Oct. 25, 1932. C. R. CRAWFORD 1,884,583

PAPER MACHINERY

Filed Aug. 20, 1930 2 Sheets-Sheet 1

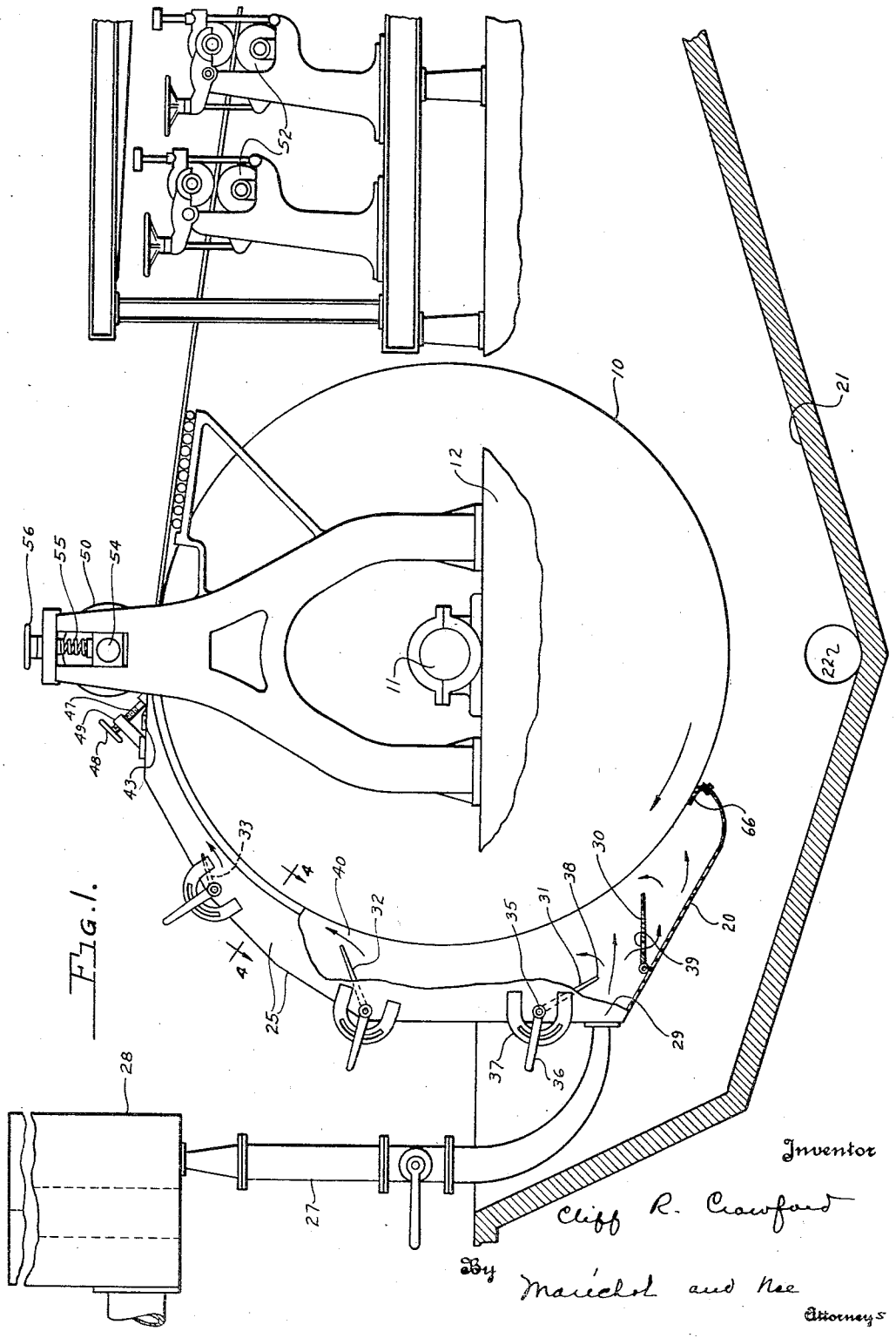


FIG. 1.

Inventor
Cliff R. Crawford
By Marshall and Nee
Attorneys

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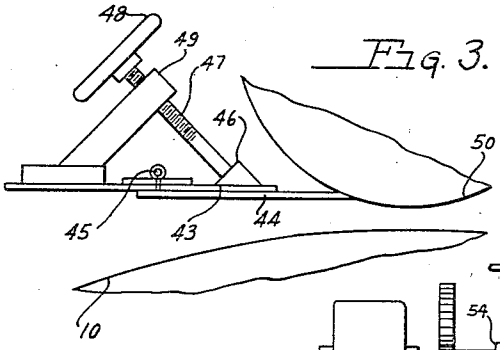


Fig. 3.

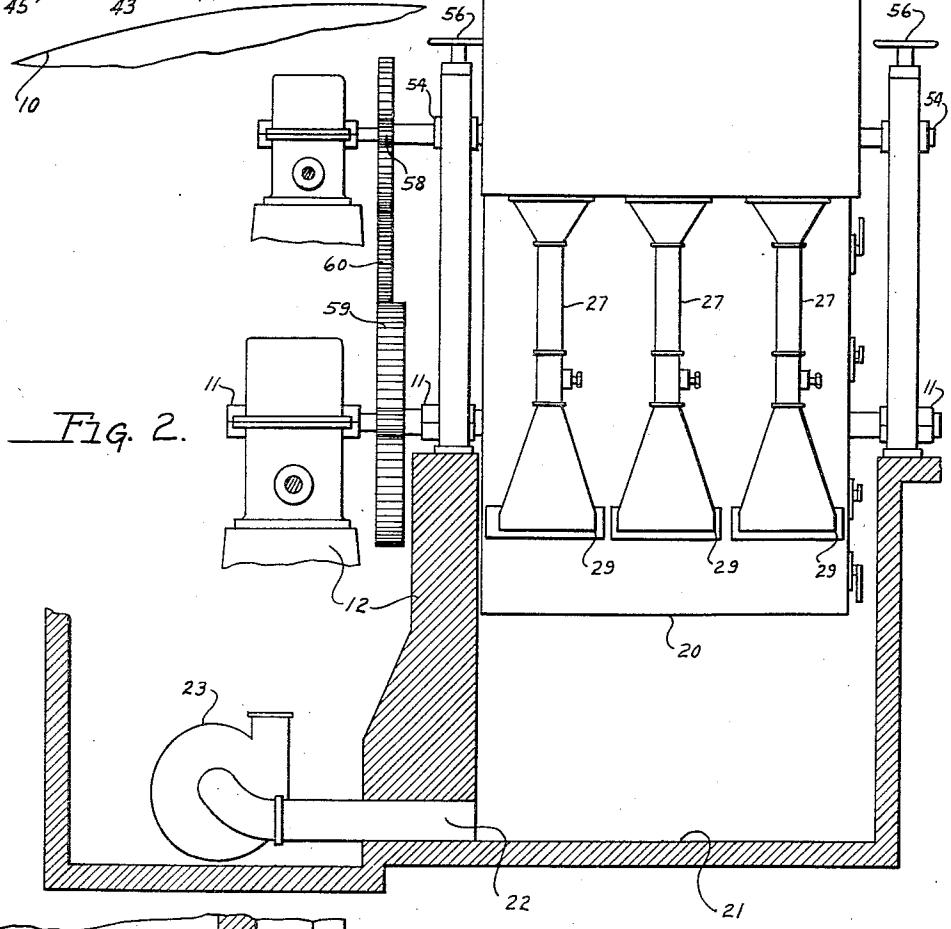


Fig. 2.

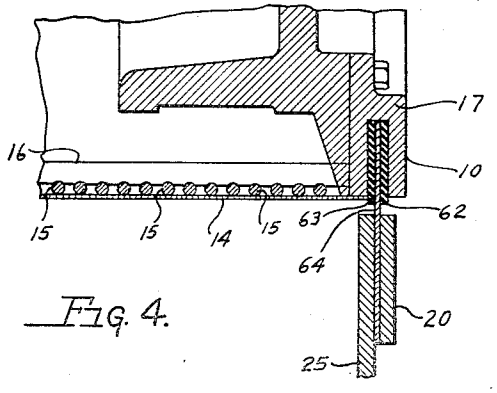


Fig. 4.

Inventor

Cliff R. Crawford

By Marechal Mac

Attorneys

Patented Oct. 25, 1932 1,884,583

UNITED STATES PATENT OFFICE

CLIFF R. CRAWFORD, OF MIDDLETOWN, OHIO, ASSIGNOR TO THE BLACK-CLAWSON COMPANY, OF HAMILTON, OHIO, A CORPORATION OF OHIO

PAPER MACHINERY

Application filed August 20, 1930. Serial No. 476,564.

This invention relates to web forming apparatus, and more particularly to apparatus adapted to form a thick fibrous web or the like.

One object of the invention is the provision of a novel web forming apparatus and process in which a forming screen moves through a vat to collect the fibres of the stock, means being provided for controlling the directional flow of the stock in the vat to control the thickness of the web and to obtain an intimately woven or matted product.

Another object of the invention is the provision of a web forming apparatus having a stock vat on one side only of a rotating cylindrical forming screen so that the water withdrawn from the vat by the forming screen can flow down and drain through the bottom of the screen.

A further object of the invention is the provision of an apparatus of the character mentioned having a pressure roll adjacent the point where the screen leaves the vat for compressing the partly formed web as it emerges from the vat.

Other objects and advantages of the invention will be apparent from the following description, the appended claims and the accompanying drawings, in which—

Fig. 1 is a side elevation of a web forming apparatus embodying the present invention, parts being shown in section for clearness of illustration;

Fig. 2 is an end elevation of the web forming apparatus, showing the water collecting chamber in section;

Fig. 3 is a detail of the adjustable control at the point where the partly formed web leaves the vat; and

Fig. 4 is a section on the line 4—4 of Fig. 1.

The web forming apparatus of the present invention is of the type in which solid fibrous material is collected on the surface of a moving screen which travels through a vat containing a rather thin stock of wood pulp or other fibrous material. As shown in the drawings, in which a preferred embodiment of the invention is illustrated, 10 designates a cylindrical forming screen, supported at its ends by journals 11 suitably mounted on supporting walls 12. This cylinder, which may be about ten or fifteen feet in diameter, and of any suitable length dependent upon the width of web desired, has a surface of wire screen of about 14-inch mesh, supported on annularly extending heavy wires 15 which in turn are supported on rods 16 extending transversely of the cylinder and suitably connected at their ends to end plates 17. This provides a rigid screen surfaced cylinder of large size, the outer surface of which is adapted to collect and carry a rather thick layer of fibres which is then compressed and dried to produce a thick fibre board such as insulation board or the like.

At one side, laterally of the forming screen or cylinder, is the vat 20. It will be noted from Fig. 1 that the vat terminates practically at the top of the forming screen cylinder and extends down to a point at one side of the bottom of the cylinder, leaving the bottom of the cylinder exposed so that water draining into the cylinder from the vat during the formation of the web can flow out by gravity through the bottom of the cylinder during the rotation of the latter. This water is collected in a collecting chamber 21, being pumped out from the chamber through a passage 22 which leads to a pump 23 from which the water is discharged or returned to be again used in the formation of new stock.

The vat 20 is formed of walls 25 of metal or other suitable material having only a single open side, namely that which is closed by the rotating forming cylinder. The stock is supplied to the vat through a pipe or pipes 27 leading up to a supply tank 28. The supply tank is preferably so located that the level of stock, maintained therein, is several feet higher than the top of the forming cylinder. Preferably there is a difference in level of from five to thirty feet so as to produce substantial pressure of the stock where the partly formed web on the forming cylinder leaves the vat.

The stock flows through the pipes 27 to spaced locations preferably near the bottom of the vat, the inlet to the vat being indicated at 29 in Figs. 1 and 2. The stock supplied to the vat is very fluent so that the water con-

stituent of the stock can readily flow through the screened surface of the forming cylinder during the rotation of the latter, and the pulp or stock fibres collect on the surface of the forming cylinder from the time the latter first enters the bottom of the vat, up to the time it leaves the vat. The partly formed web, before leaving the vat, is rather thick and closely matted where it is in engagement with the surface of the forming cylinder, the formation, however, being very loose at points more remote from the surface of the forming cylinder. In order to control the thickness of the formed web, and to provide for a denser and more homogeneous product in which the fibres are matted intimately together, the flow of stock in the vat is controlled and regulated as by a series of baffles or the like productive of a substantial flow of stock at one or more points adjacent the surface of the forming cylinder. Thus as shown in Fig. 1, there are a plurality of baffles 30, 31, 32 and 33 pivotally mounted and controlled so that their attitudes in the vat may be readily changed. The baffle 31 for example is pivoted at 35 and controlled by a handle 36 cooperating with the holding segment 37 so that the baffle 31 may be placed in the position shown, or in other positions in which its outer end 38 is much closer to the surface of the rotating cylinder. The other baffles 30, 32 and 33 are similarly supported and controlled and preferably each baffle, especially the lower baffle 30, is provided with a series of openings 39 so that stock may flow at least to a limited degree through these openings from one side of the baffles to the other. They are, however, of limited size so that when the baffles extend transversely or nearly transversely across the vat there will be a flow of stock in the vat in a direction substantially tangential to the surface of the rotating forming cylinder. With the baffles in the positions shown, the stock will follow approximately in the direction of the arrows. At the point 40 for example it will be noted that the baffle 32 nearly closes the passage through the vat so that there will be a substantial flow in an upward direction at this point because the water is being constantly withdrawn from that portion of the vat above it. The result is that wherever this comparatively rapid flow of stock obtains, the outer and loosely matted portions of the partly formed web on the surface of the forming cylinder will be washed off and this washing will effectively entwine and mat the fibres that remain on the surface of the screen so as to provide a more homogeneous and strong product. Between the points where the rapid flow adjacent the surface of the forming cylinder obtains, there will be what might be termed a dead area where the flow is sluggish and where the stock can mat rapidly on the moving screen surface. Thus there might be three or four areas where the stock is rapidly collected each separated from the other by an area where a rapid flow of stock obtains to provide for successive washings of the pulp collected. The number of washings to which the partly formed web is subjected as it moves through the vat determines the thickness of the completed product and also determines the strength and character of the product. It will be apparent that by suitable regulation of the baffles the layer of fibres first collected on the forming screen may be formed either rapidly or slowly, and the final layer may be collected in similar manners. In fact there are a great number of variations in the manner in which the stock may be collected on the screen, so that a great many different conditions and demands may be satisfied.

The stock fibres on the surface of the forming screen, when it reaches the top of the vat, might be three or four inches in thickness. As previously mentioned, the outer portions of this mass are only loosely associated with the denser inner portions in contact with the forming screen. The outer more loosely held portions of the pulp are guided out of the vat through a passage which gradually decreases in thickness so as to maintain and slightly compress the loosely associated mass of pulp fibres. For this purpose (as shown in Fig. 3, an adjustable gate or control 43 is provided at the top of the vat. Preferably this control comprises a blade or guide 44 of rubber or other resilient non-rigid material, hinged at 45 to the rigid top wall of the vat. On the upper surface of the blade 44 is a block 46 in which the end of a screw 47 is rotatably held. The screw is threaded in a standard 49 on the vat and is adapted to be rotated by a handwheel 48. Turning the handwheel 48 causes the blade to be raised and lowered about its pivot 45 and thus widens or decreases the throat opening at the top of the vat between the end of the blade 44 and the forming cylinder 10.

The end of the blade 44 bears against a rotatable pressure roll 50 so that the partly formed and collected stock fibres on the surface of the forming cylinder are conducted to the nip of the roll 50 and forming cylinder 10, where the stock is compressed very substantially to a thickness of one or two inches, or about one-half the thickness of the loosely associated mass on the forming cylinder in the vat. The pressure roll 50 is preferably of strong construction so that a pressure of several hundred pounds per inch roll length can be exerted against the forming screen. The roll 50 may have a surface of rubber or wire screen, its primary purpose being to compress the loosely associated fibres on the surface of the forming screen and to force or draw water out of the mass leaving a very wet and yet firm sheet or web. The roll 50 can be a vacuum cylinder having a wire

screen surface so that as water is drawn from the pulp mass it engages to provide a sheet or web that is practically selfsustaining and that may be conducted in a straight line tangentially from the forming cylinder to the pressure rolls 52 through which the straight line direction of movement is continued so that no bends will take place in the web during the time it is being dried and compressed.

The pressure roll 50 is preferably mounted in spring controlled trunnions 54, the springs 55 being adjustable by handwheels or the like 56 which govern the pressure exerted on the surface of the forming screen. The minimum spacing between the pressure roll 50 and the forming screen may be determined by preventing the downward movement of the bearings 54 beyond a predetermined limiting position shown in Fig. 1, and this determines the thickness of the formed web which leaves the forming cylinder. However, if an unusually large mass of pulp enters the nip of the roll 50, the roll 50 is resiliently supported so that it may move upwardly to permit the passage of this large mass.

The pressure roll 50, which is of large size, being at least two feet or so, and preferably three feet or more in diameter, is preferably driven positively through a drive gear 58 which is connected to the drive gear 59 for the forming cylinder by a transmission gear or gearing 60 or its equivalent. Thus the pressure roll 50 rotates at the same surface speed as the forming cylinder and being of large diameter, it will not disturb the matted fibre formation but will merely compress the loosely associated mass into a comparatively dense, homogeneous, wet, thick web.

As shown in Fig. 4, leakage between the vat and the rotating forming cylinder is prevented by means of a rubber connection or joint. The forming cylinder is provided with spaced rubber washers or rings 62 and 63, vulcanized or suitably fixed in an annular slot at each end of the cylinder. Each wall of the vat 20 adjacent the ends of the forming cylinder, has a projecting sheet 64 of metal or the like, conforming to the curvature of the forming cylinder, and movably received between the rubber rings 62 and 63. At the bottom of the vat its lower wall is provided with a rubber strip 66 forming a sealing flap permitting the free rotation of the forming cylinder but effectively preventing any substantial leakage. The top of the vat is of course closed by the partly formed web issuing through the funnel like throat leading up to the nip of the pressure roll 50.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. Web forming apparatus of the class described comprising a stock vat, a forming screen for said vat on which stock fibres are collected, and means spaced from the forming screen for directing the stock in the vat across the surface of the forming screen at the forming area thereof to control the thickness of the web produced.

2. Web forming apparatus of the class described comprising a stock vat, a forming screen for said vat on which stock fibres are collected, and an adjustable baffle in said vat for controlling the directional flow of stock in the vat adjacent the surface of the forming screen to control the thickness of the web produced.

3. Web forming apparatus of the class described comprising a stock vat, a forming screen for said vat on which stock fibres are collected, and a series of adjustable baffles in said vat for controlling the directional flow of stock in the vat at different points to control the thickness of the web produced.

4. Web forming apparatus of the class described comprising a stock vat, a cylindrical forming screen at one side only of said vat on which stock fibres are collected, and an individually adjustable baffle in said vat extending to a point adjacent but spaced from said screen for creating a comparatively rapid flow substantially tangentially to said screen at the ends of said baffle.

5. Web forming apparatus of the class described comprising a cylindrical forming screen on which stock fibres are collected, a stock vat provided only on one lateral side of said screen so that the water passing into said screen may flow down through the lower portion of the screen, means adjacent the top of the screen for closing the top of the vat, and collecting means below the screen for receiving water draining from said screen.

6. Web forming apparatus of the class described comprising a cylindrical forming screen on which stock fibres are collected, a stock vat provided only on one lateral side of said screen so that the water passing into said screen may flow down through the lower portion of the screen, collecting means below the screen for receiving water draining from said screen, and adjustable baffles in said vat for causing a flow of stock across the screen at the forming area thereof for controlling the thickness of the web produced.

7. Web forming apparatus of the class described comprising a stock vat, a cylindrical forming screen for said vat closing one side

thereof, means adjacent the top of said screen for closing the top of the vat, and a catch basin for liquid draining from said forming screen.

8. Web forming apparatus of the class described comprising a stock vat, a single forming screen for said vat provided in the form of a cylinder at one side laterally of the vat, a large diameter pressure roll for compressing the partly formed web adjacent the point where the screen leaves the vat, and means adjacent the pressure roll for closing the top of the vat.

9. Web forming apparatus of the class described comprising a stock vat, a single forming screen for said vat provided in the form of a cylinder at one side laterally of the vat, means adjacent the top of the screen for closing the top of the vat, and collecting means below said screen for receiving water passing through said screen.

10. Web forming apparatus of the class described comprising a cylindrical forming screen on which stock fibres are collected, a stock vat provided only on one lateral side of said screen so that the water passing into said screen may flow down through the lower portion of the screen, collecting means below the screen for receiving water draining from said screen, said vat extending up substantially to the top of said screen, a pressure roll above said screen for compressing the partly formed and collected web as it travels out of the vat, and means cooperating with said pressure roll for closing the top of the vat.

11. Web forming apparatus of the class described comprising a stock vat having one open side, a rotatable cylindrical forming screen closing the said open side of the vat and adapted to collect the solid material of the stock, the vat stopping short of the bottom of the cylinder so that liquid may flow into the cylinder from the stock vat and flow out of the bottom of the cylinder, a pressure roll adjacent the point where the screen leaves the vat for compressing the partly formed web on the surface of the screen, and means cooperating with said pressure roll for closing the top of the vat.

12. Web forming apparatus of the class described comprising a stock vat having one open side, a rotatable cylindrical forming screen closing the said open side of the vat and adapted to collect the solid material of the stock, the vat stopping short of the bottom of the cylinder so that liquid may flow into the cylinder from the stock vat and flow out of the bottom of the cylinder, a pressure roll above said screen and adjacent to but outside of the vat for compressing the collected solid material on the surface of the screen, and adjustable means adjacent the nip of the pressure roll for gradually guiding the partly formed web to the nip of the pressure roll.

13. In the manufacture of paper webs or the like, the process comprising moving a screen through stock to collect the solid material of the stock on the screen, and controlling the thickness of the collected stock by governing the directional flow of the stock in the vat at a point adjacent the screen.

14. In the manufacture of paper webs or the like, the process comprising moving a screen through stock to collect the solid material of the stock on the screen, and controlling the thickness of the collected stock by governing the directional flow of the stock in the vat at a number of spaced points adjacent the screen and parallel to the screen surface.

In testimony whereof I hereto affix my signature.

CLIFF R. CRAWFORD.