May 3, 1932. E. A. PETERSON ET AL 1,856,081

CYLINDER PAPER MACHINE

Filed April 18, 1927 5 Sheets-Sheet 1

Fig. 1.

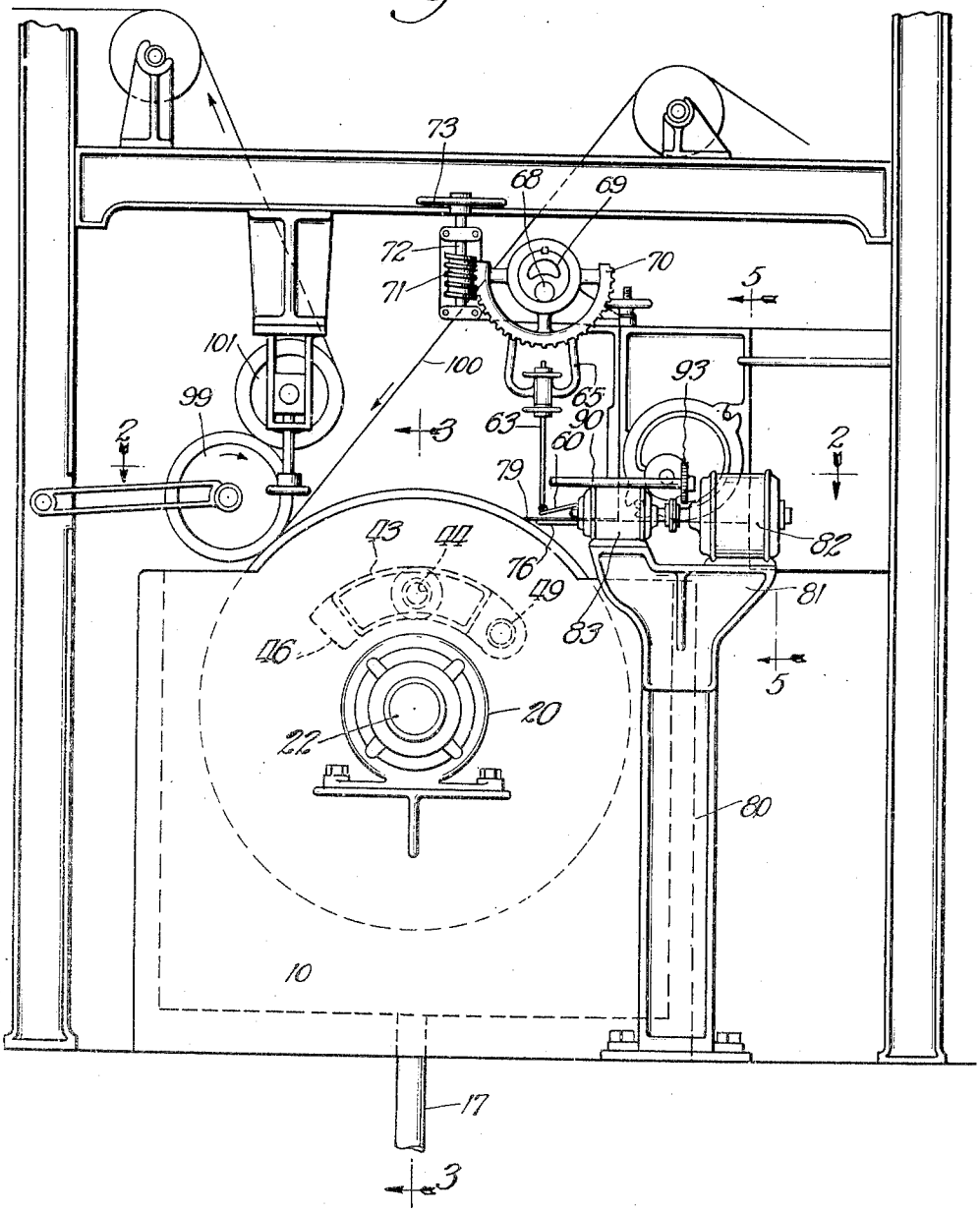

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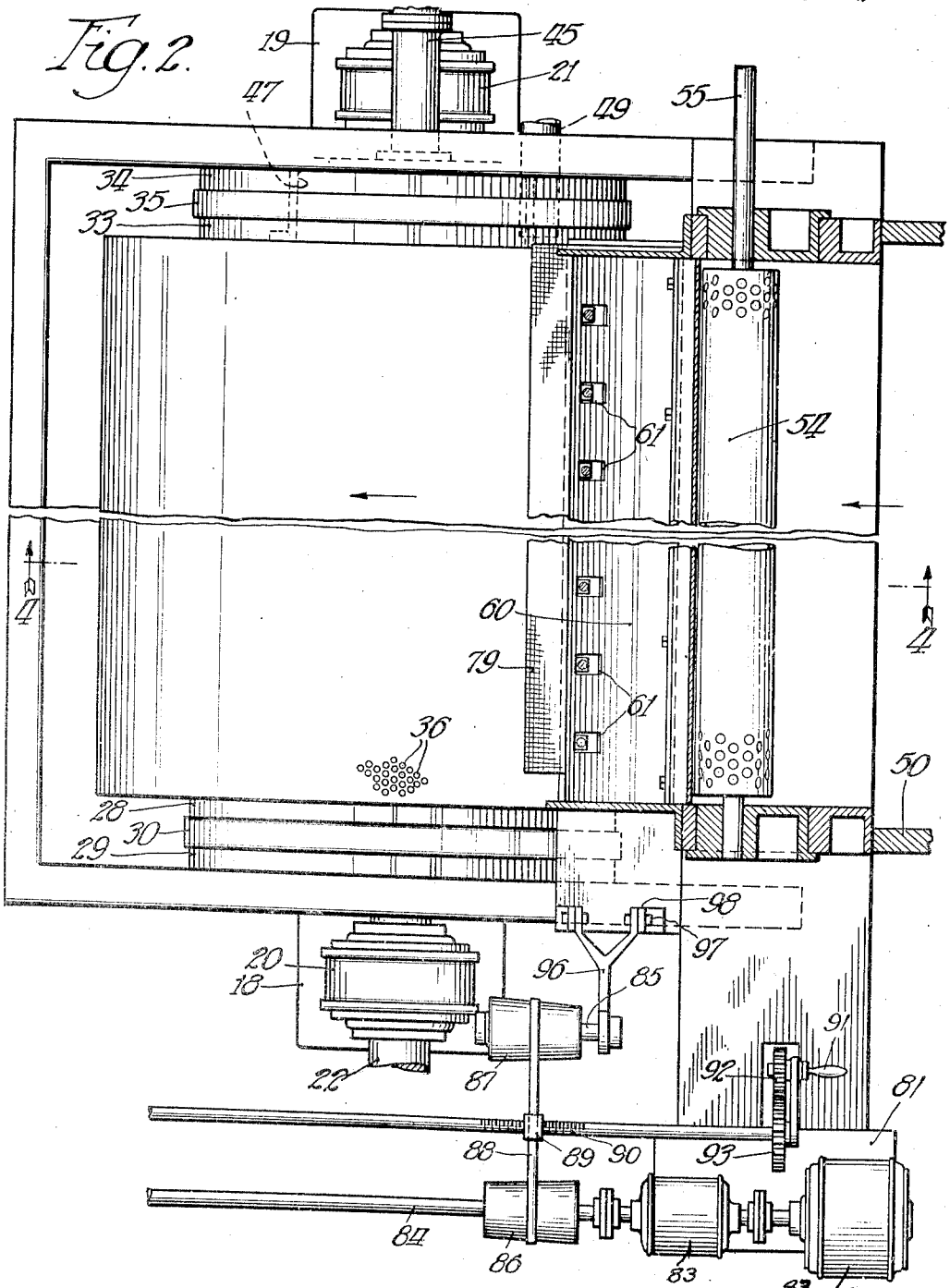
Fig. 2.



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Filed April 18, 1927 5 Sheets-Sheet 3

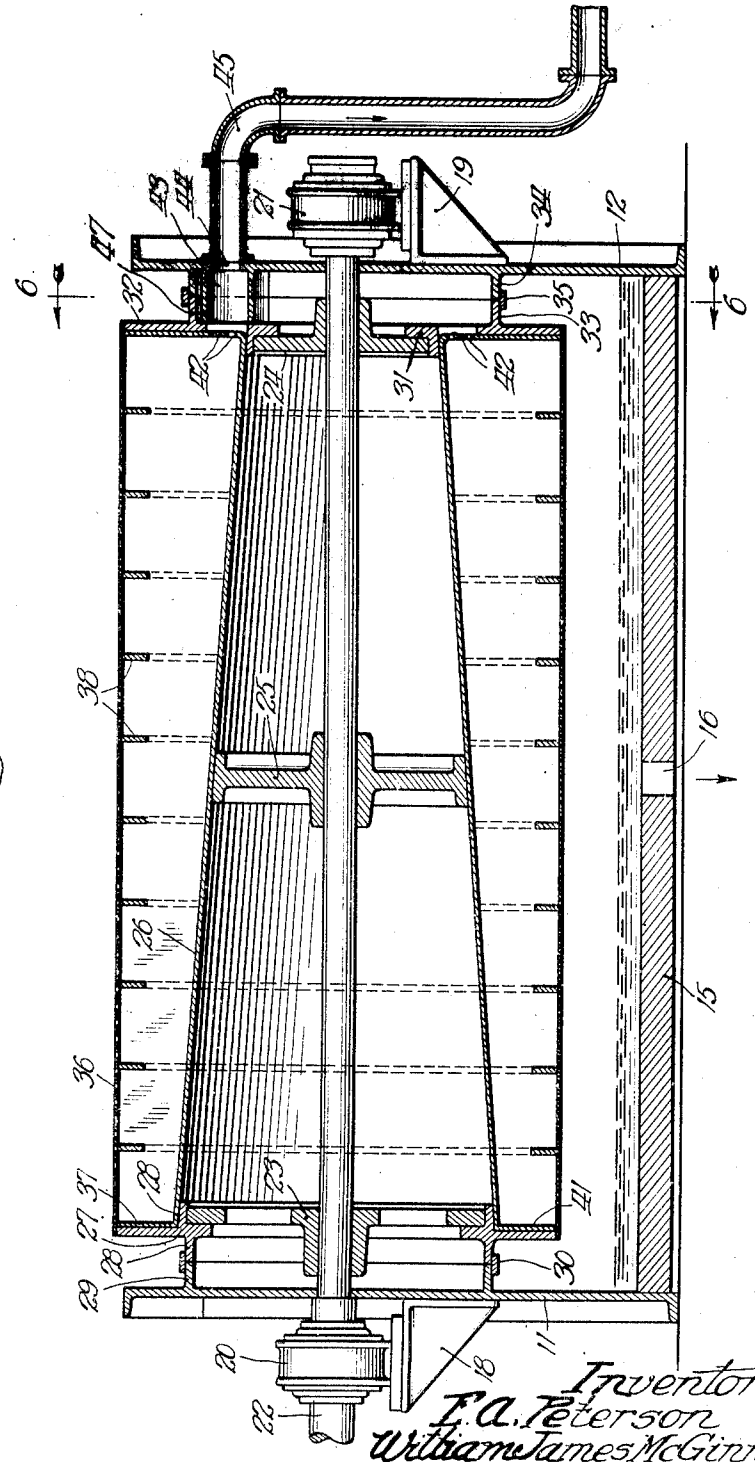

Fig. 3

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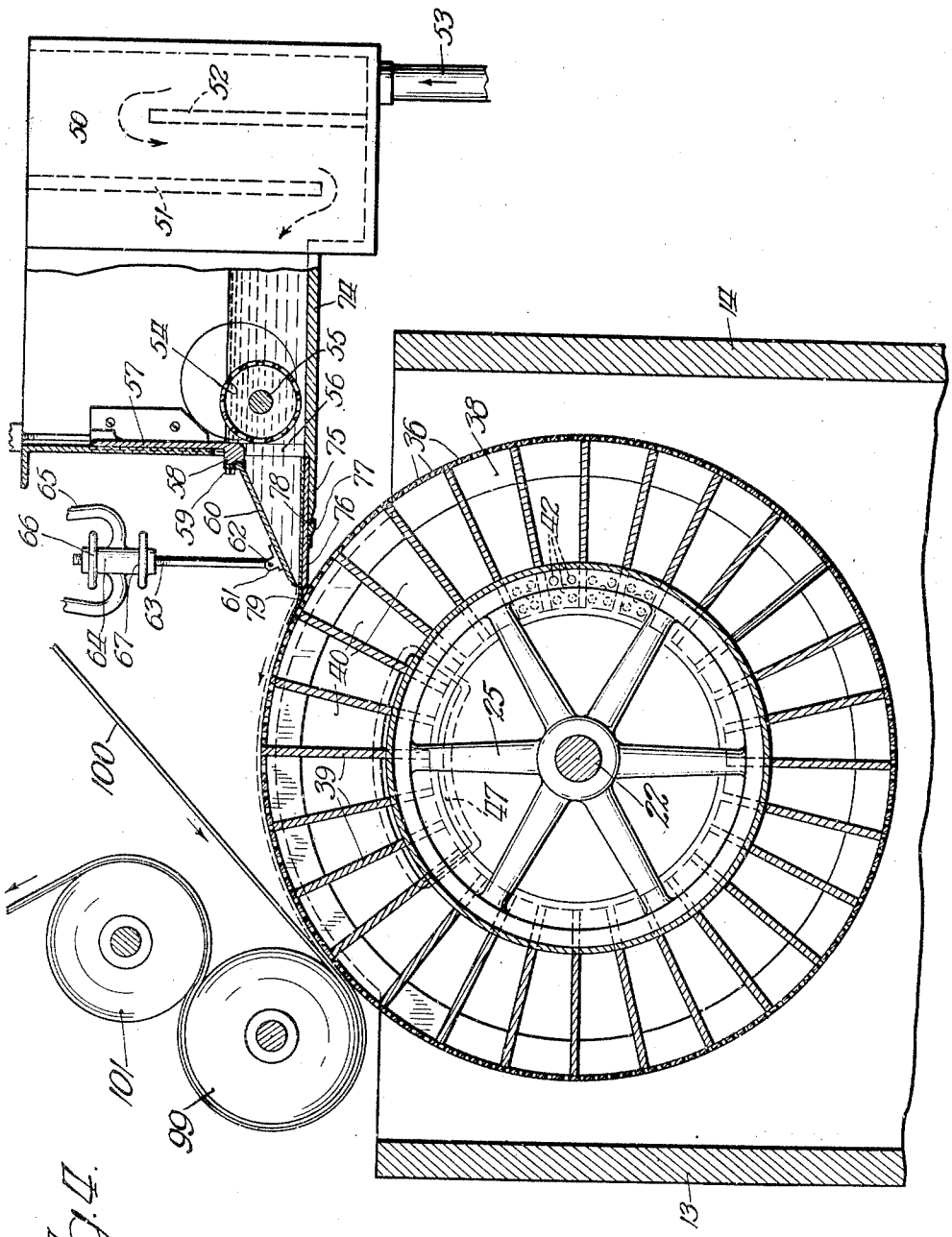

Fig. 4.

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Fig. 5.

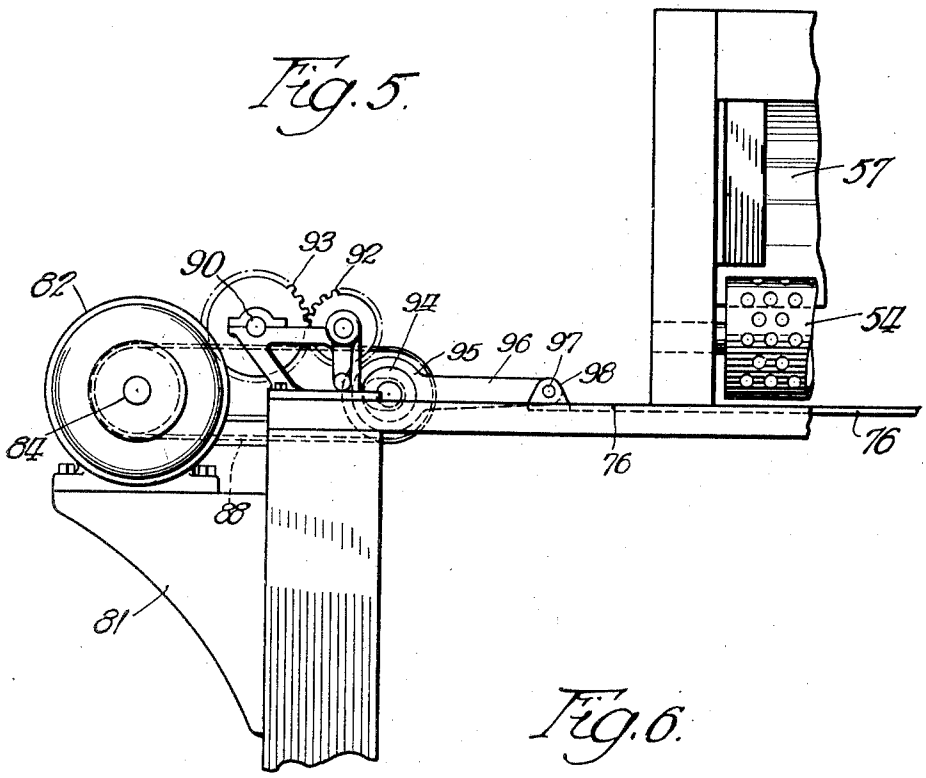
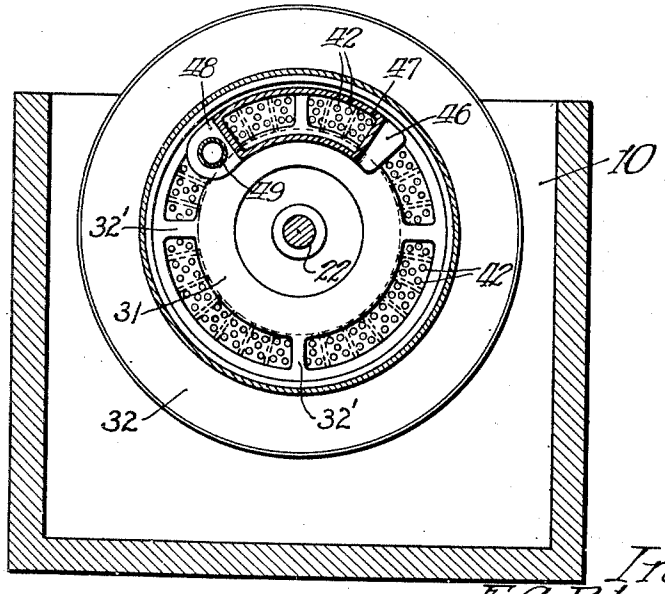


Fig. 6.



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1,856,081

UNITED STATES PATENT OFFICE

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CYLINDER PAPER MACHINE

Application filed April 18, 1927. Serial No. 184,474.

Our invention relates to improvements in paper-making machines of the cylinder type in which the paper is formed upon a revolving cylindrical screen. Heretofore, machines of the cylinder type have generally been of the immersed or wet vat type in which the paper stock fills the vat sufficiently to immerse the major part of the cylinder, leaving exposed only a relatively small zone at the top of the cylinder before the final draining of the paper is effected prior to its removal from under the couch roll.

The present invention contemplates in its preferred aspects, a machine of a somewhat different type in which the paper stock is directed upon the upper surface of the cylinder only, the remainder or lower part of the cylinder being preferably not subjected to the flow of stock. A machine of this type may be conveniently designated as a cylinder machine of the dry vat type.

Hence, the objects of the invention are to provide, in general, a cylinder paper machine of the dry vat type; to provide a machine in which the paper stock, while on the wire, is sufficiently agitated relative to the screen so as to secure a more perfect felting action of the fibers of the stock; to provide a construction which will facilitate the production of a paper web of great uniformity in thickness, not only in reference to points longitudinally of the web, but also with reference to different points across the web; to provide a machine of the class described in which the regulation of flow of stock to the screen may be effected rapidly, conveniently, and accurately; to provide a machine of the class described which is well adapted to cooperate with others of a series of such machines; to provide a construction which is relatively simple in design and economical to manufacture, and in general, to provide an efficient and improved machine of the character referred to.

Referring to the drawings which illustrate one application of the invention to a cylinder paper machine of the said dry vat type,

Fig. 1 is an end elevation of the machine.

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

Fig. 3 is a section taken on the line 3—3 of Fig. 1.

Fig. 4 is a section taken on the line 4—4 of Fig. 2.

Fig. 5 is a fragmentary elevation of a portion of the machine showing the vibratory mechanism, and

Fig. 6 is a section taken on the line 6—6 of Fig. 3.

Referring to the drawings, the numeral 10 represents the vat of the machine which, however, in this case serves principally to support the cylinder. The said vat 10, as well illustrated in Figs. 3 and 4, comprises a pair of rigid upstanding end frames 11 and 12 connected by longitudinally extending walls 13, 14, with a bottom or base wall 15. The base wall 15 is provided with a discharge opening 16 leading into a pipe 17 which takes care of the waste water from the cylinder.

On the outside faces of the end frames 11 and 12 there are suitably secured brackets 18 and 19 which support the pedestal bearings 20 and 21 in which the shaft 22 of the cylinder rotates. Said shaft 22 is driven by any usual source of power, not shown, it being understood that the speed of the shaft 22 may be regulated in accordance with the operating conditions. To the shaft 22 there are secured end spiders 23 and 24 and an intermediate spider 25, which spiders are of such diameter as to furnish rotating supports for a cone-shaped diaphragm member 26. To facilitate such connection, at the large end of the cone there is fitted a ring part 27 having flanges 28 and 29 fitting the periphery of the spider 23 and secured thereto. On the outer face of the ring element 27 there is a cylindric outwardly projecting flange 28 of the same diameter as, and fitting against a similar stationary flange 29 on the inside face of, the end frame 11, the slip joint between the ends of said flanges forming in effect a seal between the rotating and stationary elements. If desired, a slip ring 30 may be fitted over the joint so as to maintain the same in well fitting condition, even though there is a slight longitudinal movement of the cylinder causing a separation of the ends of the flanges 28 and 29.

At the smaller end of the cone, there is fitted a somewhat similar ring element 31 secured to the periphery of the spider 24 and having a radially extending, annular flange 32 which is connected to the ring element by means of webs such as 32'. The outer face of the flange 32 is formed with a cylindric outwardly projecting flange 33. The flange 33 rotates against the end of the flange 34, also similar in shape and formed as an integral part of the end frame 12. A similar sealing ring 35 is employed to make more positive the joint between the ends of said flanges 33 and 34.

The screen proper 36 which may be of the type usually employed in standard cylinder machines, is of a diameter considerably in excess of the diameter of the large end of the cone member 26, and at one end is supported by a radial flange 32 of the ring element 31, and at the other end by a similar radial flange 37 formed as an extension of the ring element 28. In order to insure that the screen 36 will maintain its truly cylindrical shape, it is preferred to support the same at intermediate points by annular rib elements 38, fitting within the screen and suitably spaced longitudinally thereof.

Referring now to Figs. 4 and 6, it will be seen that the space between the inner cone and the outer cylindrical screen 36 of the cylinder is divided longitudinally into compartments 40 by a series of radial and longitudinally extending partitions 39. Each of these compartments 40 is closed at its small end by a flange 41 secured to the flange 37 and at the large end each of the compartments is similarly partially closed by radial flange 32. However, at a point immediately above the small end of the cone 26, each of the compartments 40 is provided with a set of apertures or ports, 42.

It will be observed that the flange 33 on the right hand end of the cylinder (see Fig. 3), is of such inside diameter that the ring element 31 and its flange 32 may be machined off to form in effect a valve face having the openings 42 extending therethrough as valve ports.

On the inside face of the end frame 12, there is cast a suction chamber 43 communicating through an opening 44 with a suction line 45. The suction line 45 is connected to a suitable vacuum pump installation capable of maintaining a rarefication to suit the particular requirements. The vacuum chamber 43, as shown best in Figs. 1 and 6, is a segmental annulus of the proper dimensions and location to register with several of compartments simultaneously. The inside face of the end of the vacuum chamber 43 is machined off so as to form a running seal joint against the valve face through which extend the ports 42 of the cylinder. It will be observed that the vacuum chamber 43 is positioned at the top of the cylinder which is the place where the paper web is being formed. At one end of the vacuum chamber 43 there is formed an integral flange 46 which is faced off level with the inner end of the suction chamber so as to fit the valve face and thereby prevent loss of vacuum due to the fact that the compartments are wider than the thickness of the end wall 47 of the vacuum chamber. At the opposite end of the vacuum chamber there is a similar flange which, however, is made with a port 48 communicating with a pipe 49 extending through end frame 12 and which may be supplied with air at a pressure slightly exceeding that of the atmosphere. This port 48 and pipe 49 are for the purpose of freeing the web from the screen in the event that there is any tendency of same to stick thereto.

Having described the cylinder construction and arrangements for applying suction, there will now be described another important phase of the invention, which resides in the method and means for conducting the paper stock uniformly to the wire or screen. The arrangement which is preferred for this purpose is what may be termed the kinetic type. So far as known, this type of stock flow has never been employed successfully in connection with paper cylinder machines, although it is largely used on paper-making machines of the Fourdrinier type. Referring to Fig. 4, 50 is the head box provided with suitable baffles 51 and 52 and receiving stock through the pipe 53. In the front or delivery end of the flow box 50 there is a hollow, perforated distributor roll 54 mounted upon a horizontal shaft 55, which may be driven at suitable speed by any usual source of power. The distributor roll 54 is so located in the flow box 50 that the stock in passing through the throat or discharge opening 56 of the flow box, is compelled in large measure to pass through the perforations in the drum. Preferably, the depth of stock in the flow box is maintained at approximately the level of the top of the distributor roll or drum 54.

The throat 56 is capable of being regulated by a vertically slidable gate member 57, the lower end of which is made with an enlargement 58 extending all the way across the lower edge of the gate 57. The lower corner of the enlargement 58 is suitably machined and fitted with a correspondingly machined cap strap 59, so as to provide a bearing for a swingingly mounted regulator plate 60 inclined downwardly from the pivot, as shown. Near the lower edge of the regulator plate 60 there is secured a series of brackets or pivot blocks 61, each of which by means of a pin 62 is pivotally connected to the lower end of an adjustment rod 63, which adjustment rod 63 extends through the enlarged lower end 64 of a hanger 65 and is capable of adjustment therein by means of hand op-

erated lock nuts 66 and 67. The upper end of the hanger 65 is provided with a strap bearing (not shown) adapted to cooperate with a journal bearing (not shown) on a horizontally extending shaft 68. The shaft 68 is eccentrically mounted in cylindrical blocks 69, journaled in suitable bearings at each side of the machine and to one of the blocks 69 there is keyed a segmental worm gear 70, with which cooperates an axially fixed worm element 71 which is mounted on a vertical shaft 72 capable of being rotated in its bearings by a hand wheel 73. By means of the hand wheel 73, the eccentrically mounted shaft may be swung around so as to elevate or depress the entire series of adjusting rods 63 simultaneously. Whereas, if it is desired to adjust any portion of the plate 60 independently of other portions, such adjustment may be effected by means of the individual adjusting nuts 66 and 67. It will be understood that the plate 60 is sufficiently flexible to permit of such individual adjustment of various portions thereof.

The bottom wall 74 of the forward portion of the flow box is preferably made of metal and is extended in advance of the distributor roll a substantial distance, said extension 75 being machined as shown in Fig. 4, to constitute a bearing for the vibratory bottom plate 76. Said bottom shaker plate 76 is held in close fitting engagement with the bottom plate 75 of the flow box by means of an under-cut bar 77 secured to the lower face of the shaker plate 76, and cooperating with the reduced front edge 78 of the bottom plate 75. The top of the shaker plate 76 and the under side of the regulator plate 60 constitute, in effect, a tapered flow conduit extending all the way across the machine, the discharge opening between the outer ends of said plates determining the amount of stock which is discharged on to the screen. Said opening may be regulated as previously described. The flow of stock on to the screen, as it passes out of the opening between the orifice plates 60 and 76, is guided by a thin sheet rubber apron 79 which is secured to the upper surface of the shaker plate 76 and extends through the orifice and a short distance along the screen upon which it rests.

Although we have not illustrated anything in the nature of deckle straps, it may be desirable, in certain cases where a proper edge for the sheet is desired, to employ fixed or movable deckle straps or belts which can be fitted in any convenient manner so that the flow of stock does not spread out sidewise towards the edges of the cylinder.

In order to obtain a better felting of the stock fibers, a shaking movement is imparted to the apron 79 which, as before stated, is secured to and consequently moves with shaker plate 76. Said shaker mechanism is shown best in Figs. 1, 2 and 5. Referring to said figures, 80 represents a column or standard, the upper end of which carries a bracket 81 on which there is mounted an electric motor 82. Said electric motor 82 runs continuously and through a reducing mechanism 83 drives a shaft 84 at relatively low speed. Spaced from the shaft 84, there is also mounted in suitable bearings, a second horizontal shaft 85 and on said shafts 84 and 85 there are keyed a pair of coned pulleys 86 and 87 connected by a belt 88. The position of the belt 88 and the resulting speed of shaft 85 may be changed by a shift block 89 threadedly connected to a screw shaft 90. Said screw shaft 90 is mounted in suitable bearings, and when adjustment is desired, is actuated or rotated by a crank handle 91 which operates the shaft 90 through a pair of cooperating spur gears 92 and 93.

On one end of the shaft 85 there is keyed an eccentric 94 cooperating with an eccentric strap 95 on the end of a pitman 96. The pitman 96 is pivotally connected by means of a pin 97 to lugs 98 secured on the end of the shaker plate 76. By the above described mechanism, the shaker plate 76 may be given a vibratory movement in a longitudinal direction, i. e., transversely of the direction of stock flow, so that the apron carried by the shaker plate is correspondingly vibrated and effects the desired agitation of the stock as it flows upon the surface of the cylindrical screen.

The paper web is, of course, formed upon that portion of the screen which extends between the apron 79 and the couch roll 99, which may be of the usual form. It will be understood also, that the web is picked up by a felt 100 which extends around the couch roll 99 and passes between the couch roll and the first press roll 101. Subsequently the web is handled and dried in the usual manner, either singly or it may be combined with the webs of other similar machines to form paper or board of greater thickness.

It will be understood that in the operation of the machine, by reason of the compartment arrangement of the cylinder, and the segmental shape of the suction chamber, only that portion of the screen which is at that time carrying the stock or the partially formed web is subjected to suction, so that it is not necessary to employ an inordinate size of pump for producing the necessary suction effect. Obviously, since the cylinder surface is open to the atmosphere, except in the zone where it carries the web, the waste water which finds it way through the screen into the various compartments 40, will flow out of the compartments through the screen during the movement of the various compartments below the horizontal plane extending through the axis of the cylinder. As previously stated, such waste water is discharged through the pipe 17.

The described details of constructions and operation are illustrative of one application only of our invention, the scope of which may be determined by the following claims, said claims being construed as broadly as possible consistent with the state of the art.

We claim as our invention:

1. In a cylinder paper machine, the combination of a cylindrical forming screen, flow means for directing upon an upper portion of the screen a defined flow of paper stock in a stream substantially tangential to the periphery of the cylinder, web removing means, and means for rotating the cylinder in a direction to carry the flow of stock upwardly on the cylinder and towards the web removing means.

2. In a cylinder paper machine of the dry vat type, the combination of a cylindrical forming screen, means for rotating said screen on a horizontal axis, flow means for directing a defined stream of paper stock upon said screen in a direction substantially tangential to the periphery of the cylinder and in the direction of rotation of said cylinder, and web removing means spaced from said flow means.

3. In a cylinder paper machine of the dry vat type, the combination of a cylindrical forming screen, means for rotating said screen on a horizontal axis, flow means for directing a defined stream of paper stock upon said screen in a direction substantially tangential to the periphery of the cylinder and in the direction of rotation of said cylinder, web removing means spaced from said flow means, and means for applying suction to the inner surface of said screen located between the flow means and the web removing means.

4. In a cylinder paper machine of the dry vat type, the combination of a cylindrical forming screen, means for rotating said screen on a horizontal axis, flow means for directing a defined stream of paper stock upon said screen in a direction substantially tangential to the periphery of the cylinder and in the direction of rotation of said cylinder, web removing means spaced from said flow means, and means for effecting relative movement of said screen and flow means to facilitate felting of the fibers.

5. In a cylinder paper machine of the dry vat type, the combination of a cylindrical forming screen, means for rotating said screen on a horizontal axis, flow means for directing a defined stream of paper stock upon said screen in a direction substantially tangential to the periphery of the cylinder and in the direction of rotation of said cylinder, web removing means spaced from said flow means, means for effecting relative movement of said screen and flow means to facilitate felting of the fibers, said last mentioned means comprising an apron for supporting the flow of stock, and means for reciprocating said apron.

6. In a cylinder paper machine of the dry vat type, the combination of a cylindrical forming screen, means for rotating said screen on a horizontal axis, means for directing a relatively shallow, flowing stream of paper stock substantially tangentially onto a portion of said cylindrical screen, means for draining part of the water from said stream so as to form a layer of coherent paper stock on the cylinder, and means for removing said layer from said cylinder.

7. In a cylinder paper machine of the dry vat type, the combination of a cylindrical forming screen, means for rotating said screen on a horizontal axis, means for directing a relatively shallow, flowing stream of paper stock substantially tangentially onto a portion of said cylindrical screen, means for adjusting the depth of said stream, means for draining part of the water from said stream so as to form a layer of coherent paper stock on the cylinder, and means for removing said layer from said cylinder.

8. In a cylinder paper machine of the dry vat type, the combination of a cylindrical forming screen, means for rotating said screen on a horizontal axis, flow means for directing a defined stream of paper stock upon said screen in a direction substantially tangential to the periphery of the cylinder and in the direction of rotation of said cylinder, web removing means spaced from said flow means, means located between said flow means and said web removing means for applying suction to the inner surface of said screen, and means for applying fluid pressure to the inside of a part of said screen to facilitate removal of said web by said web removing means.

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