No. 847,857. PATENTED MAR. 19, 1907.

J. B. WALKER & A. R. BOND.

PAPER MAKING MACHINE.

APPLICATION FILED FEB. 1, 1907.

2 SHEETS—SHEET 1.

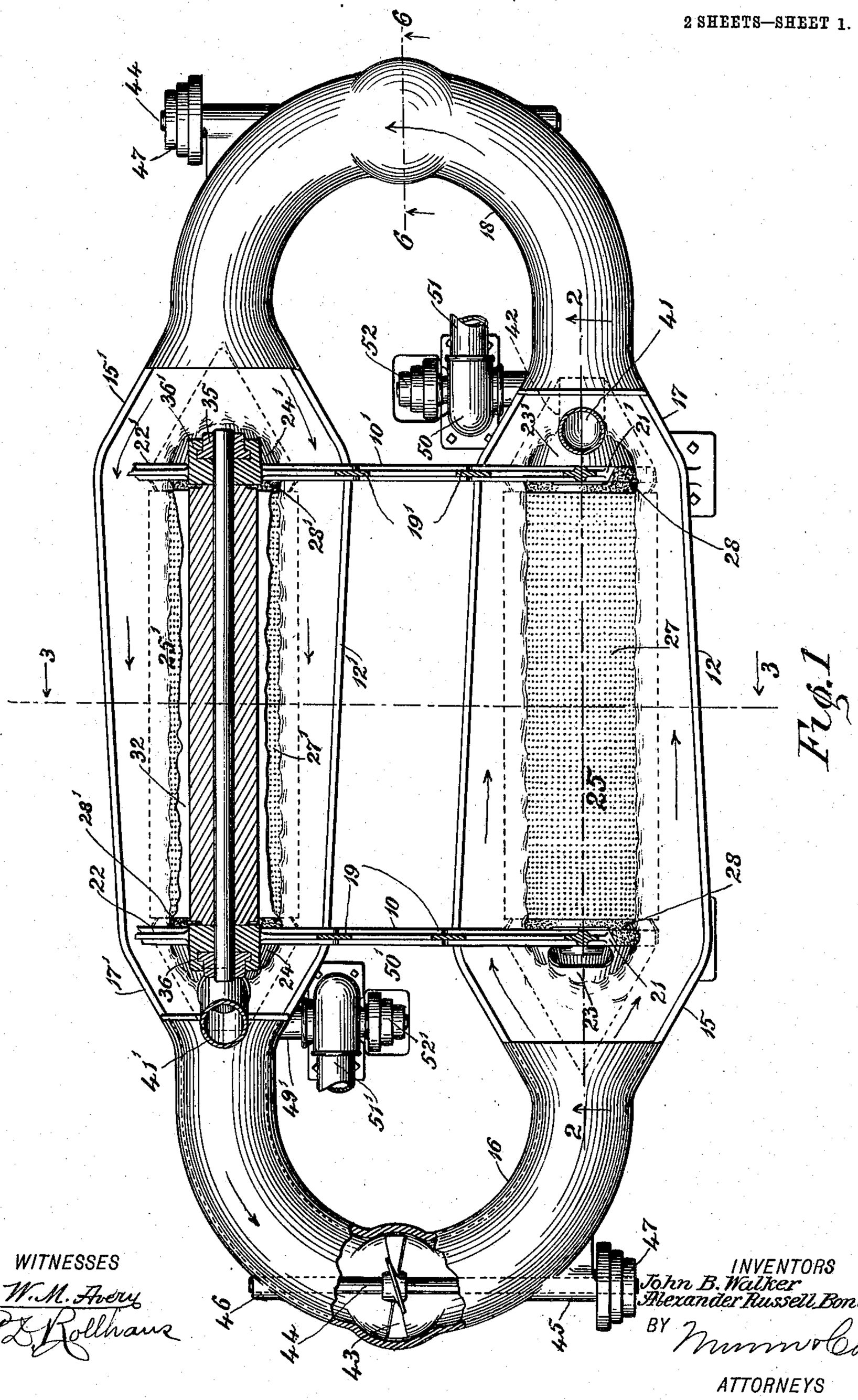

Fig. 1

WITNESSES

W. M. Avery

P. L. Rollhaus

INVENTORS

John B. Walker

Alexander Russell Bond

BY Munn & Co

ATTORNEYS

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2 SHEETS—SHEET 2.

Fig. 2

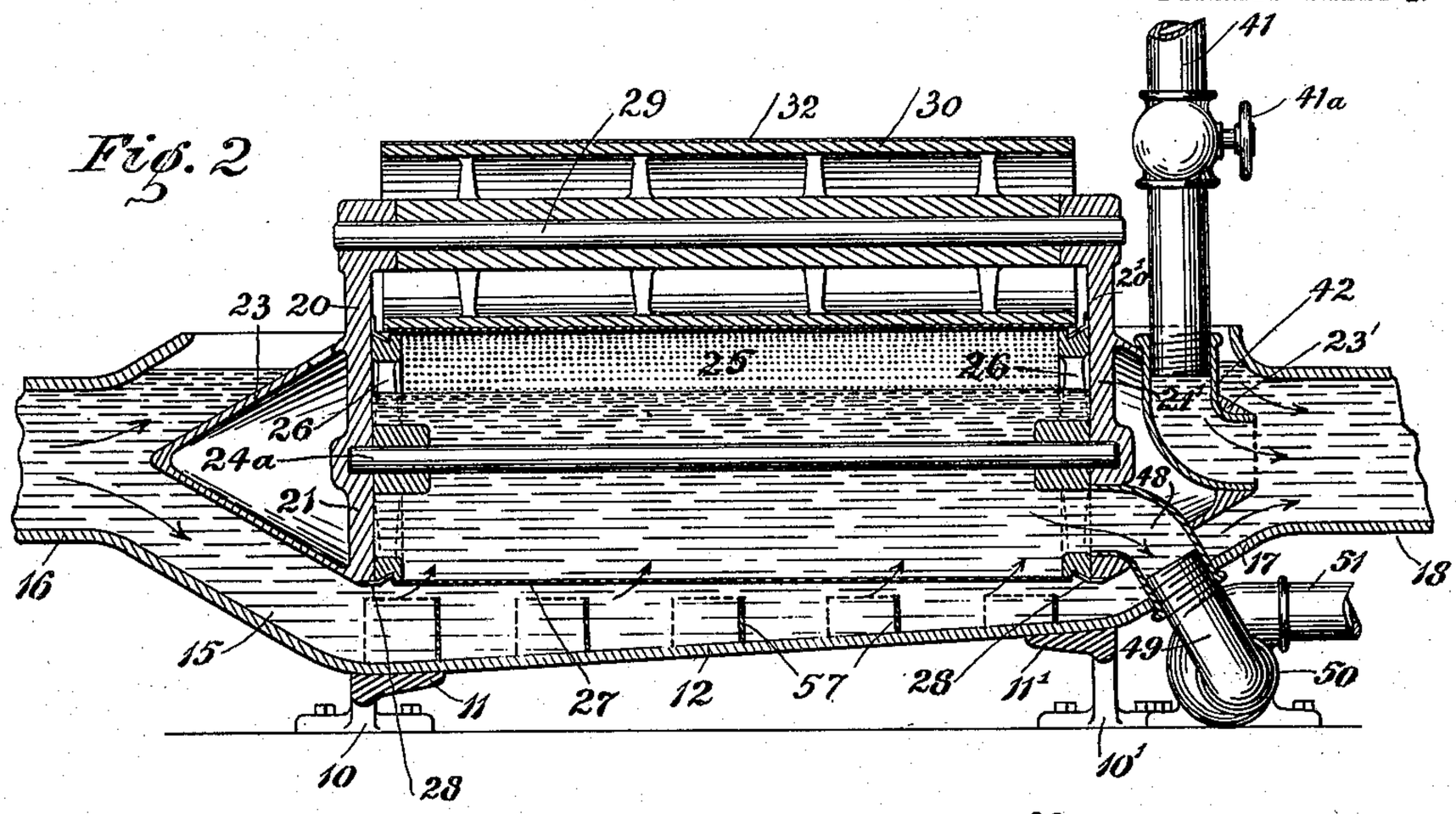
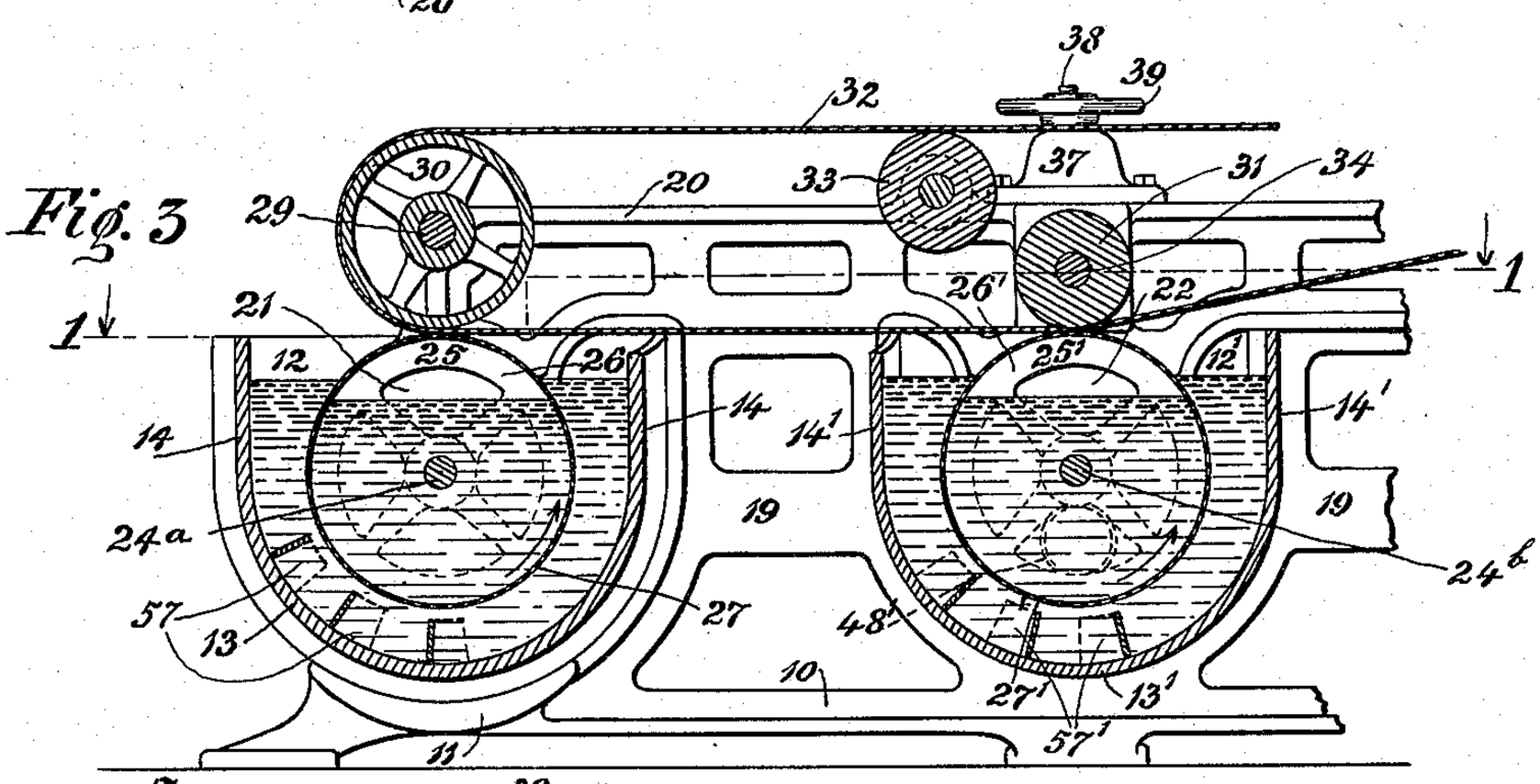


Fig. 3



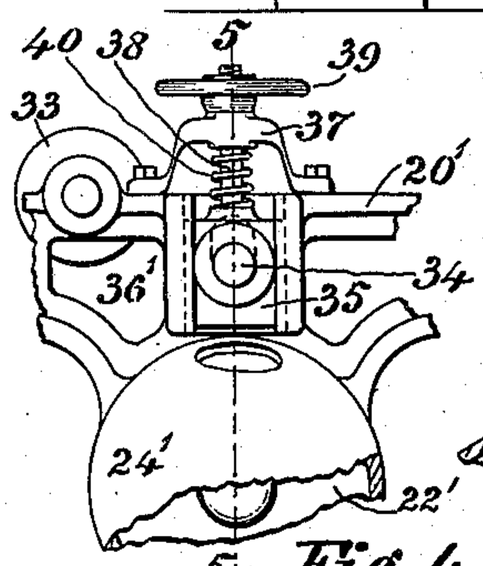


Fig. 4

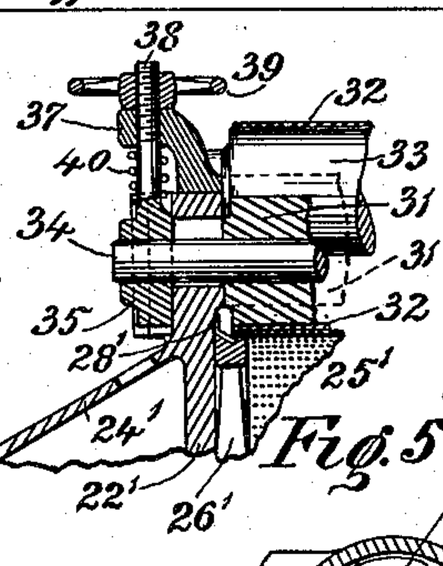


Fig. 5

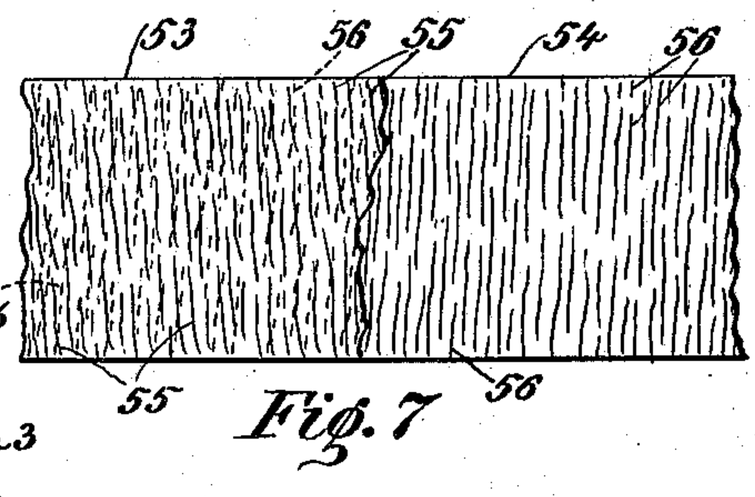


Fig. 7

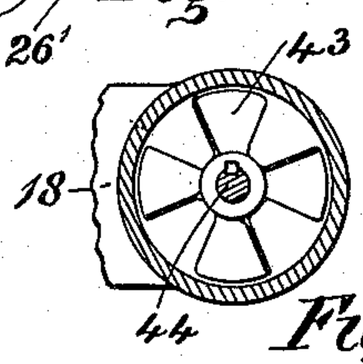


Fig. 6

WITNESSES

W. M. Avery

P. D. Rollhaus

INVENTORS

John B. Walker

Alexander Russell Bond

BY Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOHN B. WALKER AND ALEXANDER RUSSELL BOND, OF NEW YORK, N. Y.

PAPER-MAKING MACHINE.

No. 847,857. Specification of Letters Patent. Patented March 19, 1907.

Application filed February 1, 1907. Serial No. 355,195.

To all whom it may concern:

Be it known that we, JOHN B. WALKER, of the city of New York, borough of Brooklyn, in the county of Kings and State of New York, and ALEXANDER RUSSELL BOND, of the city of New York, borough of Manhattan, in the county and State of New York, both citizens of the United States, have invented a new and Improved Paper-Making Machine, of which the following is a full, clear, and exact description.

Our invention relates to paper-making machines, particularly of the type known to the art as "cylinder-machines." As ordinarily constructed cylinder-machines comprise a cylindrical screen revolved in a tank of liquid pulp, the paper being formed on the screen by drawing off the water of the pulp through the screen, and thus depositing the fibers of the pulp on the cylinder. The fibers of paper thus made have a general trend or grain in the direction of the length of the paper—that is, at right angles to the axis of the cylinder on which it is formed—this being due mainly to the fact that the fibers deposited on the screen are dragged through the pulp in the tank as the cylinder revolves and are virtually combed in the direction of the rotation.

It is desirable for certain purposes to produce a paper with a grain running transversely to the length of the paper, and it is an object of our invention to provide a machine in which paper with such a transverse grain may be produced.

With this and other objects in view our invention consists of novel features and parts and combinations of the same, as will be more fully described hereinafter and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional plan view of our invention, taken on the line 1 1 of Fig. 3. Fig. 2 is a sectional elevation taken on the line 2 2 of Fig. 1. Fig. 3 is a section on the line 3 3 of Fig. 1 viewed in the direction of the arrows. Fig. 4 is a fragmental view showing certain details of our machine. Fig. 5 is a section taken on line 5 5 of Fig. 4. Fig. 6 is a section taken on line 6 6 of Fig. 1, and Fig. 7 is a view illustrating the arrangement of the fibers in the paper produced on our machine.

The main frame of our machine comprises two oppositely-disposed members 10 and 10′, respectively. These frame members are respectively formed with brackets 11 and 11′, which serve to support a chamber 12. The chamber 12 is open at the top and consists in cross-section of a semicircular bottom wall 13, with extended vertical side walls 14, as best shown in Fig. 3. For purposes which will be explained hereinafter the chamber 12 is preferably larger at one end than at the other, and the bottom wall instead of being semicylindrical in form is tapered or slightly semiconical. At the large end of the chamber 12 is a funnel-shaped section 15, serving to connect this chamber with a pipe 16. At the opposite end of the chamber 12 is a similar funnel-shaped section 17, serving to connect this chamber with a pipe 18.

A second chamber 12′ is mounted on the frame members 10 and 10′ to the rear of the chamber 12, the upper edges of the chambers 12′ and 12, respectively, lying in the same horizontal plane. The chamber 12′ is similar in form to the chamber 12, having a semiconical bottom wall 13′ and vertical side walls 14′; but it is oppositely disposed with respect to the chamber 12—that is, the larger end of the chamber 12′ lies adjacent to the smaller end of chamber 12 and the smaller end of chamber 12′ is adjacent to the larger end of chamber 12. The pipe 16, which is curved, is connected by a funnel-section 17′ with the smaller end of the chamber 12′, and the pipe 18, which is also curved, is connected by a funnel-section 15′ with the larger end of chamber 12′. For purposes of illustration the two chambers, with their respective funnel-shaped sections, and the two pipes are all formed in a single piece.

The frame members 10 and 10′ are respectively formed with upright sections 19 and 19′, which project upward between the chambers 12 and 12′ and support top rails 20 and 20′, respectively. The top rail 20 is formed with two depending circular plates 21 and 22, which enter the chambers 12 and 12′, respectively. Similarly, the top rail 20′ is formed with two depending plates 21′ and 22′, which also enter the chambers 12 and 12′, respectively. The plates 21 and 22 are formed with cone-shaped guides 23 and 24, respectively, which project into the funnel-shaped sections 15 and 17′, respectively. Similarly, the plates 21 and 22′ are formed

with cone-shaped guides 23′ and 24′, which project into the funnel-shaped sections 17 and 15′, respectively.

Journaled in bearings in the opposite plates 21 and 21′ is a shaft 24ª, which carries a screen-cylinder 25. This screen-cylinder is formed of two end spiders or spoked wheels 26, connected by a cylindrical screen 27. The wheels 26 are adapted to turn in close proximity to the plates 21 and 21′, respectively, and in order to provide a water seal between said plates and said wheels each wheel is formed with a groove in its periphery, adapted to receive a flap 28, of felt or other flexible material, projecting from and secured to the adjacent plate. Similarly journaled in bearings in the opposite plates 22 and 22′ is a shaft 24ᵇ, which carries a screen-cylinder 25′, formed of the end wheels or spiders 26′ and screen 27′, the wheels 26 being water-sealed by means of flexible flaps 28′, fitting into grooves in the respective peripheries of said wheels, said flaps being respectively secured to the plates 22 and 22′.

Journaled in bearings in the top rails 20 and 20′ directly above the cylinder 25 is a shaft 29, which carries a large roller 30, and mounted directly above the cylinder 25′ is a similar roller 31. An endless blanket or belt 32, of flannel or similar flexible material, is adapted to pass under the roller 31 and around the roller 30, the upper stretch of said belt being spaced above the roller 31 by an idle roller 33, mounted to turn in bearings in the top rails. The belt 32 is adapted to pass about the various rollers common to all cylinder paper-making machines and which are not shown in the illustrations, as they are not elements of our invention. It will be understood, however, that the belt is driven by frictional engagement with the said rollers, which are rotated in the usual well-known manner. The roller 30 presses the moving belt 32 into frictional engagement with the cylinder 25, thereby causing the latter to revolve.

The roller 31 is carried by a shaft 34, Figs. 4 and 5, which passes through slots in the top rails 20 and 20′, respectively, and is journaled at opposite ends in slide-blocks 35. These slide-blocks are fitted to slide in the slideways 36 and 36′, Fig. 1, formed, respectively, on the rails 20 and 20′. Bolted to each top rail is a bracket 37, formed with an apertured head overhanging the adjacent slide-block 35. Each slide-block is formed with an upwardly-projecting shank 38, which passes freely through this apertured head and which is threaded to engage a nut or threaded hand-wheel 39, supported on said head. A compression-spring 40, Fig. 4, is coiled about each shank and presses against the head of the bracket and the slide-block. By turning the hand-wheel 39 in one direction the roller 31 may be raised to the position shown by dotted lines in Fig. 5, when the belt 32 will clear the cylinder 25′. When, however, the hand-wheel is turned in the opposite direction, the roller will move downward under pressure of the spring 40 until it presses the moving belt 32 against the cylinder 25′, causing the latter to revolve by reason of its frictional engagement with said belt.

Pulp is fed to our machine through a supply-pipe 41, which is threaded into an elbow 42. The latter is fitted into the guide 23′ and communicates with the pipe 18 through an opening in the end of this guide. The pulp-supply is regulated by means of a valve 41ª in the supply-pipe. A second supply-pipe 41′ is provided, which is threaded into an elbow in the guide 24 and communicates with the pipe 16 through an opening in the end of this guide.

The pipes 16 and 18 are formed each with an enlargement intermediate of its length, in which a propeller 43 is mounted to rotate. This propeller is keyed to a shaft 44, which is journaled in bearings 45 and 46, formed on the pipe. One end of the shaft projects from the pipe and carries a stepped-cone pulley 47.

Communication with the interior of the cylinder 25 is had through an elbow-pipe 48, which fits into an opening in the lower part of the plate 21′ and extends through an opening in the guide 23′ and the bottom of the funnel-section 17. A pipe 49, threaded into the outer end of the elbow 48, leads to a pump 50, which serves to draw off the liquid from the interior of the cylinder 25 and pump it into the outlet-pipe 51. The pump 50 is provided with a stepped-cone driving-pulley 52. Similarly, an elbow-pipe 48′ is fitted into an opening in the lower end of the plate 22, and a pipe 49′ connects the pipe 48′ with a pump 50′, which serves to pump the liquid from the interior of the cylinder 25′ and eject it into the outlet-pipe 51′. The pump 50′ is provided with a stepped-cone driving-pulley 52′.

In operation liquid pulp is admitted into the chambers 12 and 12′ until the latter are filled to a suitable depth, such as indicated in the drawings. A circulation of this pulp from the chamber 12 through the pipe 18 to the chamber 12′ and thence back through the pipe 16 to the chamber 12 is secured by means of the propellers 43. The rate of flow of the pulp can be regulated by driving the propellers at different speeds, variation in their rotary speed being secured in the well-known manner by means of the stepped driving-pulleys 47. The pulp in the chambers 12 and 12′ will be strained through the cylinders 25 and 25′, respectively, the water of the pulp flowing into the cylinders and leaving the fibers of the pulp on the screens 27 and 27′, respectively. This water in the cylinders is drawn off by means of the pumps 50 and 50′, which are driven at the desired

speed by means of the stepped pulleys 52 and 52′, respectively. At the same time a continuous fresh supply of pulp is fed into the pipes 18 and 16 through the pipes 41 and 41′, respectively. By operating the valves of these pipes the quantity of pulp supplied can be made to exactly equal the amount of water drawn off from the cylinders plus the amount of fiber caught by the screens.

The cylinders are revolved by contact with the moving belt 32, as stated hereinbefore, and the fibers which are caught on the screens of the cylinders are picked up by the belt and carried through the usual drying and compressing rollers to form paper. When the two cylinders 25 and 25′ are operating, a two-ply paper is formed, as the fibers gathered on the cylinder 25′ are first picked up by the belt and then on them are caught the fibers gathered by the cylinder 25. The general direction of the fibers on each cylinder will be the resultant of two components, one component being parallel to the axis of the cylinder and the other at right angles thereto. The latter component is due to the combing action of the pulp on the fibers caught on the screen as they are drawn through the pulp by the revolving cylinder, and the former component is due to the combing action of the current of pulp which passes along the revolving cylinder. The component parallel with the axis can be varied at will by regulating the speed of the propellers 43, and thus regulating the rate of flow of the circulating pulp, while the other component can be varied by regulating the rate of travel of the belt 32 and correspondingly varying the speed of the pumps 50 and 50′. It will thus be evident that the resultant direction of the fibers deposited on the cylinder may be perfectly governed, for by increasing the rotary speed of the cylinder and reducing the current speed of the circulating pulp the fibers will be made to lie approximately at right angles to the axis of the cylinder or parallel to the length of the paper, and, vice versa, if the speed of the cylinder is reduced and the current speed of the pulp is increased the fibers may be made to lie approximately at right angles to the length of the paper.

It will be observed that the direction of the current in the chamber 12′ is the reverse of that in the chamber 12. The fibers gathered by the cylinder 25′ will therefore lie at the same angle with respect to the length of the paper as those gathered by the cylinder 25, but in the opposite direction. Thus in a two-ply paper produced on our machine the fibers of one ply will cross the fibers of the other ply. This is best illustrated in Fig. 7, which shows a piece of our two-ply paper. A portion of the upper ply 53 is torn away to reveal the lower ply 54, and it will be observed that the fibers 55 of the upper ply form the same angle with the length of the paper as do the fibers 56 of the lower ply, but the fibers 55 lie across the fibers 56. The purpose of this crossing of fibers is to increase the strength of the paper in the direction of its length, and thus secure the strength of a woven or matted paper.

For some uses a double-ply paper is objectionable, and our machine is therefore so designed that it can make a single-ply paper. This is done by operating the hand-wheels 39 to raise the roller 31 to the dotted position shown in Fig. 5. The belt 32 will then clear the cylinder 25′, permitting it to lie idle. The pump 50′ is also stopped to prevent a useless accumulation of fibers on the screen 27′, and the inflow of pulp through the supply-pipe 41′ is cut off. Fibers will then collect only on the cylinder 25, and their direction can be regulated as desired in the manner described above.

In order to secure a uniform thickness and grain of the paper, it is essential that a uniform current of pulp be maintained. For this the guides 23, 23′, 24, and 24′ are used, their principal object being to prevent eddy-currents at the ends of the cylinders by providing an even distribution of the pulp. The purpose of tapering the chambers 12 and 12′ from a large cross-sectional area at their respective inflow ends to a smaller cross-sectional area at their respective outflow ends is to compensate for the fibers gathered on the cylinders 25 and 25′, respectively, and for the liquid strained into said cylinders. In practice the cross-sectional area of the pulp at any point in the pipes 16 and 18 and funnels 15 and 17 should be constant, and the cross-sectional area of pulp at any point in the chambers 12 and 12′ should be equal to said constant less the amount of pulp strained into the cylinders 25 and 25′ up to said point.

It will be evident that by providing a sufficient head of pulp in the supply-pipes 41 and 41′ the latter may be used as injector-pumps to produce a current of pulp in the chambers 12 and 12′, the rate of the flow being governed by valves 41^a, and we wish it to be understood that this method of producing a flow of pulp is included in our invention and that the propellers 43 serve as auxiliary pumps, adapted particularly for use where it is impossible or inconvenient to secure the desired head in the pipes 41 and 41′.

It has been a common practice in paper-making machines of the cylinder type to provide baffles or projections in the pulp-chamber, so that the course of the pulp as it is sucked toward the screen-cylinder will be distorted and some of the pulp fibers drained onto the cylinder will take up a position diagonal or transverse to the general trend of the majority of the fibers drained on said cylinder, the purpose of this being to produce a

partial matting or weaving of the fibers, and thereby increase the strength of the paper ultimately formed. With a similar purpose in view we provide baffles 57 and 57′ in the receptacles 12 and 12′, respectively, so that a partial matting of the fibers on the cylinders 25 and 25′ will take place. The baffles 57 and 57′ consist of series of plates secured to the bottom of their respective receptacles and extending radially therefrom to close proximity with their respective screen-cylinders. The plates are not parallel with the axis of the pulp receptacle or chamber, but are inclined thereto in such manner as to divert a portion of the stream of pulp and direct it diagonally against the direction of rotation of the cylinder. This is illustrated in the sectional view, Fig. 3, which represents the pulp as flowing toward the observer in the receptacle 12 and as flowing away from the observer in the chamber 12′, and the baffle-plates 57 and 57′ are so disposed as to direct a portion of the pulp in each chamber diagonally against the direction of rotation of the screen-cylinders, said direction being indicated by the arrows. As has been hereinbefore stated, the fibers drained onto the screen-cylinder will not lie parallel to the axis of the cylinder, as their position is the resultant of two components, one being the direction and velocity of the pulp-stream and the other the direction and velocity of the moving screen. However, at points where the baffles serve to divert the stream diagonally against the direction of rotation of the cylinder the fibers on the cylinder will be combed more nearly parallel with the axis of the cylinder. A matted effect of the fibers is thus secured, while preserving the general axial trend of the fibers on the cylinder. In practice we prefer to use baffles only at the forward side of each pulp-chamber or adjacent to that side of the screen-cylinder which first takes on the layer of pulp.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. A trough adapted to confine a stream of pulp, said trough having an inflow end and an outflow end and tapering from a larger cross-sectional area at said inflow end to a smaller cross-sectional area at said outflow end, a cylindrical screen mounted to rotate in said trough on an axis parallel with the general direction of said stream, and means for draining a portion of said pulp onto said screen.

2. A trough adapted to confine a stream of pulp, said trough having an inflow end and an outflow end and tapering from a larger cross-sectional area at said inflow end to a smaller cross-sectional area at said outflow end, a cylindrical screen mounted to rotate in said pulp on an axis parallel with the general direction of said stream, means for draining a portion of said pulp onto said screen, and means for diverting said pulp from the ends of said cylinder.

3. A trough adapted to confine a stream of pulp, said trough having an inflow end and an outflow end and tapering from a larger cross-sectional area at said inflow end to a smaller cross-sectional area at said outflow end, a cylindrical screen mounted to rotate in said pulp on an axis parallel with the general direction of said stream, said cylindrical screen being open at opposite ends, stationary guides adapted to divert said pulp from the ends of said screen, said guides being of conical form pointing outward from said screen, flaps adapted to prevent entrance of liquid between said screen and said guides, and an exhaust-pipe communicating with the interior of said screen.

4. A receptacle forming an endless channel for pulp, means for producing a flow of said pulp in said channel, a cylindrical screen mounted to rotate in said receptacle in a plane transverse to said flow of said pulp, means for draining a portion of said pulp onto said screen, and means for introducing fresh pulp into said receptacle, the latter being so proportioned as to insure a uniform rate of flow of said pulp throughout the entire extent of said receptacle.

5. In a paper-making machine, a receptacle formed with a truncated semiconical bottom and approximately vertical extensions at opposite sides, said receptacle being also formed at each end with funnel-shaped portions, a cylindrical screen mounted concentrically with said semiconical bottom, conical guides mounted respectively at opposite ends of said screen, and projecting into said funnels, an exhaust-pipe communicating with the interior of said cylindrical screen, and a feed-pipe communicating with the funnel-shaped portion at the smaller end of said receptacle, the mouth of said feed-pipe being formed in the outer end of the adjacent conical guide.

6. A pair of opposed cylindrical screens mounted to rotate on parallel axes, means for conveying pulp in axial but respectively opposite directions along said screens, means for draining pulp onto each of said screens, and a conveyer adapted to collect said drained pulp from both of said screens.

7. A plurality of opposed cylindrical screens mounted to rotate on parallel axes, means for conveying pulp in axial but alternately opposite directions past said screens, means for draining pulp onto each of said screens, and a conveyer adapted to collect said drained pulp from all of said screens.

8. A receptacle forming an endless channel for pulp, means for producing a continuous flow of said pulp throughout said channel, two cylindrical screens at opposite portions of said receptacle and mounted to ro-

tate transversely of said flow of pulp, means for draining a portion of said pulp onto each of said screens, and a conveyer adapted to carry off said drained pulp from both of said screens.

9. A receptacle forming an endless channel for pulp, means for producing a continuous flow of said pulp throughout said channel, two cylindrical screens at opposite portions of said receptacle, mounted to rotate transversely of said flow of pulp, means for draining a portion of said pulp onto each of said screens, and a belt adapted to travel in engagement with both of said screens.

10. A receptacle forming an endless channel for pulp, means for producing a continuous flow of said pulp throughout said channel, two cylindrical screens at opposite portions of said receptacle, and mounted to rotate in a plane transverse to said flow of pulp, means for draining a portion of said pulp onto each of said screens, a belt adapted normally to travel in engagement with both of said screens, and means for moving said belt out of engagement with one of said screens when desired.

11. A plurality of receptacles for containing pulp, said receptacles being arranged in a mutually parallel relation, each receptacle having an inflow end and an outflow end, said inflow end of each receptacle lying adjacent to said outflow end of an adjacent receptacle, pipes connecting said ends successively to form an endless channel, a plurality of cylindrical screens mounted respectively in said receptacles, means for circulating said pulp in said endless channel, means connected with each of said screens for draining some of said pulp thereon, and a conveyer adapted to carry off said drained pulp from all of said screens.

12. A receptacle for pulp, a cylindrical screen mounted to rotate in said receptacle, means for producing a flow of said pulp in a general direction parallel to the axis of said cylindrical screen, means for diverting some of said pulp in a direction diagonally opposed to the direction in which said screen is adapted to rotate, and an exhaust-pump communicating with the interior of said screen.

13. A receptacle for pulp, a cylindrical screen mounted to rotate in said pulp, means for producing a flow of said pulp in the general direction of the axis of said screen, means for governing the rate of said flow, means for directing some of said pulp in a direction diagonally opposed to the direction in which said screen is adapted to rotate, an exhaust-pump communicating with the interior of said screen, and means for governing the speed of said exhaust-pump.

14. A trough adapted to confine a stream of pulp, said trough having an inflow and an outflow end and tapering from a larger cross-sectional area at said inflow end to a smaller cross-sectional area at said outflow end, a cylindrical screen mounted to rotate in said trough on an axis parallel with the general direction of said stream, baffle-plates projecting radially from said trough and positioned diagonally with respect to the axis of said trough so as to divert some of said pulp in a direction diagonally opposed to the direction in which said screen is adapted to rotate, and means for draining a portion of said pulp onto said screen.

15. A pair of opposed cylindrical screens mounted to rotate on parallel axes, means for conveying pulp in axial but respectively opposite directions along said screens, means for diverting some of said pulp from said axial directions of movement, means for draining pulp onto each of said screens, and a conveyer adapted to collect said drained pulp from both of said screens.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JOHN B. WALKER.
A. RUSSELL BOND.

Witnesses:
JNO. M. RITTER,
PHILIP D. ROLLHANA.