June 5, 1934. H. R. WILLIAMS 1,961,182

PAPER WEB DRYING MEANS

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Fig. 1.

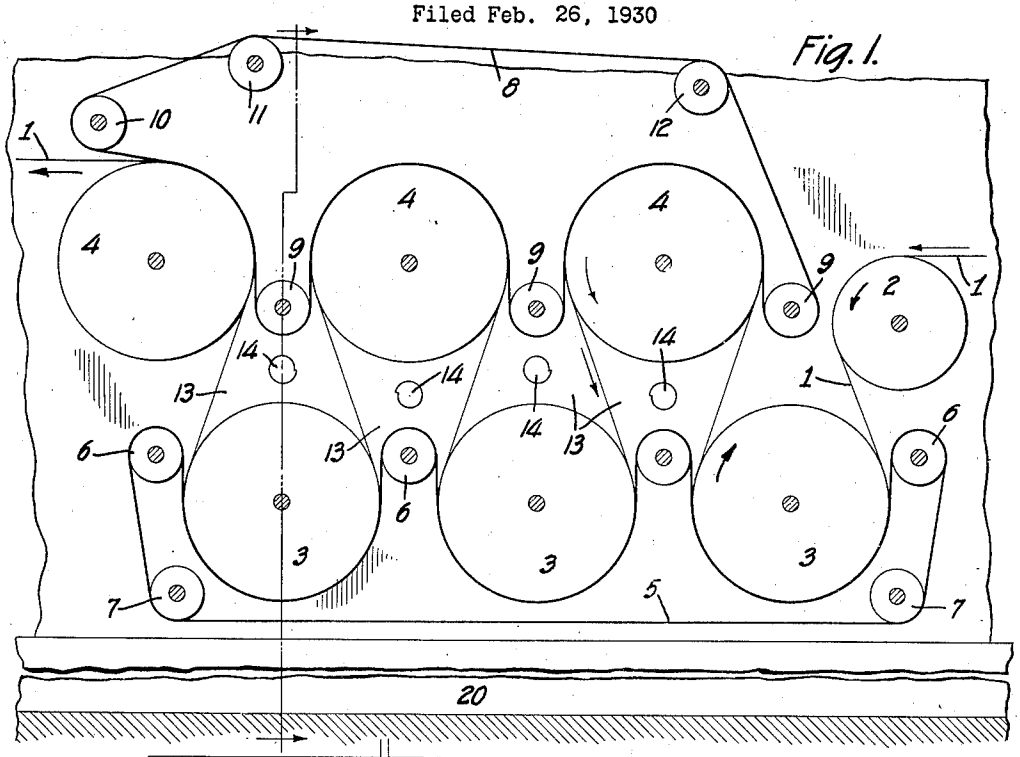


Fig. 2.

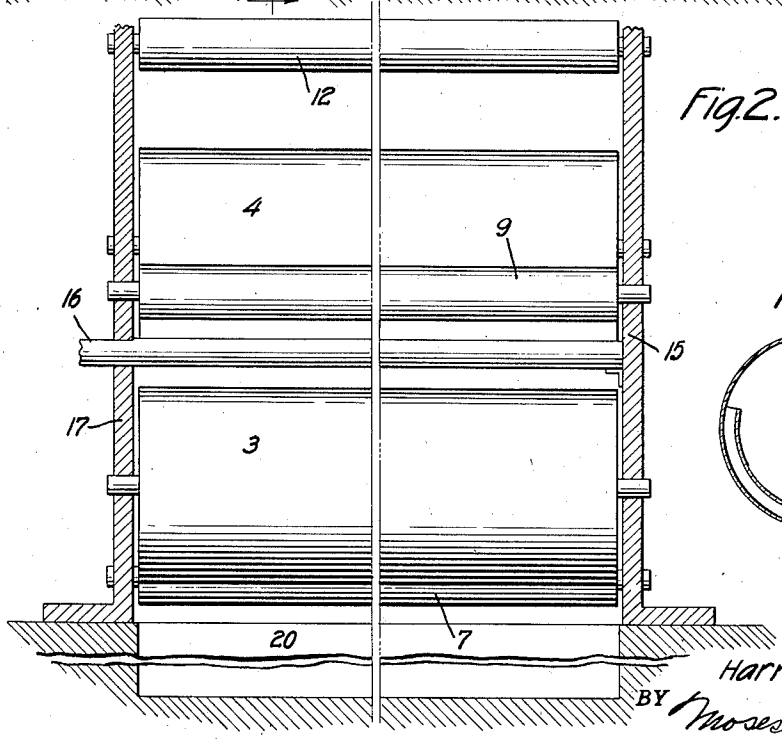
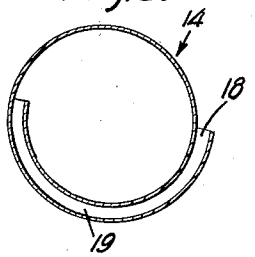


Fig. 3.



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PAPER WEB DRYING MEANS

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4 Claims. (Cl. 34—48)

This invention relates to the drying of paper webs and more particularly to web drying means in which vapor or moisture discharged from a web into pockets between the web and one or more drier felts is withdrawn from said pockets by suction means individual to said pockets.

According to the usual practice in paper making, each web of paper, after complete formation thereof and preferably a partial drying, is finally dried by passing it partially around the surface of each of a plurality of heated drying cylinders or rollers which are driven in any suitable manner. These cylinders are arranged in upper and lower groups or sets with the cylinders in the two sets arranged in staggered relation with respect to each other and the web passes back and forth around cylinders of the upper and lower sets so that both surfaces of the web are alternately in contact with the heated surfaces of cylinders.

The cylinders of the upper and lower groups are also encased at the portions of their surfaces engaged by the web by continuous traveling drier felts or belts, generally made of canvas or other suitable material. With this arrangement pockets are formed between the web and the felts above cylinders or rollers of the lower set and beneath cylinders or rollers of the upper set. While the web is passing between a heated cylinder and a drier felt, its temperature is raised and as soon as it passes from the cylinder, moisture in the form of vapor is discharged into a pocket on one side thereof or into pockets on opposite sides thereof.

Heretofore it has been the general practice to withdraw air from the drier casing by suction without any definite control of the air and vapor in the various pockets. It has, however, been proposed to remove the vapor and moist air directly from the pockets but the means for such removal and the manner of air control in general have not given the desired results.

An important object of the present invention is to provide improved drying means in which the vapor and moist air is withdrawn directly from the pockets formed between the drier cylinders and the drier felts or belts. Further objects are to provide driers having improved means for removing the vapor and moist air directly from such pockets and also controlling the admission of air, and to provide an improved form of suction head for use in each of said pockets.

Other objects and advantages will hereinafter appear.

In the drawing forming part of this specification:

Fig. 1 is a diagrammatical longitudinal sectional view of a drier embodying the present invention;

Fig. 2 is a transverse section taken along the line 2—2 of Fig. 1; and

Fig. 3 is a cross section on a larger scale of one of the suction heads.

The objects of the invention can in general be attained by use, in each of the pockets between the drier cylinders and the drier felts, of a suction head extending substantially the length of the pocket and in the general form of a coiled sheet having more than one complete coil and with the opening, between the outer edge of the sheet and the outer surface of the part coiled within the same, of substantially the same area as the cross section of the tube outlined by the interior part of the coiled sheet.

Referring to the drawing, 1 designates a moist web of paper which, after passing over a roll 2 (preferably heated), is passed alternately under heated rolls or cylinders 3 of a lower set or group and over heated rolls or cylinders 4 of an upper set or group and arranged in staggered relation with respect to the rolls 3. The lower parts of the rolls 3 where engaged by the moist paper web 1 are encased by a continuous travelling belt or drier felt 5 of which the upper stretch passes over a guiding roll 6 beneath the roll 2 and then alternately beneath the heated rolls 3 and over guide rolls 6 located beneath the roll 2 and the upper heated rolls 4, two of said guide rolls 6 being located, respectively, between the first and second rolls 3 (counting from the right in Fig. 1) and the last roll 6 at the left of the third and last heated roll 3. Beneath the rolls 3 the lower stretch of the belt 5 is guided by means of guide rolls 7 arranged below the end guide rolls 6.

The upper parts of the cylinders 4 where engaged by the moist paper web 1 are encased by a continuous traveling belt or drier felt 8 which (beginning at the right in Fig. 1) passes alternately under guide rolls 9 and over the heated rolls 4. In the arrangement illustrated, the belt 8 as it leaves the third heated cylinder or roll 4 passes beneath and upwardly around a roll 10 which, as here shown, is higher than the last roll 4 and permits the web 1 to be discharged substantially horizontally from said last roll 4. The upper part of the belt 8 extends from the top of the roll 10 rearwardly over an intermediate guide roll 11 and a guide roll 12 at the front

end of the drier, and then downwardly to the first guide roll 9.

As illustrated in Fig. 1, there are four pockets 13 formed between heated rolls and drier felts, two of these pockets being beneath the first two rolls 4 of the upper set of heated rolls and the other two pockets being above the second and third rolls 3 of the lower set. As soon as the web leaves any heated roll and the drier felt associated therewith, moisture in the web is given off and produces vapor or moist air in the spaces adjacent to the web. In order to withdraw such vapor and moist air immediately, the drier is provided with suitable controlling means including suction heads 14, one in each pocket 13 and means for controlling the flow of air to the pockets.

In order to avoid the disadvantageous feature, heretofore encountered, of not being able to obtain uniform drying at all points of the web, the withdrawal of vapor and air must be substantially uniform throughout the length of each pocket. To this end, each of the suction heads extends substantially the whole length of each pocket and is arranged to withdraw air and vapor at all points along its length. Although these suction heads may take different forms within the purview of this invention, each of them is preferably in the general form of a coiled sheet as indicated in Fig. 3 with one complete coil and a partial inner coil (shown as a half coil). At one end each suction head is closed in any suitable manner and is supported on a side 15 of the drier, and at the other end has a closed connection with a duct or tube 16 in alignment with and of substantially the same cross section as a cylindrical space corresponding in general to the interior surface of the partial inner coil, said tube 16 extending through and being supported by the other side 17 of the drier.

The inlet 18 between the outer edge of the sheet and the beginning of the partial inner coil is of such width that its area is substantially the same as the cross section of the tube 16 or of the cylindrical space corresponding in general with the inner surface of the partial inner coil, and the inlet passage 19 from said inlet 18 to the edge of the partial inner coil is of the same depth throughout corresponding to the width of said inlet or inlet opening 18. It will be seen that as the air and vapor enter the suction head 14 tangentially they will enter the interior with a whirling movement which has been found in connection with the suction head of the present invention to withdraw the vapor and moist air in the manner desired.

It has also been found desirable in carrying out the present invention to have the sides 15 and 17 close to the ends of the heated rolls 3 and 4 and to the edges of the drier felts 5 and 8 so as to restrict the passage of air into the pockets 13. In this connection it should be understood that the drier is closed as thoroughly as practicable at the sides and top and that air is admitted from the bottom through a well or duct 20. Although the sides 15 and 17 are shown for the purpose of illustration as serving to support the various heated rolls and guide rolls by means of shaft sections projecting from the ends of the rolls and journalled in said sides, it should be understood that in actual practice a frame of the usual type would be used and the drier would be closed against the passage of air where desired by suitable means such as sheet metal properly arranged and supported by the frame.

While I have illustrated and described in detail one embodiment of the invention, it should be understood that changes may be made therein. I do not, therefore, desire to limit myself to the specific construction illustrated but intend to cover my invention broadly in whatever form its principles may be utilized.

I claim:

1. In a drier for paper webs, the combination with a heated roll around a part of which a web passes and a drier felt encasing the roll where engaged by such web, of a suction head adjacent to the path of the web where it leaves the roll to maintain a partial vacuum in the pocket formed between the web and the felt and including a coiled sheet extending substantially the length of said roll and formed with a complete outer coil and a partial inner coil outlining in correspondence with its inner surface and edge an inner space of substantially circular cross section and substantially uniform cross sectional area, the inlet passage being between the outer coil and the partial inner coil and being of substantially uniform depth and of such depth and width as to make the effective cross sectional area of said passage substantially equal in cross sectional area to said inner space, the circumferential overlap of the coils being extensive and substantially uniform.

2. In a drier, the combination with two sets of heated rolls around which a web is passed alternately, an endless drier felt for each of said sets and cooperating with the portions of the rolls engaged by the web and guides for the loops of each felt between successive heated rolls, of casing sides for the drier arranged close to the ends of the heated rolls so as to restrict the admission of air to the ends of the pockets formed between the loops of drier felts and the corresponding parts of the web, and suction heads extending into said pockets and substantially the lengths thereof to remove moist air and vapor at all points across the web.

3. In a drier, the combination with two sets of heated rolls around which a web is passed alternately, an endless drier felt for each of said sets and cooperating with the portions of the rolls engaged by the web, and guides for the loops of each between successive heated rolls, of a casing for the drier including sides arranged close to the ends of the heated rolls so as to restrict the admission of air to the ends of the pockets formed between the loops of drier felts and corresponding parts of the web, a duct supplying air to the interior of said casing but outside the pockets, and suction heads extending into said pockets and substantially the lengths thereof to remove moist air and vapor from the pockets at all points across the web.

4. A suction head comprising a sheet of substantially uniform width and length which is rolled widthwise into a substantially uniform volute spiral of substantially more than a turn, the overlap of the turns defining an inlet passage of substantially uniform depth, width and circumferential length and of substantially the same cross sectional area in an axial plane as the cross sectional area of the interior of the spiral in a transverse plane, and an end closure.

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