March 14, 1944. E. E. BERRY ET AL 2,344,281

STOCK FEED FOR PAPER MAKING MACHINES

Filed Jan. 20, 1939 8 Sheets-Sheet 1

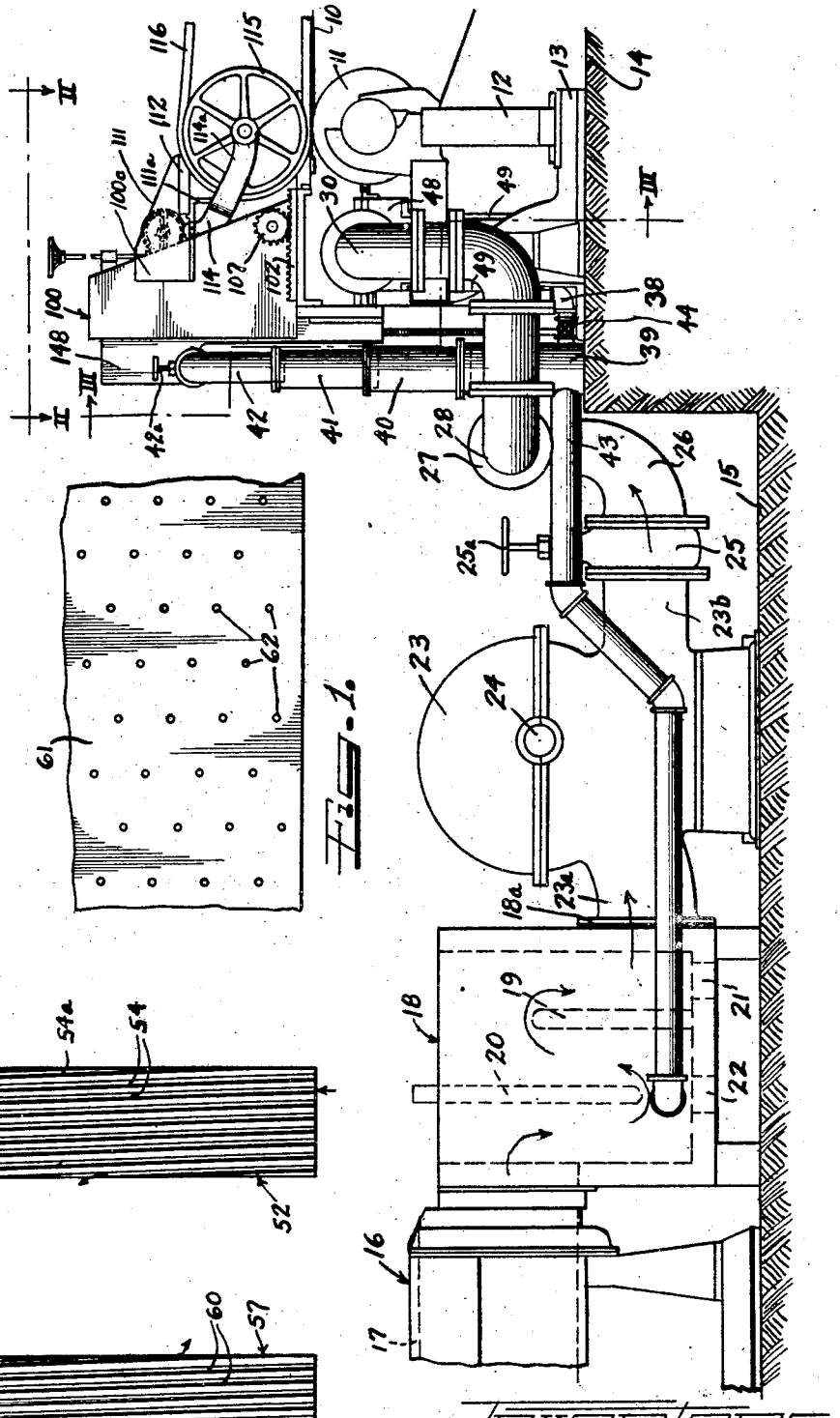

Fig. 9.

Fig. 1.

Fig. 10.

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STOCK FEED FOR PAPER MAKING MACHINES

Filed Jan. 20, 1939 8 Sheets-Sheet 2

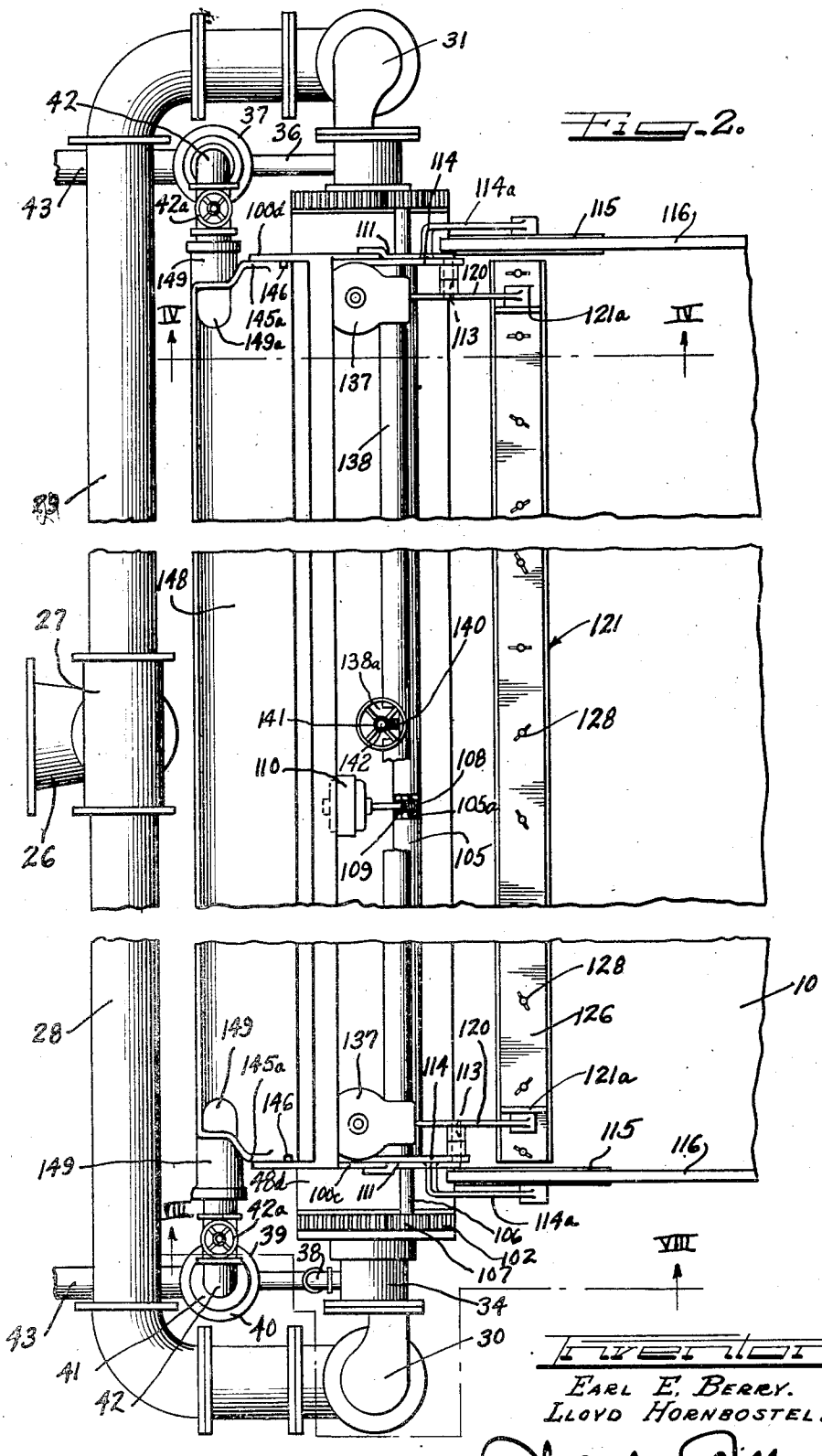

Fig. 2.

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STOCK FEED FOR PAPER MAKING MACHINES

Filed Jan. 20, 1939 8 Sheets-Sheet 3

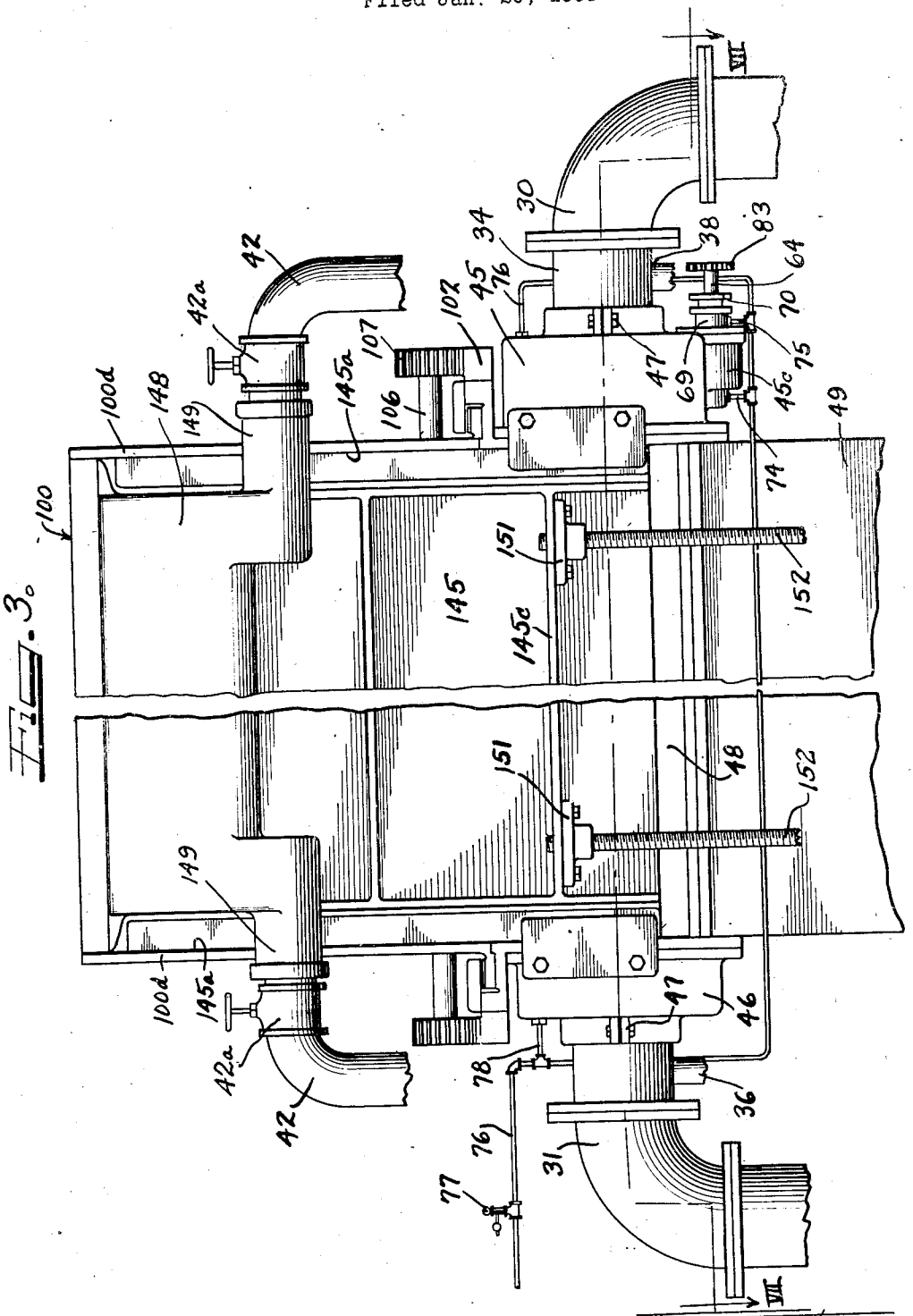

Fig. 3.

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STOCK FEED FOR PAPER MAKING MACHINES

Filed Jan. 20, 1939 8 Sheets-Sheet 4

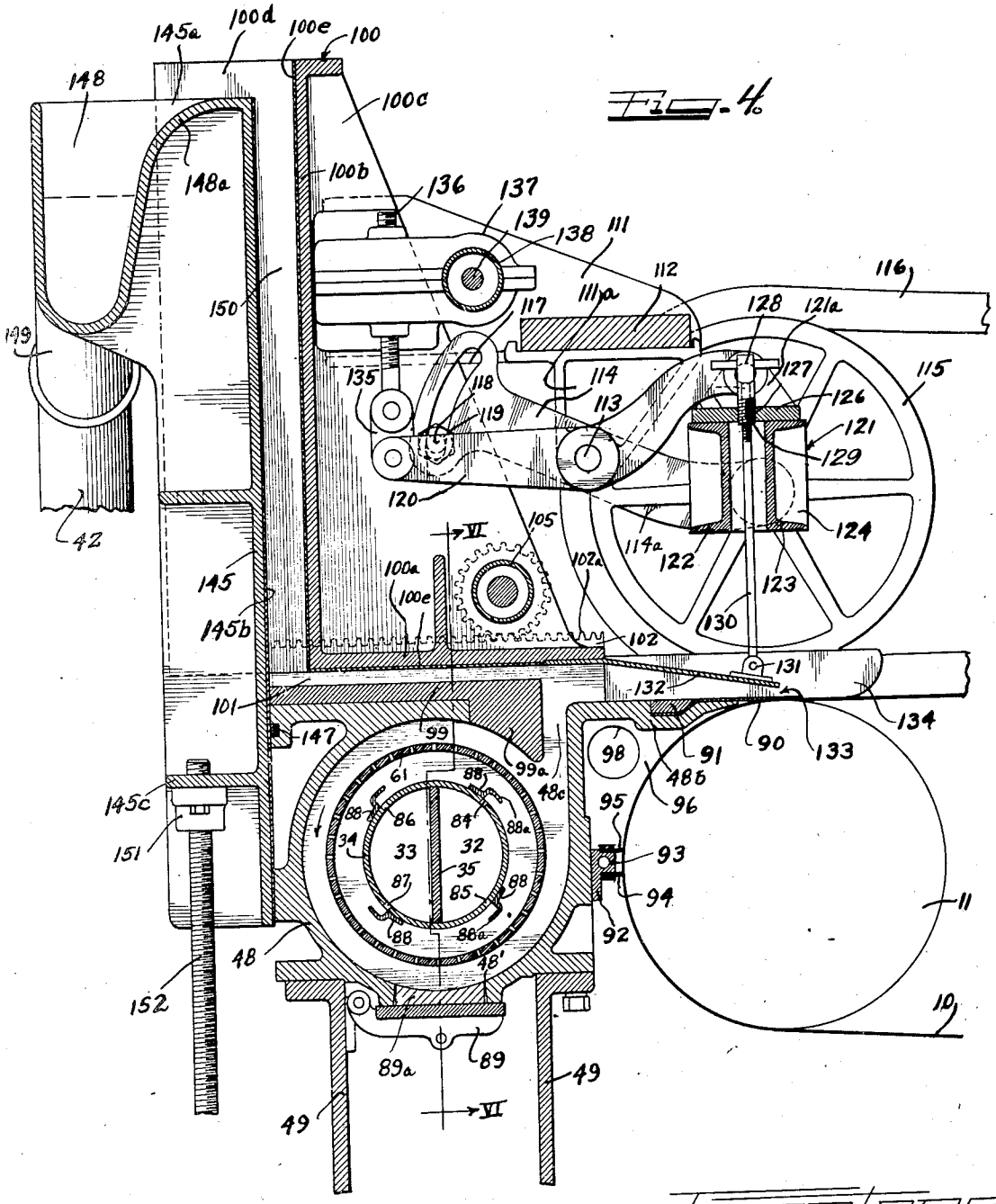

Fig. 4.

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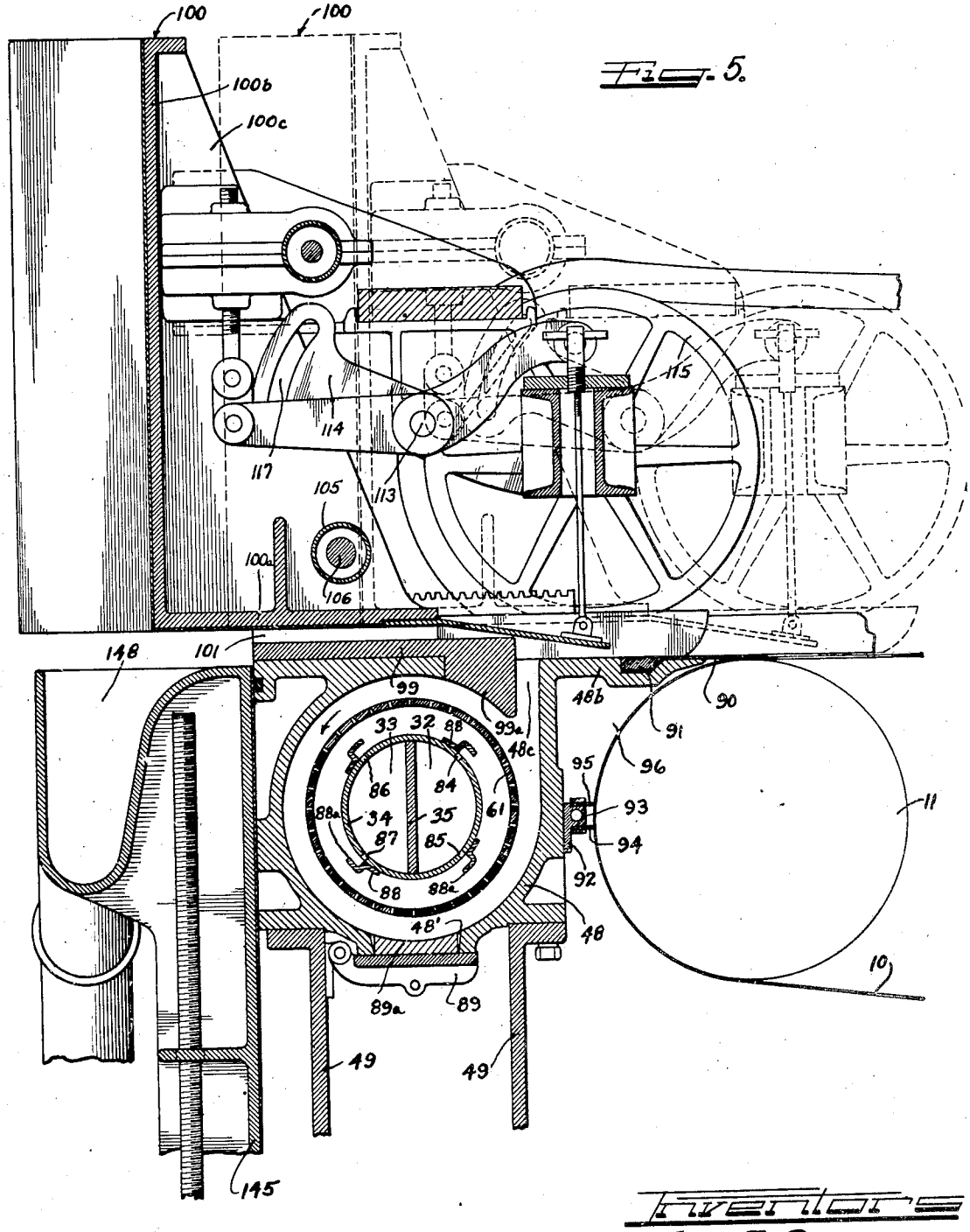
STOCK FEED FOR PAPER MAKING MACHINES

Filed Jan. 20, 1939 8 Sheets-Sheet 5

Fig. 5.



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STOCK FEED FOR PAPER MAKING MACHINES

Filed Jan. 20, 1939 8 Sheets-Sheet 6

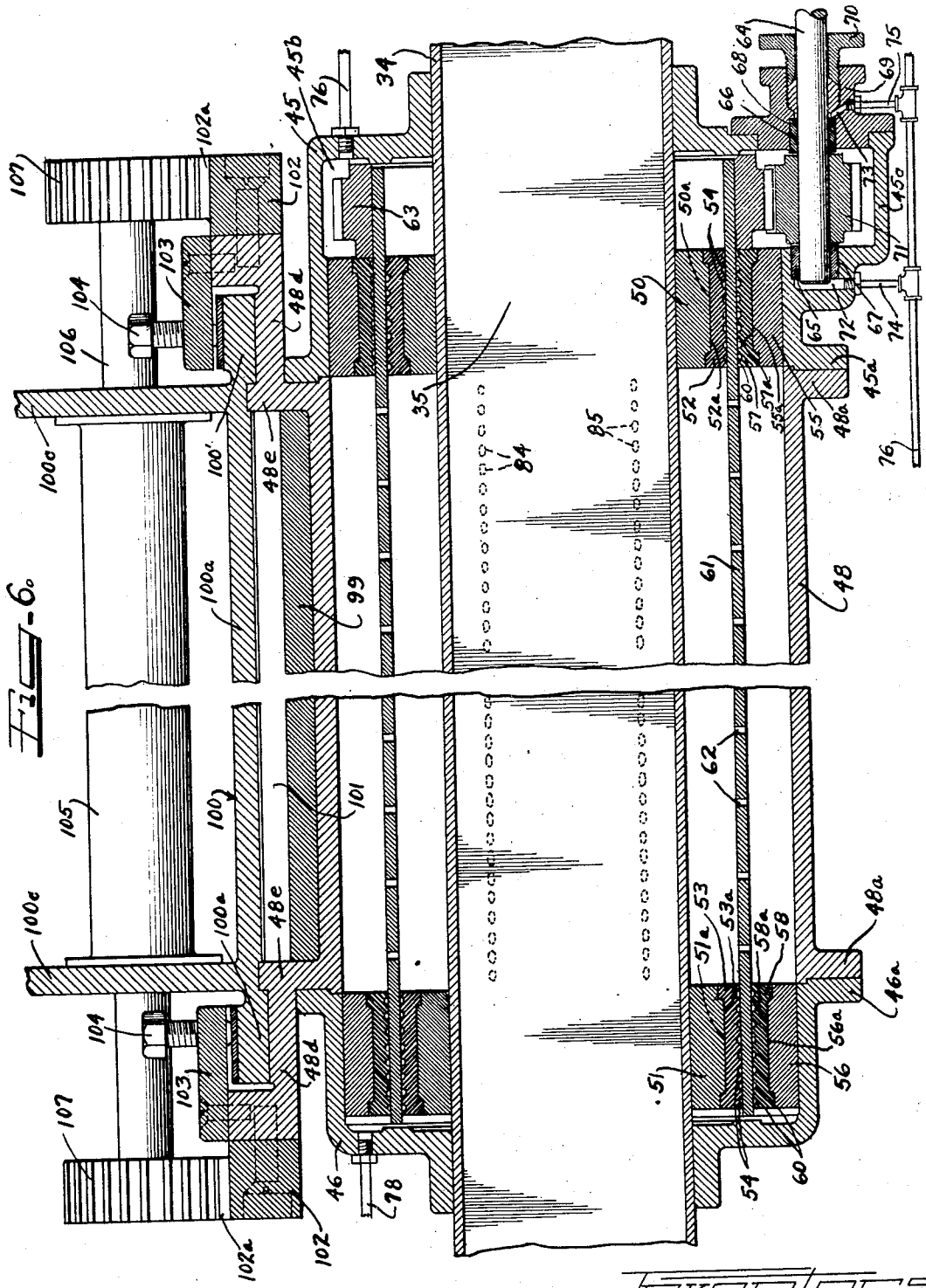

Fig. 6.

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STOCK FEED FOR PAPER MAKING MACHINES

Filed Jan. 20, 1939 8 Sheets-Sheet 7

Fig. 7.

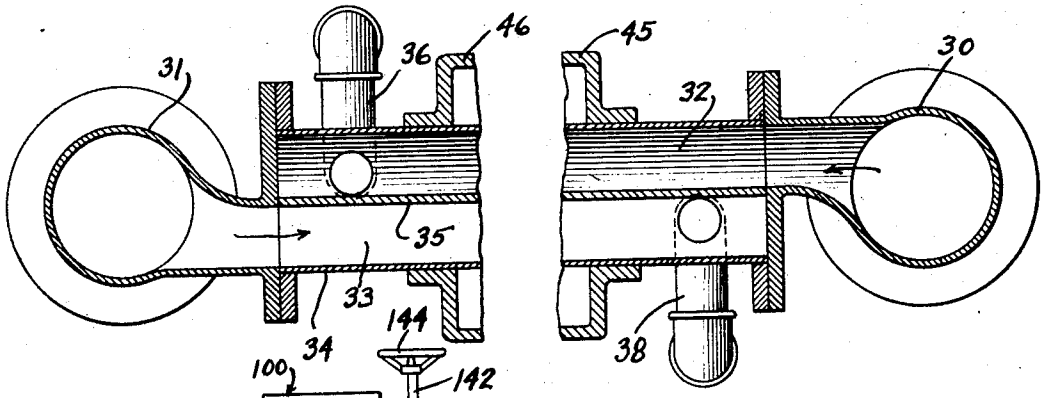
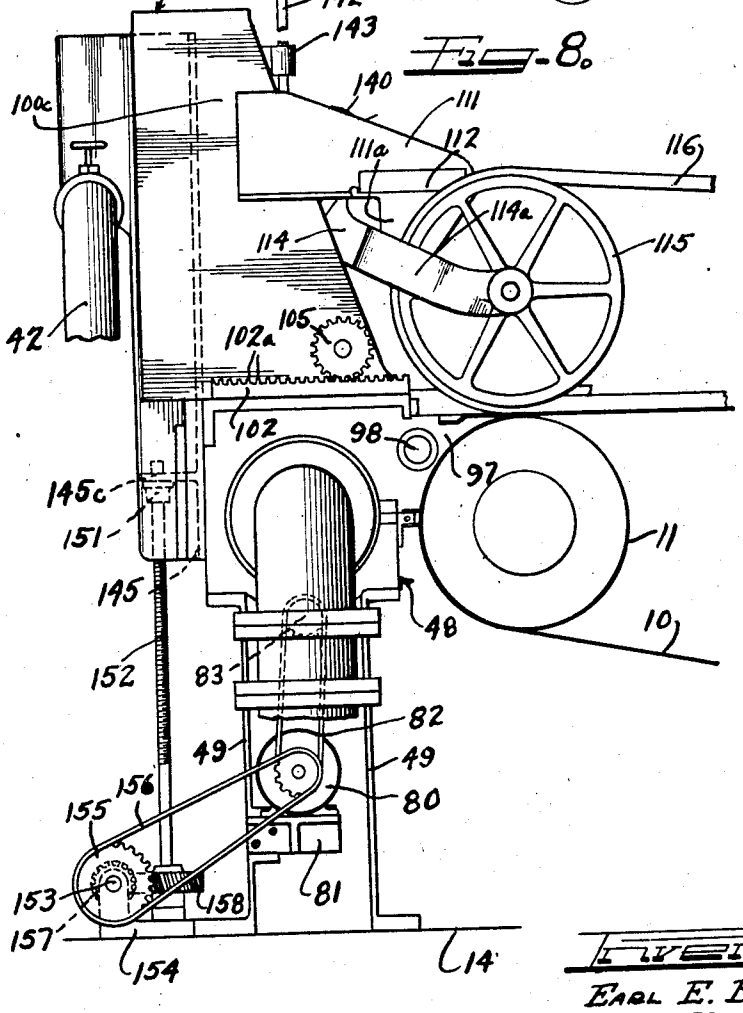


Fig. 8.



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STOCK FEED FOR PAPER MAKING MACHINES

Filed Jan. 20, 1939 8 Sheets-Sheet 8

Fig. 11.

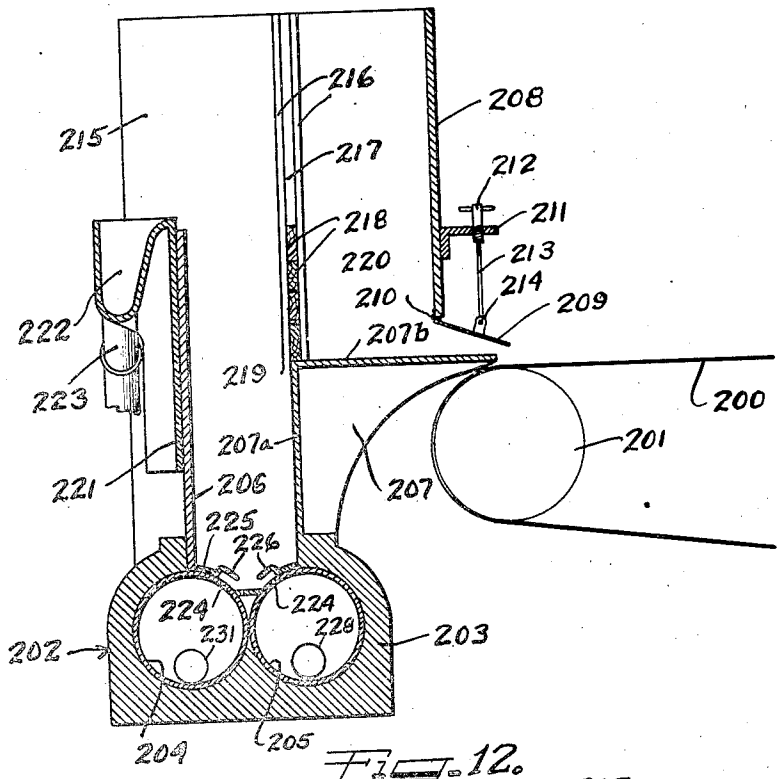
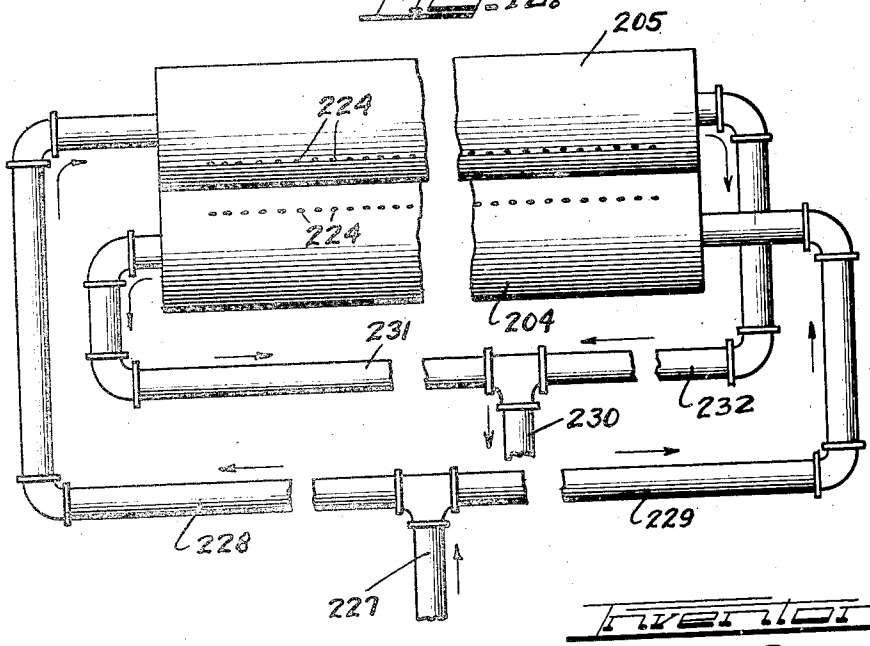


Fig. 12.



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Patented Mar. 14, 1944 2,344,281

UNITED STATES PATENT OFFICE

2,344,281

STOCK FEED FOR PAPERMAKING MACHINES

Earl E. Berry and Lloyd Hornbostel, Beloit, Wis., assignors to Beloit Iron Works, Beloit, Wis., a corporation of Wisconsin

Application January 20, 1939, Serial No. 251,887

27 Claims. (Cl. 92—44)

This invention relates to the feeding of stock onto a web forming surface.

More specifically this invention relates to a method of and apparatus for flowing paper stock from the usual pulp screen or other pulp furnishing equipment onto a web forming surface in such a way that the fibers of the stock are in a completely dispersed condition.

While the invention will hereinafter be specifically described as applied to a Fourdrinier type paper making machine, it should be understood that the principles of this invention are adapted for use on other types of web-forming apparatus including cylinder type paper making machines.

In the manufacture of paper, the paper pulp or stock is sometimes screened prior to its passage to the forming surface for the purpose of removing foreign ingredients, fiber bundles, etc. Usually several rotary type screens are required to supply a single paper making machine.

In order to uniformly mix the streams of screened stock from the screens, when screens are used ahead of the forming wire or in order to provide a fairly uniform flow of stock to the inlet or slice of the paper making machine it is necessary to accumulate a pond of stock in a head box. The stock is then flowed from this head box thru the inlet or slice onto a traveling forming wire.

It is known that screened stock issuing from screens has the fibers in a fairly well dispersed condition and therefore has the milky appearance of a uniform suspension. However, when this stream of stock is slowed up in a conventional head box, the uniform milky appearance of the stock disappears and a mass of curds are formed, giving the stock an appearance of sour milk. This fact can be readily observed by a comparison of the appearance of the stock issuing from a screen with the appearance of the stock in the heretofore known head boxes.

The curdling effect is due to flocculation of fibers in the stock suspension. This flocculation is probably caused by electrical charges, or effects of charges, produced in the fibers by the beaters and pumps. These electrical charges in the fibers cause attraction between the fibers thereby quickly building up bundles of fibers in the suspension as soon as the flow of stock is slowed up sufficiently to take care of proper distribution of stock across the machine with a conventional head box.

It has heretofore been the practice to transport the stock from the pulp supplying equipment or screens to the forming wire by flowing the same as smoothly as possible. The pipes and head boxes were therefore designed to prevent agitation of the flowing stock.

We have found that this smooth flow and the necessary slow flowing speeds promotes and makes possible the undesired fiber flocculation.

We now radically depart from the prior practices and actually effect a turbulence in the stock suspension immediately before it is deposited on the forming surface. The desired turbulence can be effected by spouting the stock under pressure through submerged orifices placed in the stock stream at a point adjacent to the forming surface.

The present invention breaks up fiber flocculation that may have occurred in the stock and makes possible the feeding of a stock with uniform fiber suspension across the entire width of the web-forming surface. The apparatus of this invention will disperse the fibers in a stock to a greater extent than the dispersion obtained in the screens.

According to this invention, the stock from the screens or other stock furnishing equipment is maintained in a continually flowing condition at a speed that is above the point where fiber flocculation can occur. Speeds in excess of 2 feet per second are desirable but the exact speed depends upon the consistency of the stock. The invention provides for the feeding of constant amounts of stock adjacent to the forming surface of the paper machine and for the directing of only the desired amount of stock onto the forming surface while the excess stock is recirculated. The stock flow onto the forming surface and the recirculation of the stock can be exactly controlled from a point adjacent the forming surface.

The invention also makes possible the use of concentrated paper stock when heretofore the stock fed to the forming surface of the paper machine had to be quite dilute to space the fibers in suspension. Thus large volumes of liquid such as water were used in an attempt to offset fiber flocculation, the theory being that less fibers per cubic inch of stock suspension meant less bunching of fibers because the same had to travel toward each other for greater distances before a bunch or bundle of fibers could form. This meant that large volumes of water had to be eliminated during the course of the web formation. However, since the high velocity flow and the turbulence effected in the stock by this invention eliminates undesired flocculation, the water content of the stock may be cut down substantially.

The concentration of the stock fed to the forming surface speeds up and lowers the cost of web production since less water is handled.

A feature of the invention includes the provision of a transverse conduit adjacent the forming surface of the paper machine having a row of equally spaced holes or orifices therethrough along the length thereof and receiving stock under pressure therein. The conduit is divided into two passages and the stock is fed into these passages from opposite ends for the purpose of obtaining a uniform distribution of stock across the machine.

The principle of operation is as follows:

As the stock flows across the machine through the passageway in the conduit, it issues from holes disposed along its length. The rate of flow from these holes might vary across the machine due to the change in the velocity of the stock flowing through the passage.

Thus by causing stock to be fed in the opposite direction through a similar passage, parallel and closely adjacent to the first, the variations in the rate of flow of stock from holes along its length will be opposite to the variations of the first. The result of the combination in a uniform rate of flow of stock across the entire machine.

The stock under pressure in the conduit is ejected through the holes into a rotating perforated cylinder or reticular drum surrounding the conduit. The stock is then ejected under pressure through the perforations of the rotating cylinder or drum into a housing surrounding the cylinder and provided with a discharge port that is coextensive in length with the width of the forming surface of the paper machine and above the top of the cylinder so that the orifices or holes in the conduit and cylinder will be submerged in stock. The stock issuing from this port can be flowed onto the forming surface of the paper machine while any excess stock can be recirculated back through the conduit.

In this manner, the stock can be maintained in a flowing condition at a speed above the point where fiber flocculation can occur, from the time it leaves the screen or other stock preparing equipment right up to the time when it is deposited on the forming surface. Before reaching the forming surface, the stock has been ejected under pressure thru two sets of holes or orifices in series that set up a turbulent action which keeps the fibers in the stock in a dispersed condition of suspension.

The invention thus makes possible the production of paper free from cloud-like formations caused by fiber flocculation.

It is, then, an object of this invention to uniformly distribute a uniform suspension of solids in liquid media onto a web-forming surface for the solids.

A further object of the invention is to eliminate fiber flocculation in the feeding of stock suspensions onto the forming surfaces of paper making machines.

Another object of the invention is to provide a feeding apparatus for paper making machines capable of maintaining the stock fibers in a completely dispersed condition right up to the time of their deposition on the forming wire of the machine.

Another object of this invention is to provide a stock feeding apparatus for a paper making machine capable of taking a stock in which the fibers are already in a bunched or flocculated condition and disperse the fibers and uniformly distribute this stock in its fiber-dispersed condition to the forming surface of the paper machine.

A specific object of this invention is to positively pump screened paper stock through a perforate conduit located adjacent the forming wire of a paper machine at a speed in excess of the speed where fiber flocculation can occur and to recirculate through the pump excess stock from said conduit.

Another specific object of the invention is to provide a stock-distributing device for a Fourdrinier type paper making machine at a point immediately ahead of the breast roll end of said machine and to flow stock issuing from the conduit in any desired amount onto the forming wire while returning excess stock to the conduit.

Another object of the invention is to provide an apparatus for uniformly mixing screened suspensions of fibers without slowing up the speed of travel of the stream and for feeding the uniformly mixed stock at high velocity into a passageway immediately adjacent the forming surface of the machine for deposition of stock onto said forming surface in any desired amount while returning excess stock to the mixing device.

Other and further objects of the invention will become apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings which disclose preferred embodiments of this invention.

On the drawings:

Figure 1 is a side elevational assembly view of a preferred form of apparatus according to this invention.

Figure 2 is a broken top plan view looking down from the line II—II of Figure 1.

Figure 3 is a rear elevational view of part of the apparatus of Figure 1 taken along the line III—III of Figure 1.

Figure 4 is a fragmentary vertical cross-sectional view, with parts in elevation, taken along the line IV—IV of Figure 2.

Figure 5 is a view similar to Figure 4, but illustrating, in solid lines, adjusted positions for parts of the structure.

Figure 6 is a vertical cross-sectional view taken along the line VI—VI of Figure 4.

Figure 7 is a horizontal cross-sectional view, with parts broken away, taken along the line VII—VII of Figure 3.

Figure 8 is a side elevational view taken along the line VIII—VIII of Figure 2.

Figure 9 is a fragmentary development of a rotary cylinder forming part of the apparatus of this invention.

Figure 10 is a development of the end seals for the rotary cylinder.

Figure 11 is a vertical cross-sectional view, with parts in elevation, of a modified form of feed device according to this invention.

Figure 12 is a fragmentary plan view of the stock conduits shown in Figure 11 and illustrating the pipe connections to these conduits.

As shown on the drawings:

In Figure 1 the reference numeral 10 designates the forming wire of a Fourdrinier type paper making machine. As shown, the wire 10 is trained over the usual breast roll 11 which is mounted on shake springs such as 12 extending from a supporting base 13. The base 13 is mounted on a floor 14.

A portion of the apparatus of this invention is mounted on a floor 15 adjacent to the breast roll end of the paper machine. The floor 15 is at a lower level than the floor 14.

The stock screens, such as the screen 16, are mounted on the floor 15. Each screen 16 has a rotating screen member such as 17. The screened pulp flows out of the center of the rotary screen 17 into a flow box 18. The flow box 18 has a vertical baffle 19 extending from the base thereof into spaced relation from the top thereof and a second vertical baffle 20 extending from the top of the flow box into spaced relation from the bottom. The baffle 20 can be adjusted vertically to vary its spaced relation from the bottom of the flow box. Drain ports 21 and 22 are provided in the bottom of the flow box.

The flow box 18 has an outlet port 18a near the bottom of its front wall. The outlet port 18a is in front of the baffle 19.

A pump 23 is mounted in front of the flow box 18 and has an inlet 23a communicating with the flow box through the port 18a. The pump 23 is preferably of the centrifugal type having the impeller supported on axles or trunnions such as 24.

The pump 23 has an outlet 23b communicating with a gate valve 25 controlled by a hand wheel 25a.

The discharge side of the valve 25 receives an L 26 which is connected to a T fitting 27 at a level above the floor 14. The T fitting also receives transverse branch pipes 28 and 29 as best shown in Figure 2.

The outer ends of the branch pipes 28 and 29 are connected through elbows and pipe sections with pipe couplings 30 and 31 respectively. The couplings 30 and 31 communicate with passages 32 and 33 respectively formed in a conduit 34 by a longitudinal dividing wall 35 (Figure 7).

The conduit 34 is mounted in spaced parallel relation behind the breast roll 11.

As shown in Figure 7, the end of the passage 32 opposite the coupling 30 has a recirculating pipe 36 communicating therewith at the bottom thereof. Likewise the end of the passage 33 opposite the coupling 31 has a recirculating pipe 38 communicating therewith.

As shown in Figure 2, the recirculating pipe 36 discharges into a vertical standpipe 37 while the recirculating pipe 38 discharges into a vertical standpipe 39. As best shown in Figure 1, each standpipe such as the standpipe 39 is mounted on the floor 14 and is adapted to receive therein a plurality of telescoping pipes 40, 41 and 42. These pipes 40 to 42 are of decreasing diameters and are adapted to be nested together. The top pipes 42 have valves 42a therein.

As also shown in Figure 1, each standpipe such as 39 communicates with a pipe line 43 leading back to the flow box 18. Valves such as 44 can be provided in each recirculating pipe 36 and 38 as shown in Figure 1. As shown in Figure 2 a pipe line 43 communicates with each standpipe 37 and 39.

As shown in Figures 3, 6 and 7, the conduit 34 carries split caps 45 and 46 therearound between the pipes 36 and 38. As best shown in Figure 3, the split caps 45 and 46 are tightly clamped around the conduit 34 by means of clamp bolts 47.

The caps 45 and 46 have annular flanges 45a and 46a secured to annular end flanges 48a of a housing member 48, as best shown in Figure 6. The housing member 48, as shown in Figures 1, 3, 4 and 5, is supported from the floor 14 on frames 49.

As best shown in Figure 6, collars 50 and 51 are tightly disposed around the conduit 34 inside of the caps 45 and 46 respectively. These collars 50 and 51 have extended central portions 50a and 51a respectively on their outer peripheries.

Rings 52 and 53 of Micarta, hard rubber or other water lubricating bearing material are disposed around the collars 50 and 51 respectively. These rings 52 and 53 have recesses 52a and 53a on their inner peripheries receiving the extended portions 50a and 51a respectively of the collars 50 and 51. The outer peripheries of the rings 52 and 53 have threaded grooves 54 cut therein for feeding a lubricant along the surface of the bearings as will be more fully hereinafter described.

Collars 55 and 56 are clamped by the caps 45 and 46 respectively in alignment with the collars 50 and 51. These collars 55 and 56 have extended central portions 55a and 56a respectively.

Rings 57 and 58 of Micarta, hard rubber or other water lubricating bearing material are seated inside of the collars 55 and 56 and have recesses 57a and 58a respectively receiving the extended portions 55a and 56a of the collars.

The inner peripheries of the rings 57 and 58 are provided with threaded grooves 60 for lubrication purposes to be more fully hereinafter described.

A cylinder 61 is placed over the conduit 34 and is carried in spaced relation therefrom by the bearing rings 52, 53, 57 and 58. The cylinder 61 extends into close relation with the end caps 45 and 46 and is perforated as at 62 throughout that portion of its length that is intermediate the pairs of bearing rings.

As best shown in Figure 9, the cylinder 61 has the holes 62 therein developed on a spiral.

It will be noted from Figure 6 that the end cap 45 is deeper than the cap 46 and provides a sealed space 45b between the walls thereof and the bearing rings. A ring gear 63 is attached to the end of the cylinder 61 extending into this space 45b.

The cap 45 has a housing portion 45c thereon receiving a drive shaft 64 therethrough. This drive shaft 64 is rotatably carried on bearings 65 and 66. These bearings can be made of Micarta or other water lubricating bearing material and may be provided with the same type of grooves described in connection with the bearing rings for the cylinder 61. The bearing 65 is seated in a socket 67 formed in the housing 45c while the bearing 66 is seated in a socket 68 formed in a housing or boss 69 closing the housing 45c. A threaded packing member 70 is threaded into the boss 69 for sealing the shaft 64.

A pinion 71 is mounted in the housing 45c and is mounted on shaft 64. This pinion 71 meshes with the ring gear 63 to drive the cylinder 61 around the conduit 34.

Lubricant passages 72 and 73 are formed in the housing 45c and cover 69 for the housing for joining the outer edges of the bearings 65 and 66 with pipes 74 and 75 respectively. These pipes 74 and 75 communicate with a water lubricant supply line 76.

As best shown in Figure 3, the water lubricant supply line 76 has a pressure reducing valve 77 therein adapted to be set to deliver water lubricant under a desired pressure to various parts of the apparatus as will be hereinafter described. The supply line 76 can be connected with a source of water under pressure.

A branch pipe 78 extends from the supply line 76 through the end cap 46. The other end of the supply line 76 extends through the other end cap 45.

As best shown in Figure 6, water lubricant is

supplied through the pipes 74, 75, 76 and 78 to the outer ends of each bearing ring. This fluid is introduced against the outer ends of the bearing rings at pressures greater than that existing in the space between the cylinder 61 and the conduit 34, so that there will be an inward flow of lubricant such as water, into this space.

As shown in Figure 10, the bearing rings such as 52 and 57 have the grooves 54 and 60 cut therein on a helical or screw-thread contour so that the lubricant at the outer edges of the bearings enters the outer grooves such as 54a and 60a and works its way in a helical path across the entire bearing surface of the ring into the housing 48, and into the space between the cylinder 61 and the conduit 34. There is thus a constant trickle of lubricant through the bearings to lubricate the shaft 64 and the cylinder 61.

As shown in Figure 8, an electric motor 80 is carried on a bracket 81 from one of the supporting frames 49. This motor 80 drives a chain 82 trained around a gear 83. As shown in Figure 3, the gear 83 is mounted on the end of the shaft 64. In this manner the cylinder 61 is rotated around the conduit 34 inside of a cylindrical housing 48.

As best shown in Figures 4, 5 and 6, the conduit 34 has two rows of holes 84 and 85 therethrough communicating with the passage 32 in the conduit. The rows of holes 84 and 85, as shown in Figure 6, extend only along that portion of the conduit 34 that is between the rings 50 and 51.

A similar pair of rows of holes 86 and 87 are formed in the conduit 34 communicating with the passage 33 therein.

Deflectors 88 (Figures 4 and 5) are secured to the outer periphery of the conduit 34 and have lip portions 88a extending in spaced relation over each row of holes 84 to 87.

The bottom of the housing 48 has a plurality of circular openings such as 48' therein closed by hinged covers such as 89 pivoted to one of the supporting frames 49. The hinged covers such as 89 are shaped as at 89a with concave faces which continue the same cylindrical contour as the inside of the housing 48.

The housing 48 has a forwardly extending horizontal apron board 48b on the front wall thereof. This apron board 48b carries an apron 90 which extends over the wire 10 on top of the breast roll 11. The apron 90 is attached at its rear end to the apron board 48b by means of an apron clamp 91 forcing the rear end of the apron into a groove formed in the top of the apron board.

The front wall of the housing 48 has a block 92 mounted thereon and defining a plurality of water nozzles such as 93 facing the breast roll 11. Seals 94 and 95 are carried by the block 92 and are adjusted to just clear the wire 10 on the breast roll 11. Water is forced out of the nozzles 93 between the seals 94 and 95, forming a water seal between the outside and a triangular chamber 96.

This chamber 96 is formed by the apron board 48b, the front wall of the housing, the seal 95 and the breast roll. This chamber is closed at its ends by means of end plates 97 for the housing 48 (Figure 8).

In order to prevent air and water entrained in the wire 10 from being drawn up into the web of paper formed on the top run of the wire, this closed chamber 96 is partially evacuated through a suction outlet 98 communicating through one of the side plates 97. Thus any water or air entrained in the meshes of the wire 10 is drawn out of the meshes by the reduced pressure existing in the space 96.

An opening 48c is provided along the length of the housing 48 at the forward top portion thereof. A cover member 99 preferably formed of stainless steel or other non-corroding alloy is disposed on the top of the housing and has a head portion 99a seated in the opening 48c of the housing. This head portion 99a has an arcuate bottom face continuing the cylindrical contour of the housing. The narrow opening 48c thus provided between the head 99a and the front wall of the housing 48 extends along the full length of the housing. The length of the opening 48c is slightly less than the width of the wire 10.

As best shown in Figure 6, the housing 48 has horizontal flanges 48d extending from the top portion thereof over the end caps 45 and 46. These flanges 48d are formed along the top of the housing and provide tracks for an L-shaped wall member 100 carried on top of the housing. The wall member 100 has side flanges 100' seated on the flanges 48d of the housing. The bottom horizontal leg 100a of the wall member 100 is thus carried in spaced relation above the cover member 99 on the housing 48 to provide a horizontal passageway 101 along the top of the housing. This passageway is closed at its ends by upstanding flanges 48e formed on the ends of the housing.

As best shown in Figures 4 and 5, the wall member 100 has the vertical leg 100b thereof extending upward for a considerable distance above the top of the housing 48. The legs 100a and 100b of the wall member 100 are reinforced by end webs 100c.

Gear racks 102 are bolted against the outer ends of the housing flanges 48d. The gear teeth 102a of the racks 102 are formed on top faces of the racks.

Cover bars 103 are bolted on top of the flanges 48d and extend in spaced relation over the flanges 100' of the wall member 100.

Bolts 104 are threaded through the inner end portions of the bars 103 and are adapted to clamp the flanges 100' tightly against the flanges 48d for preventing relative movements between the wall 100 and the housing. At the same time these bolts 104 can be loosened to permit a sliding of the wall 100 over the top of the housing.

A reinforcing tube 105 extends between the webs 100c of the wall member 100. A shaft 106 extends through this tube 105 and projects through the webs 100c as shown in Figure 6. Gears 107 are mounted on the ends of the shaft 106 and mesh with the teeth 102a of the racks 102.

As shown in Figure 2, a worm wheel 108 is mounted around an intermediate portion of the shaft 106 adjacent a slot 105a through the tube 105. A worm 109 meshes with the wheel 108 and is driven by an electric motor 110 carried by the wall member 100. A rotation of the shaft 106 by the motor 110 will thus move the wall member 100 back and forth along the top of the housing 48.

As best shown in Figures 1, 4 and 8 the webs 100c of the wall member 100 carry forwardly extending brackets 111 thereon at a level in spaced relation above the bottom leg 100a of the wall member. A catwalk board 112 extends between the brackets 111 and is carried by the brackets.

As best shown in Figures 2 and 4 each bracket 111 has a dependent leg 111a forwardly of the webs 100c. Each leg 111a carries a pivot pin 113

extending therethrough. Arms 114 are pivotally mounted at their forward ends on the pins 113. These arms 114 each have an offset leg 114a extending between the leg 111a of the bracket and the web 100c and then forwardly of the bracket along the outer face thereof. Deckle pulleys 115 are rotatably mounted on the ends of the legs 114a and have the usual deckle straps 116 thereabout.

The rear ends of the arms 114 are provided with slots 117. Bolts such as 118 extend through the webs 100c into the slots 117 while nuts 119 threaded around the bolts 118 can clamp the arms 114 in adjusted position. A swinging of the arms 114 about their pivots 113 will raise and lower the forward ends of the legs 114a to raise and lower the deckle pulleys.

The same pivot pins 113 support arms 120 on the inside of the arms 114 as shown in Figure 2.

The forward portions of the arms 120 are upwardly offset as shown in Figure 4 and are pivoted at their forward ends to ears 121a of a beam member 121 extending across the width of the machine between the deckle pulleys 115. The ears 121a are spaced inwardly from the ends of the beam member so that this member can extend to a point adjacent the deckle straps. The beam member 121 is built up from spaced opposed channel beams 122 and 123 secured at their ends to end plates 124. A top plate member 126 is mounted on top of the channel beams 122 and 123, provides a bridge across the space between the beams and carries the ears 121a which are pivoted to the arms 120.

The plate 126 has threaded holes 127 therethrough at spaced intervals along the length thereof. Internally and externally threaded handle members 128 are threaded into the holes 127. These handle members 128 have internally threaded hollow shank portions 129 receiving the threaded ends of rods 130. The threads cut in the holes 127 and on the exterior of the handle members 128 are preferably arranged one more or one less to the inch than the threads cut in the hollow shanks 129 and on the rod members 130. Thus as the handles 128 are screwed down through the openings 127 the rod 130 is threaded into the shank 129 giving a micrometer adjustment of the rods 130.

The bottom ends of the rods 130 are pivoted at 131 to a flexible plate 132 extending forwardly from the horizontal leg 100a of the wall member 100.

The plate 132 cooperates with the apron board 48b of the housing 48 and the apron 90 to form a nozzle outlet 133 to the wire 10 for the passageway 101.

Deckle boards 134 are carried at the sides of the flange 48b and form end walls for the nozzle. The plate 132 extends up to the deckle boards and is therefore slightly longer than the beam member 121. Since the beam 121 extends up close to the deckle pulleys the end rods 130 can be attached near the ends of the plate 132.

The rear ends of the arms 120 supporting the beam member 121 are pivoted to links 135. The links 135, in turn, are pivoted to screws 136 which extend through casings 137 carried by the webs 100c of the wall member 100. The casings 137 house worm wheels (not shown) and worms (not shown).

The worm wheels are threaded around the screws 136 so that a rotation of the wheels by the worms will raise or lower the screws 136 relative to the casing 137.

A tube 138 extends between the casings 137. A drive shaft 139 extends through the center of the tube 138 and has the worms in the casings 137 keyed thereon. The mid-portion of the shaft 139 carries a worm wheel 140 engaging through a slot 138a in the tube 138 with a worm 141 (Figure 2) of a hand operated rod 142 extending to the top of the wall member 100 (Figure 8). The rod 142 is rotatably mounted in a bracket 143 carried by the wall member.

A rotation of the rod 142 by means of the hand wheel 144 secured on the top end of the rod will cause a rotation of the shaft 139 to raise or lower the screws 136 relative to their casings. This in turn will cause a raising or lowering of the beam member 121 and the front end of the flexible plate 132 carried by the rods 130.

The entire length of the plate 132 can be raised or lowered simultaneously by the above-described operation of the beam member 121. In addition, individual sections of the flexible plate 132 can be raised or lowered by operation of the handles 128 for the rods 130.

As shown in Figures 2, 3 and 4, the wall member 100 has rearwardly extending flanges 100d along the sides thereof. The flanges 100d can extend beyond the back wall of the housing 48.

A vertical back wall or plate 145 is slidably mounted against the back wall of the housing 48 and has side flanges 145a in slidable engagement with the inner faces of the flanges 100d. Sealing strips 146 (Figure 2) are mounted in grooves in the flanges 145a to rub against the flanges 100d and prevent leakage between the flanges.

A sealing strip 147 (Figure 4) is also provided in the rear face of the housing 48 to rub against the non-corroding lining 145b on the front face of the plate 145. The sealing strip 147 will prevent leakage between the lining and the housing.

The plate 145 is formed at the top thereof to provide a trough 148 (Figures 2, 3 and 4) in back of the plate. This trough 148 is curved into the top of the plate 145 as shown at 148a in Figure 4.

Outlets 149 (Figures 2 and 3) are formed at the sides of the trough 148 and communicate with the bottom of the trough through openings 149a (Figure 2). The drain outlets 149 are connected to the top standpipes 42 which have the valves 42a therein and are part of the telescoping pipes 39 to 42 described in connection with Figure 1.

As best shown in Figure 4, the rear surface and the bottom surface of the wall member 100 is covered with a metal lining 100e of non-corroding alloy.

A passageway 150 is formed between the linings 100e and 145b. This passageway is closed at its ends by the flanges 100d of the wall member 100.

The bottom of the passageway 150 communicates with the horizontal passageway 101 while the top of the passageway 150 communicates with the trough 148.

As best shown in Figures 3 and 4, the rear plate 145 has a rearwardly extending web 145c. Threaded bosses 151 are bolted to the underside of the web 145c and receive threaded rods 152 in screw-thread relation therewith. The rods 152 are adapted to extend through holes in the web 145c.

As best shown in Figure 8, a cross-shaft 153 is rotatably mounted in floor brackets such as 154 and is driven by the motor 80 through a sprocket gear 155 and a sprocket chain 156. The drive shaft 153 has worms such as 157 keyed thereon and meshing with worm wheels such as

158 keyed on the lower ends of the threaded rods 152. A clutch (not shown) is disposed between the motor 80 and the drive shaft 153 so that the shaft need not be rotated except when wanted. When the clutch is engaged, however, and when the motor 80 is operating, the rods 152 can be rotated in either direction by reversing the motor to raise and lower the plate 145 and the devices carried by the plate.

A comparison of Figures 4 and 5 will illustrate the change in the positions of the plate 145 made possible by the lifting screws 152. In Figure 4 the plate 145 extends almost to the top of the wall member 100. In Figure 5 the plate 145 is lowered below the top of the housing 48.

The wall member 100, as shown in Figure 5, can be moved over the top of the housing 48 from the position shown in solid lines in Figure 5 to the position shown in dotted lines in Figure 5.

When the plate 145 is lowered as shown in Figure 5 the passageway 101 is readily accessible for cleaning purposes. A raising and lowering of the plate 145 does not require disconnection of any of the pipes cooperating therewith since the standpipes 39 to 42 are adapted to be telescoped together.

Operation of apparatus described in Figures 1 to 10, Inclusive

Aqueous suspension of paper stock are delivered into the flow box 18. The flow box 18 might receive the paper stock from one or more rotary screens 16. The paper stock in the flow box is directed around the baffles 19 and 20 and is pumped by the pump 23 into the passages 32 and 33 of the conduit 34. The inlets to the passages are at opposite ends of the conduit so that the flow of stock through the conduits is in opposite directions. The pump is operated so as to maintain a rapidly flowing stream of stock at a velocity above the point where fiber flocculation can occur (preferably above 2 feet per second). In order to insure a constant flowing of the stock, and maintain the stock in a turbulent condition throughout the passages 32 and 33, overflows communicate with the passages 32 and 33 at the ends thereof opposite the inlets. These overflows are connected through pipes 36 and 38 having valves 44 in them to the stand pipes 37 and 39, thence to return pipes 43 leading back to the flow box 18.

Stock is fed to the passages 32 and 33 under pressure from the pump 23. This stock is then ejected from the passages 32 and 33 thru the holes or orifices 84 to 87 into the space between the rotating cylinder 61 and the conduit 34. This space is at a lower pressure than the passages 32 and 33 and the pressure drop is used to create the high velocity thru the orifices 84 to 87 with the accompanying turbulent effect on the stock. The orifices are small, preferably about 5/8" in diameter.

The pressure in the space between the cylinder 61 and the conduit 34 is again higher than the pressure outside of the rotating cylinder 61 with the result the stock is again ejected thru a series of holes or orifices in the cylinder 61 and the high velocity jets create a turbulent and well deflocculated stock. A pressure drop of 2 feet or more in head of stock is desirable between the passages 32, 33 and the housing 48.

The deflectors 88 on the conduit 34 direct the stock in one circumferential or tangential direction around the conduit. The cylinder 61 is then rotated around the conduit in the opposite direction. This produces a rotary flow of stock in the space between the conduit and cylinder which is opposed by the rotating cylinder. The mouths of the orifices through the cylinder are thus constantly wiped by the stock.

The impinging of a myriad of stock streams from a rotating member into a stock passageway maintains the fibers of the stock in the passageway in a thoroughly dispersed and uniformly mixed condition.

The thus dispersed and uniformly mixed stock flows upwardly out of the housing 48 and part or all of the stock passes through the nozzle provided by the plate 132 and the apron 90 onto the forming wire 10. If a pressure formation of stock is desired on the forming wire the front end of the plate 132 can be moved beyond the front end of the apron 90 to define a confined area on the wire under stock pressure.

The stock in the horizontal passageway 101 can partially be flowed onto the forming wire 10 while the remaining portion of the stock can flow into the vertical passageway 150 from which it overflows into the trough 148 and is returned through the standpipes 39 to 42 and the pipe 43 back to the flow box.

The plate 145 can be adjusted in height to maintain a desired head on the stock issuing from the housing 48.

The stock is constantly maintained in a flowing condition and subject to turbulence so that fiber flocculation is minimized and the fibers in the stock are thoroughly mixed and dispersed before the same are fed onto the forming wire.

All adjustments for controlling flow of stock onto the wire are immediately adjacent the breast roll end of the machine and can be made without affecting remote parts of the system.

The machine provides for any desired pressure head of stock being fed to the wire by selective positioning of the rear plate 145.

The horizontally movable wall member 100 makes possible the formation of a confined stock area on the wire by moving the nozzle plate 145 ahead of the apron 90. At the same time this wall member 100 can be moved back any desired amount.

The deckle pulleys are readily adjusted and easily lifted off of the wire by the bolt and slot control of the arms 114 supporting the pulleys.

The plate 132 can be flexed along its length by micrometer devices cooperating with the rods 130. At the same time the entire length of the plate 132 can be raised or lowered by the operation of the beam supporting arms 120.

The apparatus is readily cleaned by an opening of the hinged covers 89 to the housing 48 and by a lowering of the rear plate 145 to the position shown in Figure 5.

The rotary cylinder 61 is supported on water-lubricated bearings and the driving apparatus for the cylinder is mounted in one of the end caps 45 for the housing 48. Water is fed through the bearings supporting the rotating cylinder 61 and the drive shaft for this cylinder.

Apparatus shown in Figures 11 and 12

In the modified structure shown in Figures 11 and 12, the reference numeral 200 designates generally the usual forming wire of a Fourdrinier-type paper making machine. The wire 200 is trained around a breast roll 201. A stock feed device 202 is mounted immediately behind the breast roll 201.

The stock feed 202 comprises a base 203 hous-

ing conduits 204 and 205 in adjoining parallel relation.

A rear wall member or plate 206 extends vertically upward from the base 203 and is disposed over the conduit 204.

An L-shaped wall member 207 has the vertical leg 207a extending upwardly from the base 203 above the conduit 205 therein. The leg 207a is in spaced parallel relation with the wall 206.

The horizontal leg 207b of the wall member 207 extends forwardly over the top of the breast roll 201.

A front wall member 208 is disposed above the horizontal leg 207b of the wall member 207 at a point adjacent the breast roll 201. The wall member 208 pivotally carries a slice plate or nozzle member 209. This plate 209 is pivoted at 210 to the bottom of the plate 208. A bracket 211 is secured to the front face of the wall member 208 and has handles such as 212 threaded therethrough for carrying adjusting rods such as 213 which are pivoted to the plate 209 as at 214.

Side walls such as 215 cooperate with the wall members 206, 207, and 208 to define a box.

The side walls such as the wall 215 have spaced opposed ribs 216 extending vertically downward from the top thereof to the horizontal leg 207b of the wall member 207. These ribs 216 form grooves such as 217 along the side walls. Boards 218 are slidably seated at their ends in the grooves 217 to form a partition wall between the rear wall 206 and the front wall 208.

Two stock passageways 219 and 220 are thus provided.

A plate 221 similar to the plate 145 described in connection with Figures 1 to 10 is slidable along the back face of the wall member 206. The plate 221 has a trough 222 formed in the top portion thereof similar to the trough 148. This trough is drained by means of drain outlets such as 223.

As best shown in Figure 12, the conduits 204 and 205 each have a row of holes 224 along the length thereof. As shown in Figure 11 these rows of holes 224 communicate with the stock passageway 219 and the holes are inclined toward each other. Deflector members 225 are secured to the conduits 204 and 205 and have lips 226 disposed in spaced relation above the holes 224.

As shown in Figure 12, stock is supplied to the conduits 204 and 205 from a stock supply pipe 227. Branch pipes 228 and 229 communicate with the supply pipe 227 and the branch pipe 228 enters the conduit 205 at one end thereof while the branch pipe 229 enters the conduit 204 at the opposite end of the conduit.

A recirculating line 230 receives excess stock from the conduits 204 and 205 through branch pipes 231 and 232.

The branch pipe 231 communicates with the conduit 204 at the end of the conduit opposite to the inlet end thereof.

Likewise the branch pipe 232 communicates with the conduit 205 at the end thereof opposite the inlet pipe 228.

Streams of stock are thus flowed through the conduits 204 and 205 in opposed directions. The stock in the conduit is maintained under pressure and is ejected through the holes 224 in the conduit into the stock passageway 219. The stock then flows upwardly in the passageway 219 over the top board 218 into the stock passageway 220 from which it can flow under the plate 209 onto the forming wire 200.

Any desired head of stock can be maintained in the stock passageways 219 and 220 by regulation of the height of the slidable plate 221.

If desired instead of flowing stock over the top board 218, two adjacent boards can be held in spaced apart relation so that stock will flow through the space between the boards into the passage 220.

Apparatus identical with that shown and described in Figure 1 can be used in back of the feed device 202 for feeding stock to the conduits 204 and 205 and for returning excess stock from the overflow trough 222.

The stock flow through the conduit is maintained at high velocity to cut down fiber flocculation and the stock ejected through the holes 224 has the fibers thereof thoroughly dispersed and uniformly mixed. The stock flowed through the passageways 219 and 220 is maintained at a desired high velocity irrespective of the amount of stock supplied to the forming wire by regulation of the overflow into the trough 222. In this manner the stock is maintained in a constantly flowing condition right up to the time it is deposited on the forming wire and fiber flocculation maintained at a minimum.

From the above description it should be understood that the apparatus of this invention now provides for the feeding of a uniformly mixed stock suspension having the fibers therein thoroughly dispersed. The heretofore-encountered fiber flocculation is eliminated and stock flow onto the wire is controlled from a point immediately adjacent the breast roll end of the wire.

We are aware that many changes may be made and numerus details of construction may be varied through a wide range without departing from the principles of this invention, and we, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

We claim as our invention:

1. A stock feed device for paper making machines comprising an open ended housing defining an elongated cylindrical chamber, a stock conduit extending through said chamber in spaced relation from the walls of the housing, end caps disposed around said conduit closing the ends of the housing, annular bearings in said end caps having their inner peripheries in spaced relation from the conduit, cooperating annular bearings disposed around the conduit, a foraminous drum mounted between the cooperating pairs of bearings and extending along the housing in spaced relation from the housing walls and from the conduit, said bearings sealing the interior of the housing from the end caps, said conduit having openings along the length thereof between said bearings, a ring gear in one of said end caps secured around the end portion of the recticular drum and a spur gear meshed with said ring gear for driving the drum in the housing around the conduit.

2. A stock feed device for paper making machines comprising an elonagted housing defining a cylindrical chamber therein, a stock conduit extending through said housing and having openings along its length for ejection of stock, annular bearings in said housing disposed around said conduit, cooperating annular bearings disposed in said housing in alignment with said first mentioned bearings, a cylinder in said housing rotatably carried between said cooperating pairs of bearings in spaced relation from the housing walls and from the conduit, said bear-

ings having helical grooves in the faces thereof engaging the cylinder and means for feeding a lubricant under pressure against the outer faces of the bearings for circulation through the grooves to lubricate the contacting surfaces of the bearings and cylinder.

3. A stock feed device for paper making machines comprising a bottom wall member, a top wall member in spaced relation therefrom, said wall members defining a substantially horizontal stock passageway therebetween, means for moving the top wall member beyond the bottom wall member to provide a confined stock area on the forming surface of the paper machine, spaced opposed vertical wall members defining a vertical stock passageway communicating at the bottom with the horizontal passageway and means for raising and lowering one of said wall members to vary the height of the vertical stock passageway and thereby control the head pressure of stock in the horizontal passageway.

4. A stock feed device for Fourdrinier type paper making machines including a forming wire trained around a breast roll which comprises a housing extending transversely across the machine adjacent the breast roll, said housing having a stock outlet in the top thereof substantially coextensive in length with the width of the forming surface of the paper machine forming wire, an apron extending from said housing on top of the upper run of the forming wire adapted to receive stock from said opening, an L-shaped wall member having the horizontal leg thereof slidably mounted on top of said housing and the vertical leg thereof extending upwardly above the housing, a slice plate carried by said L-shaped wall member and projecting forwardly from the front end of the horizontal leg thereof, said slice plate confining the top of the stock issuing from the opening in the housing, means for moving the L-shaped wall member to carry the end of the slice plate beyond the apron for defining a stock area on the forming wire, a vertically movable wall member cooperating with the vertical leg of the L-shaped wall member to define a vertical stock passageway communicating at its lower end with the stock passageway between the top of the housing and the horizontal leg and an overflow device on said vertically movable wall member to remove excess stock from the vertical passageway whereby stock in said passageway can be maintained in a constantly flowing condition.

5. A stock flow device for paper making machines comprising a housing for mounting across the width of the paper machine, a wall member having a horizontal leg movably mounted in spaced relation above the top of the housing to cooperate with the top of the housing for defining a horizontal stock passageway, said wall member also having a vertical leg extending upwardly from the rear end of the horizontal leg, a slice plate projecting from the front end of the horizontal leg and adapted to be disposed over the forming surface of the paper machine and a rear plate member slidable along the rear face of the housing and cooperating with the vertical leg of the wall member to define a vertical passageway communicating at the bottom thereof with said horizontal passageway whereby stock from said housing can be flowed into the horizontal passageway and onto the forming surface of the paper machine under a head determined by the height of stock in the vertical passageway.

6. A stock feed device for a paper making machine comprising a housing, a wall member carried in spaced relation above the top of the housing, means for moving said wall member back and forth along the top of the housing, a slice plate projecting from the front end of said wall member, said housing having an opening in the top thereof adapted to supply stock to the passageway between the top of the housing and the wall member and a vertically adjustable overflow device communicating with said passageway to regulate the head pressure of stock therein.

7. A stock feed device for paper making machines comprising a housing defining a cylindrical chamber, said housing having an outlet in the top portion thereof coextensive in length with said chamber, means defining a stock passageway on top of said housing communicating with said outlet, a conduit extending through said housing having holes along the length thereof, and means for introducing stock under pressure through said conduit for flowing out of said holes into the housing and out of the housing outlet into said passageway for deposit on the forming surface of the machine.

8. A stock feed for paper making machines comprising, a head box, a pair of conduits extending transversely through the bottom portion of the box, said conduits each having a row of holes therethrough along the length thereof, means for flowing stock under pressure in opposite directions through said conduits for ejection through said holes into the box, and means defining a stock outlet for flowing stock from the box to the forming wire of the paper machine.

9. The method of supplying thoroughly dispersed stock to a web forming surface which comprises flowing stock under pressure through a conduit transversely across the width of the web-forming surface, flowing stock under pressure through a second conduit transversely across the width of the web forming surface in a direction opposite to the direction of flow in the first mentioned conduit ejecting some of the flowing stock along the lengths of the conduits, recirculating the unejected stock to the conduits, flowing ejected stock upwardly into a passageway communicating with the forming surface, and recirculating excess stock from the passageway back to the conduits.

10. The method of supplying stock to a paper machine which comprises continually pumping stock in opposite directions through adjacent elongated passageways, ejecting some of the stock through holes along the length of the passageways into a pond, again pumping unejected stock from the passageways through the passageways to maintain a high speed flow through the passageways, flowing stock from the pond to the paper machine, and overflowing excess stock from the pond at a desired level to maintain the pond in constantly flowing condition under a desired head pressure.

11. In a stock feed device for a paper making machine, an elongated stock conduit adapted to extend across the paper machine and having a plurality of longitudinal passageways therethrough, stock supply means communicating with one passageway at one end of the conduit, stock supply means communicating with an adjacent passageway at the opposite end of the conduit, and said conduit having at least one orifice along the length thereof communicating with each passageway to effect turbulence in stock spouted therethrough.

12. A device for feeding stock uniformly across

the width of a paper machine forming surface which comprises means defining a pair of confined passageways for paper stock extending transversely across a paper machine adjacent the forming surface thereof, said passageways having a plurality of holes along the length thereof, and means for flowing equal amounts of stock through said passageways in opposite directions for ejection through said holes.

13. The method of feeding stock to the forming surface of a paper machine which comprises flowing stock transversely across the width of the forming surface in volume sufficient to create velocities greater than the fiber flocculation point for the stock through a device for dispersing the fibers in the stock located adjacent the forming surface, removing excess stock from said device to maintain said velocities, and flowing the dispersed stock from said device onto the forming surface in volumes independent of the volume passed through the dispersing device.

14. The method of feeding stock to the forming surface of a paper making machine for uniformly distributing the stock across the surface which comprises flowing the stock in opposite directions across the width of the machine, ejecting stock from the flowing streams along the lengths thereof, merging the ejected stock from the oppositely flowing stock streams and flowing merged stock onto the forming surface.

15. The method of feeding stock to the forming surface of a paper making machine for uniformly distributing the stock across the surface which comprises inducing oppositely flowing streams of stock across the width of the machine adjacent the forming surface, ejecting stock from said oppositely flowing streams along the lengths thereof, merging the ejected stock, and flowing merged stock in a lateral direction onto the forming surface.

16. In a paper making machine including a forming surface, a stock filtering screen, and a flow box receiving screened stock from the filtering screen, the improvements which comprise an elongated conduit extending across the width of the paper machine adjacent the forming surface, said conduit being open along the length thereof for ejection of stock across the width of the machine, a pipe line joining the flow box with one end of the conduit, means for flowing stock from the flow box through the conduit, a second pipe line joining the opposite end of the conduit with the flow box for recirculation of unejected stock, means in the second pipe line controlling flow through said second pipe line to maintain a back pressure on stock in the conduit for effecting said ejection of stock therefrom, and means defining an inclosed passageway from the conduit to the forming surface for directing ejected stock to the forming surface.

17. In a paper making machine including a forming surface, a stock filtering screen and a flow box receiving screened stock from the filtering screen, the improvements of an elongated stock conduit extending across the width of the machine adjacent the forming surface thereof and having openings along its length, a pipe line connecting the flow box with one end of the conduit, a pump in said pipe line for pumping stock from the flow box through the conduit, a second pipe line connecting the opposite end of said conduit with the flow box for recirculating stock from the conduit, a perforate cylinder telescoped around said conduit in spaced relation therefrom, means for rotating said cylinder around the conduit, and a housing surrounding the cylinder in spaced relation therefrom receiving stock ejected from the conduit through the cylinder, said housing defining a passageway directing the ejected stock to the forming surface of the paper machine.

18. In a Fourdrinier type paper making machine having a forming wire trained around a breast roll, the improvement of a stock feed device adjacent the breast roll end of the forming wire which includes a stock conduit open along the length thereof extending across the width of the machine, means for flowing stock into one end of the conduit for ejection along the length of the conduit, means for draining excess stock from the other end of the conduit to maintain the stock in the conduit in a constantly flowing stream, a housing receiving ejected stock from the conduit and defining a passageway for said stock to the forming surface, and means for draining excess stock from said passageway.

19. A stock feed device for a paper making machine comprising means defining a plurality of separate stock passageways adapted to extend across the width of a paper making machine, stock feed means communicating with one passageway at one end of said means and with an adjacent passageway at the opposite end of said means, drain devices communicating with said passageways at the ends thereof which are not connected to the stock feed means whereby a plurality of streams of stock will flow through adjacent passageways in opposite directions, said passageways being open for ejection of stock along the length thereof, and means for regulating the drain devices to maintain the oppositely flowing stock streams under pressure for ejection of some of the stock along the length of the passageways.

20. A stock feed device for the wet end of a paper making machine which comprises a conduit for extending across the wet end of a paper making machine, a partition in said conduit dividing the same into two passages, stock feed means communicating with one of said passages at one end of the conduit, stock feed means communicating with the other of said passages at the other end of the conduit, drain outlets communicating with the ends of the passages which are not in communication with the stock feed means for removing stock from the passages whereby the stock will be continually flowed through the passages in opposite directions, and said conduit having openings along the length thereof communicating with each of said passages for receiving therethrough stock from the flowing streams.

21. A stock inlet for a paper making machine having a web forming surface which comprises a pair of adjacent stock conduits having openings along the lengths thereof, means for flowing stock in opposite directions through said conduits for ejection through said openings, and means defining a stock passageway from the conduit openings to the web forming surface of the paper machine.

22. The method of feeding stock to the forming surface of a paper machine which comprises flowing streams of stock under pressure in opposite directions transversely across the entire width of the paper machine, removing excess stock from the ends of the streams to maintain rapid flow through the streams, spouting stock upwardly from said streams into a superposed

chamber, and overflowing stock from said chamber onto the forming surface.

23. The method of feeding stock to the forming surface of a paper machine which comprises flowing two streams of stock in opposite directions transversely across the entire width of the paper machine, spouting stock from said oppositely flowing streams into a superimposed chamber, and overflowing stock from the top of said chamber onto the forming surface.

24. The method of feeding stock to the forming surface of a paper machine which comprises flowing streams of stock in a closed circuit in opposite directions transversely across the entire width of the paper making machine, ejecting stock under pressure from said transversely flowing streams into a superimposed chamber, overflowing stock from the top of said chamber and confining the overflowed stock in a laterally extending passageway discharging onto the forming surface.

25. The method of feeding stock to the forming surface of a paper making machine which comprises ejecting stock from oppositely flowing streams into a stock passageway communicating with the paper machine forming surface at its front end and with a stock feed box at its rear end, and regulating the amount of stock fed to the forming surface by controlling drainage from the passageway to the feed box.

26. The method of feeding stock to the forming surface of a Fourdrinier type paper making machine which comprises continually flowing stock under pressure in opposite directions through a pair of stock conduits extending transversely across the width of the machine behind the breast roll thereof, recirculating excess stock from said conduits back to said pump, spouting stock from said conduits uniformly along the length thereof, merging the spouted stock in a chamber having the same width as the forming wire of the machine, overflowing stock out of the top of the chamber into a confined passageway having the same width as the forming wire of the machine and regulating flow out of both ends of the passageway.

27. The method of feeding stock to a forming surface which comprises, screening the stock, discharging the screened stock into a feed box, pumping stock from the feed box into an opposite end of a pair of parallel conduits extending transversely across the width of the forming surface, ejecting stock along the length of the conduits into an open ended longitudinal passageway, discharging stock from the front end of the passageway onto the forming surface, and draining stock back to the feed box out of the rear end of the passageway to control the velocity and volume of stock fed to the forming surface.

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