June 5, 1923. 1,457,349

W. S. CRANDELL

PAPER MAKING MACHINE

Filed May 28, 1921 2 Sheets-Sheet 1

Fig. 1.

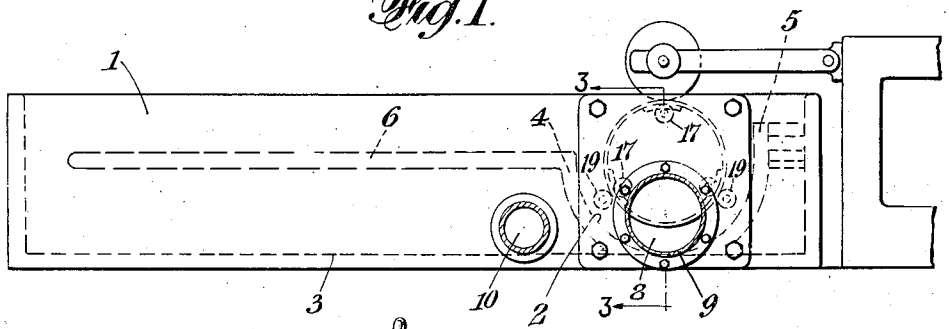
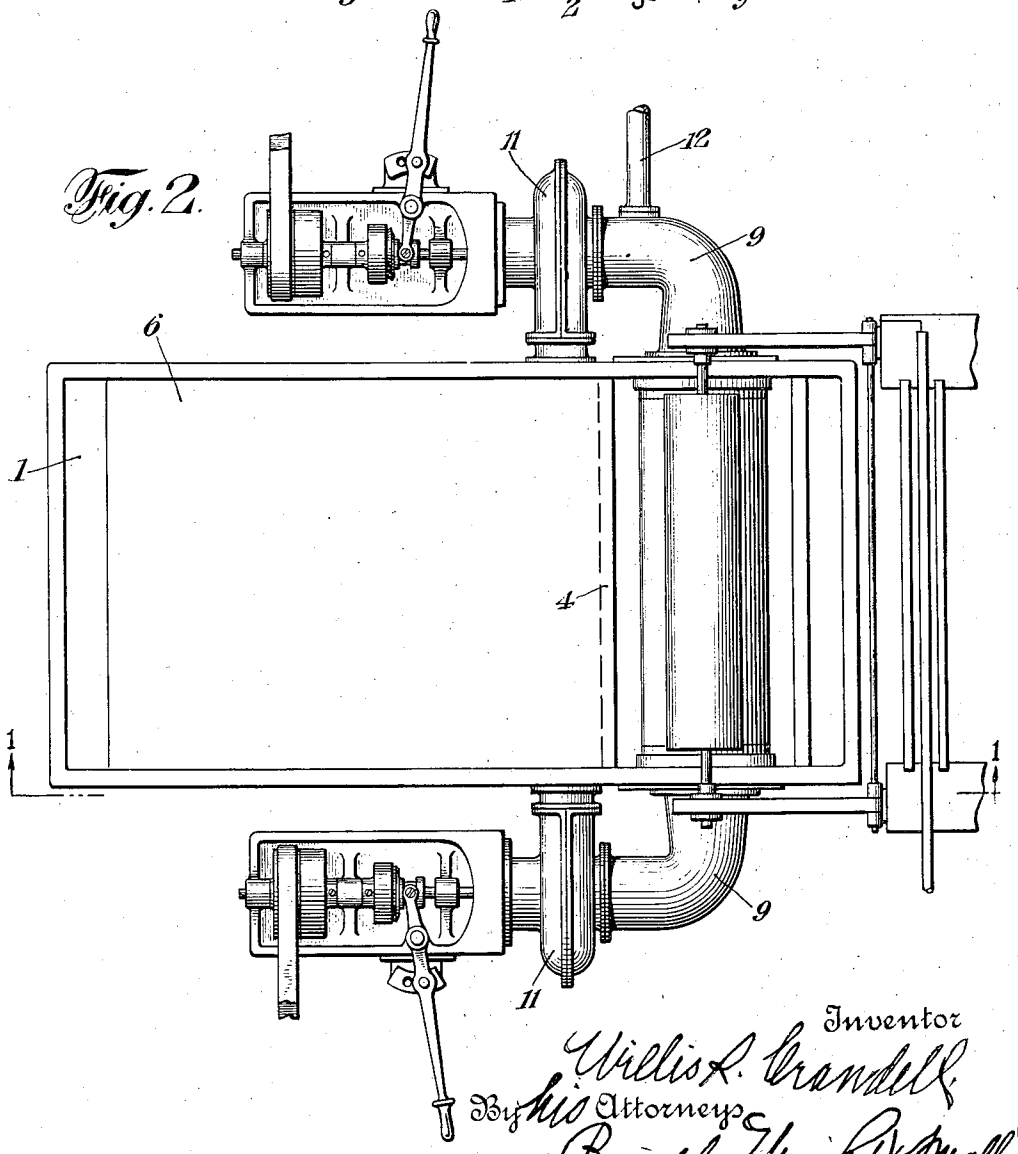


Fig. 2.



Inventor

Willis S. Crandell.

By his Attorneys

Brindle, Wright & Mall.

June 5, 1923. 1,457,349

W. S. CRANDELL

PAPER MAKING MACHINE

Filed May 28, 1921 2 Sheets-Sheet 2

Fig. 3.

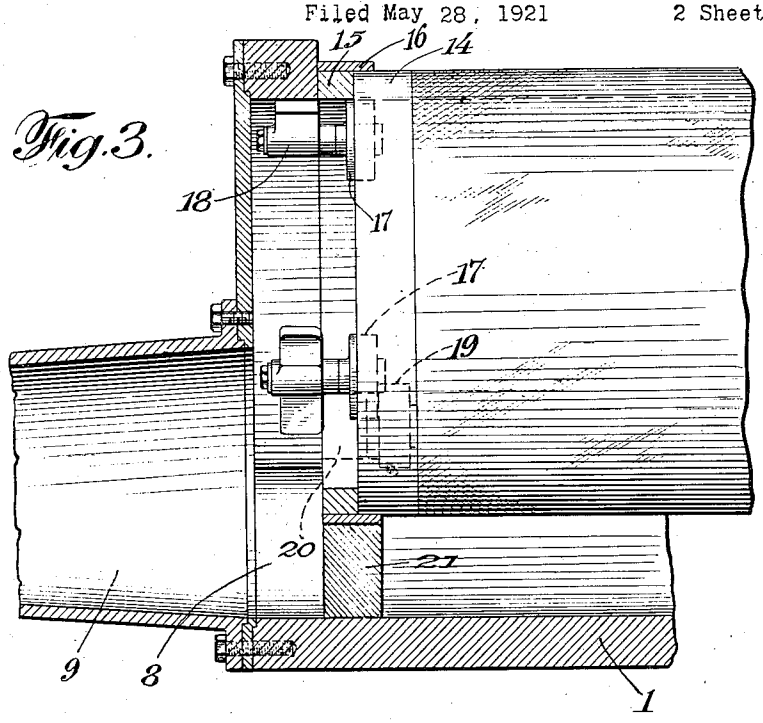
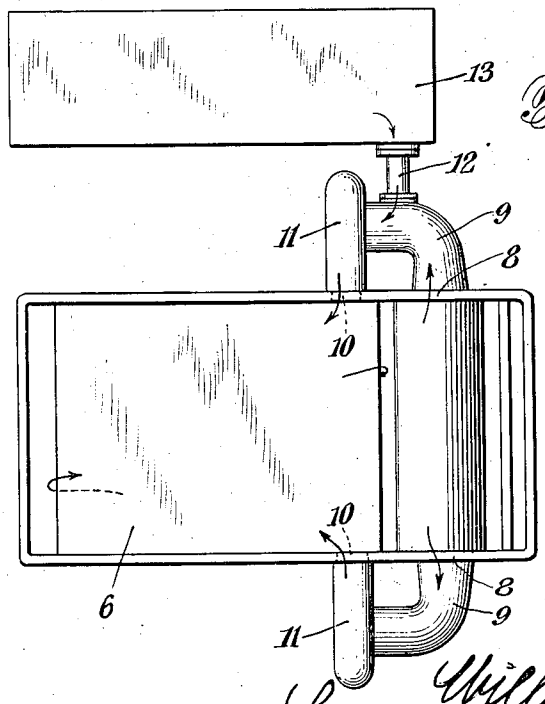


Fig. 4.



Inventor,
Willis S. Crandell,
By his Attorneys
Prindle, Wright & Small.

Patented June 5, 1923. 1,457,349

UNITED STATES PATENT OFFICE.

WILLIS S. CRANDELL, OF ELSMERE, NEW YORK.

PAPER-MAKING MACHINE.

Application filed May 28, 1921. Serial No. 473,435.

To all whom it may concern:

Be it known that I, WILLIS S. CRANDELL, a citizen of the United States, residing at Elsmere, in the county of Albany and State of New York, have invented a certain new and useful Improvement in Paper-Making Machines, of which the following is a specification.

My invention relates to paper making machines of the type commonly known as cylinder paper machines in which the web of paper is initially formed upon the surface of a wire screen cylinder rotating in the fibre bearing liquid.

In machines of this type the cylinder mould is immersed in the fibre bearing liquid flowing thru a trough or restricted passageway, generally semi-circular in cross section to correspond with the surface of the cylinder mould, this trough or restricted passage being commonly termed a "circle". The edge of the upstream side of the "circle" forms in effect a dam over which the water flows into the "circle" while the opposite edge of the "circle", elevated somewhat above the dam provides an overflow. The fibre bearing liquid is generally educted from the opposite ends of the semi-cylindrical trough or "circle" and returned to the upstream side of the fresh supply of the fibre bearing liquid. It is highly important that there be a smooth even flow of the fibre bearing liquid over the dam and it has been customary to cause the fibre bearing liquid to flow thru a vat to the dam referred to and to locate in said vat baffles and other current directing devices to dispose the surface of the flowing liquid at a certain level and to extinguish eddies or currents therein.

To provide a convenient and compact structure, it has also been customary to locate the "circle" and the cylinder mould rotating therein, in the vat, with the floor or lowest point of the semi-cylindrical wall of the "circle" at some distance above the floor of the vat; and, when any of the fibre bearing liquid was to be returned from the circle to the upstream side of the "circle", to provide return conduits from the opposite ends of the semi-cylindrical trough or "circle" to the main portion of the vat on the upstream side of the "circle". As it is essential that the liquid returned from the "circle" to the stream flowing to the "circle" be inducted into that stream substantially below the surface thereof and hence adjacent the floor of the vat, the return conduits were necessarily tortuous due to the difference in level between the floor of the "circle" and the floor of the vat.

Machines as thus constructed were fairly effective up to a certain speed of rotation of the cylinder mould. At higher speeds of the cylinder mould, however, the cylindrical surface of the cylinder mould moves at a greater peripheral speed than the oncoming fibre bearing liquid so that the fibres suspended in the liquid were, so to speak, forcibly drawn from the water by the faster moving surface of the cylinder mould, this action preventing the proper matting and deposit of the fibres upon the cylinder and thus causing the web formed thereon to be too thin in spots or drawn out to too great thinness entirely across the web.

This difficulty could not be obviated by a speeding up of the pump producing the circulation of the fibre bearing liquid because, upon an increased rate of flow of the liquid thru the vat, the numerous baffles and directing devices therein, produced conflicting currents and eddies which prevented that smooth even flow of the fibre bearing liquid over the dam and thru the "circle" essential to the formation of the web upon the cylinder mould.

A further serious objection to these machines has been the deposit of slime throughout the vat and in the communicating conduits, due to the numerous places of lodgment for such matter in the baffles and directing devices in the vat, and in the tortuous return conduits referred to.

Among the objects contemplated by my invention are to avoid the difficulties and objections referred to, and particularly to produce a smooth even flow of the fibre bearing liquid at a substantially predetermined level without the deposit of slime, and to coordinate the speed of flow of this liquid with the speed of rotation of the cylinder mould, up to the limit of the power of the pumps to withdraw the liquid from the down-stream sides of the cylinder mould.

In accomplishing these objects my invention contemplates, among other things, the provision of an always unobstructed passage thru the vat or other conduit for the fibre liquid in its travel to the cylinder mould and without any devices therein which could set up counter-currents or eddies in the flowing liquid or form lodgments for the deposit of

slime, and the provision of communicating conduits without angles or tortuous passages.

These and other objects of my invention will appear from an illustrative embodiment thereof about to be described. While by this illustrative embodiment I shall describe my invention in the best form known to me, it is to be understood that my invention is capable of embodiment in many different forms and is not to be limited to the form described.

In the accompanying drawings, forming a part of this specification, like numerals of references indicate like parts, throughout the various views, of which—

Fig. 1 is a vertical side elevational view of that part of a paper making machine showing a vat for the fibre bearing liquid, the cylinder mould partially immersed and rotatable therein and the couch roll and other cooperating parts of the machine, the conduits for the fibre bearing liquid communicating with the vat being omitted, however, and the side openings therefor only being shown;

Fig. 2 is a plan view of the machine shown in Fig. 1, with the conduits and the associated pumps for the circulation of the fibre bearing liquid shown therewith;

Fig. 3 is a view partially in side elevation and partially in section on the line 3—3 of Fig. 1 showing a preferred form of mounting for the cylinder mould in the side walls of the vat;

Fig. 4 is a diagrammatic plan view showing the tank for the fresh supply of the fibre bearing liquid associated with the parts shown in the preceding figures and showing by arrows the path of circulation of the fibre bearing liquid.

Any conduit for the passage of the fibre bearing liquid to the cylinder mould may be employed but I preferably employ a tank or vat. This vat for the fibre bearing liquid may be of the usual form and is so shown in Fig. 1 as indicated by the reference numeral 1. The semi-cylindrical trough or "circle" 2 in which the cylinder mould is disposed for rotation is preferably made with the lowest part of its semi-cylindrical wall, or its bottom, flush with the bottom 3 of the vat itself instead of disposed thereabove as has heretofore been customary. The upstream side of this semi-cylindrical trough constitutes a dam 4 extending entirely across the vat from side wall to side wall as shown in Fig. 2, and the downstream side 5 of the semi-cylindrical trough being disposed at a higher level than the upper edge of the dam 4 and providing an overflow in the usual manner.

Extending from the dam 4 towards the opposite end of the vat 1 is a broad, flat shelf 6 disposed to extend in a single plane, preferably but not necessarily in a horizontal plane, substantially mid-way of the height of the vat and completely thereacross from one side wall to the opposite side wall, and hence extending longitudinally of the vat, but not to the end thereof, there being a substantial space between the end of the shelf and the adjacent end of the vat, as shown in Figs. 1 and 2.

By the arrangement described it is apparent that the vat on the upstream side of the cylinder mould trough is divided into two portions or passageways, one below the shelf 6 and the other thereabove, which passageways communicate with each other thru the space between the shelf 6 and the adjacent end of the vat and which communication is, therefore, at a point remote from the dam and the cylinder mould.

It is also apparent that the upper portion or passage referred to communicates with the semi-cylindrical trough of the cylinder mould over the edge of the dam 4 and that there is no direct communication between that portion of the vat beneath the shelf 6 and the semi-cylindrical trough of the cylinder mould.

The side walls of the vat, it will be apparent, form the opposite end walls of that semi-cylindrical portion of the vat in which the cylinder mould rotates and in these walls eduction apertures 8 are formed flush at the lowest point of their curves with the bottom of the cylinder-mould trough, which lead to conduits 9 circular in cross section and of smooth interior contour, whose lowest-most wall is flush with the bottom of the semi-cylindrical trough and with the bottom of the vat, as shown in Fig. 1. The conduits 9 each communicate thru induction apertures 10 located in the lower side walls of the main body of the vat with the lowest point of the curves also flush with the bottom of the vat, closely adjacent to the dam 4, and hence leading to the lower passage in the vat 1 beneath the shelf 6.

Inserted in the conduits 9 are the pump chambers of rotary pumps 11 of the usual or any preferred type. These pumps are designed to be operated each independently of the other, and in a direction to withdraw the liquid from the semi-cylindrical trough of the cylinder mould thru the education ports 8, the conduits 9 and the induction ports 10 to the lower passage in the main portion of the vat. Suitable partitions 21 are interposed between the conduits 9 and the space within circle 2 which is exterior to the cylinder mould, whereby the liquid must pass through the cylinder mould before being withdrawn through conduits 9. A conduit 12 for fresh supplies of the fibre bearing liquid is connected to one of the conduits 9. In Fig. 4 the source of supply 13 of the fibre bearing liquid is diagrammatically shown. The independent operation of the pumps 11,

as will be apparent, permits of that pump receiving the fresh supply of the fibre bearing liquid to take care of that supply and yet to withdraw the spent liquid thru an eduction port 8 in a quantity corresponding to that withdrawn by the oppositely disposed pump by speeding up the pump referred to to a correspondingly increased rate over the oppositely disposed pump. Any suitable devices (not illustrated), such as are known to the art may be employed to prevent the level of the liquid in circle 2 from exceeding its proper height.

It is particularly to be observed that the conduits 9 are short and direct, having their eduction and induction ports flush with the bottom of the vat and having smooth interior contours, obstructed only by the moving blades of the pump so that no angular abutments are provided for the lodgment of slime or the obstruction of the fibre bearing liquid.

A comparison of this arrangement with the arrangement old in the art heretofore mentioned, shows that the number of passages thru which the fibre bearing liquid is to be transported is thereby greatly reduced, and hence the greater efficiency of the device and the less deposit of slime and less interruption to the transportation of the fibre in the fibre bearing liquid.

In order to produce as smooth a contour of the communicating passages 9 as possible, and with no obstruction in the eduction ports 8, the cylinder mould is preferably mounted with its opposite ring ends 14 in end abutment with a ring 15 extending inwardly from the side wall of the vat 1, a flexible ring 16 being provided to overlap the rings 14 and 15, and hence lying over the joint between the end of the cylinder and the ring 15, to make a substantially watertight connection. Roller bearings 17 are provided extending from brackets 18 in the walls of the vat 1 to bear upon the upper side of the interior of the cylinder mould, and other roller bearings 19 are provided extending from brackets 20 to bear upon the exterior surface of the ring 14 of the cylinder mould. By thus mounting the opposite ends of the cylinder mould in bearings extending from the walls of the vat 1, it is apparent, as shown in Fig. 3, that no central bearings for the cylindrical mould obstructs the eduction aperture 8 or the conduit 9 extending therefrom or are present to produce deposits of slime.

It is also apparent from this arrangement that the interior of the cylindrical mould itself is substantially free from rotating parts or a central bearing so that there is a practically uninterrupted passageway throughout the interior of the cylindrical mould and thru the eduction ports 8, the conduits 9, the pumps 11 and the induction ports 10 to the lower passage in the main body of the vat.

The independent operation of the two pumps enables such a control that if, for any reason, there is a greater flow of water thru the cylindrical surface of the mould at the one end than at the other, the speeding up of the pump on the opposite end will equalize this flow and thus cause an even deposit of the fibres from the fibre bearing liquid upon the cylinder mould.

The fibre bearing liquid, as it enters the main portion of the vat beneath the shelf 6 and at a point remote from the free end of this shelf, must traverse the entire length of the vat beneath the shelf as shown in Figs. 1 and 4, and this fibre bearing liquid, under the pressure imparted by the pumps, flows over the free end of the shelf, the fibre bearing liquid being under sufficient pressure to cause this overflow and its continued traverse along the upper surface of the shelf in the direction opposite to its traverse below the shelf until the upper end of the dam is reached, when it flows thereover and into the semi-cylindrical trough 2 in which the cylinder mould rotates. The fibre bearing liquid flowing under the shelf 6, under sufficient pressure to overflow the end of that shelf, maintains a constant even flow over the upper surface of that shelf without currents or obstructions of any kind to cause deposits, and the flow over the dam is there fore constant and smooth.

The shelf 6, as stated, is preferably disposed in a horizontal plane altho it may, if desired, be disposed substantially in a horizontal plane and yet at a sufficient angle thereto in downward inclination toward the dam 4 to speed the flow of the fibre bearing liquid toward the dam.

It has been found that with the arrangement here described the effectiveness of the machine is prolonged thru a much higher range of speed of the cylinder mould than heretofore the only limitation in this respect being the capacity of the pumps or the time required for the passage of the spent liquid thru the conduits 9 and the fresh supply thru the supply conduit 12. A greater speed of the flowing fibre bearing liquid can be maintained without eddies or currents than where baffles or other current-directing devices are employed so that the speed of flow of the fibre bearing liquid can be coordinated with the speed of rotation of the cylinder mould throughout substantially all the desired speeds of said cylinder-mould thus enabling a speedier production of the web of paper.

Having particularly described my invention, what I claim and desire to secure by Letters Patent is:

1. In a cylinder paper machine, bottom and side confining walls providing a passage for the flow of a fibre bearing liquid, a cyl-

inder mould having its lower portion immersed and rotating in said passage, a flat shelf disposed in a substantially horizontal plane in said passage on the upstream side of said cylinder mould, and dividing said passage and having its rear edge free, said shelf being adapted to extinguish currents or eddies in the fibre bearing liquid in its flow to said cylinder mould and means for supplying said liquid to said passage beneath said shelf.

2. In a cylinder paper machine, bottom and side confining walls providing a passage for the flow of a fibre bearing liquid, a cylinder mould having its lower portion immersed and rotating in said passage, a dam in said passage adjacent said cylinder mould and on the upstream side thereof and a flat shelf disposed in a substantially horizontal plane in said passage on the upstream side of said dam and dividing said passage and having its rear edge free, said shelf being adapted to extinguish currents or eddies in the fibre bearing liquid in its flow to and over said dam and means for supplying said liquid to said passage beneath said shelf.

3. In a cylinder paper machine, a trough for the passage of the fibre bearing liquid, a cylinder mould having its lower portion immersed and rotating therein, and a runway whose length is more than twice the diameter of the cylinder mould, said runway being free from baffles or other obstructions to the flow of the liquid.

4. In a cylinder paper machine, a trough for the passage of the fibre bearing liquid, a cylinder mould having its lower portion immersed and rotating therein, an unobstructed runway for the fibre bearing liquid leading to said trough, means for delivering the fibre bearing liquid to said runway under a sufficient head to cause said liquid to flow thereover and means to vary said head to vary the speed of flow of said liquid.

5. In a cylinder paper machine, a trough for the passage of the fibre bearing liquid, a cylinder mould having its lower portion immersed and rotatable therein at variable speeds, an unobstructed runway for the fiber bearing liquid leading to said trough, means for delivering the fibre bearing liquid to said runway under a sufficient head to cause said liquid to flow thereover and means to vary said head in correspondence with the variable speeds of rotation of said cylinder mould.

6. In a cylinder paper machine, a trough for the passage of the fibre bearing liquid, a cylinder mould having its lower portion immersed and rotating therein, an unobstructed runway for the fibre bearing liquid leading to said trough including a flat shelf adapted to extinguish currents or eddies in the fibre bearing liquid directed thereover, said shelf dividing said runway and the rear edge of said shelf being free, and means for introducing the fibre bearing liquid under the shelf.

7. In a cylinder paper machine, a vat for the fibre bearing liquid, a cylinder mould rotating therein, a dam about said cylinder mould, a runway for the fibre bearing liquid disposed in said vat in a single plane to extend to said dam, said vat having unobstructed spaces above and below said runway and communicating only at a point remote from said dam, means for admitting the fibre bearing liquid to the space below said runway under sufficient pressure to cause said fibre bearing liquid to flow over said runway to and over said dam.

8. In a cylinder paper machine, a vat for the fibre bearing liquid, a cylinder mould rotating therein, a dam about said cylinder mould, a runway for the fibre bearing liquid disposed in said vat in a substantially horizontal plane to extend to said dam, said vat having unobstructed spaces above and below said runway and communicating only at a point remote from said dam, means for admitting the fibre bearing liquid to the space below said runway at a point remote from said communication with said upper space under sufficient pressure to cause said fibre bearing liquid to flow over said runway to and over said dam.

9. In a cylinder paper machine, a vat for the fibre bearing liquid, a cylinder mould rotating therein, a dam about said cylinder mould, a runway for the fibre bearing liquid disposed in said vat in a substantially horizontal plane to extend to said dam, said vat having unobstructed spaces above and below said runway and communicating only at a point remote from said dam, means for admitting the fibre bearing liquid to the space below said runway at a point remote from said communication with said upper space under sufficient pressure to cause said fibre bearing liquid to flow over said runway to and over said dam, and means to vary said pressure to vary the speed of flow of said liquid.

10. In a cylinder paper machine, a vat for a fibre bearing liquid, a dam extending transversely of said vat, a rotating cylinder mould partially immersed in said vat on one side of said dam, a flat shelf extending in a substantially horizontal plane transversely of said vat from the spillway of said dam on the side thereof opposite said rotating cylinder mould and means for delivering the fibre bearing liquid to said vat beneath said shelf under sufficient pressure to overflow said shelf.

11. In a cylinder paper machine, a vat for the fibre bearing liquid, a dam extending transversely of said vat, a cylinder mould partially immersed in said vat on one side of said dam, and rotatable at variable speeds, a flat shelf extending in a substan-

tially horizontal plane transversely of said vat from the spillway of said dam on the side thereof opposite said rotating cylinder mould, means for delivering the fibre bearing liquid to said vat beneath said shelf at a point adjacent the wall of said dam under sufficient pressure to overflow said shelf, and means to vary said pressure in correspondence with the varying speeds of peripheral travel of said cylinder mould.

12. In a cylinder paper machine, upper and lower substantially horizontally disposed passageways for the fibre bearing liquid connecting at a corresponding end thereof a trough semi-cylindrical in cross section at the opposite end of said upper passageway and adapted to receive the fibre bearing liquid from said upper passageway, the bottom of said trough being substantially level with the floor of said lower passageway, a cylinder mould having its lower portion immersed in and rotating in said trough, passageways each having a bottom substantially flush with said bottom of said trough and the floor of said lower passageway, leading from the opposite ends of said trough to said lower passageway at a point remote from its communication with said upper passageway, and means for forcing the fibre bearing liquid in circulation thru said passageways and said trough.

13. In a cylinder paper machine, a vat for the fibre bearing liquid, a dam extending transversely of said vat, a rotating cylinder mould partially immersed in said vat on one side of said dam, a shelf extending in a substantially horizontal plane transversely of said vat from the spillway of said dam on the side opposite said rotating cylinder mould, conduits about said dam at opposite ends thereof forming return conduits from the end portions of the space occupied by said rotating cylinder mould to the space beneath said shelf, a source of supply for the fibre bearing liquid communicating with one of said conduits, and pumps, one for each of said conduits, adapted to force the fibre bearing liquid thru said conduits beneath said shelf with sufficient pressure to overflow said shelf, said pumps adapted to be independently operated at variable speeds.

14. In a cylinder paper machine, a vat, a dam in said vat, a cylinder mould immersed in said vat on one side of said dam and conduits circular in cross section, one on each side, communicating with the interior of said vat on the same side of said dam as said cylinder mould by an eduction port and with the interior of said vat on the opposite side of said dam by an induction port and bearings about said eduction port adapted to rotatably mount said cylinder mould, whereby said cylinder mould, said eduction ports and said conduits present substantially unobstructed interiors.

In testimony that I claim the foregoing, I have hereunto set my hand this 25th day of May, 1921.

WILLIS S. CRANDELL.