June 15, 1926.

1,589,120

W. S. CRANDELL

METHOD AND MEANS OF MAKING PAPER

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Fig. 1.

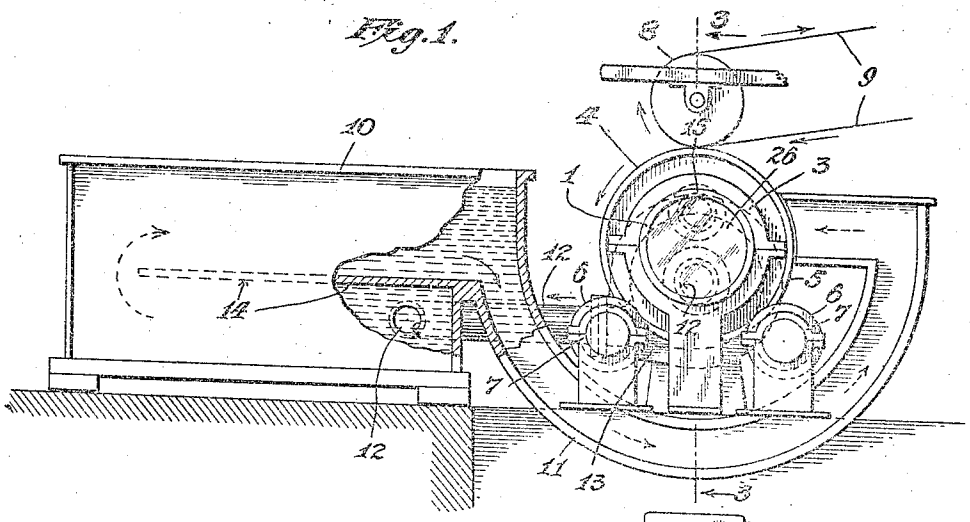
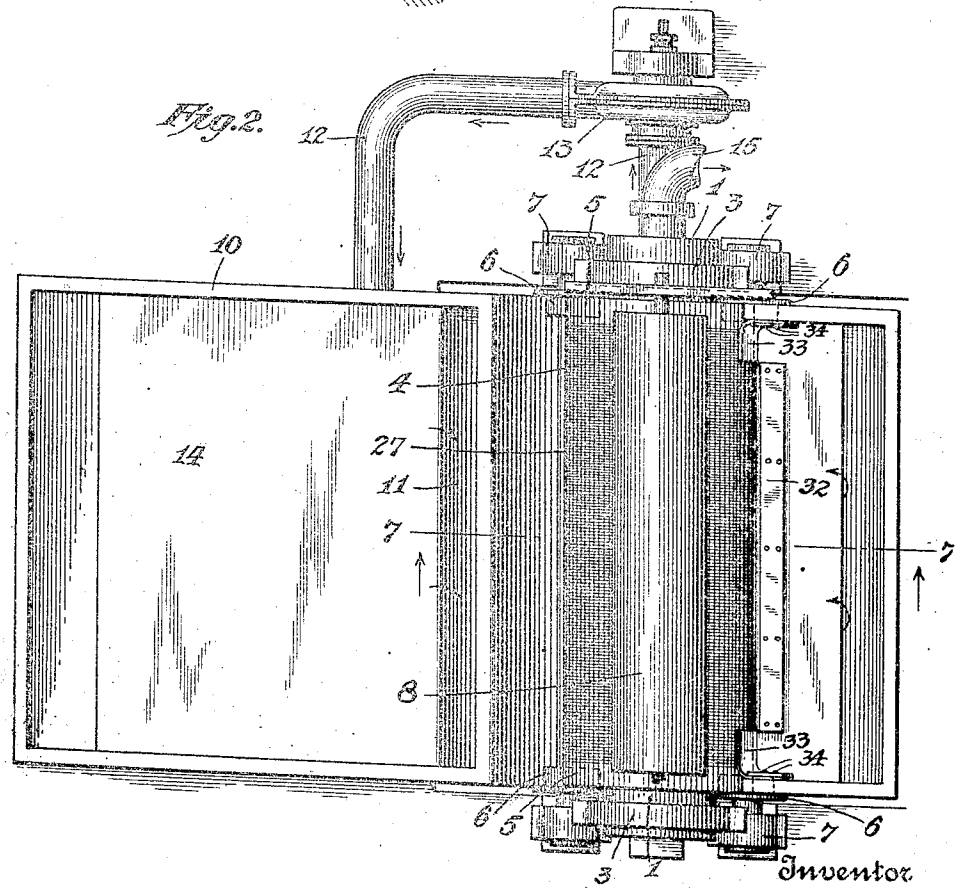


Fig. 2.



Inventor

Willis S. Crandell

By his Attorney

A. C. Becker

June 15, 1926.

W. S. CRANDELL

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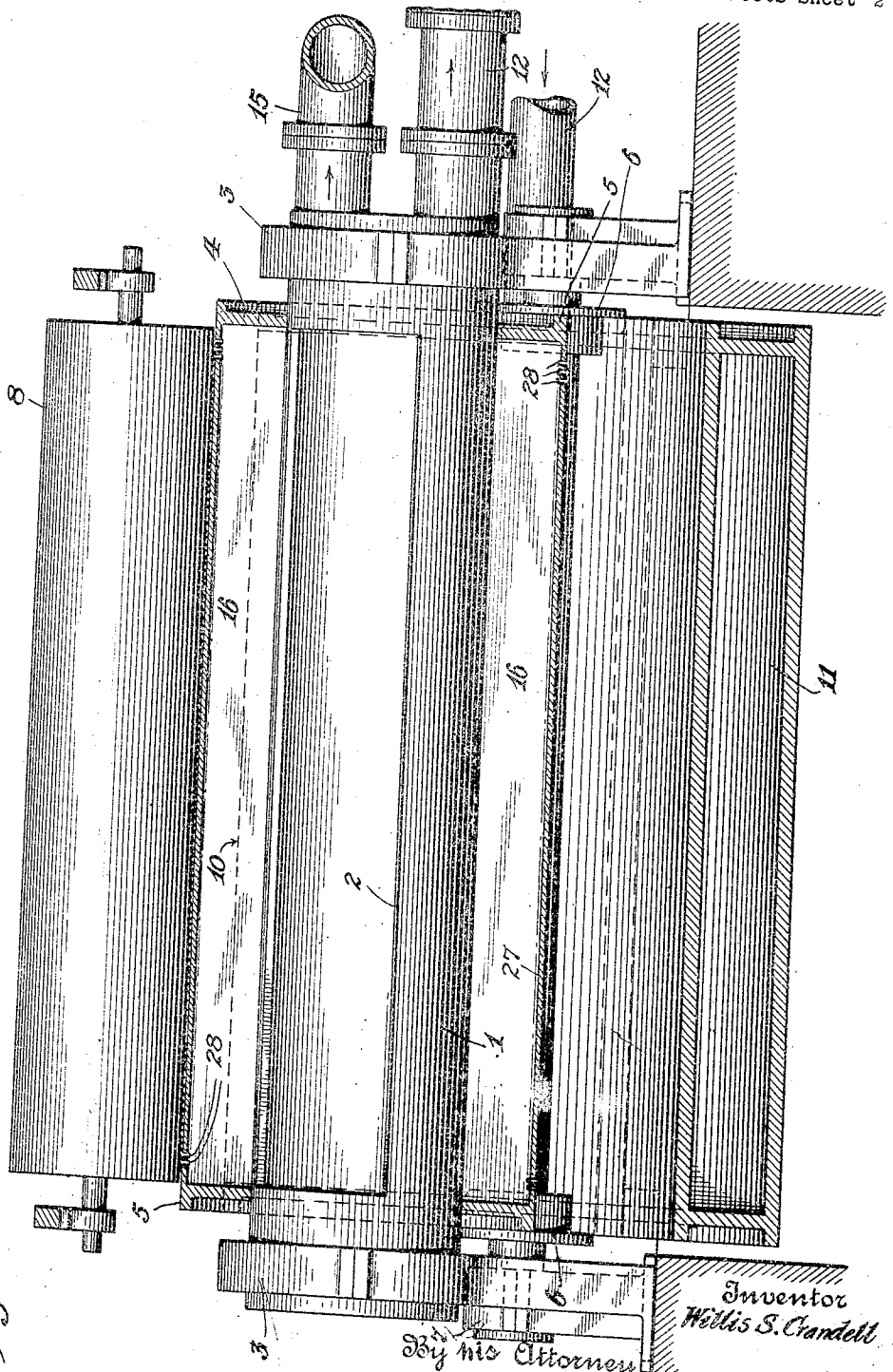


Fig. 3.

Inventor
Willis S. Crandell

By his Attorney
W. W. Beeken

June 15, 1926. 1,589,120

W. S. CRANDELL

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Fig. 4.

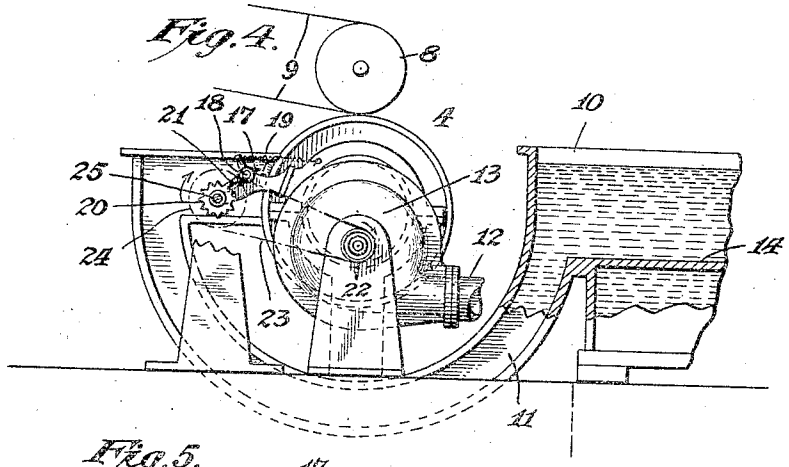


Fig. 5.

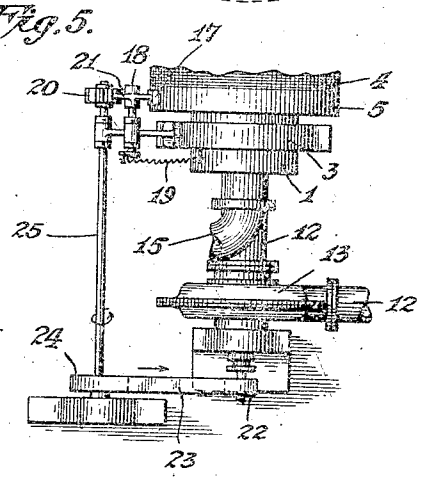
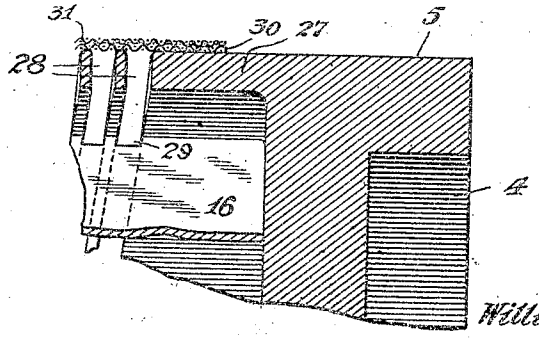


Fig. 6.



Inventor
Willis S. Crandell

By his Attorney

June 15, 1926.

W. S. CRANDELL

1,589,120

METHOD AND MEANS OF MAKING PAPER

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Fig. 7.

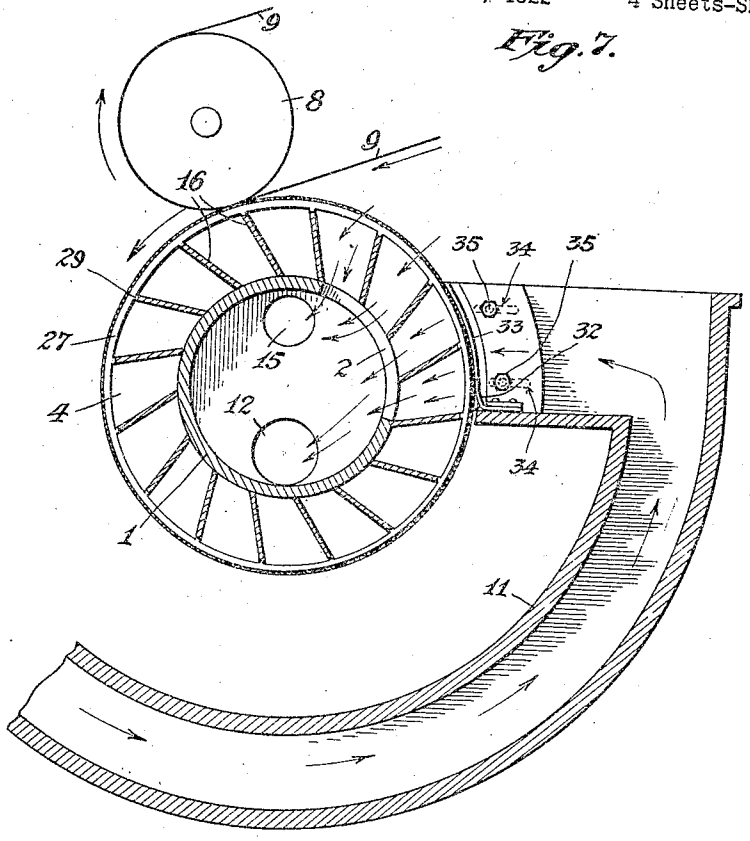
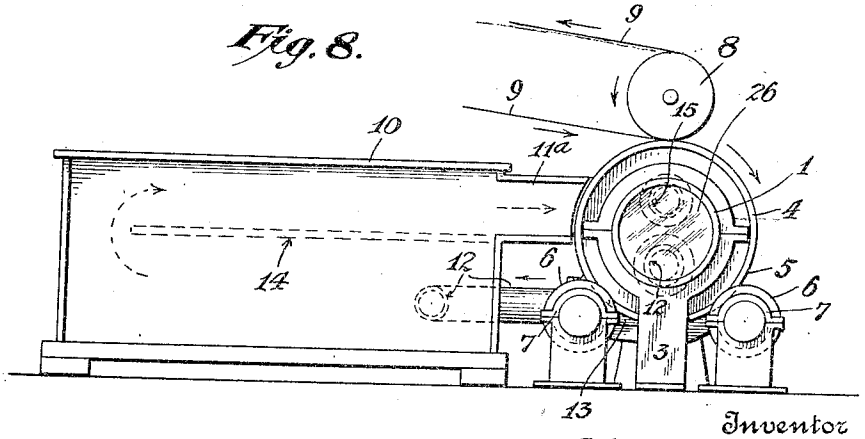


Fig. 8.



Inventor
Willis S. Crandell

By his Attorney
Wilfred Peeler

Patented June 15, 1926. 1,589,120

UNITED STATES PATENT OFFICE.

WILLIS S. CRANDELL, OF ELSMERE, NEW YORK.

METHOD AND MEANS OF MAKING PAPER.

Application filed August 10, 1922. Serial No. 580,821.

This invention relates to the class of paper making machines in which there is employed a rotatable mold cylinder on which the paper is formed, said mold acting in conjunction with a couch roll over which latter passes a felt for carrying off the paper formed on the mold.

In this art, as heretofore practiced, it has been the custom to immerse the cylindrical mold in a tank or vat containing liquid stock, leaving only a small part, adjacent the couch roll, of the upper portion of said mold above the surface of the liquid stock. The cylinder mold has usually been of a skeleton construction including a series of spiders carried by a series of collars on a shaft, the spiders being connected by transverse bars at the peripheries thereof and the cylinder being covered with a coarse winding wire, say fourteen to twenty mesh, forming the under-face of the mold. Over the under-face or supporting structure thus formed, is placed the usual forming face consisting of wire screen of relatively fine mesh, say from sixty to one hundred fine. A circulation of the liquid stock is established in the vat from beneath, a horizontal table or dividing element, thence toward, around and through the surface of the mold to the interior thereof; the exhaust water being carried out of the interior of the cylinder and back to the vat or tank at a point beneath the horizontal dividing element.

It will be understood from the foregoing that the cylinder is filled with liquid to the extent of its immersion in the vat because there are no separate compartments within the cylinder and it follows that the body of liquid, within the cylinder, reacts outwardly through the surface thereof, and this in spite of the circulating movement imparted to the liquid throughout the system. This outward reaction constitutes one of the main difficulties in paper making machines of this type because, unless the forces are properly balanced, there will be a tendency to throw off the stock accumulated on the forming surface of the cylinder thereby producing imperfect paper. In addition, the extent of the cylinder surface above the level of the liquid in the vat is so slight that there is difficulty in drying the stock sufficiently to convert it into a paper web before it reaches the couch roll and hence the speed of the machine is necessarily limited by this factor, and for the further reason that the paper web, unless it has acquired sufficient stability by the time it reaches the couch roll, will tend to follow the cylinder mold beyond the point of its tangential engagement with the couch roll and hence will not be carried off by the felt passing between said cylinder and couch roll.

The main object of this invention is to overcome the foregoing objections and to render the manufacture of paper more certain, speedy and inexpensive than has heretofore been possible.

One phase of the invention centers primarily around a new means whereby the liquid stock is deposited on the forming surface of a cylinder rotating in a dry path and not immersed in a vat containing liquid stock as heretofore. In accordance with this feature of the invention there is provided a central stationary tube having an opening in its surface at a part of the upper portion thereof. Rotating around this tube is a cylindrical mold having a series of compartments formed by vanes extending inwardly from its periphery and adjacent to the forming surface of the mold is a connection for supplying liquid stock thereto, said connection being in line with the opening in the surface of the stationary tube. The end of the tube is connected to the vat containing the liquid stock. Rotation of the mold allows the stock to accumulate on its forming surface, and the vanes act to direct the exhaust water to the stationary tube without permitting it to pass to other parts of the mold. In other words, the vanes or compartments act as a cut-off or valve. By the above means no outward pressure is exerted by the exhaust water, ample space is provided for drying the paper before the couch roll is reached, the speed of the machine can be increased and more perfect paper is produced. In addition certain other advantages attach which will be more fully described hereinafter.

The cylinder mold may be constructed in any suitable way so long as it is provided with vanes or compartments in the manner above set forth. The cylinder mold, however, embodies in itself new and valuable features of construction and is capable of use either in connection with the method and construction of a mold rotating in a dry path, or in connection with the construction in which the mold is immersed in a vat. It will be understood that the construction

of mold heretofore used, involving as it does the use of a shaft, collars, spiders and transverse bars soldered or otherwise fastened to the spiders, is expensive in its assemblage and also renders it difficult to maintain a true forming surface; the result being that water does not pass through from the outer surface to its interior in the proper manner and that the structure becomes clogged by particles of stock improperly adhering to and building up on the surface of said mold, with the result that a tear or other unevenness or inequalities is produced in the paper. That phase of the invention which relates to the cylinder mold consists primarily in the provision of the vanes aforesaid, and these vanes may be attached to the structure in any suitable manner and by any suitable means. Preferably, however, the cylindrical structure is an integral member capable of admitting the water from its exterior to its interior in the proper manner, the structure being so arranged that the so-called under-face forms a part of the cylinder structure itself, the shaft, the numerous rings or collars and the spiders being omitted.

Other features will appear as the specification proceeds.

In the accompanying drawings the invention is shown in several concrete and preferred forms in which:

Fig. 1 is a side elevation, with parts broken away and in section, of a machine embodying the invention.

Fig. 2 is a top plan view of the parts shown in Fig. 1

Fig. 3 is a vertical sectional view on the plane of line 3—3 of Fig. 1.

Fig. 4 is a fragmentary side elevation, with parts broken away and in section, of that side of the machine which is opposite to the one shown in Fig. 1.

Fig. 5 is a plan view of the parts shown in Fig. 4.

Fig. 6 is an enlarged fragmentary sectional detail view of the upper right hand corner of the cylinder mold shown in Fig. 3.

Fig. 7 is an enlarged sectional view through the cylinder mold and adajcent parts on the plane of line 7—7 of Fig. 2.

Fig. 8 is a view somewhat similar with Fig. 1, but showing a modified construction.

1 indicates a stationary tube having an opening 2 in a part of the upper portion of its surface and suitably supported in end bearings 3. Surrounding tube 1 is a mold cylinder 4 mounted to rotate with respect to said tube. Said mold cylinder may be mounted in any suitable manner, but preferably heads 5 thereof are supported on four rollers 6 mounted in bearings 7 of an anti-friction character such as ball or roller bearings. Rotation is imparted to cylinder mold in any suitable manner, but preferably a couch roll 8 having a felt 9 is employed which serves not only to frictionally drive the mold cylinder, but also to carry off the web of paper. It will be observed, especially from Figs. 1 and 7, that the mold cylinder rotates in a dry path, that is it is not immersed in the stock contained in vat 10. Said vat may be of any suitable construction and is provided with a conduit 11 that extends beneath the mold cylinder and its supporting means as shown in Figs. 1 and 7 and terminates at the other side of the said mold and comes in contact with the forming surface of said mold at a point adjacent to opening 2 of stationary tube 1. Or, if rotation of the parts is reversed, the construction shown in Fig. 8 may be employed and conduit 11^a may then extend directly to the forming surface of the mold without passing beneath the same. In the latter case it will be understood that the opening in the surface of the stationary tube must likewise be reversed and must be appropriately located with respect to the terminus of conduit 11^a. Stationary tube 1 is in communication with vat 10 by any suitable means such as pipe 12, in which pipe is interposed a pump 13 driven by suitable means, not shown. Vat 10 is provided with a horizontal partition or table 14 and pipe 12 enters vat 10 at a point below said table. Tube 1 is also preferably connected to an air exhaust pipe 15 to which may be attached an exhaust fan (not shown). The mold cylinder is provided with cut-offs or vanes 16 extending inwardly from the periphery of said mold to a point adjacent the stationary tube, and these vanes are preferably non-radial with respect to the cylinder mold.

It will now be understood, circulation being established from the vat to the mold and back again, that liquid stock will flow, as indicated by the arrows, through conduit 11 and against the forming surface of the mold as it rotates past the terminal point of said conduit, and that the surplus or exhaust water will pass through the compartments, formed by the vanes of the cylinder mold, through opening 2 in the stationary tube, and through pipe 12 and pump 13 back to the vat. It will be apparent that, as a vane moves upwardly past the lower point of the terminus of conduit 11, exhaust water begins to flow through the compartment formed between adjacent vanes to opening 2 and thence into the tube itself and that this action continues until the vane passes above the level of the liquid in the terminus of conduit 11. This action will take place only over a relatively small part of the periphery of the mold cylinder; less than forty-five degrees having been found, in practice, a suitable distance. This

leaves a relatively large part of the upper portion of the mold on which the stock may dry before the couch roll is reached, and to assist the drying process an air exhaust as previously described may be used. If a line is drawn between the centers of the tube and of the couch roll it will be seen that opening 2 terminates short of the point where this line passes through the circumference of the tube, with the result that the suction on the paper web stops before the tangential point of the mold and the couch roll is reached and the paper will therefore pass readily around the couch roll with the felt. It will also be understood that the stationary tube is not completely filled with water.

Comparing this with the method and construction used in the prior art it will be seen that there is no outward pressure of water to be balanced, first because tube 1 is not completely filled with water and secondly because the water rests on the bottom of the tube and is therefore out of contact with the inner surface of the periphery of the mold as it is being carried off.

To assist in drying the paper a slight vibration may be imparted to the mold. This may be done by any suitable means but in Figs. 4 and 5 I have shown a suitable expedient whereby this may be accomplished. As there shown a hammer 17 is pivoted at 18 and is urged toward the mold by means of spring 19. A star wheel 20, or other contrivance, engages the other end 21 of the hammer and produces a rapid rocking of said hammer against the mold thereby imparting a vibration thereto. As a matter of convenience this star wheel may be rotated by means of a pulley 22 on the end of the pump shaft, belt 23 and pulley 24 on star wheel shaft 25. If desired, one end of the tube may have a pane of translucent material 26 so that the internal behavior of the machine may be observed (Figs. 1 and 8).

The construction of the cylinder mold may vary widely, but I pause to remark here that the non-radial disposition of the vanes also tends to prevent outward pressure of the water, and this is particularly true if the mold is used with a construction where the mold is immersed in a vat, and I desire particularly to point out here that this construction of mold can be used with the standard construction of machine. In the particular form here disclosed the mold is characterized by a hollow cylindrical body portion 27 having formed integrally therewith end heads 5 and having also formed integrally therewith longitudinal bars or vanes 16, these vanes being arranged near the periphery of the cylindrical portion and extending between the heads from one end of the cylinder to the other. 28 indicates circumferential openings in this cylindrical portion that may be in the form of concentric openings, if so desired, but which are shown as being in the form of a spiral. Preferably these openings extend part way into longitudinal vanes 16 as indicated at 29 in order to facilitate the passage of water through the surface of the cylinder and so as not to form an obstruction on which stock may lodge. Surrounding the cylindrical portion is the usual forming face indicated here by coarse wire mesh 30 and superimposed wire mesh 31. The under-face is formed by the cylinder structure itself. It will be evident that by this construction the cylindrical mold is of unusually simple formation and can be machined true so as to present a better surface for supporting the forming face of the mold and permits more thorough washing by showers. The mold is the subject matter of an application, Ser. No. 573,901 filed July 10, 1922.

At the point where the terminus of conduit 11 comes adjacent to the forming face of the mold cylinder suitable sealing means are provided. 32 indicates a lower sealing means consisting of a longitudinally extending flap of rubber or other suitable material secured to the bottom of the terminus of the conduit and having a wiping contact with the forming surface of the cylinder. 33 indicates side sealing means which are also in the form of flaps of rubber and which are adjustable by means of slots 34 and bolts 35 so that the width of the paper web produced may be regulated by adjusting the amount of endwise overlap.

I claim:

1. A paper making machine including: a rotatable cylinder mold, a stationary tube extending through said mold, and a translucent end wall in said tube to admit of inspection of its interior.

2. A paper making machine including: a rotatable mold cylinder, two rollers engaging the lower surface of said cylinder at each end thereof and on which the cylinder rests, and means for rotating the cylinder, a stationary tube extending through said cylinder, and fixed bearings at the ends thereof to support the tube independently of the cylinder, and a translucent end wall in said tube to admit of inspection of its interior.

3. A paper making machine including: a stationary tube having an opening in a part of the upper portion of its surface, a rotatable cylinder mold surrounding said tube having a forming surface in spaced relation to the tube, and vanes carried by the mold, extending inwardly from the forming surface thereof to the tube, a source of supply of liquid stock, a conduit between said source of supply and the forming surface of the mold, a connection between the lower

part of the tube and the source of supply, and an air exhaust pipe connected adjacent to the upper part of said tube.

4. A paper making machine including: a rotating cylinder mold having a forming surface, a couch roll above said cylinder mold, a stationary tube within said cylinder mold having an opening in its upper surface terminating short of the point at which a line drawn between the center of the couch roll and the stationary tube intersects the circumference of the tube, and vanes extending inwardly from the forming surface of the mold forming partitions therein, means for supplying liquid stock to the forming surface of the mold adjacent the lower part of the opening of the tube, a vat containing liquid stock to which said supply means are connected, a connection between the lower part of the stationary tube and said vat, and an air exhaust pipe connected to the upper part of said tube.

5. A paper making machine including: a cylinder mold rotating in a dry path, means for depositing liquid stock on the forming surface of said mold including a conduit terminating adjacent to the mold, flexible sealing means carried by said conduit at the terminus thereof and adjacent the ends of the cylinder with which said cylinder mold has a wiping contact, and means for adjusting the amount of overlap of said sealing means lengthwise of the cylinder to thereby regulate the width of the web to be produced.

6. A paper making machine including: a cylinder mold, a hammer, and means to actuate said hammer to impart blows in rapid succession to said cylinder mold to facilitate drying the paper.

Signed at Albany in the county of Albany and State of New York, this 31st day of July, 1922.

WILLIS S. CRANDELL.