft 15 carried by end bearings 16 suitably supported on a platform 17 mounted on the vat 18. The supporting rings 19 of the spiders carry several wire screens 20 of an open mesh and construction best adapted for retaining the paper fibres to form the desired web. The cylinder is so mounted within the vat that its upper portion projects beyond and above the top of the vat so that the pulp may be transferred to the felt 10. The cylinder mold may be rotated either by power or as illustrated by the frictional drag of the felt 10. The rollers 11 are so located that the felt is forced into contact with the stock on the cylinder wire over a considerable area, so as to drive the cylinder and aid in the transfer of the pulp to the under face of the endless traveling felt 10.

One feature of this invention comprises a vat construction so arranged that the cylinder is immersed in a comparatively quiet and large body of pulp stock, and the pulp flow to the cylinder is not turbulent and does not have streams or cross currents running through the body of the pulp which would interfere materially with the lay of the pulp on the wire screen. That is, the pulp is introduced into the bottom of the vat 18 through a pipe 30, and the vat bottom may be constructed with a hopper shaped bottom having steeply sloping side walls 32 and 33 which terminate near the sides of the cylinder mold. The other two walls 34 and 35 slope to points near the bottoms of the cylinder ends. Hence, the stock will be distributed to all of the submerged portions of the cylinder, and it will lie therebeneath as a large and comparatively quiet body.

In the preferred form of construction, the vat has vertical side walls 40 (Fig. 1) and vertical end walls 41 (Fig. 2). The latter are slotted vertically for removal of the cylinder shaft 15, and each slot is closed by a plate 42. Suitable glands 43 surround the shaft 15 and desired constructional features are used to prevent leakage of white water therepast. Deckle straps or sealing members 44 are mounted in the customary manner to minimize leakage of stock around the ends of the cylinder.

At one end, and preferably both ends, of the vat, the parts are so constructed as to provide an outlet 46 (Fig. 2) for the white water passing through the screen. An outflow passage is provided by the plate 17, the end wall 41 of the vat, and the vertical wall 47, bottom 48 and side walls 49 and 50, top plate 51 (Fig. 1), and a further vertical wall 52 arranged to form a closed channel. An outlet pipe 53 communicates with the space between the walls 50, 51 and 48. This construction permits the white water to flow from the inside of the cylinder through the opening 46 into the enlarged chamber formed by the vertical walls 41, 47, 49, 52 and associated parts (Fig. 1) and finally into the outlet pipe 53. In order to regulate the height of the water level within the cylinder, a slide valve or gate 56 is suitably mounted in advance of the opening to the pipe 53. This gate is suspended by a rod 57 having a threaded upper end cooperating with a nut 58 and operatively supported from the vat ends for vertical movement of the gate. The same construction may be provided at each end of the cylinder, so that the water may be caused to flow towards both ends or either end as may be desired.

The inflow of water and pulp to the vat space beneath the cylinder may be controlled in part by suitably shaping the walls of the casing and particularly the hopper. For example, the side walls may be straight or they may be curved to provide a streamline flow, as illustrated in Fig. 1. Whatever their shape and arrangement, it is desirable that they provide a space beneath the cylinder which is of large volume as compared with the bottom space of the cylinder mold vats as heretofore made. Or, if a more constricted space is desired, the walls should be arranged to introduce the pulp directly to the space beneath the cylinder and not near its upper portion. We prefer to incorporate both of these features in our construction and to have the large volume for minimizing turbulence and to introduce the pulp where it may flow up both sides of the cylinder. The walls may be so arranged as to provide any desired volume for the stock, and the angles of the sloping walls will preferably be such as to prevent the pulp from coagulating and otherwise to aid in a uniform distribution of the stock throughout the vat. It will be seen that the rate of flow of the stock coming through the pipe 30 gradually decreases as it goes into the expanded opening formed by the hopper walls. It will also be noted that the side walls 32 and 33 diverge from the inlet 30 to positions fairly close to the cylinder so that the pulp is carried directly into proximity with the cylinder screen.

To aid in making the flow of pulp more uniform and to break up any direct flowing current into small eddys and so cause the material to spread throughout the vat, we provide a baffle 68 located in the hopper above the inlet pipe 30. The baffle may be either a solid board or a perforated one. It is preferably perforated to provide openings 69 through which the stock may flow, and the ends of the baffle are preferably spaced from the walls of the hopper so that the pulp may flow therearound. The baffle is also preferably mounted for pivotal movement, so that the current of stock may be directed toward one side or the other of the cylinder so as to provide a desired flow thereof. To this end, the baffle is mounted on two aligned shafts 70 at its opposite ends which pass through bearings in the hopper walls suitably provided for the purpose. These shafts are preferably axially parallel with the cylinder axis. A lever 72 fixed to the outer end of one of these shafts 70 is pivotally connected to a rod 73 threaded at its other end and provided with nuts cooperating with a flange 74 mounted on the wall 51, whereby suitable adjustment of the baffle may be made. It may be held in a horizontal position as shown at the right hand part of Fig. 1 or tilted one way or the other as indicated at the left hand portion of the same figure. Various other types of baffle construction may be substituted for the one illustrated, or other features may be combined therewith to aid in distributing the pulp to the cylinder in as uniform a condition as possible.

In operation, the cylinder may rotate within a comparatively large volume of quiescent stock, and the pulp fibres will be laid on the rotating cylinder while the water passes through the screen and escapes through the outlets 46 and 53. The head of water between the outside of the cylinder and the inside is controlled by regulating the escapement valve 56 which determines the level of white water within the cylinder and this, of course, affects the rate of deposit of the

pulp on the cylinder as well as the lay of the fibre.

As a further feature, we may also cause the stock to flow past one or both sides of the cylinder and thus affect the formation of the web materially. This is accomplished by providing for an overflow of the stock at the top of the vat and its return. To these ends, a weir is provided at one side of the cylinder, and preferably at both sides, as illustrated in Fig. 1. Each weir comprises a flexible plate 80 of metal or other resilient material suitably secured at its bottom to the upper end of the wall 32 or 33 and thereby forming a continuation of the wall. The upper end of this plate 80 carries two sets of spaced rods 82 and 83 (Fig. 3) which are mounted on a channel iron attached to the wall plate 80. These are arranged to support therebetween a set of wooden blocks or boards 84. These blocks 84 extend the entire length of the vat, but they may be short pieces separately removable for local regulation of the stock overflow. That is, they are removably mounted between the rods in such a manner as to form a weir or dam of adjustable height, so that by taking out one or more of these boards, as illustrated in Fig. 1, it is possible to provide for an overflow of water and pulp at either or both sides of the cylinder as the latter rotates. The weir boards contact with the end walls of the vat and prevent the escape of stock except over the top of the weir.

The flexible plate 80 may be bent towards or from the cylinder by means of the adjusting rods 86 which are pivotally connected to ears on the plate and passing outwardly through the walls 40 of the vat, where their threaded ends carry adjusting nuts 87 suitably cooperating with a plate 88 for adjusting the positions of the weirs. Thus, either weir may be bent either towards or from the cylinder to provide for a greater or lesser flow of stock over the dam or otherwise to aid in distributing the stock to the cylinder. Suitable outlet pipes 90 communicate with the space between the backs of the weirs and the sides 40 of the vat; and the overflow stock may be conducted to any desired point, but it is preferably returned with further stock for recirculation through the machine.

As a further feature, we may regulate the flow of stock to the cylinder mold by means of a valve mechanism which may control the rate of flow of the stock and may be arranged to divert stock towards one end or the other of the cylinder. A suitable valve mechanism for this purpose, as shown in Figs. 4 and 5, comprises the use of an elongated slot at the bottom of the vat instead of the small pipe 30 of Figs. 1 and 2 and the control of flow of pulp throughout the entire length of this slot.

The cylinder mold and the vat construction may be the same as above described except with reference to the hopper at the bottom of the vat and the inlet for the pulp. Referring to Figs. 4 and 5, the side walls 92 may be shaped as shown in Fig. 1, or as desired, to cause the pulp to flow to positions between the weirs and the cylinder. The two end walls 93 may be vertical and spaced near the ends of the cylinder. The bottoms of the two walls 92 are spaced apart to provide an elongated slot which communicates with a box 95 of similar or greater length. This box 95 receives the stock from one or more inlet pipes 96. In order to regulate the flow of stock outwardly into the cylinder vat,

we provide a valve which is adjustable to close the entrance slot or to provide a restricted opening for the flow of stock therethrough. This valve may comprise a cylindrical pipe 97 or other suitable shape arranged horizontally, as illustrated, and the walls 92 and 93 are shaped to interfit with that valve and provide a tight joint when the valve is closed. The box 95 may have removable closure plates at the ends to permit assembly of the valve. The valve plug 97 may be raised or lowered by suitable mechanism so as to regulate the flow of stock. This may comprise rods 98 secured to the opposite ends of the valve plug 97 by means of a ball and socket joint, each of which is formed of a ball 99 on the rod removably secured within the slotted end of a lug 101 secured to the valve plug 97. The rod 98 passes around the shaft 15 and has a nut 100 at its upper end cooperating with a stationary part on the vat for raising and lowering the rod. Hence, the valve plug 97 may be held horizontal and adjusted to cause a uniform flow of stock past the valve throughout its entire length, or either end of the valve may be raised more than the other so as to divert part of the stock flow towards the opposite end. In this way, the paper maker may control the flow of stock as desired. The valve plug 97 may be made of suitable material and shape for the purpose.

It will be appreciated, in view of the above disclosure, that the inlet for the stock may be variously arranged to bring the stock into position beneath the cylinder. It, for example, is feasible to remodel the standard prior art apparatus by lowering the curved bottom thereof and providing a large space beneath the cylinder within which the flowing stock may be quiescent. The stock may be flowed into that bottom space in either an upward direction or laterally or downwardly, provided the stock then passes upwardly and contacts for the first time with the cylinder in that upward flow. Modifications are shown in Figs. 6 and 7 wherein the cylinder 110 is rotatably mounted on its shaft 112 within the vat; and the parts may be suitably made in accordance with prior art practice and as above described. The vat is, however, so constructed as to provide either a lateral entrance for the stock or a downward flow to the bottom thereof. The vat may be shaped to provide the walls 114 and 115 which are curved or straight but preferably diverge upwardly, as illustrated, to positions closely adjacent to but spaced from the cylinder. These walls may terminate in the adjustable weir construction comprising the resilient plates 116 carrying the removable boards 117 as above described. The weirs may be moved towards and from the cylinder by means of the adjusting rods 118 having nuts 119 on their outer ends engaging a fixed part of the vat casing. An outlet trough is formed of the walls 120 and 121 with their associated walls which communicates with an outlet pipe 122, through which the excess of stock passes if it is desired to have it flow over either one or both of the weirs. The apparatus is symmetrical on both sides with respect to these outlets, so that the stock may be caused to flow in either direction or at both sides of the rotating cylinder. Each end wall has an opening connecting with outlet pipes 124 arranged for carrying off the white water that accumulates within the cylinder, and suitable constructional details may be employed, such as valves and the like, to provide

for a proper differential in level between that white water and the stock in the vat.

The primary feature of this particular construction is concerned with the inlet for the stock. In the form shown in full lines in Fig. 6, the stock enters through an inlet pipe 130 and thence passes between diverging walls 132 which open into the space beneath the wall 115 and the bottom portion 134 of the tank. Thus, although the stock flows downwardly through the spreading passage formed by the walls 132 and associated parts, it is nevertheless admitted into the bottom of the vat before it meets the cylinder and it passes upwardly into contact with that cylinder in accordance with the method above described. The space formed between the walls 114, 115 and 134 and the bottom of the cylinder is preferably large enough to insure a quiescent flow of stock.

If desired, a suitable baffle construction may be employed for the purpose of distributing the stock flow more uniformly into that space. This may comprise a set of baffles or vanes 140 having straight or curved or streamlined sides. Each is mounted on shafts 142 which pass through one of the side walls of the vat in which they are pivotally mounted, so that the baffle may be adjusted by a suitable mechanism to swing it about the shaft axis into various positions as deemed desirable for directing the flow of stock upwardly. This prevents the stock from passing in a current along the round bottom 134 of the vat and upwardly along the wall 114.

As a further modification, the inlet may be arranged as shown in dotted outlines in Fig. 6, wherein the inlet pipe 150 communicates laterally with the space at the bottom of the vat. It will, therefore, be appreciated that the claims are to be interpreted as covering these and other constructions in which the stock may be introduced in various directions into the bottom of the vat but is then caused to flow upwardly for its first contact with the cylinder mold.

It will now be understood that the manner of use of these constructions and the method of making paper may be varied considerably. The stock enters through the bottom pipe 30 of Fig. 1 at a desired velocity; but owing to the widening of the hopper bottom of the vat and the presence of the baffle 68 the rate of flow diminishes to such an extent that the pulp is fed throughout the entire hopper beneath the cylinder without channeling of the stock or the formation of currents therethrough so that the suspension of pulp in the water is substantially quiet beneath the cylinder. If the baffle plate 68 is horizontal and if the weirs stand at their full heights, then all of the water must flow through the perforated walls of the cylinder while depositing the fibre stock thereon and the rate of flow of stock will be regulated accordingly. The cylinder may be rotated in the direction shown by the arrow and the stock passing to the left hand side of the cylinder moves in a counterflow direction while that on the other side runs in the same direction with the cylinder and the fibres are laid on the wire in a manner determined simply by the rotation of the cylinder.

If some of the top weir boards 84 are removed from the left hand side, as illustrated in Fig. 1, then the pulp is caused to flow at a controlled rate toward the left and against the direction of movement of the cylinder. The baffle plate 68 may be tilted either way to regulate further the

velocity of movement of the pulp or to obtain a desired distribution. If the weir boards 84 are also removed from the right hand weir, the pulp will flow out of the vat at both sides; or if desired the parts may be so arranged that the pulp flows only at the right hand side and in the direction of movement of the cylinder. It will be appreciated that the fibres will be laid on the cylinder screen somewhat differently for each of these weir adjustments as determined in part by the direction of rotation of the cylinder and the direction and rate of flow of the pulp. If the stock flows in the same direction and at the same rate as the cylinder rotates, the fibres tend to deposit at random or in various directions; while a difference of velocity or direction of movement between the cylinder and the pulp tends to align the fibres. Hence, by a proper control of the relative rates and directions of movement of the pulp and the cylinder, the fibre deposit may be regulated to a considerable extent. The parts may be so regulated that the major portion of the stock deposits on the cylinder from a substantially quiet stock which does not flow rapidly or with any turbulence. It will also be observed that the difference in head between the stock in the vat and the water in the cylinder may be varied in accordance with the positions of the gates 56. The construction of Figs. 4 and 5 lends itself to a careful control of the flow of stock and insures that it will reach both ends of the cylinder at substantially the same consistency as that found at the middle of the cylinder. The valve may, however, be so regulated as to cause the stock to flow more rapidly towards one or the other end of the cylinder.

It will be appreciated, in view of the above disclosure, that we have overcome a serious problem inherent in prior constructions, wherein the stock has flowed as a stream from one side of the mold to the other and its consistency or concentration has gradually increased in the direction of its flow, so that the stock has often settled out or flocculated and caused an uneven formation of the paper web. Our construction is such that the consistency of the stock remains substantially uniform throughout the effective surface of the submerged mold, and the flow of water through the web and cylinder does not cause a material difference in concentration on the opposite sides of the cylinder. The consistency of the stock adjacent the upper parts of the vat may also be regulated by adjustment of the weir plates 80 and the overflow boards so that it may be made substantially uniform throughout or it may be varied as desired. We thereby avoid any thickening of the stock at the point of its initial application to the cylinder and maintain a desired low consistency throughout substantially the entire effective area of the mold.

It will now be understood that many changes may be made in the construction to make it operate as desired and that equivalent or other constructions well known in the art may be added to the device here illustrated or substituted for parts thereof in order to vary the operation of the same. Hence, the above description is to be considered as illustrative of the general principles of the invention and our preferred embodiments and not as limitations on the invention except as is defined in the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A paper making apparatus comprising a vat,

a cylinder rotatably supported near the top of the vat which has an open mesh surface for the formation of a paper web thereon, means providing an outlet for white water passing into the cylinder and means providing for an overflow of excess stock at the top of the vat, said vat having inlet walls defining a narrow, horizontally elongated, inlet passage beneath and parallel with the axis of the cylinder and being shaped as a hopper having its sides at the inlet substantially vertically below the cylinder and medially thereof and flaring to positions closely adjacent to the periphery of the cylinder, so as to provide a slowly moving, quiescent mass of pulp and direct it upwardly towards the bottom of the cylinder and distribute it uniformly on both sides thereof.

2. A paper making apparatus comprising a vat having end and side walls, a cylinder rotatably supported near the top of the vat which has an open mesh surface for the formation of a paper web thereon, a laterally movable weir at the top of a side wall, means for adjusting the weir towards and from the cylinder to vary the width of the passage therebetween, means providing an outlet for the water which passes to the interior of the cylinder, and walls defining an elongated inlet located beneath and parallel with the cylinder axis which is substantially as long as the cylinder, the inlet and the vat bottom being constructed to cause the stock to move vertically in a substantially non-turbulent condition and uniform distribution towards the bottom and both sides of the cylinder throughout its length.

3. A paper making apparatus comprising a vat, a cylinder rotatably supported near the top of the vat which has an open mesh surface for the

formation of a paper web thereon, means providing an outlet for white water passing into the cylinder, means providing for an overflow of excess stock at the top of the vat, said vat having inlet walls defining a narrow, horizontally elongated, inlet passage beneath and parallel with the axis of the cylinder and being shaped as a hopper having its sides at the inlet substantially vertically below the cylinder and medially thereof and flaring to positions closely adjacent to the periphery of the cylinder, so as to provide a slowly moving quiescent mass of pulp and direct it upwardly towards the bottom of the cylinder and distribute it uniformly on both sides thereof, an adjustable, elongated valve plug fitting said inlet passage and means for moving the plug to control the flow of stock to the cylinder.

4. A paper making apparatus comprising a vat for holding paper stock, a cylinder which has an open mesh surface for the formation of a paper web thereon, means supporting the cylinder in the vat for rotation about a horizontal axis, means providing an outlet for the water passing into the interior of the cylinder, walls defining a narrow horizontally elongated inlet passage which is substantially as long as the cylinder for introducing stock to the vat as a stream of substantially uniform width so that the stock may be distributed uniformly to the entire length of the cylinder, an adjustable elongated valve plug fitting the opening to said inlet passage, and means for independently moving each end of the valve plug so as to vary the distribution of stock throughout the length of the cylinder.

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