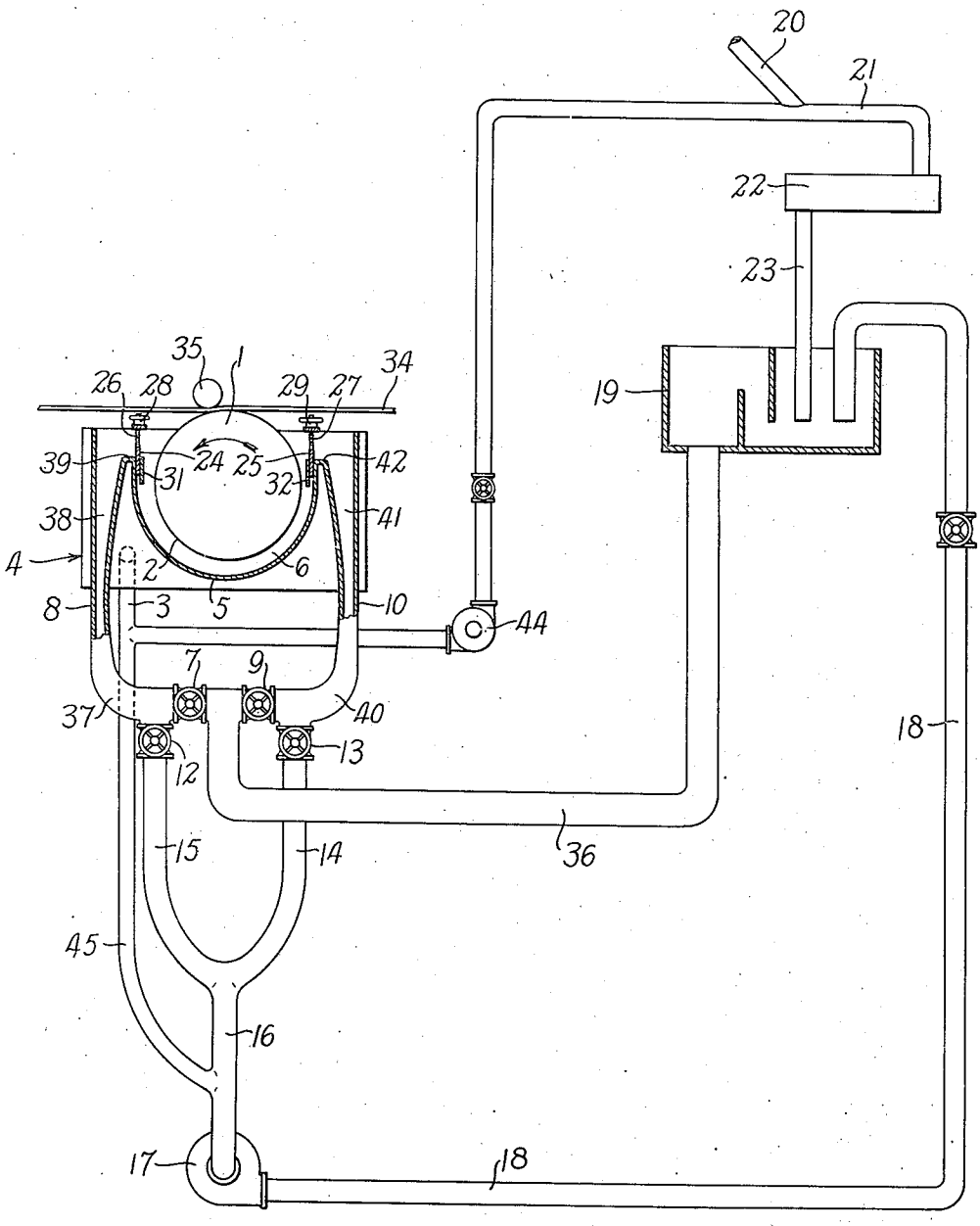
July 15, 1941. P. H. GOLDSMITH 2,249,128

CYLINDER PAPER MACHINE

Filed Dec. 23, 1937



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Patented July 15, 1941

2,249,128

UNITED STATES PATENT OFFICE

2,249,128

CYLINDER PAPER MACHINE

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Application December 23, 1937, Serial No. 181,305

2 Claims. (Cl. 92—43)

This invention relates to paper making machinery and more particularly to cylinder paper machines of the type commonly used for manufacturing the heavier grades of paper, such as paperboard and the like.

A cylinder paper machine consists of one or more vats, each equipped with a foraminous rotatable cylinder mold partially immersed in a quantity of stock contained in the vat. The water from the stock passes through the foraminous surface of the rotating cylinder mold, and the fibers are retained on the surface to form a continuous web which is removed near the top of the cylinder mold onto an endless felt belt. On multi-cylinder machines the same felt usually picks up the web from several cylinder molds to form a composite sheet. Since it is frequently desirable to make the different plies of the sheet of different materials and different thicknesses, each vat is ordinarily equipped with its own stock supply system and is really a separate machine.

The physical characteristics of the web are largely determined by the rate at which stock flows past the surface of the cylinder and by the direction of flow of stock relative to the surface of the cylinder. For relatively light papers, it is usually desirable to supply stock to the vat at such a rate that considerable quantities may be removed at a point beyond the cylinder and recirculated. For relatively heavy papers, on the other hand, it is thought desirable to operate without recirculation of stock.

There are many types of vats known in the art, each suitable for a particular grade of board under individual conditions of speed, nature of raw material, and requirements of product. The two types of vat most widely used heretofore, may be referred to for the purposes of this description as the counterflow type of vat and the overflow type of vat. In the counterflow vat stock is fed to the upturning side of the cylinder mold and flows in a direction contrary to the direction of rotation of the cylinder mold. Such a vat normally operates without recirculation of stock. In the overflow type of vat, the stock is supplied to the downturning side of the cylinder mold and flows in the same direction as the surface of the mold. In vats of this type, a portion of the stock is removed at a point beyond the cylinder and recirculated.

In many cases, particularly where a mill makes such products as the numerous varieties of paperboards grouped under the name boxboard, a cylinder machine is required to form a wide variety of products from many different types of stock. Such a machine might, for example, be required to form a sheet as light as .009 of an inch thick in finished dry caliper, and also a sheet as heavy as .063 of an inch thick in finished dry caliper. At times it may be necessary to handle as many as four different stocks on different vats of the same machine at the same time. Different plies of the same sheet, each made in its own vat, must often have widely different characteristics, and cylinder mold speeds must be varied widely to make a variety of products. It is known by those conversant with the art that the various factors affecting web formation must be adjusted properly for each different set of conditions, and that it is not possible to do this within wide enough limits with the machines which have been developed heretofore.

The following illustrative example is given to point out a type of limitation to which machines of the prior art are subject:

Suppose that a vat of the overflow type is designed for a normal flow through the mold of 1500 gallons per minute with a particular type of stock, and an overflow of 500 gallons per minute. The thickness of the sheet formed is inversely proportional to the peripheral speed of the cylinder mold and for best operating conditions it is desirable that the rate of flow of stock be about one-half the peripheral speed of the mold. Hence, if the speed of the mold is doubled to make a sheet one-half as thick, it will be necessary to supply 4000 gallons per minute of stock instead of 2000 gallons per minute. Since the flow through the mold is substantially independent of the speed of rotation of the mold, approximately 2500 gallons per minute of overflow would be recirculated under these conditions. As indicated above, it is sometimes desirable to produce sheets having a sevenfold variation in thickness. Such a sevenfold variation in sheet thickness would require a sevenfold variation in peripheral speed of the cylinder mold and a twenty-five fold change in the quantity of stock recirculated. It is apparent that practical problems of structural design and the large cost of power involved, make it highly undesirable to handle such large quantities of stock. Since the overflow vat is admirably suited to produce the lighter weights of paper, it is usually desirable to use such a vat in making sheets up to, say, .030 of an inch, and to use a counterflow vat for forming extremely heavy grades. The counterflow vat has long been used to form relatively heavy sheets at relatively low speeds, and does not produce a good sheet at high speeds.

It is an object of this invention to provide a cylinder paper machine having a high degree of operative flexibility, so that the operator may select the particular type of flow best suited to produce the particular grade of paper he is making. The machine of the present invention is adapted to use any of the four following methods of flow:

1. The overflow method as described above;
2. The counterflow method as described above;
3. Flow against the cylinder (i. e. supplying stock to the upturning side of the cylinder) with recirculation of a portion of the stock; and
4. Flow from both sides of the cylinder.

Machines adapted to use the above methods of flow individually are well known in the art. U. S. Patent No. 2,059,184 to Kutter discloses a typical machine adapted to use method No. 1. And U. S. Patent No. 2,036,168 to Gibson and Engert discloses a typical machine adapted to use method No. 4. But method No. 4 cannot be used with the Kutter machine, nor can method No. 1 be used with the Engert and Gibson machine.

Since an average cylinder machine produces one hundred tons or more of finished board per day, most mills operate only one or two machines. In order to take advantage of certain economies in the cutting operation, it is desirable where two machines are used that they be of different widths or trims. In many cases these economies must be sacrificed in order to obtain a sufficiently wide operating range with respect to the various grades of paper produced. The present invention makes possible a two-machine installation wherein the machines have different trims, and wherein each machine can produce a wide variety of papers at optimum operating conditions.

The many other objects and advantages of the present invention may best be appreciated by reference to the accompanying drawing, which shows somewhat schematically one embodiment of the invention. Referring to the drawing:

A rotatable cylinder 1 having a foraminous surface 2 is partially immersed in a quantity of stock contained in a vat generally indicated at 4. A partition 5, commonly called a vat circle, forms within the vat 4 a hemi-cylindrical chamber in which the rotatable cylinder 1 is suspended in such a way as to form a passage 6, commonly called the vat circle space, through which stock may flow. Suitable seals at the end of the cylinder 1 prevent stock from flowing into the interior thereof. As the cylinder rotates, water from the stock, commonly called whitewater, passes through the foraminous surface 2, leaving a web of fiber deposited thereon, flows from the ends of the cylinder into a pair of compartments, not shown, and leaves the vat through pipe line 3. Spills are provided in each compartment to remove excess whitewater from the system. The web of fiber formed on the surface of cylinder 1 is removed near the top of the cylinder, and is caused to adhere to the under side of an endless belt 34, by the use of a couch roll 35.

Stock is supplied to the vat 4 through a main underfeed supply pipe 36, and may pass to the vat circle space 6 in any of three ways. If valve 7 is open and valve 9 is closed, the stock will flow into a conduit 8, comprising a lower portion 37 called the vat hopper, and an upper portion 38 referred to as the vat inlet pass. Thence, the stock flows over a shoulder 39 commonly called the making board to the vat circle space 6. If the valve 9 is open and the valve 7 shut, stock will flow through the hopper 40 and inlet pass 41 of the conduit 10, over the making board 42 and thence into the vat circle space 6. If valves 7 and 9 are both open, stock will flow to the vat circle space 6 through both conduit 8 and conduit 10.

The level of stock over the making boards 39 and 42 is controlled in part by a pair of adjustable dams 24 and 25. The dam 24 is supported by a pair of threaded shafts 26, only one of which is shown, and may be raised or lowered by rotation of a pair of hand wheels 28, only one of which is shown. The dam 25 is supported in a similar manner by the shaft 27 and may be similarly raised or lowered by rotation of hand wheels 29. The dams 24 and 25 are held against the upper extremities of the vat circle by suitable guides 31 and 32 at the vat ends.

Overflow stock may leave the vat either through conduit 8, valve 12 and pipe line 15, or through conduit 10, valve 13 and pipe line 14. Pipes 14 and 15 converge to form a pump suction line 16 of the circulating pump 17. The circulating pump 17 returns overflow stock and some of the whitewater through a pipe line 18 to the headbox 19 which communicates with the feed pipe 36. Fresh stock is admitted to pipe line 20 and flows through line 21, where it is diluted by the proper amount of whitewater, to a screen 22, thence through pipe 23 to headbox 19, where it is mixed with the recirculated stock before passing into the main supply line 36. Enough whitewater is drawn by whitewater pump 44 to dilute the fresh stock coming to the screen 22 through pipe 21 as described. The remainder of the whitewater passes through pipe 45, pump suction line 16, and is mixed with the overflow stock in circulating pump 17.

The operation of the vat is as follows:

When it is desired to flow in the overflow manner as described above, valves 7 and 13 are opened and valves 9 and 12 are closed. Stock then flows through the conduit 8 to the vat circle space 6. A portion of the stock is overflowed over dam 25 and returned to the circulating pump 17 through conduit 10 and pipes 14 and 16. When it is desired to operate in counterflow manner as described above, valve 9 would be opened, and valves 7, 12 and 13 would be closed. Under these conditions, the dam 24 would be raised to its uppermost position, as no overflow is recirculated when using this method. Stock would flow through conduit 10 and over making board 42 to the vat circle space 6. When it is desired to operate with method No. 3 described above, valves 9 and 12 would be opened, and valves 7 and 13 would be closed. Under these conditions stock would flow in through the conduit 10 and over the making board 42 to the vat circle space 6. A portion of the stock would pass over the dam 24 through conduit 8 and pipe lines 15 and 16 to circulating pump 17. When it is desired to operate according to method No. 4, described above, valves 12 and 13 would be closed and valves 7 and 9 opened. Under these circumstances, stock would flow through both conduit 8 and conduit 10, over making boards 39 and 42 to the vat circle space 6.

From the above description, it should be apparent that the machine of the present invention makes possible the use of any of the four methods of flow outlined above, and that it

may be converted from one method of operation to another by means of simple manipulations and adjustments. The machine is so designed and constructed that the operator may form in counterflow manner or with an overflow at will, depending on the product he wishes to make, its weight, the origin, treatment and freeness of the stock, the speed of the machine, etc. Such a machine eliminates wasteful duplication of production equipment and may be used as one vat of a multi-cylinder machine to produce papers having widely different characteristics.

Since many embodiments might be made of the above invention, and since many changes might be made in the embodiment above described, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is interpreted as illustrative only and not in a limiting sense.

I claim:

1. In a cylinder paper machine of the type wherein a foraminous rotatable cylinder is suspended in a vat to form a vat circle space which is supplied with a paper stock from a headbox and wherein stock in passing from said headbox to said vat passes through a main supply line and recirculating stock in leaving said vat passes through a pump suction line, the combination of a branch conduit connecting said vat circle space at the downturning side of said cylinder with said main supply line and said pump suction line, valve means in said branch conduit for selectively causing stock to flow through said conduit either from said supply line to said vat circle space or from said vat circle space to said pump suction line, a second branch conduit connecting said vat circle space at the upturning side of said cylinder with said main supply line and said pump suction line, and valve means in said second branch conduit for selectively causing stock to flow through said conduit either from said main supply line to said vat circle space or from said vat circle space to said pump suction line.

2. In a cylinder paper machine of the type wherein a foraminous rotatable cylinder is suspended in a vat to form a vat circle space which is supplied with a paper stock from a headbox and wherein stock in passing from said headbox to said vat passes through a main supply line and recirculating stock in leaving said vat passes through a pump suction line, the combination of a branch conduit connecting said vat circle space at the downturning side of said cylinder with said main supply line and said pump suction line, a pair of valves located in said branch conduit for selectively causing stock to flow through said conduit either from said supply line to said vat circle space or from said vat circle space to said pump suction line, a second branch conduit connecting said vat circle space at the upturning side of said cylinder with said main supply line and said pump suction line, and a pair of valves located in said second branch conduit for selectively causing stock to flow through said conduit either from said main supply line to said vat circle space or from said vat circle space to said pump suction line.

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