No. 786,996.

PATENTED APR. 11, 1905.

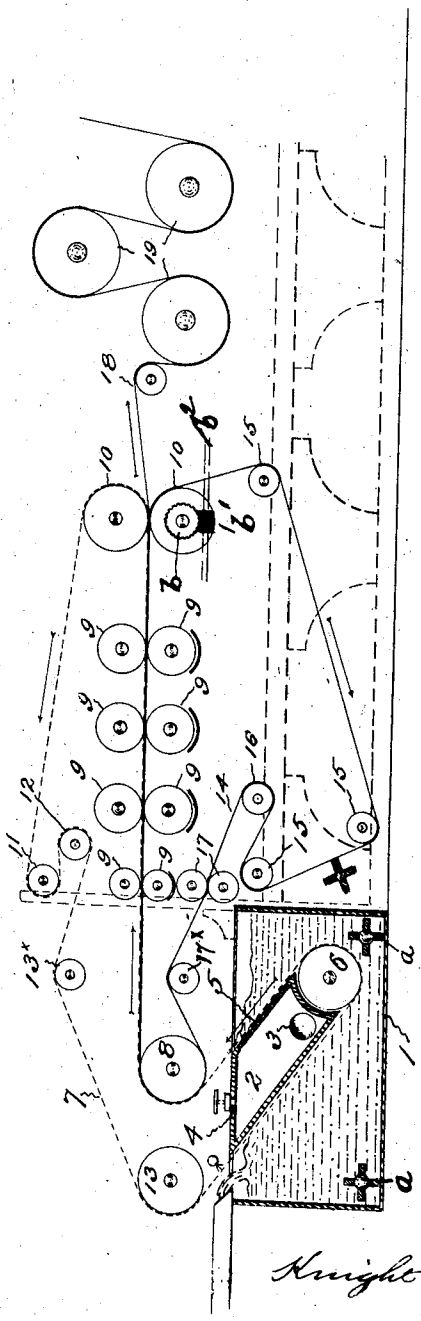
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PAPER MACHINE.

APPLICATION FILED OCT. 6, 1904.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 1a.

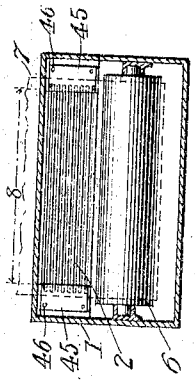
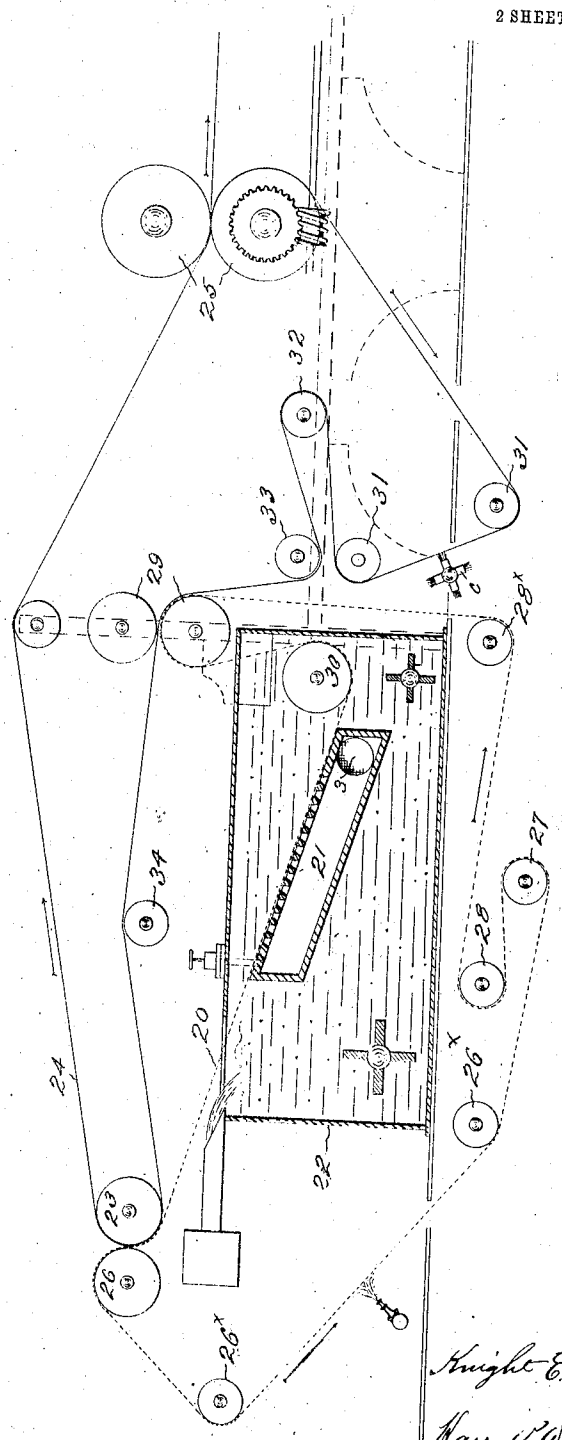


Fig. 2



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No. 786,996. Patented April 11, 1905.

UNITED STATES PATENT OFFICE.

KNIGHT E. ROGERS, OF SOUTH MANCHESTER, CONNECTICUT.

PAPER-MACHINE.

SPECIFICATION forming part of Letters Patent No. 786,996, dated April 11, 1905.

Application filed October 6, 1904. Serial No. 227,402.

To all whom it may concern:

Be it known that I, KNIGHT E. ROGERS, a citizen of the United States, residing at South Manchester, in the county of Hartford and State of Connecticut, have invented a new and useful Paper-Machine, of which the following is a specification.

This invention, relating to paper-making machines, has for its object the production of a novel machine wherein an endless wire belt or gauze is made to travel over a non-rotative suction-box having its perforated face immersed in the pulp in the vat, the water holding the pulp in suspension being drawn into the box, the incoming water passing also through the woven-wire belt or gauze, the fibers in the pulp being directly deposited on the belt or gauze, the fibers sucked onto the wire belt or gauze from the pulp, which is kept well churned or agitated, being crossed or matted together, thus insuring the production of a strong web which may be varied in thickness through controlling the intensity of the vacuum-creating means coacting with the suction-box to exhaust the same, variations in the intensity of the vacuum causing the fibers of the pulp to be deposited more or less rapidly on the wire belt. Variations in thickness of the web of paper may also be effected by changing the speed of the wire belt or gauze across the non-rotative suction-box in the pulp. The wire belt has coacting with it an apron, preferably of felt, that receives the pulp-sheet from the wire belt.

Prior to my invention no part of a non-rotative suction-box over which a wire belt is made to travel has ever been immersed in pulp contained in a pulp-vat. By locating a part of the non-rotative suction-box in the pulp in the vat and keeping the pulp stirred it is not only possible to make stronger paper when thus laying the fibers of the pulp, floating in every direction, across each other, and thus insure the formation of a very closely-matted web, but it is also possible to deposit more or less of the fibers of the pulp and deliver from one wire belt a homogeneous web of any desired thickness.

Prior to my invention heavy webs for paper, &c., have been made by the employment of a plurality of cylinder-molds, each located in its own pulp-vat, the webs formed on the separate cylinder-molds being brought in contact and united by pressure, &c., thus making a thick web of a plurality of thin plies, the thick web so produced presenting a laminated structure which is not so strong as a homogeneous web, such as may be made by the apparatus herein described as being formed by depositing fibers on one wire belt or gauze.

My invention therefore comprises, broadly, a vat to contain pulp, a non-rotative suction-box sustained in the pulp, and a movable endless wire belt or gauze on which the pulp may be deposited by exhausting the suction-box.

Other features of my invention will be hereinafter more fully set forth in the claims at the end of this specification.

Referring to the drawings, Figure 1 represents a paper-making machine in which the fibers of the pulp embodying my invention are shown in one good form. Fig. 1ª shows my novel suction-box with deckles applied thereto to control the width of the pulp-web and of the paper; and Fig. 2 represents a machine embodying my invention, the endless wire belt or gauze and the felt or apron being somewhat differently arranged one with relation to the other.

The vat 1, Fig. 1, receives in usual manner thin liquid pulp composed of water and fibers of any consistency. I have located in the vat a non-rotative suction-box 2, having perforations 5, through which the water containing the pulp in suspension is sucked, the box being extended into the pulp in the vat and being provided with an outlet 3, leading to any usual box-exhausting means or means for creating a vacuum in the box—such, for instance, as a suction-pump. The suction-box has a valve 4, that may be adjusted to admit more or less air to the box for regulating the intensity of the vacuum and the effective force thereof in depositing the fibers of the pulp more or less rapidly upon the endless belt or wire, to be described, as the latter is moved over the perforations in the suction-box.

The vat contains a roll 6, located near the

end of the suction-box, where the same is immersed in the pulp in the vat, which roll supports and guides the wire belt 7, which is fed upwardly through the pulp over a guide-roll 8, located outside the vat, the line of movement of said wire belt being substantially parallel with the perforated face of the suction-box. From the guide-roll 8 the wire belt passes between a series of squeeze-rolls 9 and press-rolls 10 and is turned around the upper press-roll and fed over a guide-roll 11 and a tension-roll 12, thence over guide-rolls 13 and $13^{\times}$ into the vat and to the roller 6, the starting-point.

I have provided the machine with a felt or apron 14, which coacts with the wire belt in carrying the pulp-web from the guide-roll 8 between the squeeze-rolls 9 and press-rolls 10, said felt or apron being fed downwardly from the lower press-roll about suitable guide-rolls 15, a tension-roll 16, between squeeze-rolls 17, and over a guide-roll $17^{\times}$ to the guide-roll 8, thus making a continuous felt or apron. The press-rolls 10 in Fig. 1 are employed to drive the endless wire belt and the endless felt or apron, the lowermost press-roll having a worm-toothed gear b, which is engaged by a worm-gear b' on a shaft b^2, that may be rotated at any desired speed from any usual source to thus provide for running said belt and felt or apron slower or faster in accordance with the thickness of the pulp web it is desired to have deposited upon the wire belt as the same is being moved upwardly out of the pulp in the pulp-vat.

The formed paper 18 is represented as fed from between the press-rolls under and about usual drying-rolls. The vat 1 has agitators a, that are rotated in any usual way to keep the thin pulp in circulation and the fibers therein floating, so as to be readily deposited upon the wire belt as a more or less perfect vacuum is formed in the suction-box. The suction apparatus draws the water from the pulp through the wire belt and the perforations in the suction-box less rapidly as the valve 4 is opened, so that it will be understood that the rapidity with which the fibers in the pulp may be deposited upon the wire-belt depends in one form of my invention upon the opening or closing of the valve 4, thicker pulp being formed when the valve is closed, the pulp web being made thinner as the valve is opened. It will also be understood that the speed of operation of the means for forming the vacuum or sucking the water in the pulp through the wire belt and the suction-box may be increased as it is desired to increase the thickness of the mass of pulp being deposited upon the wire belt.

Referring to Fig. 2, the vat marked 22 is provided with a suction-box 21, having an outlet 3, corresponding with the outlet referred to with relation to the suction-box 2. The wire belt 20 (shown by dotted lines) is represented as entering the vat containing the pulp at or near one end, where it is led under a guide-roll 30 and thence across the perforated face of the suction-box in a direction substantially parallel to said face, the belt passing between a couching-roll 23 and an opposed guide-roll 26 and thence over a series of smaller guide-rolls $26^{\times}$ 27 about a tension-roll 28, thence over a guide-roll $28^{\times}$, back to and over a squeeze-roll 29 and into the box to the guide-roll 30. The wire belt 20, Fig. 2, has coacting with it an endless felt or apron, and said apron and wire belt derive their movement from a worm gear and shaft, and the lower press-roll may be rotated at any desired speed, as provided for with relation to Fig. 1. The vat 22 has agitators, and the felt is shown as being adapted to be cleaned by a whipper c, and the wire belt is represented as being cleansed by a stream of water ejected from a suitable nozzle. It will be understood that the press-rolls employed for moving the wire belt and the felt or apron may be turned by any usual mechanism, not necessary to be herein shown.

From the foregoing it will be understood that the thickness of the pulp web can be regulated by the amount of vacuum in the suction-box controlled either through the speed of the exhausting means or the manipulation of the valve connected therewith and also by regulating the surface speed of the belt with relation to the perforated face of the suction-box, over which the wire belt is moved. The pulp sheet is formed of fibers sucked from the liquid pulp directly upon the wire belt, and as the fibers in the pulp are extended in every direction owing to the pulp being kept in agitation it consequently follows that the fibers are crossed and interlaced and piled one on the other for the thickness desired for the web of paper to be made, and consequently the web is homogeneous or uniform throughout, as distinguished from a web composed of a plurality of independent sheets or plies of paper superimposed one on the other and subjected to pressure.

I believe I am the first, as stated, to employ in a pulp-vat a non-rotative suction-box having coöperating therewith an endless wire belt or gauze upon which the fibers of the pulp are deposited as a pulp web, said web being thereafter taken away from the endless wire belt by a felt or apron coacting with said wire belt, and consequently I desire to claim these features broadly and to include as within the scope of my invention any construction that will come within the claims hereinafter following.

The width of the pulp web, and consequently of the sheet of paper, may be regulated by attaching deckle-plates 45 to the suction-box at the sides of the perforated portion of the box,

(see Fig. 1ª,) said plates being shown as held in position by screws 46, the dotted lines showing the endless wire belt or gauze. It will be understood that the suction-box is movably sustained in any suitable manner within the pulp-vat.

Instead of applying, as above stated, one layer of pulp on another layer until the paper is of the thickness desired I determine the thickness of the paper by depositing the same as a single web of the required thickness, and in doing this the inclination of the face of the suction-box over which the endless wire-gauze belt is moved is of very decided importance for the reason that the part of the wire-gauze belt first to receive the pulp is immersed deeper in the stuff or liquid pulp in the vat than if the face of the suction-box occupied a position in a horizontal plane, and consequently the vacuum or suction in the box is enabled to start toward the belt a greater amount of fiber held in suspension in the liquid pulp than as though the depth of the stuff or liquid pulp were less than shown. Hence the inclination of the suction-box becomes a matter of great importance.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a paper-making machine, a vat to contain pulp, a non-rotative suction-box adapted to extend into the pulp, a belt on which the pulp may be deposited by exhausting the suction-box, and rolls to sustain said belt.

2. In a paper-making machine, a vat to contain pulp, a non-rotative suction-box adapted to extend into the pulp, a belt on which the pulp may be deposited by exhausting the suction-box, and means to move said belt over said suction-box.

3. In a paper-making machine, a vat to contain pulp, a non-rotative suction-box adapted to extend into the pulp, and a belt on which the pulp may be deposited by exhausting the suction-box, means to move said belt over said suction-box, and a felt or apron to act on the pulp deposited on said belt.

4. In a paper-making machine, a vat to contain pulp, a non-rotative suction-box extended into the pulp in the vat, and rollers within and without the vat to lead the belt over the perforated face of the suction-box.

5. In a paper-making machine, a vat to contain pulp, a non-rotative suction-box extended into the pulp in the vat, rollers to sustain and lead said belt over the perforated face of the suction-box, and a felt or apron to contact with the pulp web on said belt.

6. In a paper-making machine, a vat to contain pulp, a non-rotative suction-box extended into the pulp in the vat, and rollers located beyond the ends of said suction box to sustain said belt in its movement.

7. In a paper-making machine, a vat to contain pulp, a non-rotative suction-box adapted to be extended into the pulp in the pulp-vat, a belt, means to cause the belt to travel over the suction-box, means to exhaust the suction-box to suck the fiber from the pulp onto said belt and the water into the suction-box, and means to control the force of the exhaust and consequently the rapidity at which the fibers of the pulp will be deposited upon said belt to thereby vary the thickness of the pulp web.

8. In a paper-making machine, a vat to contain pulp, a suction-box adapted to be extended into the pulp in said vat, said box having one of its faces perforated, and a belt movable over said perforated face.

9. In a paper-making machine, a vat to contain pulp, an upwardly-inclined and perforated suction-box adapted to enter the pulp in said box, and a belt movable over said inclined suction-box.

10. In a paper-making machine, a vat to contain pulp, a suction-box having a perforated face adapted to enter the pulp in said box, a belt movable over said box, and rollers to sustain said belt, said belt being extended in a straight line between said rollers and being maintained in a line parallel to the perforated face of said suction-box.

11. In a paper-making machine, a vat to contain pulp, a suction-box adapted to enter the pulp in said box, said box having a perforated face, a belt movable thereover, rollers to sustain said belt, said belt being extended in a straight line between said rollers and being maintained in a position substantially parallel to the perforated face of the suction-box, and a felt or apron to contact with the pulp web while yet resting on the belt.

12. In a machine of the class described, a vat to contain pulp, a non-rotative suction-box having a perforated face and occupying an inclined position in the vat, a belt, sustaining-rollers therefor and means to actuate said belt that it may be moved upwardly out of the pulp in the vat substantially parallel to the perforated face of the suction-box.

13. In a machine of the class described, a vat to contain pulp, a non-rotative suction-box occupying an inclined position in the vat and having its perforated portion immersed therein, a belt, a felt or apron, rollers to sustain said belt that it may be moved upwardly out of the pulp in the vat substantially parallel to the perforated portion of the suction-box, said felt or apron contacting with the sheet of pulp on the belt and aiding in compacting the pulp and expressing extra water therefrom.

14. In a paper-making machine, a vat to contain pulp, a suction-box entering said vat and the pulp therein, a wire belt, means independent of said suction-box to sustain and move said belt, means to exhaust the suction-box, and means to control the intensity of

the exhaust to thus determine the thickness of the pulp deposited on the belt as a thicker or thinner paper may be desired.

15. In a paper-making machine, a vat to contain pulp, a non-rotative suction-box located therein and adapted to extend into the pulp in the vat, a wire belt, means to move it over said suction-box, and deckles applied to the perforated face of the suction-box to control the width of the pulp web deposited on the wire belt.

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