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C. H. CROWELL.

DRIER FOR PAPER, CLOTH, &c.

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NO MODEL.

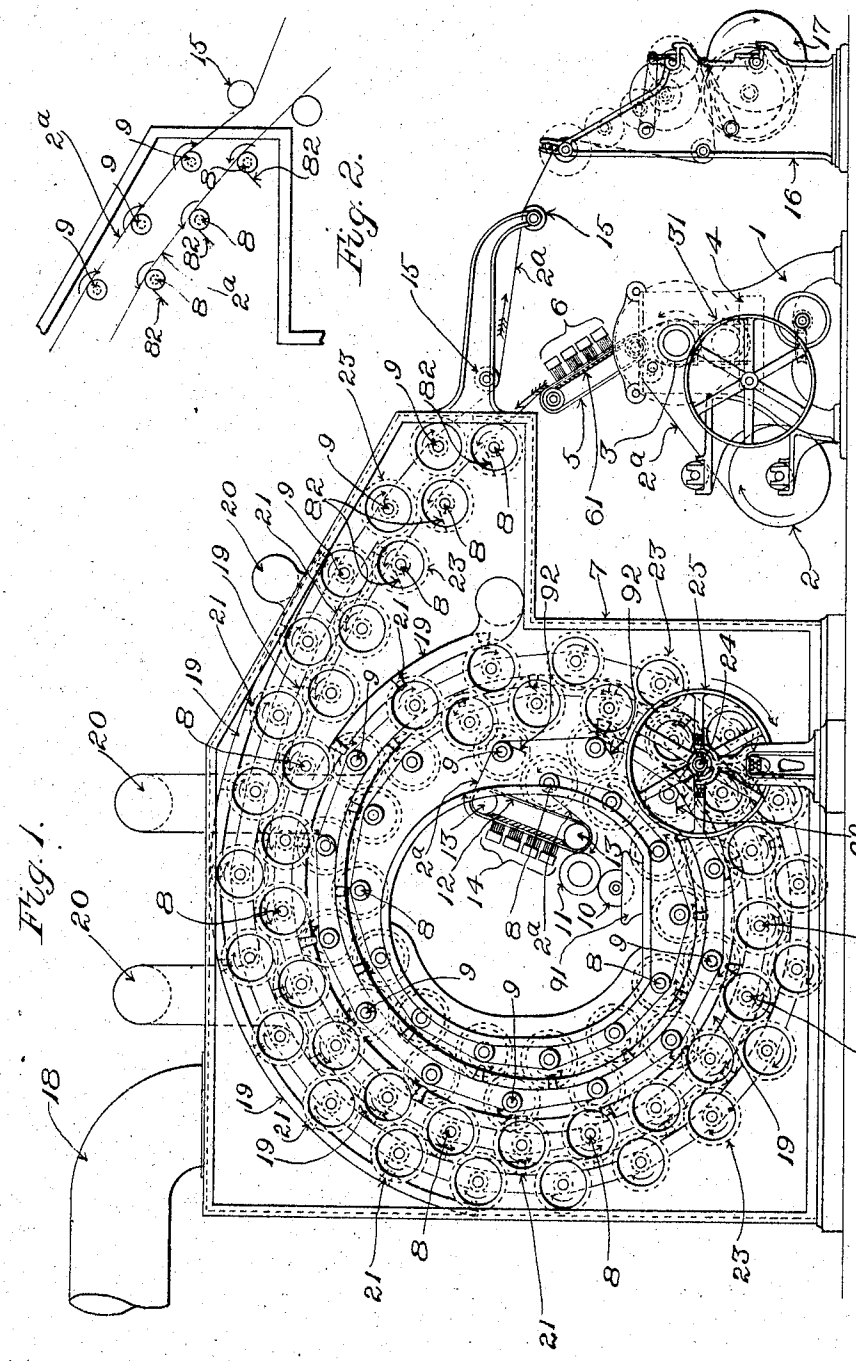


Fig. 1.

Fig. 2.

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No. 772,695. Patented October 18, 1904.

UNITED STATES PATENT OFFICE.

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DRIER FOR PAPER, CLOTH, &c.

SPECIFICATION forming part of Letters Patent No. 772,695, dated October 18, 1904.

Application filed August 9, 1902. Serial No. 119,104. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. CROWELL, a citizen of the United States, residing at Swampscott, in the county of Essex, State of Massachusetts, have invented a certain new and useful Improvement in Driers for Paper, Cloth, &c., of which the following is a specification, reference being had therein to the accompanying drawings.

The invention embodies the principles of the drier for which Letters Patent of the United States were granted to me on June 24, 1902, No. 703,044. The said drier is characterized by the employment of a series of supporting and guiding rods or rolls which are disposed in a continuous curved line, forming a spiral, the web to be dried passing onto the said series at one extremity thereof and following in its course the curvature of the series to the other extremity thereof. The spiral series of rods or rolls is inclosed within a suitable casing. Means is provided for supplying currents of heated air to the interior of the said casing, and ducts are arranged parallel with the turns of the spiral, the said ducts having mouths or discharge-openings through which jets or streams issue against the web supported by the rods or rolls. Among the advantages of the drier of the said Letters Patent are the extended course through which the web under treatment may be caused to travel while exposed to the drying action, the expedition and economy with which the web is satisfactorily dried, and the very small amount of space, comparatively speaking, which is required to be occupied by the drier. The curvature of the series of rods or rolls, these being mounted in fairly close proximity to one another, causes the web traversing the said series upon the convex or outer side of the curve thereof to be drawn by its own tension into close and firm contact with the surface of every rod or roll. Thereby the rods or rolls are enabled to support the web from edge to edge thereof, and they prevent the web from curling, which a moistened web of paper tends to do when in a relaxed state, as when it is not positively supported throughout its entire width. In the said drier the rods or rolls located at a short distance from one another, as just indicated, are positively driven—*i. e.*, are driven by the mechanism of the drier and not by the frictional contact of the web of material passing through the drier. Thereby the feeding action is distributed throughout the whole length of the portion of the web which is within the drier and liability to injury of the web from longitudinal strains is obviated, while the paper is relieved from tendency to draw into wrinkles in consequence of such strains. The use of the series of rotating rods or rolls located, as aforesaid, at a short distance apart also causes the web to follow a straight course—*i. e.*, without lateral deviation—through the drier and to wind truly upon the receiving mandrel or roll. The said drier is of great value for drying webs of material which have been gummed, coated, colored, or otherwise finished or treated upon one side thereof. Such webs reach the series of rods or rolls with the gummed, coated, colored, or otherwise finished side outermost, the other side alone making contact with the rods or rolls throughout the traverse of the entire series of rods or rolls by the webs.

One general object of the invention is to increase the efficiency and drying capacity of a drier of the type which is presented in my Letters Patent aforesaid without loss of the compactness and economy of space thereof. Another general object thereof is to facilitate the manufacture of paper or cloth which is gummed upon both of the surfaces thereof or is required to have both of said surfaces coated, colored, or otherwise finished.

An important characteristic of the present invention is the addition of a second spiral series of rods or rolls parallel with the first series, so that the turns thereof alternate with those of the first series, whereby the web of paper or cloth under treatment after having traveled along its spiral course to the central portion of the drier is caused to be returned through the drier along a similar course parallel with the first. This feature of the invention is useful in enabling certain classes

of material—as, for instance, paper or board—as it comes from a forming-machine to be dried satisfactorily with great efficiency, for it permits the length of the travel of the material within the drier to be doubled, which doubles the duration of the period of the exposure of the material to the drying action. It also enables one surface of a web to be gummed, coated, colored, or otherwise finished and the web to be dried and then the other surface to be similarly or otherwise treated and the web again dried during the continuous travel of the said web through the drier.

The embodiment of the invention which is illustrated in the drawings has been designed more especially for use in coating the two surfaces of a continuous web, and by way of making clear the nature and relations of the invention I will first proceed to explain the said embodiment.

In the drawings, Figure 1 shows the said embodiment of the invention in side elevation. Fig. 2 is a detail view illustrating the removal of gum, coating material, or the like from the rods or rolls.

The general features of the apparatus which is shown in the drawings comprise a machine for treating one surface of a continuous web of material, a double spiral drier to which and through which the said web passes from the said coating or covering machine, a second machine located at the center of the said drier and by means of which is treated the surface of the said web which was not treated by the first machine, and a winding mechanism by which the web is received and wound after returning from the second machine through the spiral drier. The character and construction of the two machines and of the winding mechanism are not material to the invention and may be varied as deemed desirable in practice. The said machines may be such as are suitable for gumming or otherwise coating or covering the web of material or may be suitable for coloring purposes or otherwise finishing the said web. For the purposes of this case I have shown two coating-machines. Various well-known forms of machines for the various purposes are in use and so are various forms of winding mechanism, and I will therefore merely refer to the illustrated features of the same briefly herein, inasmuch as the details of construction, &c., are familiar to those who are skilled in the art.

At 1, Fig. 1, is the framing of the first covering or coating machine, and at 2 is the supply-roll from which is drawn the web of material to be treated. At 3 3 31 are shown rolls in the said first coating or covering machine, between which the web 2^a passes.

At 4 is a trough containing the coating or covering material, into which latter the roll 31 dips, the said roll serving to transfer a proper portion of the said coating or covering material to the surface of the web 2^a.

5 is the traveling apron, which backs up the web 2^a under the action of the moving brushes 6, which are employed for distributing the coating or covering material over the surface of the web 2^a and working it into the said surface. 61 is a fixed plate or the like for supporting the said apron against the pressure of the brushes.

7 is the casing of the drier.

8 8, &c., are the guiding and supporting rods or rolls within the casing 7 of the drier, constituting the series to which the web 2^a passes from the coating or covering machine and by means of which it is supported and guided during its travel within the said casing. The said rolls 8 8, &c., are arranged in a spiral series, as in my Letters Patent aforesaid, the said series gradually converging toward a central point and making substantially two complete turns upon itself after the fashion of an involute spiral. The web travels along the series of rolls 8 8 with the coated or covered face turned outward, only the uncoated surface of the web making contact with the said rolls. From the last roll 8 of the said spiral series the dried web 2^a passes around a guide or guides at the center of the drier, by which guide or guides the direction of its movement is changed, and it then is led outward through the drier. At the center of the drier the second coating or covering machine is located, and by the latter the uncoated side or surface of the web is given its coating or covering. The guides for changing the direction of movement of the web at the center of the machine are constituted in the present instance by the rolls 13 13, which support the backing-apron 12 of the second coating-machine. The trough of this machine for holding the coating or covering material is indicated at 91, 10 being a wallower-roll which is partly immersed in the contents of the said trough and also makes contact with a transfer-roll 11, which last applies the coating or covering material to the previously-uncoated side or surface of the web 2^a as the said web passes, together with the backing-up apron 12 of the second coating or covering machine, around one of the supporting and guide rolls 13 for the said backing-up apron 12. 14 are the brushes for distributing and working the coating or covering material which has been applied to the web by the second coating or covering machine. From the said coating or covering machine the said web passes, moist face outermost, to the rolls 9 9, &c., of the drier, the said rolls 9 9, &c., being arranged in a series which is parallel with the series 8 8, &c.—that is to say, the said rolls 9 9, &c., are disposed in a second spiral, the turns of which alternate with those of the

spiral comprising the rolls 8 8, &c.—and by means of the rolls 9 9, &c., the web after passing the second coating or covering machine is conducted through the drier again, its path being parallel with that of the web on its way inward from the first coating or covering machine.

From the outer or delivery end of the series of rolls 9 9 the web, coated on both sides or surfaces and dried, passes to the winding mechanism, it being conducted thereto by means of suitable guide-rolls, as at 15 15. The framing of the winding mechanism is designated 16, the roll on which the web is wound being designated 17.

In practice a supply of air, usually in a heated state, enters at the bottom of the casing 7, 18 being the exhaust at the top of the said casing for the withdrawal or escape of the moisture-laden air.

At 19 19 are shown ducts arranged parallel with the respective spiral series of rolls in the drier, the same being supplied with air, usually heated, by means of conduits 20 20 and having mouths at 21 21 discharging inwardly upon the web 2^a, usually in practice at places where the said web is supported by rolls 8 and 9. These features are in general the same as in my Letters Patent aforesaid, to which reference may be had for full information respecting the same.

The rolls are rotated in directions to facilitate the travel of the portions of the web making contact therewith. Hence the series 8 are rotated in one direction, and the series 9 are rotated in the opposite direction. I drive the said rolls by providing each thereof with a pinion 23, the rolls of the two series being arranged so as to alternate relatively to each other and the pinions of each series of rolls being engaged with those of the other series of rolls in an alternating order. The driving-shaft for the rolls is shown at 24, it being suitably geared to one of the pinions 23 or otherwise to one of the rolls and being furnished with a band-pulley, as at 25, for the reception of driving power through a suitable band or belt. (Not shown.)

My present invention is not only adapted to be used, as already explained herein, in the manufacture of paper or other material having the two surfaces thereof covered or otherwise finished, but is expressly intended and adapted to be employed in the drying of web materials requiring long-continued subjection to the drying action. Thus it is designed to be employed in the drying of paper or board as it comes from the forming-machine, the web of paper or board being conducted continuously from the forming-machine to and along the series of rolls 8 8, &c., to the center of the machine, there around the direction-changing roll or rolls or other device, and then back to and along the series of rolls 9 9, &c., from which last the material may pass to a winding mechanism or be otherwise disposed of.

In the process of coating paper a certain proportion of the coating compound works around the side edges of the web onto the reverse side of the paper. This on drying renders the edges slightly thicker than the other portions of the paper. From this thickening of the edge portions difficulties arise in the subsequent operations of winding and of calendering unless the thickened portions are trimmed off. For example, when the web of paper is being wound the edge portions will tend to wind up faster than the rest of the web, and consequently such portions will be strained and torn. It frequently is necessary for the workman to hammer down the edge portions of the roll of paper as it is winding in order to reduce this increase of thickness. Again, if the web with its thickened edge portions were to be passed through the calender such portions would take the pressure of the rolls and the middle portion of the web would not receive its full pressure, thereby affecting the quality of the finish. The narrow thickened edge portions, moreover, have a tendency to injure the calender-rolls, the paper or cloth roll becoming dented or worn. It is customary on the foregoing account to take in the first instance a web which is from at least one-half of an inch to an inch wider than the finished web is required to be and trim off the thickened edge portions as the paper passing through the coating-machine is being rewound.

For the purpose of preventing the edges of the web from becoming thickened in the manner just noted certain of the rolls 8 and 9 of my drier have combined therewith doctors 82 92 for the purpose of removing from such rolls the moist coating composition which is transferred by the paper to the rolls. As it passes from each coating-machine the coated sheet reaches the rolls of the corresponding series 8 or 9 before the coating has become at all set. Consequently the portion of such coating which is on the back of the web is transferred to the first few of the said rolls. Such portion, however, is stripped from the rolls by the doctors, and thereby the rolls are always kept clean. In this manner the first few rolls serve to remove with almost perfect completeness whatever material lies on the surface of the back of the web. The doctors are employed at both the outer end of the spiral series 8 8, &c., and at the inner end of the spiral series 9 9, &c.

In the foregoing manner I render it unnecessary to trim the paper for the passage through the calender. This saves largely in the matter of waste, rendering it unnecessary to cut off the one-half inch or so of material

which heretofore it has been necessary to trim off, and it also obviates the injury to the paper or cloth roll of the calender which heretofore has resulted from passing the untrimmed coated paper through the calender.

I claim as my invention—

1. The improved drier having the two series of rods or rolls arranged in a double involute spiral and means to rotate the respective series in opposite directions with relation to each other, whereby the material under treatment is conducted within the drier along two corresponding spiral courses.

2. The improved drier having the two series of rods or rolls arranged in a double spiral whereby to conduct the material under treatment within the drier along two concentric spiral courses, and having at one extremity of said double spiral a guide around which said material changes direction in passing from one series to the other.

3. The improved drier having the two series of rods or rolls arranged in a double spiral whereby to conduct material under treatment within the drier along two concentric spiral courses, and having one extremity of the said double spiral provided with means for enabling the said material to change direction in passing from one series to the other, and means to rotate the respective series in opposite directions with relation to each other.

4. The improved drier having the two series of rods or rolls arranged in a double spiral, having at one extremity of the said double spiral the machine to treat one face of the material prior to the passage of said material along one of said series of rods or rolls, and having at the other extremity of said double spiral the second machine to treat the other face of said material prior to returning along the other series of said rods or rolls.

5. The combination with the drier having the two series of rods or rolls arranged in a double spiral, of the machine located at one extremity of the said double spiral, the material passing from said machine to one of the said series of rods or rolls, the machine at the other extremity of said double spiral, the material passing from said second machine to the other of said series of rods or rolls, and means to rotate the respective series in opposite directions with relation to each other.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES H. CROWELL.

Witnesses:
CHAS. F. RANDALL,
WILLIAM A. COPELAND.