Dec. 6, 1932. E. E. BERRY 1,889,819

METHOD AND MEANS FOR DELIVERING STOCK FOR WEB FORMING

Filed June 2, 1930 5 Sheets-Sheet 1

Fig. 1

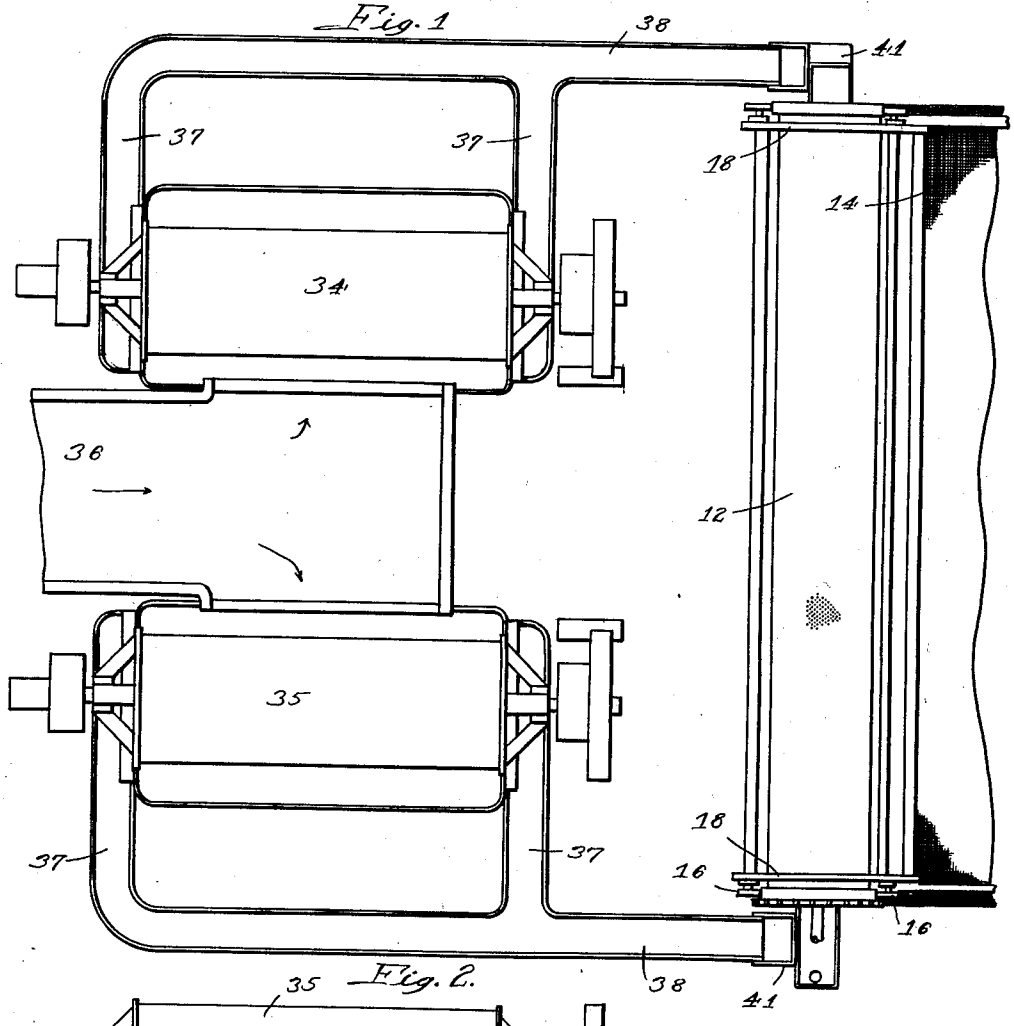
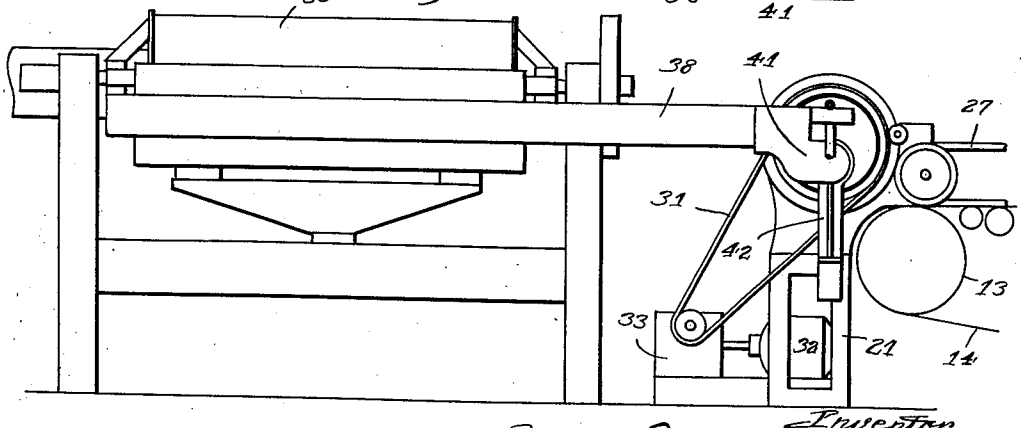


Fig. 2.



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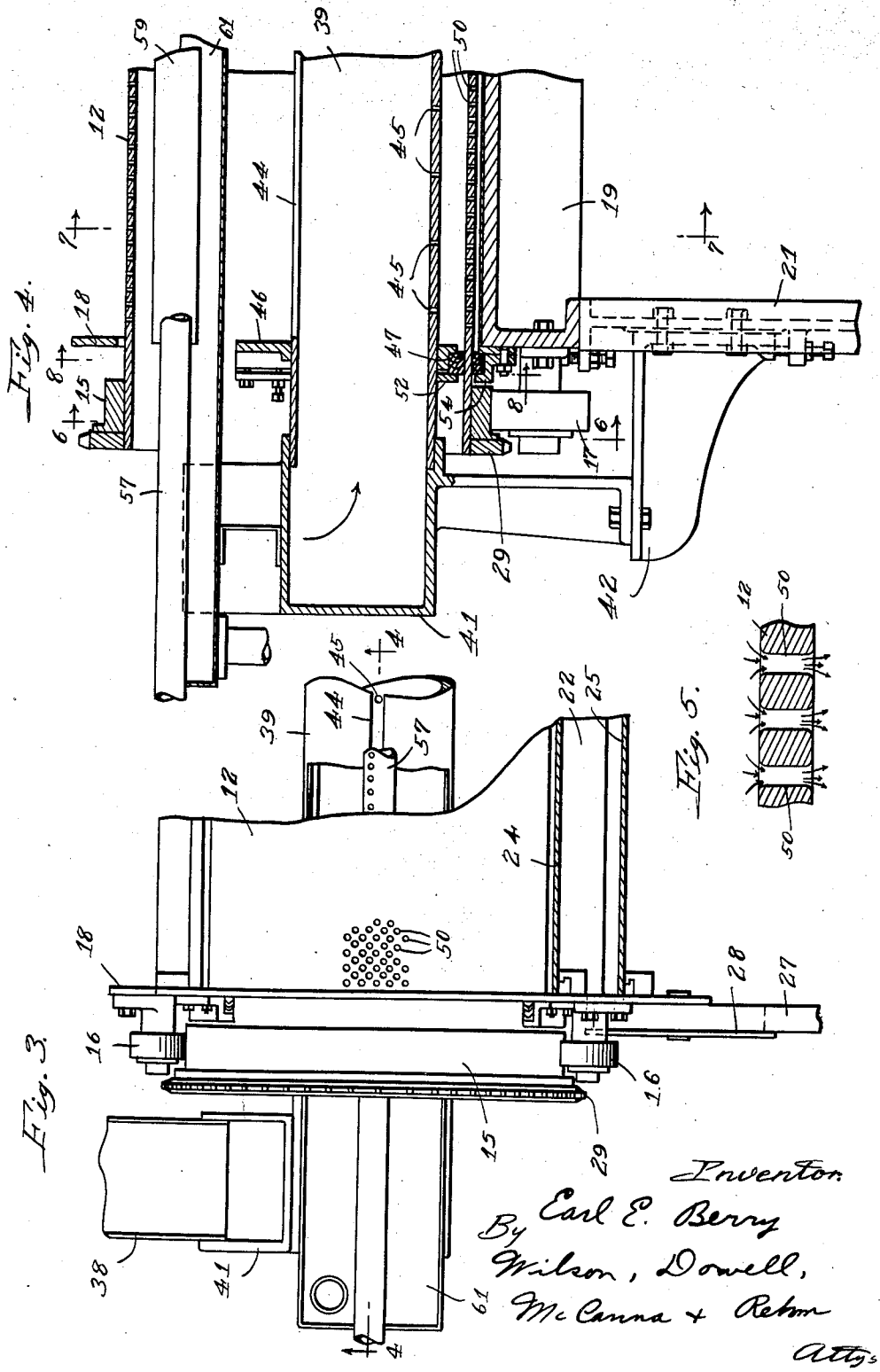


Fig. 4.

Fig. 5.

Fig. 3.

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METHOD AND MEANS FOR DELIVERING STOCK FOR WEB FORMING

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Fig. 6

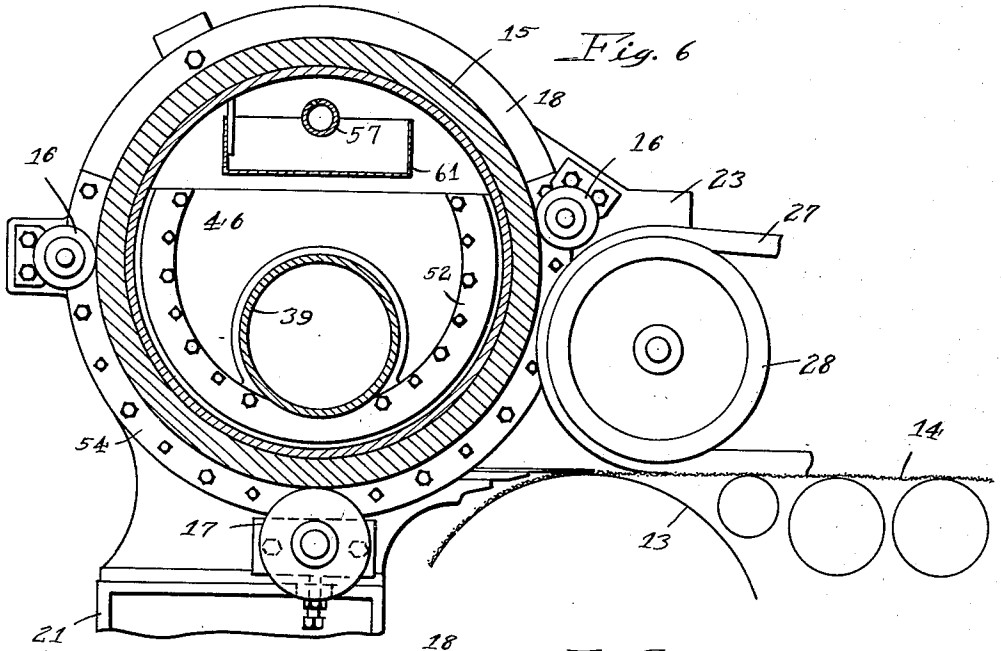
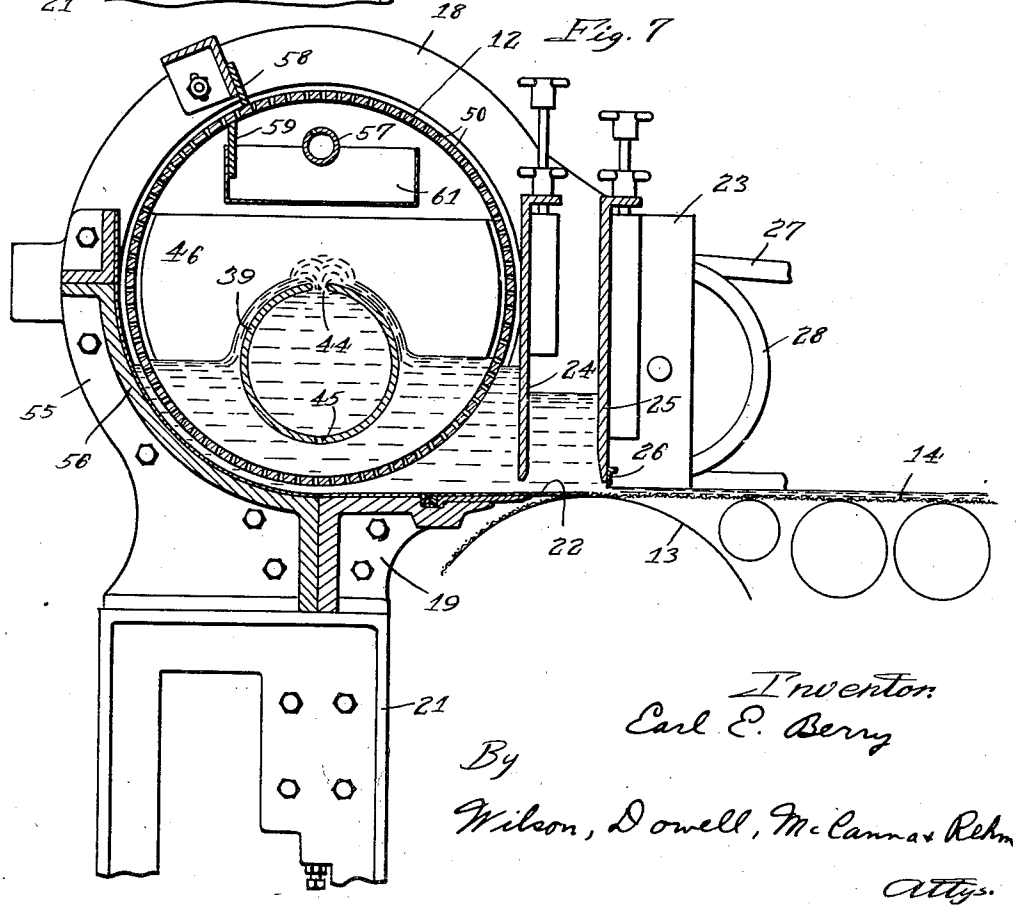


Fig. 7



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METHOD AND MEANS FOR DELIVERING STOCK FOR WEB FORMING

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Fig. 8.

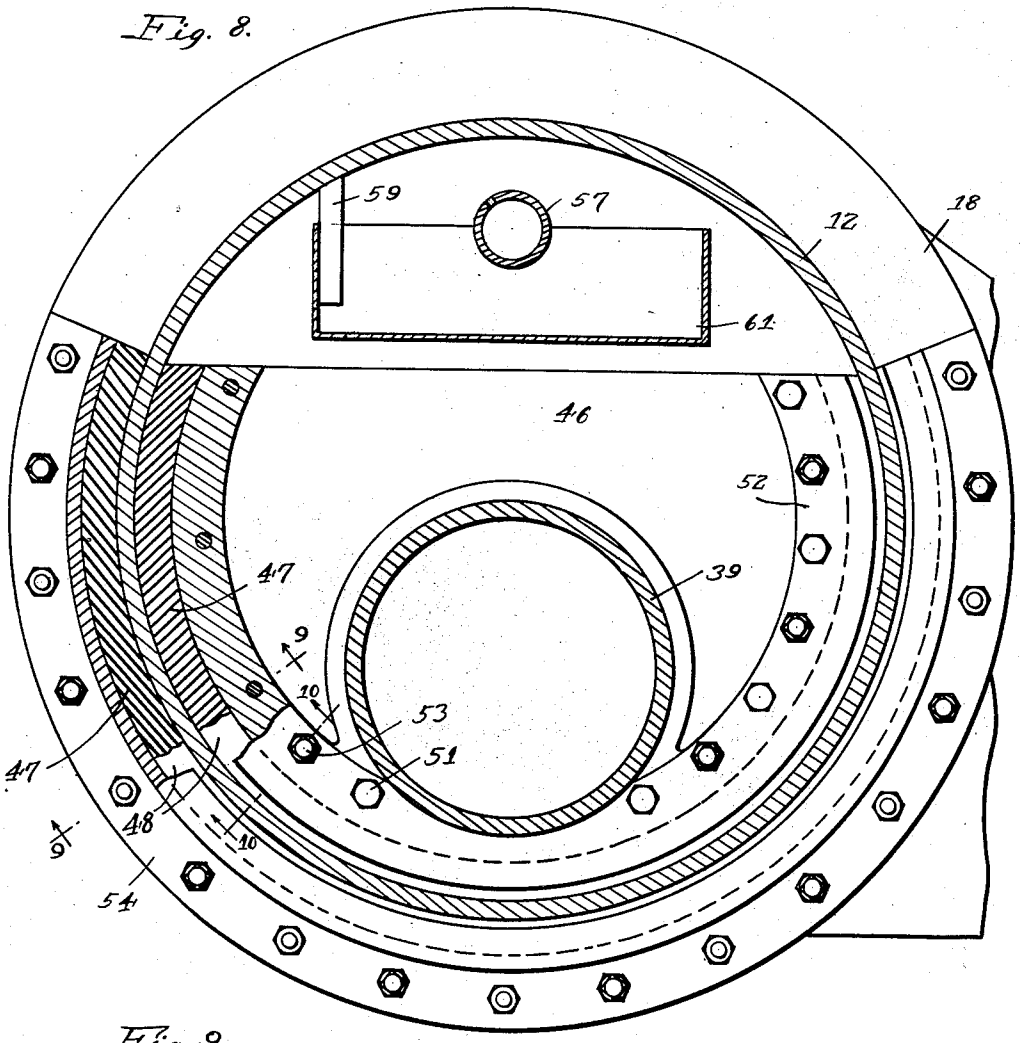


Fig. 9.

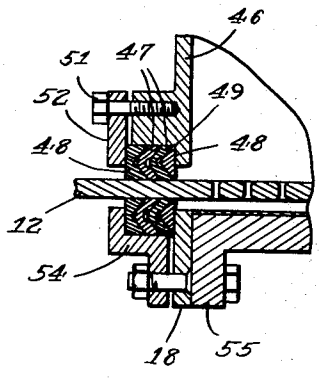
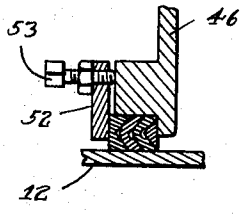


Fig. 10.



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METHOD AND MEANS FOR DELIVERING STOCK FOR WEB FORMING

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Fig. 11.

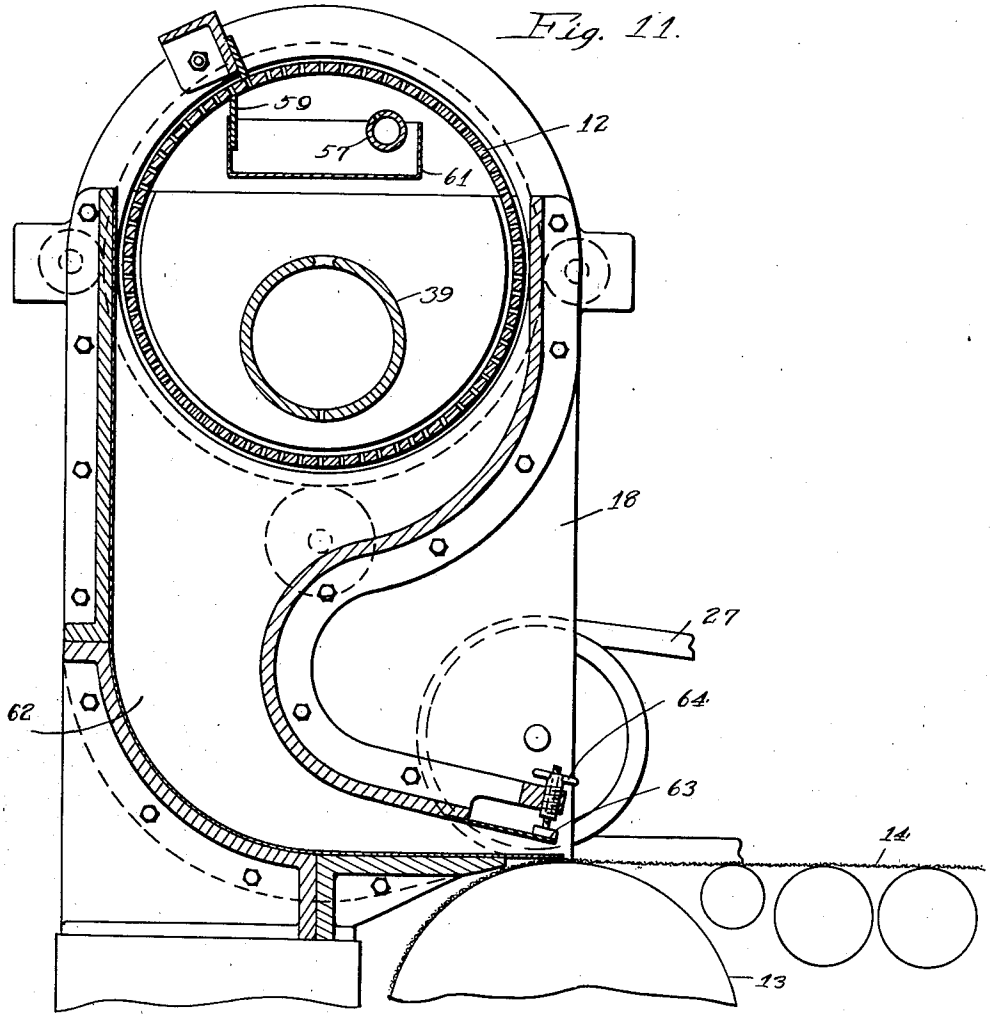
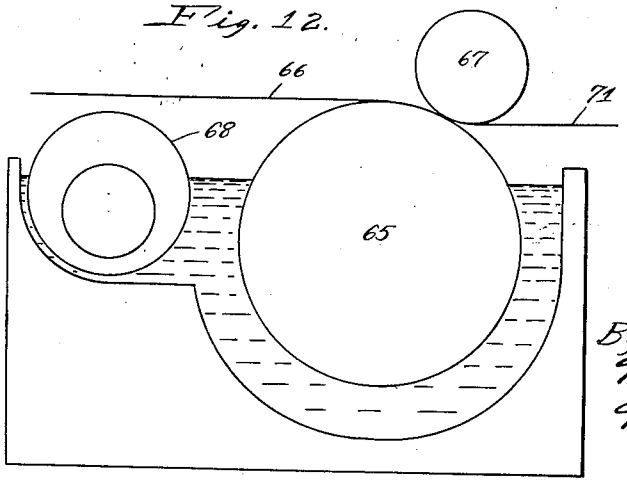


Fig. 12.



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UNITED STATES PATENT OFFICE

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METHOD AND MEANS FOR DELIVERING STOCK FOR WEB FORMING

Application filed June 2, 1930. Serial No. 458,952.

This invention relates to the manufacture of paper, board and the like, and to any product embodying the formation of a fibrous web. In the paper and board making industry my invention is applied to both Fourdrinier and cylinder machines, and machines combining the characteristics of both. It is also applicable to cellucotton machines.

The main object of my invention is to improve the method and means of delivering the fibrous stock to the sheet or web forming element, to thereby produce a better product.

In describing my invention I will take the case of its application to a Fourdrinier machine which I believe best illustrates the principles involved. After the stock has been properly prepared it must be delivered to the wire for formation of the sheet. The preparation of stock varies considerably according to the kind and grade of paper and in many cases it is customary to put the stock through screens for removing rough stuff, breaking up lumps and mixing the fibers. The stock coming from the screens is in condition for making a good quality of paper because the fibers are uniformly distributed. However, in delivering the stock from the screens or other source of supply to the wire many difficulties are encountered. Not only is the condition of the stock apt to be disturbed or impaired by bunching, collecting or accumulating of the fibers during the flow of the stock from the screens or some other source of supply to the wire, but the velocity and direction of flow are difficult to control and are subject to variations and disturbances especially in the vat just prior to entering the wire. This presents problems having many difficulties, especially in view of the varying conditions arising during the operation of a machine. In the first place, it is necessary to convert the rapid flow of the stock from the screens or supply into a smooth, flat stream that will flow out evenly without cross-currents or variations in velocity, to the full width desired on the wire. In other words, the flow of stock must be spread out or distributed from one or more comparatively high velocity deliveries from troughs or pipes to the long narrow slice orifice, so that it will flow upon the wire in the desired condition.

Heretofore, it has been uniformly customary to deliver the stock into a head box or vat of substantially the same width as the wire and to provide means of one form or another within the head box intended for converting the one or more rapid inlet flows to a smooth flat outlet flow to the wire and for keeping the stock in a uniform condition. One of the most common means employed is a series of baffles in the the head box which cause the stock to flow in a circuitous path. These baffles, usually vertical, are intended to eliminate eddy currents and cross-currents and to convert the flow to a uniform velocity when delivered to the wire. However, the incoming stock delivered to the head box has such high stream velocity that although its force continues with diminishing degree in the vat it is apt to, and frequently does, reach the wire, thereby causing variation in the velocity of the stock flowing onto the wire. Sometimes where plural inlets are used the delivery from one is at a higher velocity than another with the result that the flow through the head box or vat is diverted toward one side instead of being parallel with the travel of the wire with the result that more stock is delivered at one side of the wire than to the other. These varying conditions with respect to velocity and direction of flow of the stock are apt to cause thin and heavy streaks in the sheet and are also apt to make the sheet heavier at one side or in the vicinity of the higher velocity. To add more baffles and length to the flow through the head box for correcting velocity troubles only aggravates conditions and causes bunching and collecting of the fibers. In this connection it is noted that the stream tendencies of the flow through the head box or vat produce quiescent areas where the fibers tend to collect and bunch together with the result that the fibers are not uniformly distributed and, moreover, the small bunches and lumps are eventually drawn into the flow and mar the quality of the paper. Furthermore, the up and down flow between the baffles gives more opportunity for the fibers to coagulate, and where a

pond head is maintained in the vat the flow is sluggish at the top and not infrequently a stagnant condition develops. In these upper stratas there is a marked tendency for the fibers to bunch and coagulate and in some cases form an encrusted top layer. The heavier bunches and lumps settle and sooner or later are drawn into the flow to the wire and mar the quality of the sheet sometimes to the extent of causing breaks. In the attempt to remedy these conditions agitators, perforated rolls, and the like, have been provided within the head box or vat, but while such devices may serve a useful purpose to some degree, they are invariably ineffective for the purposes intended and not infrequently they set up other disturbances such as producing foam and collecting lumps of fibers. In the attempt to remedy foam conditions, so-called foam killers have been provided involving sprays and the like, but these in turn are objectionable because they are apt to cause clear water streaks in the sheet and other troubles. While these conditions prevail to a greater or lesser degree through the entire industry due to the inherent limitations incidental to delivering the stock through the customary head box or vat, they are magnified and particularly troublesome in wide machines and high speed machines.

One of the objects of my invention, therefore, is to avoid the conditions and troubles above referred to by eliminating entirely the customary head box or vat and its accessory devices and to provide in lieu thereof an improved means for delivering the stock to the sheet or web forming element.

Another object is to provide a novel flow evener and stock mixer for machines of the character described.

My invention contemplates the provision of a rotating stock delivery cylinder into the interior of which the stock is fed from the screens or other source of supply. In the embodiment herein illustrated, the stock is fed through both ends of the rotating cylinder and is distributed lengthwise therein. The stock then passes from the interior of the rotating cylinder outwardly through small delivery orifices and thence flows to the wire. This new method, described more fully hereinafter, eliminates the vat conditions and disturbances incident to prior practices and reduces the lineal travel of the stock between the screens or stock source and the wire. By this new method the fibers are uniformly distributed in the stock delivered to the wire, the velocity of the stock is uniform, the flow is parallel with the travel of the wire throughout its width, and it is not necessary to slow the velocity down to such a point as to create tendencies for bunching and lumping of the fibers.

Other objects and attendant advantages will be appreciated by those skilled in this art as the invention becomes better understood by reference to the following description and considered in connection with the accompanying drawings, in which—

Figure 1 is a plan view showing one application of my invention to a Fourdrinier machine, the parts being shown somewhat diagrammatically;

Fig. 2 is a side elevation of the installation shown in Fig. 1;

Fig. 3 is a fragmentary top view of the stock delivery cylinder and parts at the driving end;

Fig. 4 is a vertical section taken substantially on the line 4—4 of Fig. 3;

Fig. 5 is a full size section through the delivery orifices of the rotating stock delivery cylinder;

Figs. 6 and 7 are cross-sections taken substantially on the lines 6—6 and 7—7, respectively, of Fig. 4;

Fig. 8 is an enlarged cross-section taken substantially on the line 8—8 of Fig. 4;

Figs. 9 and 10 are detail sections taken on the lines 9—9 and 10—10, respectively, of Fig. 8;

Fig. 11 is a vertical section showing a modification of my invention applied to a Fourdrinier machine; and

Fig. 12 is a diagrammatic illustration of my invention applied to a cylinder machine.

In applying my invention to a Fourdrinier machine the customary head box or vat is eliminated. In its place, and occupying considerably less space, my new stock delivery means is installed. This includes, briefly stated, a stock delivery cylinder 12 mounted for rotation just at the rear of and parallel with the breast roll 13 over which the wire 14 travels. In this case the cylinder 12 is equipped at each end with an annular supporting ring or track 15 mounted to rotate on rollers 16 and 17 in turn supported on a suitable frame structure. In this instance the rollers 16 at each end of the cylinder are mounted on what I have termed the flow evener end wall, designated generally by 18, and the roller 17 is mounted on the end of a transverse frame structure 19. This frame structure in turn is suitably supported as on the upright frame columns 21. The frame structure 19 serves also to support the apron 22. Each flow evener end wall 18 circumscribes the cylinder and has a forwardly extending deckle portion 23 overreaching the wire. Upon and between these deckle portions is mounted one or more slice gates such as designated by 24 and 25. The slice arrangement here shown is of the type claimed in my copending application Serial No. 194,304, filed May 26, 1927. Each slice is vertically adjustable and the front slice 25 is equipped with an independently adjustable and flexible lip 26. This type of slice is shown merely for convenience and it

should be understood that my invention contemplates the use of any suitable kind or type of slice. Any suitable deckle may likewise be used and in addition to the deckle portions described, I also employ deckle straps 27 trained over pulleys 28 mounted on said deckle portions. Any suitable means may be employed for rotating the cylinder 12 at different speeds. In this case I have shown a sprocket wheel 29 on the cylinder driven by a sprocket chain 31, in turn driven by an electric motor 32 through the intermediary of a change-speed box 33.

The stock is delivered to the interior of the rotating cylinder through one or both ends thereof, in the present case, both ends. The stock comes from the screens, of which two are used in the present installation designated generally by 34 and 35. The screens may be close coupled with the rotating cylinder, thus reducing the over-all length of the machine. The screens shown are of the end delivery type. Stock is supplied to the screens by way of the trough 36 and is delivered from the ends of each screen into troughs 37 which connect to a trough 38. Each trough 38 delivers stock into one end of a stock feed tube or conduit 39 located within the cylinder 12. As shown in Figs. 2, 3 and 4 a suitable elbow coupling 41 connects each trough 38 to the adjacent end of the tube 39. The stock feed tube is supported by suitable means, as by a bracket 42 at each end, with suitable provision for adjustment of the tube in locating it with respect to the cylinder. This arrangement is not essential but is merely illustrative of one installation. It should be understood that any suitable means may be employed for preparing the stock for delivery to the wire and delivering it into the interior of the cylinder. In case screens are required any type may be used and the arrangement of the screens and their delivery troughs may be suited to the conditions at hand. The stock discharges from the tube 39 into the interior of the cylinder 12 and, in so doing, is distributed lengthwise in said cylinder in such manner as to eliminate high velocity, localized delivery, the influence of which might carry to the wire. In the present embodiment of my invention the discharge from the feed tube or conduit 39 is at the top through one or more narrow openings 44 extending substantially from one flow evener wall to the other. The one or more openings 44 may, if desired, be graduated lengthwise of the tube to promote better distribution, and relief openings 45 may be provided in the bottom so as to allow escape of stock and thereby prevent collection of fibers in the bottom of the tube. As indicated in Fig. 7 the stock fills the tube 39 and discharges through the one or more openings 44 down over the sides into the rotating drum 12, building up a head within the drum depending primarily on the adjustment of the slice and rate of delivery of stock from the screens, and the desired velocity of the flow to the wire. The head of stock within the cylinder may, however, be increased above the top of the feed tube where higher velocities within the range of the machine are required. While I prefer to discharge the stock into the interior of the drum through the agency of a tubular conduit of suitable diameter, it should be understood that my invention contemplates the use of any suitable trough structure or other means for delivering and distributing the stock into the rotating cylinder through one or both ends thereof.

The stock is confined at the ends of the rotating cylinder by the flow evener end walls 18, above mentioned, each of which has an inner section 46 which, in this case, is supported on the feed tube 39. Escape of stock through the joints between each flow evener wall and the periphery of the cylinder and between the interior of the cylinder and the inner section of said wall is prevented by suitable packings. A single strip of rubber rectangular in cross-section may be used but I prefer to employ a type of packing shown in Fig. 9 consisting of rubber packing elements 47 in strip form interposed between rubber adapters 48. This packing is set into a rabbeted edge 49 in the inner section 46 of the end wall and is adapted to be put under compression for expanding the packing to take up wear by tightening the bolts 51 which in turn bear against the clamping plate 52. In order to limit compression of the packing by the clamping plate 52 adjustable stop bolts 53 are mounted on the clamping plate in alternation with the bolts 51. These bolts 53 bear against the inner end wall section 46, as shown in Fig. 10, and should be adjusted in connection with the bolts 51 for properly tightening the packing. As shown in Fig. 8, this packing is interposed between the interior wall of the cylinder 12 and the inner end wall section to a height substantially above the highest level of the stock intended with this machine. The same kind of packing is applied at the periphery of the cylinder and includes an adjustable clamping plate 54 for tightening the packing against the end wall 18, as shown in Fig. 9. In Fig. 9 the flow evener end wall is shown bolted to the flange 55 of the flow evener back wall 56 which extends upwardly to the height of the inner end wall section 46. Said wall 56, spaced from and following the curvature of the cylinder 12, serves to confine the stock at the rear of the cylinder and, as shown in Fig. 7, merges with the flow evener bottom wall which in this application of the invention is coplanar with the apron board.

The stock delivery cylinder is of a foram-

inous construction throughout its length intermediate the end walls. The rotating cylinder serves as a flow evener and also as a mixer. It evens out all eddy currents and cross-currents and effects such distribution of the stock as to insure uniform velocity and uniform direction of the flow to the wire. It also mixes the fibers by creating a turbulent action of such degree as to insure uniform distribution of the fibers in the water. In the preferred embodiment of my invention the cylinder is drilled to provide rows of small holes 50 closely arranged as, for example, in the order shown in Figs. 3 and 5, the latter figure showing a full size section through the holes which, as noted, are beveled at the inner and outer ends. These holes provide nozzle-like delivery orifices. The stock has a turbulent, nozzle-like delivery through these orifices with the result that the fibers are mixed by the action of being drawn into the orifices, the passage therethrough at a higher velocity, and the delivery at the nozzle-like outlet ends. This action mixes the fibers sufficiently to break up any bunches or collections of fibers if any should reach this point. In this condition of uniform distribution and absence of eddies and cross-currents the stock flows to the wire in a smooth, flat and uniform stream, the characteristics of which make for a better and more uniform grade and quality of paper.

The Fourdrinier application of my invention herein illustrated is intended for a book machine of 150″ width designed to operate within a range of about 200 to 400 feet per minute. I intend to rotate the stock delivery cylinder at 2 to 6 R. P. M., the cylinder shown being 24″ outside diameter. It will be understood, of course, that these specifications are merely for purpose of illustration and are in no way a limitation on the subject matter or scope of my invention. It should also be understood that the size, shape and arrangement of the delivery orifices may be varied according to the nature of the stock being handled and the product to be made.

In order to cleanse the cylinder 12 and its delivery orifices, one or more sprays of water or other fluid may be directed against the cylinder from the inside, or from the outside, or both if desired, as by means of a spray pipe 57. Suitable rubber wipers 58 and 59 may be applied to the cylinder both outside and inside. The residue from spraying and wiping the cylinder may be collected in a suitable "save-all" trough 61 which discharges at either one or both ends of the cylinder.

In Fig. 11 I have shown my invention applied to a machine of considerably higher speed. The construction and operation is substantially the same as in the application just described except that the rotating stock delivery cylinder is located considerably above the wire and the delivery of stock to the latter is downward through a vertically disposed nozzle-like passage 62 which converges progressively from its greatest dimension at the cylinder to its smallest dimension at the slice lip 63. In this case the slice lip is flexible and adjustable at spaced points throughout its length by suitable adjusting connections 64. While the line of flow bends rearwardly and downwardly after leaving the cylinder before turning forwardly to the wire my invention contemplates direct downward flow from the cylinder in a plane substantially intersecting the center of the cylinder and then bending forwardly to the slice orifice. In this phase of my invention the elongated nozzle-like passage 62 increases the velocity of the flow.

Fig. 12 shows my new flow evener applied to a cylinder machine. This shows diagrammatically the cylinder mould 65, the felt 66, the coucher 67 and the rotating cylinder 68 of my invention which delivers the stock to the cylinder vat. The stock is deposited on the wire mould and formed into the sheet 71 in a manner well known in this art. The flow evener functions here substantially the same as in the case of a Fourdrinier machine.

In the claims "paper making" is used for convenience to designate the class of machines to which my invention applies.

I claim:

1. In a paper making machine, a rotating stock delivery cylinder, and means for feeding stock into the cylinder through one or both of its ends and for distributing the stock lengthwise within the cylinder, the cylinder having small nozzle-like orifices serving to even the flow of stock to the web forming element and to mix the fibers.

2. In a paper making machine, a rotating stock delivery cylinder having nozzle-like delivery orifices, means for feeding all of the stock into the cylinder through the ends thereof, and means for distributing the stock lengthwise within the cylinder.

3. In a paper making machine, a rotating stock delivery cylinder having small, closely arranged delivery orifices, a conduit located within the cylinder through which stock is fed from an outside source to the interior of the cylinder and distributed lengthwise therein, whereby to even the flow and mix the fibers.

4. In a paper making machine, means for delivering the stock to the web forming element, including a rotating cylinder having closely arranged orifices through which the stock is delivered from the interior outwardly, and means for feeding the stock into the cylinder through at least one end thereof and for discharging the stock therein substantially throughout the length of the cylinder.

5. In a paper making machine, means for delivering the stock to the web forming element, including a rotating cylinder having

small, closely arranged orifices through which the stock is delivered from the interior outwardly, means for cleansing the cylinder, and a save-all trough within the cylinder cooperating with said cleansing means.

6. In a paper making machine, in combination with the wire and a slice, of means for delivering the stock to the slice including a rotating stock delivery cylinder having small, closely arranged orifices through which the stock is delivered from the interior of the cylinder outwardly and thence flows through the slice orifice to the web forming element, and means for delivering the stock to the cylinder through at least one end thereof and for distributing said stock lengthwise within the cylinder.

7. In a paper making machine, means for delivering stock at substantially uniform velocity in a flow parallel with the direction of travel of the wire and with substantially uniform distribution of the fibers in the stock as it is delivered to the wire, including a rotating cylinder having small, closely arranged orifices through which the stock is delivered from the interior of the cylinder outwardly, from whence it flows to the wire, and a conduit for feeding the stock into the cylinder and distributing it lengthwise interiorly therein.

8. In a paper making machine, in combination with the wire and the slice, of a rotating cylinder for delivering stock to the slice, end walls through which the cylinder extends and between which the slice is mounted, means supporting the cylinder for rotation, means providing a stock seal between the rotating cylinder and the end walls, a stock feed conduit arranged interiorly of the cylinder and extending through and beyond the end walls whereby stock will be fed into the cylinder from both ends thereof, the cylinder being foraminous whereby the stock fed into the cylinder will be delivered outwardly therethrough and will thence flow to the web forming element.

9. In a paper making machine, means for delivering the stock to the web forming element including a rotating cylinder having stock delivery orifices, and a stock feed tube within the cylinder for distributing the stock lengthwise interiorly thereof.

10. In a paper making machine, the combination of the wire, the screens, and means for delivering the stock from the screens to the wire including a rotating stock delivery cylinder into one or both ends of which the stock is fed from the screens, and means for distributing said stock lengthwise within the cylinder, the cylinder having small orifices through which the stock is delivered from the interior outwardly for flow to the wire.

11. In a paper making machine, means for delivering the stock from the screens to the wire, including a rotating stock delivery cylinder having small, closely arranged orifices through which the stock has a nozzle-like delivery from the interior outwardly, and means for feeding all of the stock into the interior of the cylinder through at least one end thereof and distributing it lengthwise interiorly therein.

12. In a paper making machine, the combination with the wire, breast roll and the apron, of a cylinder mounted for rotating parallel with and above the breast roll, end walls circumscribing the cylinder and having sections within the cylinder, means sealing the joints both between the periphery and the interior of the cylinder and the end walls, a transverse structure joining the end walls and including a slice whereby the stock delivered from the rotating cylinder may flow through the slice orifice, a stock feed tube within the cylinder extending through and beyond the inner sections of the end walls adapted to feed the stock into the interior of the cylinder, and means for rotating the cylinder, the cylinder having small, closely arranged orifices through which the stock is delivered outwardly.

13. In a paper making machine, the method of delivering stock to the web forming element, consisting in feeding the stock into a rotating cylinder through at least one end thereof, causing the stock to be distributed within and substantially throughout the length of the cylinder, causing the stock to be delivered outwardly through nozzle-like orifices in the cylinder, and thence causing the stock to flow directly to the web forming element.

14. In a paper making machine, the method of delivering stock to the web forming element, consisting in feeding the stock into a rotating cylinder through at least one end thereof, causing the stock to be distributed within and substantially throughout the length of the cylinder, causing the stock so distributed to be delivered outwardly through small orifices in the cylinder, and thence causing the stock so delivered to flow to the web forming element.

15. In a paper making machine, the method of delivering stock from the screens to the wire, consisting in flowing the stock from the screens into both ends of a rotating cylinder disposed adjacent to and parallel with the breast roll, causing the stock to be distributed within and substantially throughout the length of the cylinder, and causing the stock to be delivered outwardly from the cylinder through small orifices, and thence causing the stock to flow to the wire.

16. In a paper making machine of the character described, a rotating cylinder provided throughout its periphery with delivery orifices for applying the stock to the web forming element, and a stock feed tube lo-

cated within the cylinder for distributing the stock lengthwise interiorly thereof.

17. A paper making machine, as set forth in claim 16, including means for cleansing the rotating cylinder, and a save-all trough within said cylinder for cooperating with said cleansing means.

18. A paper making machine, as set forth in claim 16, in which said rotating cylinder delivers the stock to a slice, said slice having an opening through which the stock flows upon the web forming element.

19. A paper making machine, as set forth in claim 16, in which the stock feed tube within the cylinder is provided with one or more longitudinal discharge openings in the upper wall portion for distributing the stock lengthwise of the cylinder interiorly thereof.

20. A paper making machine, as set forth in claim 16, in which the cylinder is mounted for rotation parallel with and above the breast roll, end walls circumscribing said cylinder and having sections within latter, and means sealing the joints both between the periphery and the interior of the cylinder and the end walls.

21. In a Fourdrinier paper making machine, in combination with the wire, breast roll, and apron board, of a stock compartment having an orifice through which the stock flows onto the wire, a rotary stock delivery cylinder in said compartment on an axis parallel with that of the breast roll and having small nozzle-like orifices for delivery of the stock outwardly from the interior, means for feeding the stock into one or both ends of the cylinder and distributing it interiorly within and substantially throughout the length of the cylinder, said compartment being close fitting around the rotary cylinder and allowing direct passage of the stock from the cylinder to the wire, and said stock feeding means serving to deliver the stock into the cylinder from a substantially high position within the cylinder to maintain a predetermined head therein but allowing a free space within the top portion of the cylinder.

In witness of the foregoing I affix my signature.

EARL E. BERRY.