Oct. 4, 1932. E. E. BERRY 1,880,691

PAPER MAKING MACHINE AND METHOD OF MAKING PAPER

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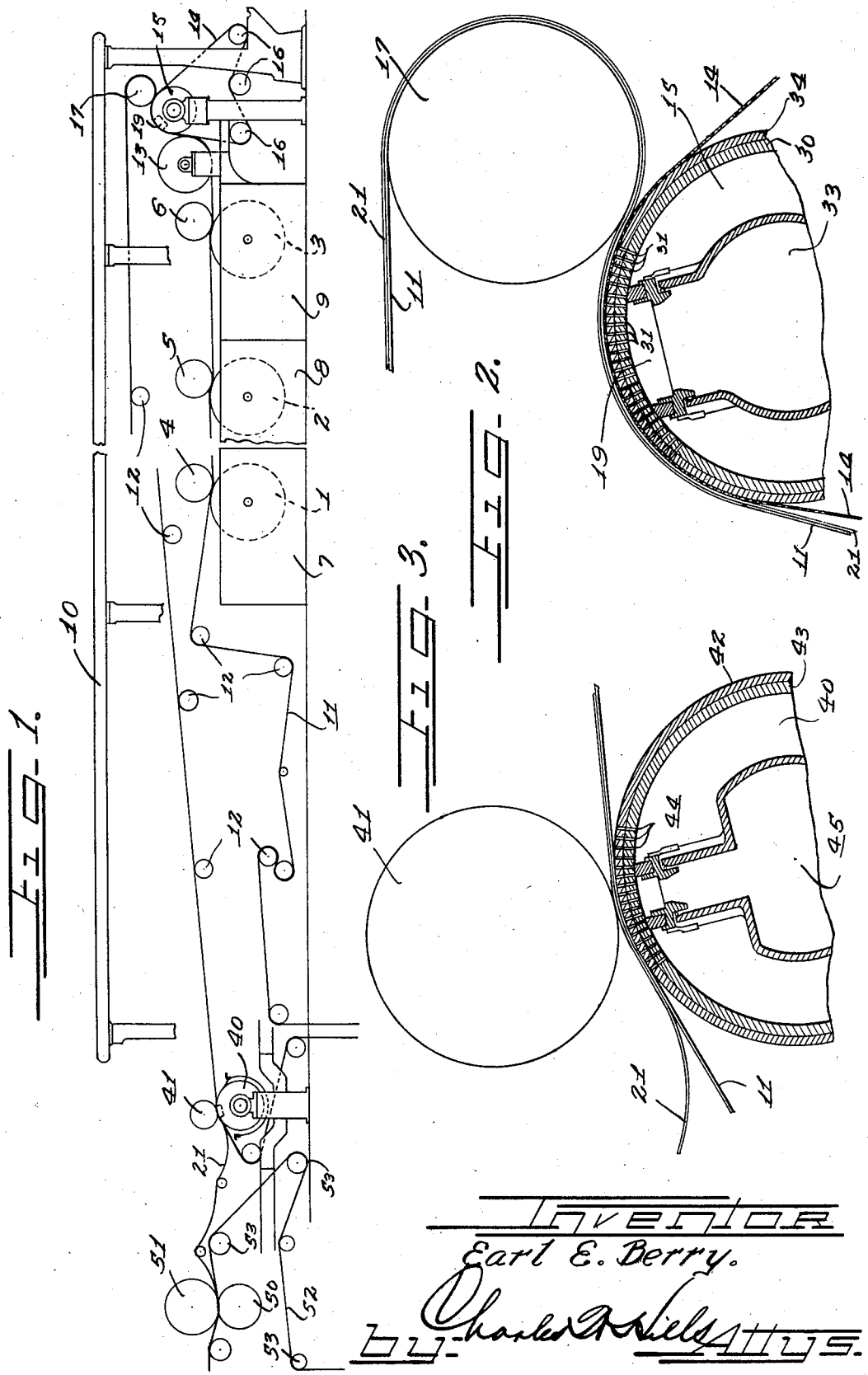


FIG. 1.

FIG. 2.

FIG. 3.

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UNITED STATES PATENT OFFICE

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PAPER MAKING MACHINE AND METHOD OF MAKING PAPER

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This invention relates to a paper making machine of the cylinder type and includes a novel process of making paper.

More specifically this invention relates to an improved form of cylinder paper machine in which the wet paper web on the carrier felt is subjected to suction to remove water therefrom without the aid of the large number of heavy duty presses heretofore used in conventional cylinder type paper machines.

In the conventional cylinder type of paper machine, the pickup or carrier felt is contacted with the top portion of each cylinder mold thereby removing the wet fibrous web from the revolving cylinder. A built-up fibrous web is thus caused to adhere to the under side of the pickup felt. After leaving the last cylinder mold the wet felt goes to a strain or drum roll positioned at the rear of the machine, is entrained therearound and thus has its direction of travel reversed back over the cylinder mold. The fibrous web is now on the upper surface of the pickup felt.

The felt on its journey back through the machine meets with an upper felt and the fibrous web between the two felts is gently squeezed by means of press rolls to remove water from the web. The first pair of press rolls exerts only a light pressure on the web but the pressure is gradually increased as the felt passes between other press rolls in succession.

The wet web is now sufficiently compacted between the two felts to enable it to stand a greater squeezing without being substantially damaged. It is then directed, while still between the upper and lower felts, between a series of baby presses, each pair of which exerts a heavier pressure than the pair preceding. Since the paper web is easily crushed it is necessary to gradually coax out water from the web by means of an entire battery of presses, the operation of which is cumbersome, expensive and power consuming.

After passing through the baby press rolls the top felt is generally entrained around the last baby press where it leaves the fibrous web and is directed back over the paper machine. The paper web while still supported on the lower felt is then passed between heavier duty press rolls until it is sufficiently formed to support itself, at which point the lower felt is directed back to the first cylinder mold and the paper web allowed to proceed by itself through the heavy duty press section of the machine.

By means of my novel water removing device, I am able to entirely dispense with the baby presses and allow the paper web unsupported by the carrier felt to pass directly to presses of the suction or plain type.

I am also able to produce, by my novel arrangement of water extracting means, a paper sheet having a maximum strength per unit weight, since each time the sheet goes through a set of press rolls on the conventional type of cylinder machine it is compacted, thereby making it weigh more per unit area. The press rolls also distort the sheet, which distortion when added to the stress that takes place on the sheet between each set of presses greatly reduces the strength of the final product. By dispensing with the large number of presses ordinarily used it is possible to entirely avoid the evil of crushing and distortion and produce a sheet of paper having less weight per unit area and having greater strength. I have also found that it is possible to entirely do away with the top felt ordinarily used in the cylinder type of machine.

It is therefore an object of this invention to produce a variation of the conventional type of cylinder paper making machine in which the pressing operation is reduced to a minimum and the water removed from the fibrous web by the aid of suction.

It is a further object of this invention to provide a novel water extracting means for the conventional type of cylinder paper machine which may be readily installed in the conventional machine without necessitating the provision of an entirely new machine.

Another specific object of this invention is to provide a cylinder type paper machine in which the top felt and the baby press rolls are entirely dispensed with and in which the fibrous web is sufficiently formed on the carrier felt by the aid of suction alone

so that it will support itself upon leaving the carrier felt before the application of heavy pressures thereon.

Another object of this invention is to provide a process of producing a cylinder made paper having a maximum strength per unit weight and being less dense than the cylinder made papers now on the market.

Other and further objects of this invention will become apparent as the description proceeds.

According to my invention I provide a foraminous carrier entrained around a suction roll located at the rear end of the cylinder machine. The wet pickup felt and fibrous web are supported on the foraminous carrier and directed over the suction roll where suction is applied at a point before the pickup felt contacts with the customary strain roll around which it is entrained and its direction of travel reversed back over the cylinder molds. In this manner the fibrous web, since the suction is not applied at the point where the felt carrying the web is separated from the foraminous carrier, will always follow and stick to the smoother surface of the felt and will not follow the foraminous carrier which is generally of a metallic wire mesh construction.

The fibrous web, now on top of the carrier felt is directed back through the machine and passed between a suction press roll carrying a high degree of suction sufficient to form the web so that it will support itself. After passing through the suction press roll the felt is separated from the web and returned to the first cylinder mold. The web itself may then be treated by additional press rolls either unsupported or while supported on a foraminous carrier.

On the drawing:

Figure 1 is a diagrammatical side view of the cylinder type of paper machine embodying the principles of this invention.

Figure 2 is a fragmentary view partly in section of the suction roll showing the pickup felt, fibrous web, foraminous carrier and strain roll of the paper machine.

Figure 3 is a fragmentary view partly in section of the suction roll showing the pickup felt, a fibrous web, foraminous carrier and strain roll of the paper machine, showing the suction press roll, carrier felt and fibrous web together with the upper press roll.

As shown on the drawing:

In Figure 1 the reference numeral 10 indicates the general framework of the apparatus. As the figure shown is merely diagrammatical the particular supporting members and bearing journals of the rolls have not been shown.

Reference numerals 1, 2 and 3 indicate cylinder molds of the conventional type coacting with couch rolls 4, 5 and 6 to build up a web of paper on the under side of a carrier felt 11 as it passes between the cylinder molds and couch rolls. The cylinder molds are immersed in pulp stock vats 7, 8 and 9 of the general type for supplying pulp fibers to the cylinder molds. While the drawing discloses three cylinder molds and stock vats, it is to be understood that any number may be used as is readily appreciated by those skilled in the art.

The pickup felt 11 is an endless belt of felt supported throughout the machine by means of guide rolls 12. After leaving the last cylinder mold 3 the pickup felt is directed around a contact roll 13 where the fibrous web on its under side is contacted against a foraminous carrier 14 of similar construction to an ordinary Fourdrinier wire. The foraminous carrier 14 is entrained around a suction roll 15 and guide rolls 16. The suction roll 15 is interposed between the contact roll 13 and the strain or drum roll 17 around which roll 17 the felt is reversed and directed back over the cylinder mold.

As will more readily be understood from Figure 2 pickup felt 11 with a fibrous web 21 on its under surface is contacted against the foraminous carrier 14 and guided around the rotating suction roll 15. The suction roll 15 is of a similar structure to that disclosed in the copending application of Berry and Roberts Serial No. 547,215 filed June 27, 1921 and comprises a hollow metallic shell 30 which is perforated by holes 31. These perforations extend all around the periphery to permit water drainage into the interior of the drum. The suction area of the roll at any instant is indicated by the reference numeral 19 and suction is applied to the roll through a stationary suction chamber 33. As shown on the drawing the roll 30 is covered with a material of resilient construction such as a rubber sheet 34 to prevent the fibrous web 21 from being crushed as it passes over the roll. However the rubber covering may be entirely dispensed with since the carrier felt 11 ordinarily provides enough of a cushioning effect to prevent crushing of the fibrous web. Then, too, the strain roll 17 is positioned beyond the point of contact of the web with the suction roll and therefore exerts only a slight pressure against the web. By this arrangement it will be readily seen that the fibrous web is kept taut while passing over the suction area 19 of the suction roll 15 thereby sealing the vacuum from the air and obtaining a maximum amount of water extraction with the suction applied. The holes 31 are, of course, extended through whatever covering is placed around the roll 30.

The top roll or strain roll 17 being placed outside of the suction area of the suction roll 15 permits the fibrous web 21 to adhere to the felt 11 which passes around the roll 17 rather than follow the wire 14, since the fibrous web always sticks to the smoothest surface.

After passing around the strain roll 17 the fibrous web 21 is now on the upper side of the carrier felt 11 and in this position is directed back over the machine between a suction press roll 40 coacting with an upper roll 41.

As best shown in Figure 3 the suction press roll 40 comprises a hollow metallic shell 43 which may be covered with a resilient covering such as rubber sheet 42. The shell 43 is provided with perforations 44 through which the suction is applied to the carrier felt 11. A suction chamber 45 is located inside of the shell 43 for supplying a vacuum to the felt and fibrous web to remove water therefrom at the points of contact or nip between the upper and lower rolls.

After passing through a suction press roll of this type the fibrous web 21 is formed sufficiently to support itself and may be removed from the carrier. The carrier felt is then directed back to the first cylinder mold by means of the guide rolls 12.

The fibrous web 21 may next be passed to additional press rolls 50 and 51 while supported on a foraminous carrier 52 entrained around guide rolls 53.

While I have described the fibrous web and carrier felt from the strain roll 17 as being directed between a suction press roll, it should be understood that other types of water extracting means may be used such as ordinary press rolls and the like.

It will be readily appreciated by a person skilled in the art that according to my invention it is possible to convert the conventional cylinder type of paper machine to embody the features of my water extracting system without the installation of an entire new machine. In other words the multiplicity of light duty and baby press rolls of the conventional cylinder type paper machine may be replaced by the suction roll and foraminous carrier by the mere installation of this unit into the conventional machine.

By doing away with the customary top felt I am able to effect a great saving in operating cost since a carrier felt has only a limited life and is very expensive to replace. By dispensing entirely with one of these felts the cost of operation is naturally reduced. Furthermore the lifetime of the lower carrier felt is greatly increased when my novel invention is used in place of the multiplicity of press rolls conventional in the cylinder machines. The press rolls have wearing action upon the felt which is dispensed with by my water extracting system.

By the term "rear of the machine" as used in the claims, I mean that end portion of the cylinder type of machine ordinarily referred to as the wet end.

I am aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. In a cylinder type of paper machine including a fibrous web forming part, a pickup felt for receiving said web on the under side thereof while traveling towards the rear of the machine and a strain roll around which the felt is entrained to reverse its direction of travel after the last cylinder mold so that the web is on the top of the felt, a foraminous carrier located after the last cylinder mold for cooperative association with the wet felt and fibrous web therefrom, a suction roll acting through said foraminous carrier for removing water from said felt and fibrous web while allowing the web to follow the pickup felt and a suction press roll for receiving said felt and web from said suction roll to remove further quantities of water from the web so that it may be separated from the pickup felt without damage to its structure.

2. In a cylinder type of paper machine including a fibrous web forming part, a pickup felt for receiving said fibrous web on the under side thereof while traveling toward the rear of the machine and a strain roll around which the pickup felt is entrained to reverse its direction of travel so that the fibrous web is on the top of the felt, a foraminous carrier for receiving said felt and web from the last cylinder mold, a suction roll acting through said foraminous carrier for removing water from said felt and web and suction means located at a subsequent point in the travel of the felt and web to extract further quantities of water from the web.

3. In a cylinder type of paper making machine, a fibrous web forming part, a pickup felt for receiving said fibrous web, a strain roll located at the rear of the machine for reversing the direction of travel of said pickup felt and fibrous web, a suction roll contacting said strain roll, guide rolls, a foraminous carrier entrained around said suction roll and guide rolls, and a contact roll for contacting said pickup felt and fibrous web against said foraminous carrier.

4. In a cylinder type of paper making machine, a plurality of cylinder molds, a pickup felt for receiving the fibrous web from said cylinder molds, a strain roll located after the last cylinder mold for reversing the direction of travel of the pickup felt and fibrous web thereon, a foraminous carrier for receiving the pickup felt and fibrous web before reaching said strain roll, a suction roll cooperating with said strain roll and acting through said foraminous carrier to remove water from said fibrous web and a contact roll to direct the pickup felt and fibrous web against said foraminous carrier.

5. In a cylinder type of paper making machine including cylinder molds and a pick-up felt for receiving the fibrous web from the molds, a suction roll located after the last cylinder mold, guide rolls, a foraminous carrier entrained around said guide rolls and suction roll, a contact roll cooperating with a strain roll for directing the fibrous web on the pick-up felt against the foraminous carrier during its travel over the suction area of the suction roll to prevent loss of suction without applying pressure to the fibrous web.

6. In a cylinder type of paper making machine including a fibrous web forming part and a pick-up felt to receive said web, water extracting means comprising a suction roll, a foraminous carrier entrained therearound, a contact roll for directing the fibrous web on the pick up felt against the foraminous carrier and a strain roll cooperating therewith and located above the suction roll back of the suction area of said roll to guide the web and felt tightly over the suction area without applying pressure to the web.

7. In a cylinder type of paper machine including a pick up felt for transferring a fibrous web from the forming molds, means for extracting water from said felt and web carried thereon comprising a suction roll having a defined suction area, a foraminous carrier passing over said suction area and means located outside of said suction area for bringing said felt and web into direct cooperation with said carrier and suction roll for the application of suction through said carrier to said felt and web.

8. In a cylinder type of paper making machine, means for removing water from the paper web while on the pickup felt comprising a suction roll, a foraminous carrier entrained around said suction roll, and means located outside of the suction area of said suction roll for directly contacting without pressure the fibrous web against said foraminous carrier when traveling over the suction area of said suction roll.

9. The process of making paper which comprises forming a fibrous web on the conventional cylinder mold, picking up said web on a carrier felt on the under side thereof, directly contacting said fibrous web while on the felt with a bare foraminous carrier, applying suction through said foraminous carrier to remove water from the web, allowing said web to follow the carrier felt in its travel back over the machine, extracting further quantities of water from said web while still on said carrier felt by means of a suction press roll, removing said web from said carrier felt and directing said carrier felt back to the cylinder mold.

10. The process of making paper on a cylinder type of paper making machine including a web forming portion, a suction roll, a foraminous carrier, and a pick up felt, which comprises building up a fibrous web on the under side of the pick up felt, directing the felt and web against a bare foraminous carrier located at the rear of said machine and passing said web between the felt and bare foraminous carrier over the suction area of a suction roll with the aid of rolls not exerting a direct pressure on the web to extract water from the web and felt without crushing the web, reversing the direction of travel of the web and felt and extracting further quantities of water therefrom.

11. In the process of removing water from a fibrous web built up on the carrier felt in a cylinder type of paper making machine, the step which comprises contacting said web and carrier felt directly against a bare foraminous carrier, applying suction through the foraminous carrier and allowing the web to follow the carrier felt back over the machine.

In testimony whereof I have hereunto subscribed my name at Beloit, Rock County, Wisconsin.

EARL E. BERRY.

DISCLAIMER

1,880,691.—*Earl E. Berry*, Beloit, Wis. PAPER MAKING MACHINE AND METHOD OF MAKING PAPER. Patent dated October 4, 1932. Disclaimer filed January 2, 1935, by the assignee, *Beloit Iron Works*.

Hereby enters this disclaimer to claim numbers 3, 4, 7, 8, and 11 in said Patent No. 1,880,691.

[*Official Gazette January 29, 1935.*]