July 21, 1931. L. W. CASE 1,815,237

PROCESS AND APPARATUS FOR MAKING PAPER

Filed March 12, 1929 2 Sheets-Sheet 1

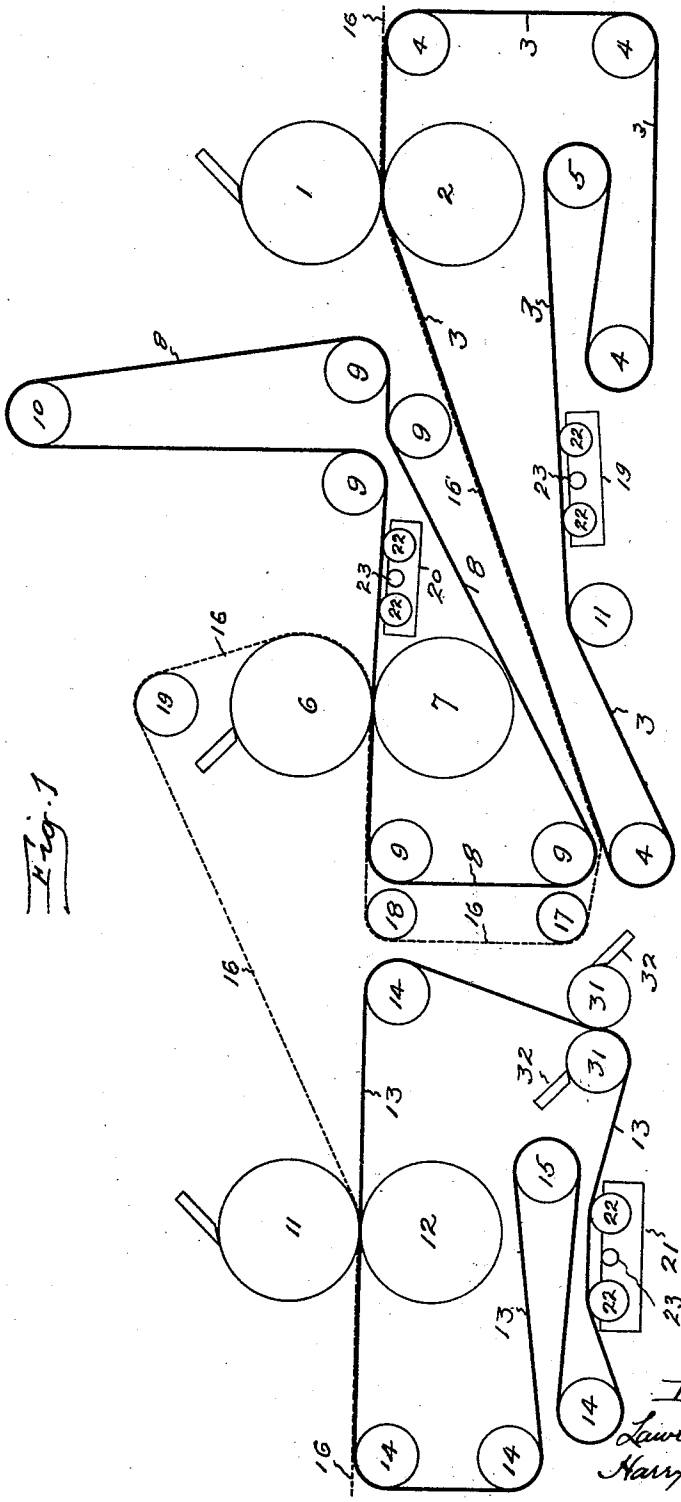


Fig. 1

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Fig. 2

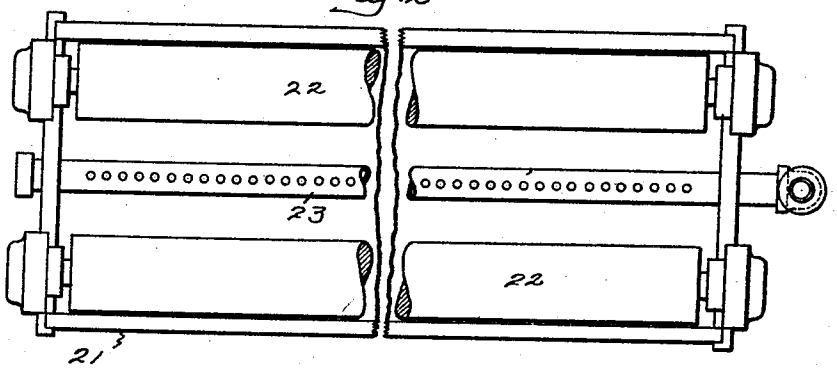


Fig. 3

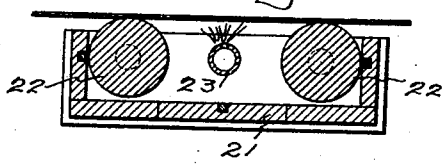


Fig. 4

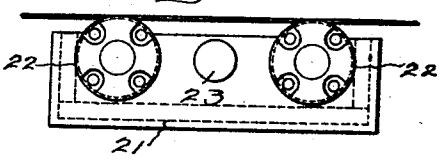


Fig. 5

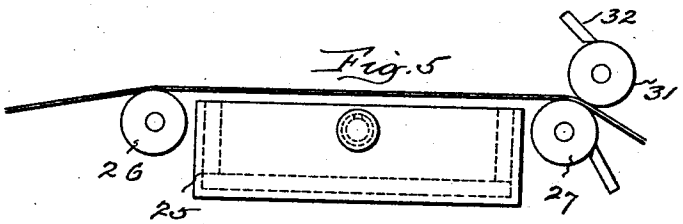


Fig. 6

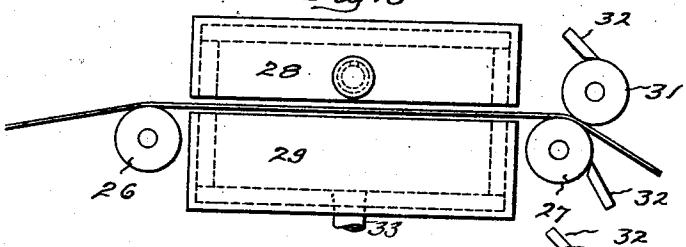
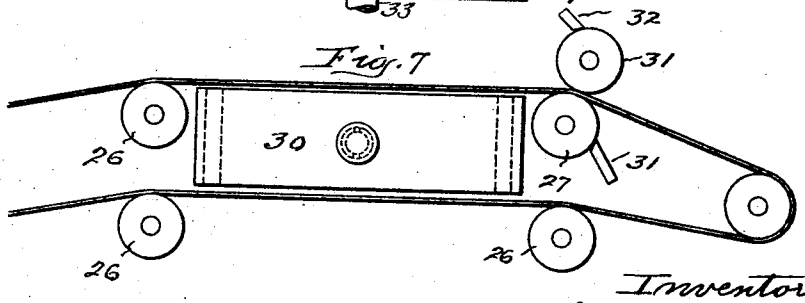


Fig. 7



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UNITED STATES PATENT OFFICE

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PROCESS AND APPARATUS FOR MAKING PAPER

Application filed March 12, 1929. Serial No. 346,275.

This invention relates to a method of and apparatus for treating the wet pulp web as it travels through the press section of a paper making machine.

The invention has for an object to provide a novel method of and apparatus for treating the web of pulp, whereby superior paper is produced more economically than with any existing paper machines, or in accordance with any of the prior methods in commercial use at the present time.

As is well known, in a Fourdrinier machine the paper stock is caused to flow onto the wire where the web is formed and a portion of the water extracted. In a cylinder machine water is extracted from the pulp through the perforated faces of cylinder molds leaving the web adhering to the mold surfaces from which it is picked up by a traveling felt. In both the Fourdrinier and cylinder machines the web of paper is carried by felts through one or more sets of pressure rollers by which water is mechanically squeezed from the web. From the last set of pressure rollers the web is usually carried over a series of steam drums which evaporates more water from the web. In practice these machine are operated at as high a speed as possible in order that a maximum production may be obtained. With the commonly practiced methods of pressing to obtain the most efficient removal of moisture from the web the speed at which the machines may be run has been limited.

In accordance with the present process the wet web of paper during its passage through the wet pressing apparatus is heat treated through the medium of the traveling supporting felts, so that the speed may be increased and a better texture produced The supporting felts are carried over, under, or between one or more steam chests suitably located with relation to the press rollers, and their surfaces sprayed with or subjected to steam in such a manner as to cause the felt to expand and open up so that foreign materials, such as short detached fibers, filling and sizing, which have become attached to or embedded in the felt become loose and are readily taken from the felt by means of cleaning rollers having doctors arranged to free the rollers from foreign matter gathered from the felt. The felt in passing the steam chamber and through the nip of the cleaning rollers is not only cleaned and expanded but has its temperature raised, and when this traveling heated and opened felt comes in contact with the traveling web of paper, which is several degrees colder, a portion of this heat is transmitted to the web of paper, and this causes the surface tension of the paper to relax. Owing to the open meshes of the felt and the expansion of the surface tension of the paper, the web of paper when passing through the nip of the pressure rollers releases a larger percentage of water than was previously considered possible, and the opened meshes of the felt allow this excess water to freely escape, thereby increasing the efficiency of the pressure rollers.

It has been found in practice that in a paper machine embodying the present invention it is possible to remove sufficient moisture by mechanical means to bring the web of paper to the driers quicker than previously with a minimum amount of moisture, and that paper made by the practice of this process, due to the mechanical extraction of moisture and the cleanliness of the felts, possesses important qualities not obtained with the types of machines in common commercial use.

To obtain the desired diminishing of the water tension in a web of paper traveling at the relative high speed which is desirable in commercial practice, it is necessary to heat the felt, cleanse it while heated and then transmit the heat from the felt to the web as they travel together, and it has also been discovered that by transmitting moist heat to the traveling web of paper from the traveling supporting felts, that in papers containing size, such as rosin size, the sizing material gives more binding strength to the fibers, reduces the liability of the paper sticking to the rollers and felts, serves to lay the fibers of the paper, and allows a higher finish to the surface of the paper.

In the accompanying drawings Fig. 1 is a diagrammatic view of the press section of a paper making machine provided with means

for practicing the present invention. Fig. 2 is a plan view, on larger scale, of one of the means used in this section of the machine for conditioning the felt in accordance with this invention. Fig. 3 is a transverse section of the felt conditioning means. Fig. 4 is an end view of the same. Figs. 5, 6 and 7 show modifications of the felt conditioning means.

Fig. 1 conventionally illustrates the relative locations of the press rolls, the rolls carrying the supporting felts, and the traveling web, of a paper making machine of either the common Fourdrinier or of the cylinder type. In this figure 1 indicates the first press top roll and 2 the first press bottom roll. The supporting felt 3 travels about the rolls 4 and between these first press rolls, and its tension is regulated by the adjustment of the stretcher roll 5. 6 indicates the second press top roll and 7 the second press bottom roll. The supporting felt 8 travels about the rolls 9 and between the second press rolls, and is tensioned by the roll 10. 11 indicates the third press top roll and 12 the third press bottom roll. The supporting felt 13 travels about the rolls 14 and between the third press rolls, and is tensioned by the roll 15.

The web of pulp, indicated by the dotted line 16, coming from a Fourdrinier wire or cylinder mold, is carried by the traveling felt 3 between the nip of the first press rolls 1 and 2 where the initial pressure is given for expressing water and condensing the pulp. As the web of paper is reversed for the second press, after leaving the felt 3 of the first press section, it passes about the rolls 17 and 18 and is carried by the traveling felt 8 between the nip of the second press rolls 6 and 7. After being squeezed by the second press rolls and more water extracted the web of paper passes over the roll 19 and then with the felt 13 to the nip of the third press rolls 11 and 12 where it is further squeezed. The web of paper then usually passes to a drier.

For the purpose of conditioning the felts and accomplishing the objects of this invention, a steam chest 19 may be located between the first press rolls 5 and 11 adjacent to the path of the felt 3, a steam chest 20 may be arranged adjacent to the second press felt 8 near the second press rolls, and the steam chest 21 may be arranged beneath the third press felt 13, in such positions that the felts may be subjected to the action of steam.

In practice it has been found advantageous to arrange steam chests for spraying all of the felts with heated moisture, although of course they could be used with only two of the felts, or even with only one.

The steam chests, as shown in Figs. 2, 3 and 4, may contain two felt supporting rolls 22 and may have between these rolls a perforated spraying pipe 23 that is connected with a supply of steam and is arranged to throw a spray of steam against the under side of the felt which passes over it.

While the felt supporting rolls of the steam chest first shown are within the chest, as indicated in Fig. 1 and shown in Figs. 2, 3 and 4, these rolls can be arranged outside of the steam chest 25, as are the rolls 26 and 27 shown in Figs. 5, 6 and 7. The chests may be arranged underneath the felts as first shown, or two chests 28 and 29 may be arranged with the felt passing between them, as illustrated in Fig. 6, in which latter case a pipe 33, leading from suction means, may open into one chest so as to produce a difference of pressure on opposite sides and facilitate the penetration of the felt by the steam. The chest can be open at top and bottom and the felt pass both above and below the chest 30 as illustrated in Fig. 7.

By these means the felts are subjected to the action of steam so that they expand, that is, their pores open up so that any foreign substances, such as short fibers, size, or filling, which has adhered to the felts is softened and loosened.

Adjacent to the steam chests there are arranged felt cleaning rolls 31 provided with doctors 32 for removing such material as collects on the surfaces of the rolls from the steam heated felt, these cleaning rolls readily picking up the softened material from the expanded felt.

Not only does the steam from the chests expand the felts and soften them and the material which they have gathered, but it also heats the wet felts, and as the felt travels along in engagement with the web of pulp, this heat is transmitted to the pulp and warms it. This not only tends to increase the evaporation of moisture therefrom, but it also has been found that more water can be mechanically expressed by the press rolls from the web thus warmed, and consequently greater pressure can be given to the press rolls. Furthermore, owing to the opening of the pores of the felt, the water which is expressed from the pulp more readily escapes through the felt. It has also been found in practice that by moist heating the web of paper indirectly by means of the felts, as the felts travel in contact with the webs for considerable periods and uniformly heat the paper, and with the paper thus heated subjected to the heavier pressure that is possible, the texture of the paper and its surface are greatly improved. The use of the increased pressure at the nip of the pressure rolls cause a greater firmness to the finished paper, frees the web from wire and felt marks, gives a better bending test, and increases its strength.

While the invention has been illustrated and described for use in connection with Fourdrinier and cylinder machines, it works equally well with wet machines used for

mechanically ground wet pulp, sulphite and other chemical pulp.

The invention claimed is:

1. The process of manufacturing paper which consists in forming a web of pulp, carrying said web between press rolls by means of an endless felt, and conditioning said felt by subjecting it to hot vapor while in motion and before it reaches the press rolls, whereby the felt is opened up, cleaned and heated and heat is transferred indirectly by the traveling felt to the traveling web previous to the passage of the web between the press rolls.

2. The process of manufacturing paper which consists in forming a web of pulp, carrying said web between press rolls by means of an endless felt, and subjecting said felt to a spray of steam while in motion and before it reaches the press rolls, whereby the felt is opened up, cleaned and heated and heat is transferred indirectly by the traveling felt to the traveling web previous to the passage of the web between the press rolls.

3. The process of manufacturing paper which consists in forming a web of pulp, carrying said web between a plurality of sets of press rolls by means of endless felts, and conditioning said felts by subjecting them to sprays of steam while in motion and before they reach the press rolls, whereby the felt is opened up, cleaned and heated and heat is transferred indirectly from the traveling felts to the traveling web previous to the passage of the web between each set of press rolls.

4. The process of manufacturing paper which consists in forming a web of pulp, carrying said web between press rolls by means of an endless felt, and subjecting said felt while in motion to the action of steam and cleaning rolls before it carries the web to the press rolls, whereby heat is transferred from the cleaned and heated traveling felt to the traveling web previous to the passage of the web between the press rolls.

5. An apparatus for manufacturing paper which comprises rolls for compressing a web of pulp, an endless felt traveling between said rolls and adapted to carry a web of pulp therewith, a steam chest adjacent to the path of said felt for exposing the felt to hot vapor, and means adapted to remove foreign material from the heated felt, arranged adjacent to the said chest.

6. An apparatus for manufacturing paper which comprises a plurality of sets of rolls for compressing a web of pulp, an endless felt traveling between each set of said rolls and adapted to carry a web of pulp therewith, a steam chest and sprayer located adjacent to the path of travel of each felt, and felt cleaning rolls arranged adjacent to each of said chests.

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