

July 31, 1923.

G. L. BIDWELL

1,463,544

CYLINDER PAPER MAKING MACHINE

Filed June 23, 1922

3 Sheets-Sheet 1

FIG. 1.

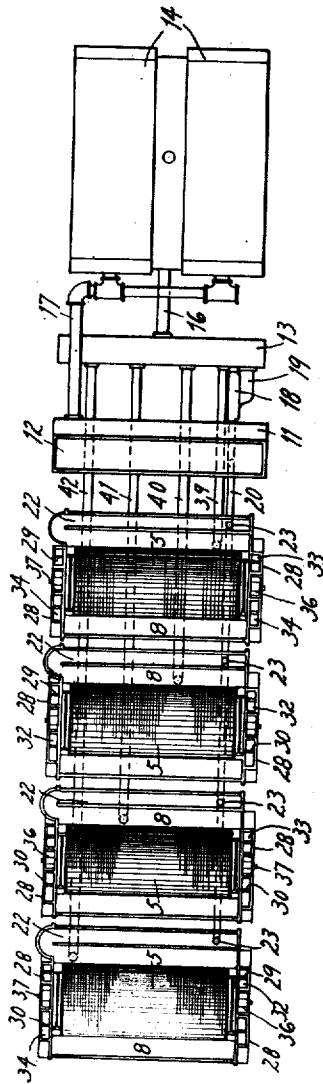
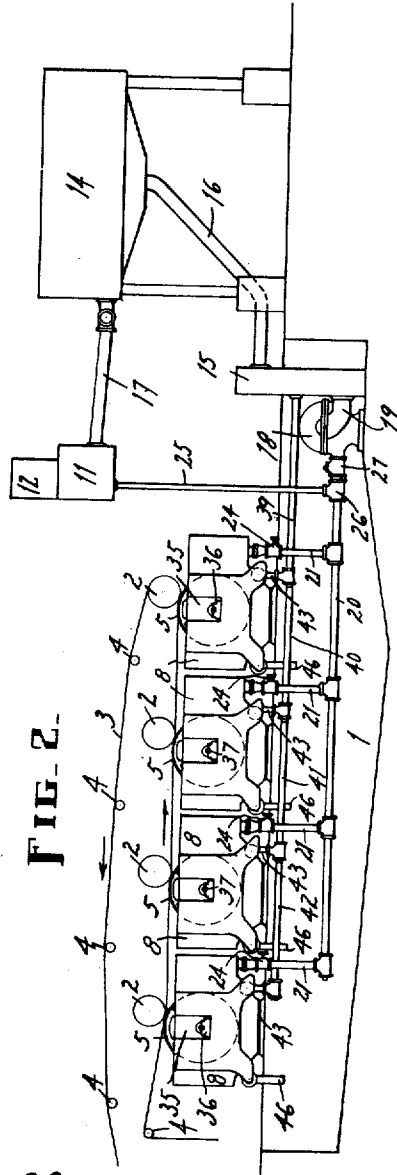


FIG. 2.



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July 31, 1923.

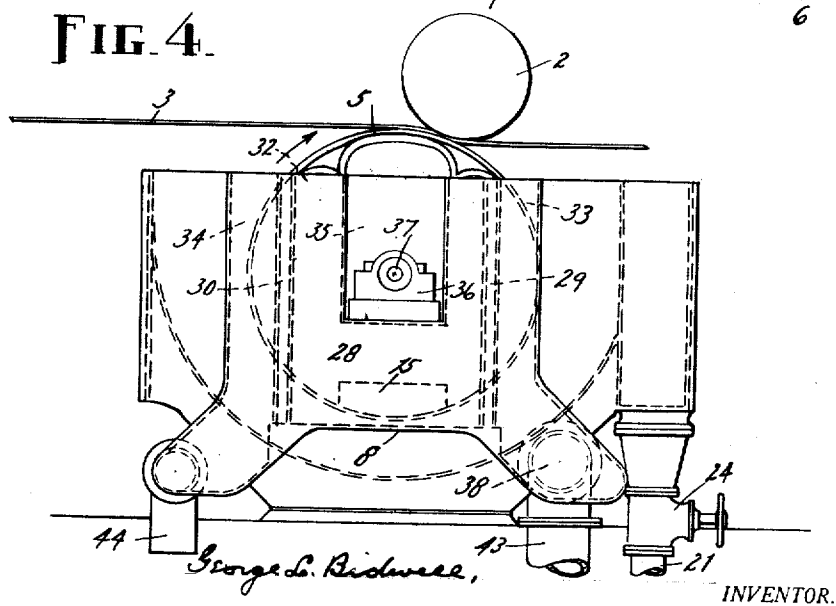
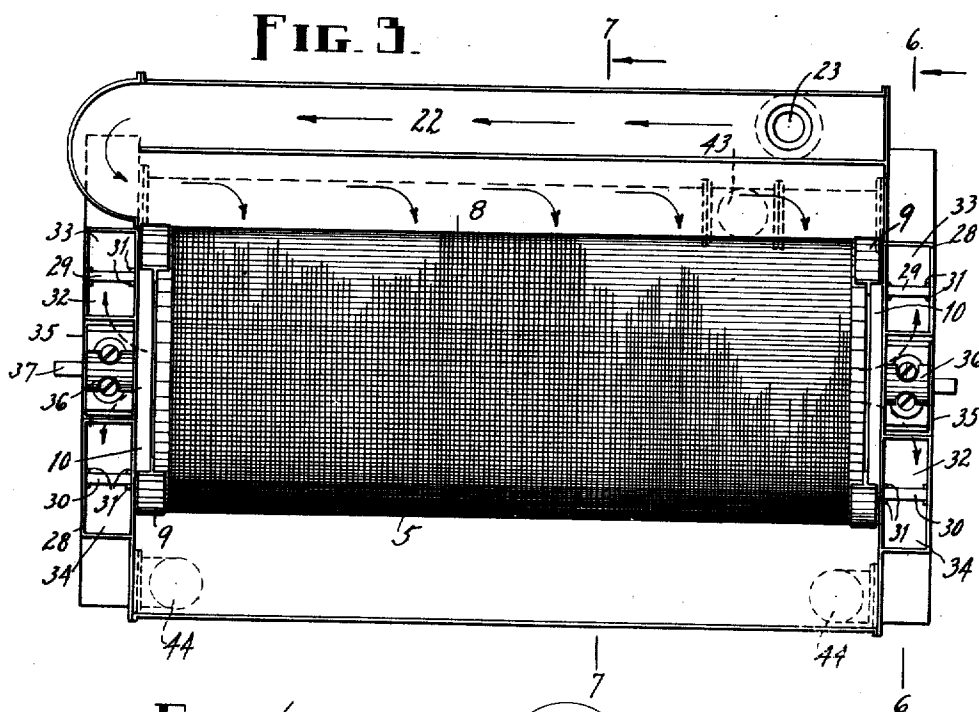
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BY

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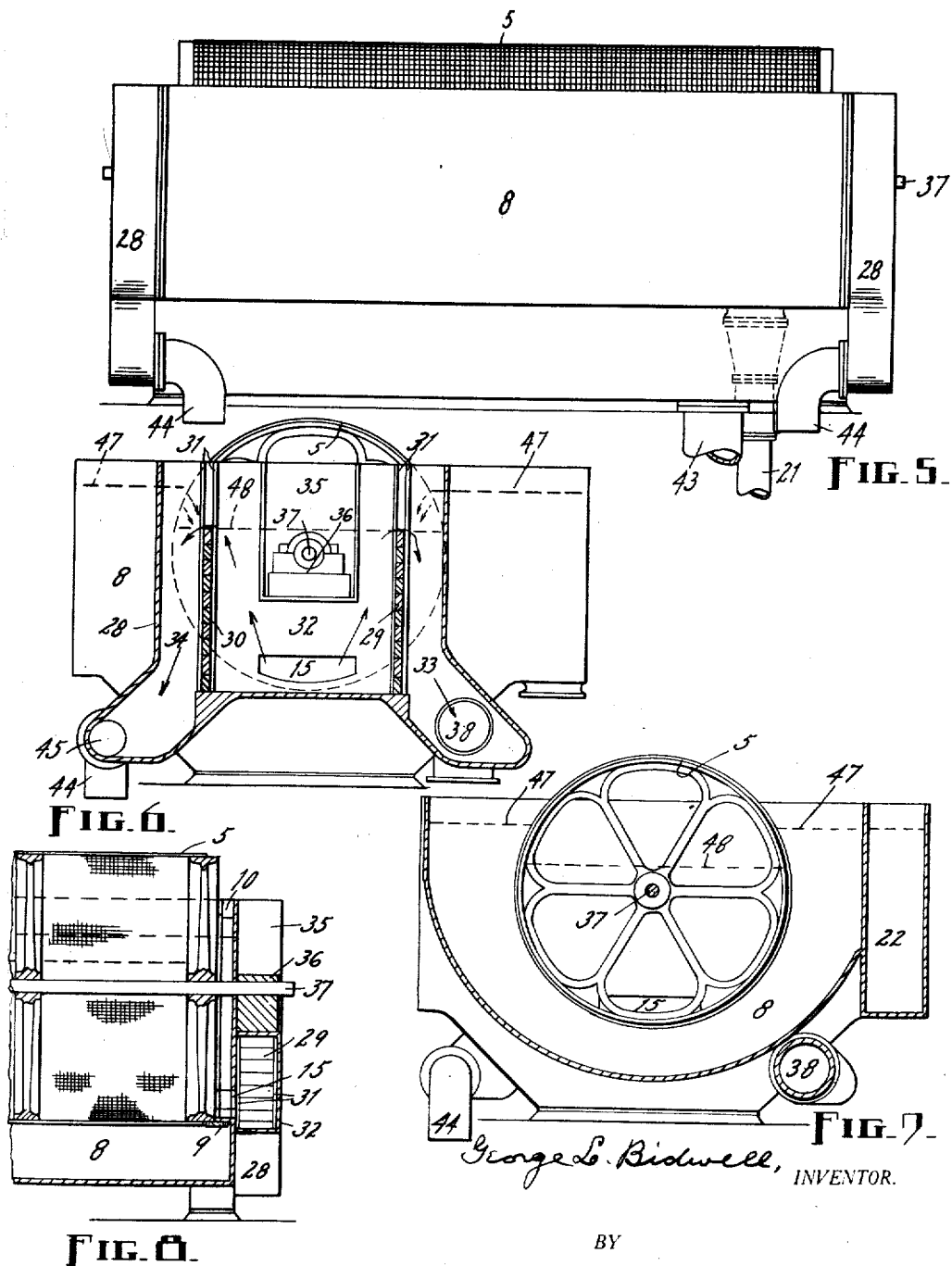
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CYLINDER PAPER MAKING MACHINE

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3 Sheets-Sheet 3



George L. Bidwell, INVENTOR.

BY

Frank A. Cutter,

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UNITED STATES PATENT OFFICE.

GEORGE L. BIDWELL, OF RIEGELSVILLE, PENNSYLVANIA.

CYLINDER PAPER-MAKING MACHINE.

Application filed June 23, 1922. Serial No. 570,490.

To all whom it may concern:

Be it known that I, GEORGE L. BIDWELL, a citizen of the United States of America, and a resident of Riegelsville, in the county of Bucks and State of Pennsylvania, have invented a new and useful Cylinder Paper-Making Machine, of which the following is a specification.

My invention relates to improvements in paper-making machines of the cylinder type, and consists of a construction wherein there is means to produce a forced feed from the head or flow box to each cylinder vat, means of control for such feed, means to provide a gravity discharge of suction or "white" water from the inside of each cylinder mold to said flow box, which latter is located below the level of discharge from said mold, means located between said discharge and said flow box for regulating and controlling said discharge, and means to provide an overflow between said discharge from said mold and said flow box, together with such other elements and parts and members as may be necessary or desirable in order to render the machine complete and serviceable in every particular, all as hereinafter set forth.

One object of my invention is to produce a cylinder paper-making machine wherein there are improved means for feeding the cylinder vats with the solution of water and fiber, for removing the water from the inside of the cylinder molds, and for controlling the suction, whereby is produced a more nearly uniform, stronger, and better closed sheet of paper, which is free from lumps, and the paper is made at a greater speed, whereby the output of the machine is materially increased.

Another object is to provide a machine of this character with a simplified and therefore less expensive piping system, the advantages of which will be clearly apparent.

It is highly important, in a machine of this character, thoroughly to mix the water with the fiber so that the sheet forms on the mold uniformly, well closed, and free from lumps, and a further object of my invention is to provide the machine with means and mechanism wherewith the aforesaid thorough mixing together of the water and fiber is obtained.

Still another object is to afford simple

yet highly efficient means of control for the solution and suction water, to the end that the same may be regulated to meet any and all conditions.

Other objects and advantages will appear in the course of the following description.

A preferred embodiment of my invention, whereby I attain the object and secure the advantages of the same, is illustrated in the accompanying drawings, and I will proceed to describe the invention with reference to said drawings, although it is to be understood that the form, construction, arrangement, etc. of the parts in various aspects are not material and may be modified without departure from the spirit of the invention.

In the drawings, in which similar characters of reference designate similar parts throughout the several views, Figure 1 is a top plan of a cylinder paper-making machine which embodies a practical form of my invention as aforesaid, the couch rolls and endless felt being omitted; Fig. 2, a side elevation of said machine; Fig. 3, an enlarged, top plan of one of what may be termed the cylinder units of the machine, without the associated couch roll and felt; Fig. 4, an end elevation of said unit; Fig. 5, a left-hand side elevation of said unit as the same is disposed in the preceding view and in Figs. 1 and 2; Fig. 6, a transverse, vertical section through said unit, taken on lines 6—6, looking in the direction of the associated arrow, in Fig. 3, some of the connections being omitted; Fig. 7 a transverse, vertical section through said unit on lines 7—7, looking in the direction of the associated arrow, Fig. 3, the associated couch roll and felt being omitted from this and the two preceding views, and, Fig. 8, a central, vertical section through an end portion of said unit, taken longitudinally.

I will briefly describe some of the old elements of the machine illustrated in the drawings, and refer to the manner in which paper is made on a cylinder machine, before taking up the new features of the machine. It may be noted at this point that the machine here comprises a battery of four cylinder units, but that such number may be increased or decreased.

At 1 in Fig. 2 is represented a pit beneath the cylinder units, such as is commonly to be found in connection with machines of this character.

In Figs. 2 and 4 a couch roll for each cylinder unit is represented at 2, and an endless, woolen felt at 3, supporting rolls for which felt are represented at 4 in Fig.

2. The couch rolls 2 are above and operate in conjunction with four cylinder molds 5 of usual construction. The felt 3 is driven and in time drives or causes to rotate the couch rolls 2 and the cylinder molds 5 by the customary means and in the customary manner. The covering of each mold 5 consists of a fine wire-mesh made up of from fifty to one hundred wires to the inch, according to the refinement of the fiber.

Each cylinder mold 5 is located and revolves in a cylinder vat 8, which latter in practice contains a solution of water and fiber in the proportions of approximately 99½% water and ½% fiber. A tight joint is formed between each end of the mold 5 and the adjacent side of the vat 8, as by means of a felt collar 9 and a metal collar 10. The only way, therefore, for water to enter the interior of the mold 5 from the vat 8 is through the wire-mesh of said mold. In flowing freely from the inside of the mold 5 the water creates what is technically known as "suction." The degree of suction is measured by the difference in the level of the solution in the vat 8 and the level inside of the mold 5. This suction causes the fibers to be deposited on the mold, and, as said mold rotates and carries the upper portion of its periphery above the level of the solution in the vat, the wet sheet of paper is "felted" or "couched," by means of the endless felt 3 which rides on top of the mold and under the associated couch roll 2, said felt passing up and over the right-hand couch roll, all of which is well understood.

It is of the utmost importance to provide means, in a machine of this character, whereby the amount of suction can be controlled and varied, because such suction must be regulated according to the length of the fiber and to the degree of hydration attained in preparing the fiber in the beater. Heretofore it has been the practice to remove the water from the inside of the cylinder mold by the use of a centrifugal pump, a gate valve being placed in the discharge of such pumps, and the suction being regulated by opening and closing such valve according to the freeness of the fiber in the solution. My invention departs widely from this construction and arrangement, as will hereinafter be made plain.

Adjacent to the end of the battery of cylinder units where the endless felt 3 passes up and over one of the couch rolls 2 to return, the same in the present example being the right-hand end of such battery, are located a riffle box, a stuff-box, a head or flow box, and a screen, of any usual and

well-known construction, and respectively represented conventionally, (as are also the felt 3, couch rolls 2, and supporting rolls 4), at 11, 12, 13, and 14.

In each end of each cylinder vat 8 is a discharge opening 15, such opening having an arcuate bottom edge which would be concentric with the wire-mesh periphery of the adjacent cylinder mold 5, if the same were extended over such opening and also having a radius which is of approximately the same length as that of said periphery, and the flow box 13 in this machine is located below the level of said opening, instead of above such level as in the old type of machine. The flow box is fed from the screen 14 by gravity through a pipe 16. The screen 14 is fed by gravity from the riffle box 11 through a suitable pipe line represented at 17.

As is well understood by those skilled in the art, the riffle box 11 is provided for the purpose of thinning down the fibers coming from the stuff-box 12, and to catch sand and other foreign matter that is separated from the fiber by the thinning-down process. The fiber in the stuff-box is diluted with about 92% water, and as said fiber passes to the riffle box the fiber is thinned down with suction water until the solution consists of about 97% water. The fiber solution passes readily through the screen 14 at this consistency, wherein dirt is removed from said solution, and the latter enters the flow box 13 from which box the solution is pumped, instead of flowing by gravity, into the cylinder vats 8. A pump by means of which this result is attained is represented at 18. There is a connection 19 between the flow box 13 and the pump 18. A horizontal pipe 20 leads from the pump 18, and a vertical pipe 21 leads from said first-named pipe to each one of the vats 8, there being the same number of pipes 21 as there is of vats. A compartment 22 is formed by a hollow extension on the side of each vat 8 which is adjacent to the flow box 13, and one of the pipes 21 opens at 23 into the bottom of said compartment near the front end thereof which is closed. The compartment 22 at its rear end communicates with the interior of the vat 8 of which said compartment forms a part, as clearly shown in Fig. 3. A gate valve 24 is provided for each vertical pipe 21. A vertical pipe 25 leads from the pipe 20, at a point between the pump 18 and the first or next adjacent pipe 21, to the riffle box 11, a three-way valve 26 is interposed between the pipes 20 and 25 and controls the flow of solution pumped out of the flow box 13 into said pipes. A check valve 27 is interposed between the pump 18 and the three-way valve 26, to control the amount of solution which is delivered to

the three-way valve. Thus there is a line of pipes between the flow box and the vats and riffle box.

The flow box 13 in its present location, and the connected pump 18, the pipes 20 and 21 with the gate valves 24 in the latter, the pipe 25, the three-way valve 26, and the check valve 27 are new features.

At each end of each vat 8 is a hollow extension 28, and such extension is or may be divided into three compartments by means of two sets of sectional wickets 29 and 30, there being two pairs of oppositely-disposed, vertical projections or ribs 31 in said extension to form channels or guides for said wickets. The sections of the wickets 29 and 30 are arranged one on top of the other in their respective channels to form dams that divide the space in the extensions 28 into an intermediate, discharge compartment 32, a flanking return compartment 33, and a flanking waste compartment 34. The height of each dam formed by the wickets 29 and 30 may be increased or decreased by adding additional sections to the top of the wicket or removing sections therefrom.

The central portion of each extension 28 is recessed, as represented at 35, to accommodate suitable bearing members, indicated at 36, for a shaft 37 with which the adjacent mold 5 is provided. The discharge opening 15 in each end of each vat 8 affords communication between the adjacent end of the mold 5, which mold operates in said vat, and one of the associated pair of compartments 32, adjacent portions of the metal collar 10 and felt collar 9 being cut away, as shown in Fig. 8, to open a clear passageway from said mold to said discharge opening. A horizontal pipe 38 connects the legs at the bottoms of the two compartments 33 of each vat.

Extending from the flow box 13, above the level of the pipe 20, are pipes 39, 40, 41, and 42, the first of which is in front, and each increasing in length in the order named. The pipe 39 is connected, at the end which is the more remote from the flow box 13, by means of a vertical pipe 43, with the pipe 38 of the right-hand cylinder unit, the pipe 40 is similarly connected with the pipe 38 of the next cylinder unit, the pipe 41 is similarly connected with the third cylinder unit, and the pipe 42 is similarly connected with the last cylinder unit. A gravity feed or flow is obtained by these pipe lines from the compartments 33 through the pipes 38 and 43, and the pipes 39, 40, 41, and 42, to the flow box 13.

Each compartment 34 at the bottom discharges into the pit 1 through an elbow 44, into which said compartment opens at 45, and a vertical pipe 46 extending downwardly from said elbow.

The level of the solution in each vat 8 is represented at 47—47 in Figs. 6 and 7, and the level of the suction or white water inside of each mold 5 and in the compartments 32 is represented at 48 in said views. These levels are regulated and maintained by means of the forced-feed valves and the heights of the wickets 29 and 30. In the present case these wickets are of the same height. The office of the wickets 30 is merely to take care of the excess if any of water that enters the compartments 32, or the quantity of water that enters said compartments which is over and above that required to pass therefrom into the compartments 33, whereby the required level in the mold 5 is obtained and maintained.

The gravity flow from the molds 5 to the flow box 13 being largely controlled by the wickets 29, although to some extent by the wickets 30, all of which are located between the discharge openings 15 from said molds and said flow box, by putting in or taking out sections of said wickets it is possible to regulate such flow, and the suction incident thereto, with a great degree of exactness. In this connection it will be remembered that the suction is dependent upon the distance between the solution level 47 in the vats and the water level 48 in the molds.

The separate connections (39, 40, 41, and 42) between the cylinder units and the flow box lend themselves to the independent control of the suction in each cylinder mold, when taken in connection with the sectional wickets.

The compartments 33 receive white water from the compartments 32, after such water has risen in said second-named compartments and passed over the tops of the wickets 29, and deliver said water to the gravity-return pipe lines which return it to the flow box 13. In the flow box the white water combines with the solution already in said box, which solution comprises approximately 97% water, as hereinbefore stated. Said solution is now further thinned until it stands at approximately 99½% water, when the same is in condition to come under the influence of the suction in the cylinder units, and to deposit itself or its saturated fiber content readily, or to become deposited readily, on the molds 5 in separate sheets which unite to form a thick sheet at the right-hand end of the battery of cylinder units, or by the time the right-hand couch roll 2 is reached.

The discharge from the pump 18 is divided by the three-way valve 26 so that the greater portion of the same passes on to the vat compartments 22, while a small percentage is forced through the pipe 25 into the riffle box 11. Further control of the solution on its way to the vats is afforded by

the valves 24, so that more or less of said solution can be delivered to one vat than to another. And it is by means of the valves 24 that the heads of the solution in the vats 8 and the riffle box 11 are balanced.

The 99½% water solution is agitated so thoroughly by the centrifugal pump 18 that the fiber and water are most completely and intimately mixed, consequently, when the fiber therein is disposed on the molds 5, the resulting sheets of paper are "closed up", and they form at or under a higher rate of speed than is possible on the old gravity-flow of 97% water solution machine, wherein the solution is thinned down in the compartments 22 and vats 8.

In the operation of the machine as a whole, or so much of such operation as is dependent on my improved features resident in said machine, the solution is pumped from the flow box 13 through the check valve 27, which valve has been properly set, into and through the three-way valve 26, which latter valve has also been properly set, into and through the pipes 20 and 21 and the gate valves 24 to the compartments 22, which valves 24 have been set to admit the proper quantities of said solution to said compartments, and through the pipe 25 into the riffle box 11, a comparatively small quantity being diverted to said riffle box. From the compartments 22 the force behind the solution carries the same into the vats 8 and through to the interior of the molds 5. The head of the solution forced into the vats 8 by the pump 18 establishes the level 47 in said vats. The revolving molds 5 screen out the saturated fiber from the solution, and the same forms into sheets which pass to the traveling felt 3 to be united into a single thick sheet. The directions of the movement of the felt 3 are indicated by the associated arrows in Fig. 2, and the direction of movement of each mold 5 is indicated by the associated arrow in Fig. 4. The white water left, after the saturated fiber has been deposited on the wire-mesh peripheries of the molds 5, escapes from the ends of said molds by gravity, through the openings 15 in the sides of the vats 8, into the compartments 32, and rises in said compartments, to the level established by the wickets 29, which wickets have been built up to the required height, passes over the tops of said wickets, falls into the chambers 33 and the pipes 38, from which latter said water passes back or returns to the flow box 13 by way of the pipes 43, 39, 40, 41, and 42, the last four pipes being inclined downwardly from said pipes 43 to said flow box. When the white water in the compartments 32 reaches the tops of the wickets 30, which latter also have been built up to the required height, so much of such water as fails to pass over the wickets 29 into the

compartments 33 passes over the tops of the wickets 30 into the compartments 34, and from said last-named compartments escapes into the pit 1 by way of the elbows 44 and the pipes 46.

The white water is sucked into the molds 5 by the gravity flow from said molds and the compartments 32 over the wickets 29, due to the fact that the water line 48 is below the solution lines 47, and the amount of this suction is readily increased or decreased by decreasing or increasing the height of said wickets accordingly.

The solution that is pumped through the pipe 25 into the riffle box 11, mingles with the solution in said box from the stuff-box 12, passes therewith through the line of pipes 17 to the screen 14, and through said screen and the pipe 16 to the flow box 13, so that there is a forced circulation from said flow box, by way of said riffle box and said screen, back to said flow box, in addition to the forced outward movement from said flow box through the cylinder units, and the gravity return movement from said units to said flow box.

Arrows in Figs. 3 and 6 indicate the directions of the flow of the solution through each compartments 22 to its vat, and of the white water from each cylinder mold to the associated gravity return and waste.

More or less change may be made in the shape, size, construction, and arrangement of some or all of the parts of this machine, without departing from the spirit of my invention, or exceeding the scope of what is claimed.

What I claim as my invention, and desire to secure by Letters Patent, is:—

1. In a cylinder paper-making machine, mechanical means to produce a forced feed from the flow box to the vat, and gravity-return means from said vat to said box.
2. In a cylinder paper-making machine, mechanical means to produce a forced feed from the flow box to the vat, gravity-return means from said vat to said box, and means to regulate said gravity-return means.
3. In a cylinder paper-making machine, mechanical means to produce a forced feed from the flow box to the vat and the riffle box, and gravity-return means from said vat to said flow box.
4. The combination, in a cylinder paper-making machine, with a flow box, a vat, and a cylinder mold in said vat, of means to force the solution from said box into said vat.
5. The combination, in a cylinder paper-making machine, of a riffle box, a flow box, a vat, and a cylinder mold in said vat, of means to force the solution from said flow box into said vat and also into said riffle box.
6. The combination, in a cylinder paper-making machine, with a riffle box, a flow

box, a vat, pipe connections, and a cylinder mold in said vat, of means to force the solution from said flow box into said vat and also into said riffle box, such means consisting

of a pump located in the pipe connections between said flow box and said vat and riffle box.

7. The combination, in a cylinder paper-making machine, with a riffle box, a flow box, a vat, pipe lines, and a cylinder mold in said vat, of means to force the solution from said flow box into said vat and also into said riffle box, a three-way valve in the pipe connections between said flow box and said vat and riffle box, and a pump between said flow box and said valve.

8. The combination, in a cylinder paper-making machine, with a flow box, a vat, and a cylinder mold in said vat, of a pipe line from said flow box to said vat, a pump in said pipe line to force the solution from said box to said vat, and a valve in said pipe line to regulate the flow into said vat.

9. The combination, in a cylinder paper-making machine, with a riffle box, a flow box, a vat, and a cylinder mold in said vat, of a pipe line from said flow box to said vat and said riffle box, a three-way valve in said pipe line between said flow box and said riffle box, a pump in said pipe line between said flow box and said valve, and a valve in said pipe line to control the flow into said vat.

10. In a cylinder paper-making machine, a flow box, a vat, a cylinder mold in said vat, an extension into which said mold discharges, the point of discharge being at a higher elevation than said flow box, and controlling means for the discharge, said last-named means being located in said extension.

11. In a cylinder paper-making machine, a flow box, a vat, a cylinder mold in said vat, an extension into which said mold discharges, the point of discharge being at a higher level than said flow box, and a sectional wicket in said extension to control the discharge from said last-named means.

12. In a cylinder paper-making machine, a flow box, a cylinder mold, and means to discharge by gravity the suction water from the inside of said mold into said flow box, the latter being located below the level of the discharge.

13. In a cylinder paper-making machine, a flow box, a cylinder mold, and means to discharge by gravity the suction water from the inside of said mold into said flow box, the latter being located below the level of the discharge, and means to control such discharge.

14. In a cylinder paper-making machine, a flow box, a cylinder mold, and means to discharge by gravity the suction water from the inside of said mold into said flow box,

the latter being located below the level of the discharge, and removable means to control said discharge.

15. In a cylinder paper-making machine, a head box, a cylinder mold, and means to discharge by gravity the suction water from the inside of said mold into said flow box, the latter being located below the level of the discharge, and controlling means for said discharge, said controlling means comprising sectional wickets.

16. The combination, in a cylinder paper-making machine, with a cylinder mold and a flow box, of gravity means to carry the white water from said mold to said box which is above the level of said box.

17. The combination, in a cylinder paper-making machine, with a cylinder mold and a flow box, of a discharge from said mold which is above the level of said box.

18. The combination, in a cylinder paper-making machine, with a flow box, a vat, a cylinder mold in said vat, and an extension into which said mold discharges, of mechanical means to force the solution from said flow box into said vat, and gravity means to carry the white water from the inside of said mold back to said flow box, which latter is below the level of the discharge from said mold.

19. The combination, in a cylinder paper-making machine, with a riffle box, a flow box, a vat, a cylinder mold in said vat, and an extension into which said mold discharges, of mechanical means to force the solution from said flow box into said vat and said riffle box, and gravity means to carry the white water from the inside of said mold back to said flow box, the level of the solution in said vat being above the level of the white water in said mold.

20. The combination, in a cylinder paper-making machine, with a flow box, a vat, a cylinder mold in said vat, and an extension into which said mold discharges, said extension being provided with means to assist in maintaining the suction water in said mold at a lower level than the solution in said vat, of mechanical means to force the solution from said flow box into said vat, and gravity means to carry the suction water from said extension back to said flow box.

21. The combination, in a cylinder paper-making machine, with a flow box, a vat, a cylinder mold in said vat, and an extension divided into two compartments into one of which said mold discharges, of mechanical means to force the solution from said flow box into said vat, and gravity means to carry the suction water from the other of said compartments back to said flow box.

22. The combination, in a cylinder paper-making machine, with a flow box, a vat, a cylinder mold in said vat, and an extension into which said mold discharges, said extension being divided into intermediate, return,

and waste compartments, whereby the level of the suction water in the mold is maintained at a lower level than that of the solution in the vat, of mechanical means to force the solution from said flow box into said vat, gravity means to carry the suction water from said return compartment back to said flow box, and gravity means for the discharge of the suction water from said waste compartment.

23. In a cylinder paper-making machine, a flow box, a vat, a cylinder mold in said vat, a gravity discharge for the suction water from said mold to said flow box, which latter is located below the level of said discharge, and means to produce a forced feed to said vat from said box.

24. In a cylinder paper-making machine, gravity discharge means for the suction water from the mold to a flow box located below the level of the discharge, means to produce a forced feed of the solution from the flow box to both the vat and the riffle box, and a check valve, three-way valve, and gate valve to control such feed.

25. The combination, in a cylinder paper-making machine, with a vat, a forced feed for said vat, a cylinder mold in said vat, and a gravity discharge for the suction water from the inside of said mold, of means to maintain a uniform level of solution in said vat and rid the cylinder unit of surplus water.

26. The combination, in a cylinder paper-making machine, with a vat, a forced feed for said vat, a cylinder mold in said vat, and a gravity discharge for the suction water from the inside of said mold, of means to maintain a uniform level of solution in said vat and rid the cylinder unit of surplus water, such means consisting in part of gravity overflow means.

27. The combination, in a cylinder paper-making machine, with a vat, a forced feed for said vat, a cylinder mold in said vat, and a gravity discharge for the suction from the inside of said mold, of removable overflow means to assist in maintaining a uniform level of solution in said vat, and rid the cylinder unit of surplus water.

28. The combination, in a cylinder paper-making machine, with a vat, a forced feed for said vat, a cylinder mold in said vat, and a gravity discharge for the suction from the

inside of said mold, of adjustable overflow means to assist in maintaining a uniform level of solution in said vat, and rid the cylinder unit of surplus water, such overflow means comprising a sectional wicket.

29. The combination, in a cylinder paper-making machine, with a vat, a cylinder mold in said vat, and an extension at the end of said vat, of means in said extension to divide the same into compartments into one of which the discharge from said mold is received and into the other of which such discharge flows away after passing over the dividing means.

30. The combination, in a cylinder paper-making machine, with a vat, a cylinder mold in said vat, and an extension at one end of said vat, of means in said extension to divide the same into compartments, into one of which compartments the discharge from said mold is received, into another of which compartments such discharge flows away after passing over one of the divisions, and into still another of which compartments the overflow escapes over the other division.

31. The combination, in a cylinder paper-making machine, with a vat, a cylinder mold in said vat, and an extension at the end of said vat, said extension being provided with guides, of removable members in said guides adapted partially to divide said extension into a compartment to receive the suction water from said mold, and into a compartment to receive said water from said first-named compartment, after the same passes over the top of said removable members.

32. The combination, in a cylinder paper-making machine, with a vat, a cylinder mold in said vat, and an extension at the end of said vat, said extension being provided with guides, of removable members in said guides to form partitions which partially divide said extension into a receiving compartment for the white water from said mold, a compartment into which such water escapes over the top of one of said partitions, and a compartment into which the waste portion of such water escapes over the top of the other partition.

GEORGE L. BIDWELL.

Witnesses:

RAYMOND D. LOPER,
KARL S. HOLDEN.