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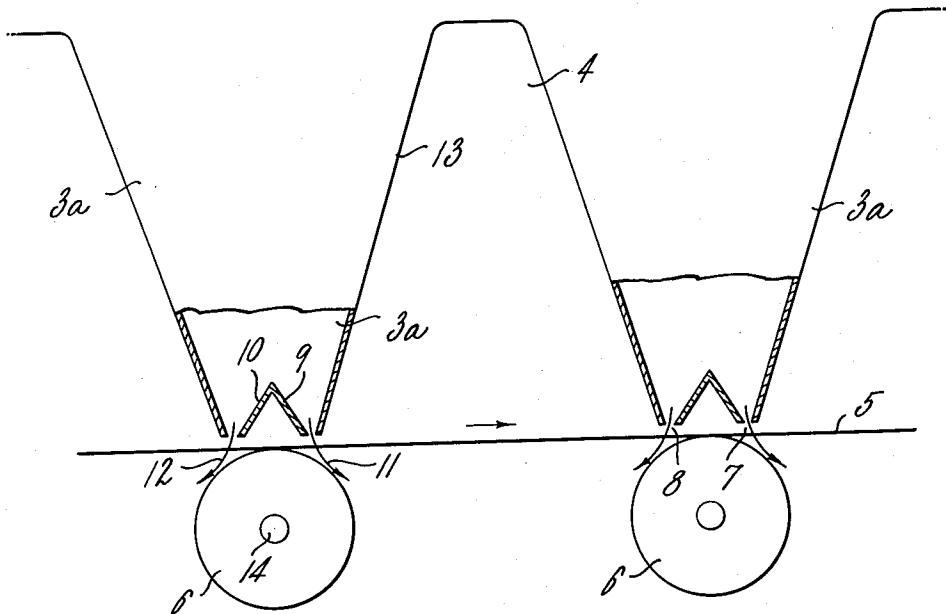
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DRYING APPARATUS FOR LENGTHY WEB MATERIAL

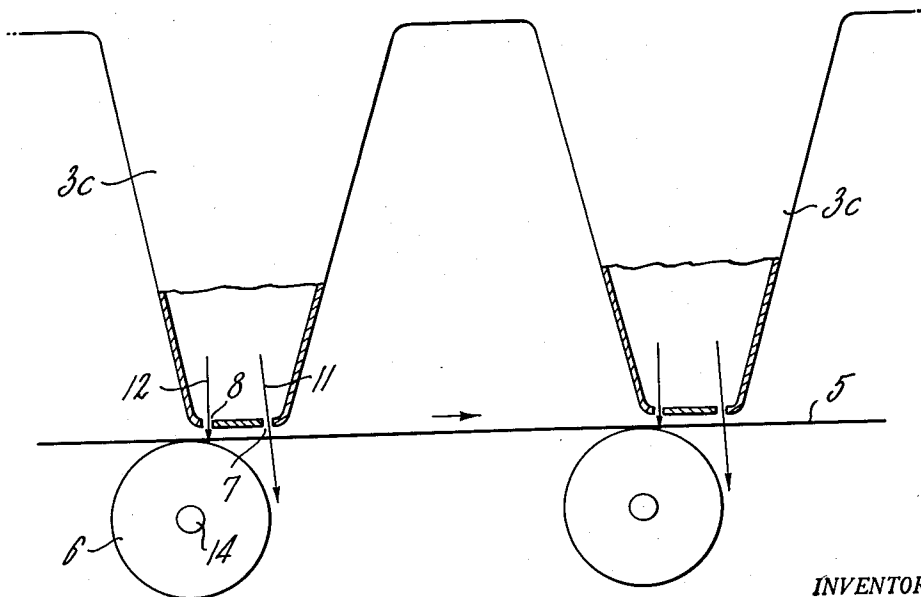
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DRYING APPARATUS FOR LENGTHY WEB MATERIAL

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10 Claims. (Cl. 34—160)

This invention relates to drying and like treatment machines for lengthy web material, cloth, paper and similar cellulose material of various forms, such as strips, bands, etc.

It is one of the objects of the invention to provide means affording efficient distribution and coordination of respective zones of support for the material to be treated during its travel or passage through the machine and of nozzle outlet or outlets for the supply of the treatment fluid to be impinged upon said material.

It is another object of the invention to provide means effectively preventing lateral slippage, deviation or displacement of the material from its predetermined path of travel while the material is subjected by means of said nozzle outlets to the action of jets of treatment fluid, which is subsequently evacuated or guided to the exhaust in a direction transverse to the path of travel of the material.

Yet another object of the invention is to provide means facilitating the arrangement of the nozzle outlet or outlets substantially symmetrically with respect to the support for the material, which may be maintained at full width and in substantially taut condition.

Still another object of the invention is to provide means rendering the possibility of locating the zones of support for the material by means of supporting rollers and the zones and direction of the nozzle outlets for the emission of the jets of treatment fluid in proximity or unilaterally of the axes of symmetry of said supporting rollers.

Yet a further object of the invention resides in the provision of means conducive to efficiently administering through suitably disposed outlets of nozzles fluid jets against the material during its forward and return passage through the machine while the supporting rollers are placed intermediate oppositely arranged nozzles which define said passage.

It is still a further object of the invention to provide means permitting adjustment of the fluid jets against the material to be treated in substantially tangential directions with respect to the surfaces of the supporting rollers.

A still further object of the invention is to provide means enabling gradually changing conditions and effects of the jets of treatment fluid on the material, while same is held and guided along said supporting rollers.

A still further object of the invention is to provide means avoiding shifting of the material under treatment from a predetermined path of travel over supporting rollers placed opposite the discharge outlets of the nozzles, but nevertheless assuring thorough treatment and penetration of the material by the fluid jets whose actions are not interfered with by the otherwise obstructive supporting rollers.

A still further object of the invention is to provide means for retaining the material through fluid jets on the supporting rollers, and simultaneously permitting gradually unobstructive penetration of the material by further fluid jets.

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With the above and other objects in view, the invention will be hereinafter more fully described and the combination and arrangement of parts will be shown in the accompanying drawings and pointed out in the claims which form part of the specification.

Fig. 1 is a diagrammatic view of a treatment apparatus constructed according to the present invention;

Fig. 2 is an enlarged fragmentary elevational view, with parts broken away and shown in section, of one nozzle and roller construction according to the present invention;

Fig. 3 is an enlarged fragmentary elevational view, with parts broken away and shown in section, of a modified nozzle and roller construction according to the present invention; and

Fig. 4 is an enlarged fragmentary elevational view, with parts broken away and shown in section, of still a further modified nozzle and roller construction.

Referring now to the drawings, there is shown in Fig. 1 a drying apparatus or similar treatment machine which includes a blower box 1 provided with an inlet 2 for treatment fluid, such as air, steam, superheated steam, vapor and the like. The treatment fluid is delivered with a predetermined velocity to a group of spaced apart nozzles 3 and is discharged in the form of jets onto the web of lengthy fabric or other cellulose material 5. The spent treatment fluid is thereafter evacuated through the exhaust channels 4 arranged intermediate adjacent nozzles 3. Adjacent the nozzles 3 and the exhaust channels 4 are rollers 6 which support the material 5. Each of the rollers 6 is mounted for rotational movement about a substantially horizontal axis, the rollers 6 being spaced from the nozzles 3 to define a predetermined path for the moving material 5. The nozzles 3 and exhaust channels 4 are arranged to extend in a direction transverse to the direction of travel of the material 5 under treatment so that spaced areas of the material are simultaneously impinged upon by the jets of treatment fluid while spent fluid is evacuated through the exhaust channels 4.

According to the present invention, the material 5 being treated is effectively prevented from lateral slippage, deviation, or displacement from the predetermined path of travel by a nozzle and roller arrangement wherein the treatment fluid urges the material 5 against the rollers 6 and ensures positive guidance of the lengthy material in a direction transverse to rotational axes of the rollers 6 and from one roller to an adjacent roller.

Referring specifically to Fig. 2, the nozzles 3a are arranged substantially opposite the roller 6 and are spaced apart from each other by the exhaust channels 4. Each of the nozzles 3a is provided with a pair of spaced fluid outlets or discharge openings 7, 8 for the egress there-through of the treatment fluid. The fluid outlets 7, 8 are defined by the convergent outer walls 13 of the nozzles 3a and the divergent plates 9, 10 arranged there-between. As clearly illustrated, the plates 9, 10 extend downwardly and outwardly of the axis of symmetry of the nozzle 3a and terminate in coplanar relation with the lower edge of the outer walls 13 of the nozzles 3a. The rotational axis 14 of each of the rollers 6 is arranged in a substantially vertical plane defined by the axis of symmetry of the adjacent nozzle 3a and the fluid outlets 7, 8 are arranged to direct the jets 11, 12 issuing therefrom in planes laterally and offset with respect to the plane of the aforesaid axis of symmetry and of the rotational axis 14.

The jets 11, 12 which issue from the outlets 7, 8, on opposite side of the axis 14 of the adjacent roller 6, penetrate and treat the material 5 and then are deflected substantially in tangential direction outwardly by the adjacent peripheral portions of the rollers 6, whereupon

the treatment fluid passes again through the material 5 for evacuation through adjacent exhaust channel means 4. Simultaneously the material 5 is urged into engagement with the underlying peripheral portion of the roller 6 which is intermediate the fluid outlets 7, 8, whereby the material 5 is maintained against lateral displacement under the action of the jets 11, 12.

By varying the spacing of the fluid outlets 7, 8 with respect to the material 5 and for varying the velocity of the treatment fluid, the force provided to counteract slippage and displacement can be varied. In determining optimum and practical distance between the nozzles 3a and the adjacent rollers 6, reference is made to applicant's copending application Ser. No. 756,875 dated June 27, 1947, now forfeited.

In Fig. 3, there is shown a nozzle and roller arrangement particularly constructed for treating material 5 which includes a first length 5a extending through the machine in one direction and a second length 5b extending through the machine in the opposite direction. The material is passed along a rectilinear path which is tangential to the uppermost and lowermost peripheral portions of the rollers 6. The nozzles 3a are arranged opposite to and above the rollers 6, while the nozzles 3b are arranged opposite to and below the rollers 6. Each of the nozzles is provided with spaced fluid outlets 7, 8 for the egress therethrough of the treatment fluid. In this arrangement the fluid outlets 7, 8 of the upper and lower nozzles 3a, 3b are each defined by a plate 15 having a curvature corresponding to the curvature of the adjacent peripheral portion of the respective rollers 6.

In the device of Fig. 3, the material 5 is moved along the path defined by the upper and lower lengths 5a, 5b and subjected to the treatment fluid being discharged from the fluid outlets 7, 8 of the upper and lower rollers. Each of the jets 11, 12 contributes to the effective penetration of the material 5 with the treatment fluid and further urges the material into engagement with the adjacent peripheral portions of the rollers 6.

Accordingly, the material 5 is maintained against lateral deviation from the path of travel over the supporting rollers 6 which are placed opposite the discharge outlets 7, 8 of the respective nozzles, and is subjected to a gradually increasing thorough treatment by the jets 11, 12 whose actions are not interfered with by the otherwise obstructive rollers 6.

Referring now to Fig. 4, there is shown another nozzle and roller arrangement which retains the material 5 against lateral displacement and assures the gradual unobstructive penetration by the treatment fluid. In this embodiment, the axis of symmetry of each of the nozzles 3c is laterally offset or asymmetric with respect to the rotational axis 4 of the adjacent rollers 6. The offset location is selected so that both discharge openings or fluid outlets 7, 8 are arranged on one side of the vertical plane of axis 6, with the jet 11 issuing from the outlet 7 being directed substantially tangentially of the roller 6 and with the jet 12 issuing from the outlet 8 being directed substantially normal to the adjacent peripheral portion of the roller 6. The jets 12 being discharged from adjacent nozzles 3c effectively maintain the material 5 against the adjacent peripheral portions of the rollers 6 and contribute somewhat to the treatment of the material while the jets 11, 12 effectively penetrate the material 5 without deflection by or interference from the rollers 6.

In the arrangements illustrated in Figs. 2 to 4, the roller opposite the respective nozzle has a diameter larger than the spacing between the outlets 7, 8 of the respective nozzle, and the outlets are symmetrically disposed with respect to the center plane of the respective nozzle.

The nozzle and roller arrangement of Fig. 4 can be employed in an apparatus of the type disclosed in Fig. 3 by providing a lower group of nozzles laterally offset with respect to the axes 14 of the rollers 6 in a direc-

tion opposite to the offset location of the upper group of nozzles 3c.

It can thus be seen that there has been provided in accordance with the present invention a machine for treating web material along a predetermined path comprising a plurality of nozzle means, and rotatable roller means substantially opposite said nozzle means and spaced therefrom for the passage therebetween of said material, each nozzle means being provided with at least one fluid outlet for the discharge of a jet of treatment fluid, each of said fluid outlets being arranged to direct said jet along a course offset a predetermined distance from the rotational axis of the roller means substantially opposite said outlet.

While several embodiments of the invention have been shown and herein described, it will be understood that the same is capable of modifications without departure from the general scope and spirit of the invention as defined in the claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. A machine for treating sheet, web and like lengthy material comprising a group of roller means mounted for rotation about spaced, parallel axes, a group of nozzle means arranged substantially opposite said roller means, respectively, and spaced therefrom to define therewith a predetermined substantially rectilinear path for said lengthy material, each nozzle means being provided with an end wall defining said path at said nozzle means, said end wall being provided with at least one pair of fluid outlets arranged coplanar with said end wall for facilitating discharge of jets of treatment fluid, and exhaust channels means arranged intermediate adjacent nozzle means for evacuating spent treatment fluid, each pair of said fluid outlets being arranged to direct said jets in planes asymmetrically with respect to the axis of the respective roller means opposite thereto and being spaced from the latter a predetermined distance ensuring positive linear guidance of said lengthy material in a direction transverse to the axes of said roller means and from one to an adjacent roller means, each fluid outlet of said pair of outlets being arranged on a respective side of the rotational axis of said roller means, one of said fluid outlets being arranged to direct the jet tangentially to the surface of the respective roller means.

2. A machine according to claim 1, wherein said pair of outlets is disposed symmetrically with respect to the center plane of the respective nozzle means, but asymmetrically with respect to the rotational axis of the respective roller means.

3. A device for treating web material comprising a group of roller means mounted for rotation about spaced, parallel and horizontally disposed axes, vertically disposed nozzle means respectively arranged substantially opposite said roller means and spaced therefrom to define therewith a predetermined substantially rectilinear path for said material, each nozzle means being provided with an end wall having at least one pair of fluid outlets symmetrically disposed with respect to the center plane of the nozzle means and adapted to direct jets of treatment fluid toward portions of said material spaced from said roller means, and exhaust channel means arranged intermediate adjacent nozzle means for evacuating spent treatment fluid, each pair of fluid outlets being spaced apart a distance less than the diameter of the respective roller means and being arranged to direct said jets in planes laterally offset with respect to the axis of the respective roller means and on one side thereof, at least one of said fluid outlets being arranged to tangentially direct the jet with respect to the surface of the respective roller means.

4. In a drying and like treatment apparatus for cloth and like web material; a plurality of nozzle means for directing treatment fluid to said material, exhaust channel means intermediate each two adjacent nozzle means for evacuating spent treatment fluid, and a plurality of roller

guide means opposite said nozzle means and spaced a predetermined distance therefrom and disposed to guide said material in a substantially rectilinear path past said nozzle means, said nozzle means including an end wall, each end wall being provided with a pair of slots constituting discharge ends, said discharge ends being spaced from each other with the major portion of said end wall therebetween, the respective vertical planes through the horizontal axes of said roller means being offset with respect to the vertical planes in which the respective discharge ends extend, the diameter of each roller means and the distance between the slots of each pair of slots of each nozzle means being coordinated to each other so that treatment fluid is only directed against and impinges upon portions of said material out of contact with said roller means.

5. In a drying and like treatment apparatus according to claim 4, wherein the end wall of each nozzle means is recessed toward the interior of the respective nozzle means.

6. In a drying and like treatment apparatus according to claim 5, wherein said end wall is angularly shaped in cross section with the apex of said end wall substantially in a plane perpendicular to the plane of said material and to the plane passing through the axis of the respective roller means.

7. In a drying and like treatment apparatus according to claim 4, wherein said end wall of each nozzle means is curved toward the interior of the respective nozzle means.

8. In an apparatus for treating web material; a plurality of nozzle means for directing treatment fluid toward said material, exhaust channel means intermediate each two

adjacent nozzle means for evacuating spent treatment fluid from said material, and a plurality of roller means opposite said nozzle means and disposed to guide said material in a predetermined substantially rectilinear path past said nozzle means, each nozzle means including an end wall provided with at least a pair of slots constituting treatment fluid discharge ends, said discharge ends being spaced apart a sufficient distance and so correlated with respect to the diameter of the opposite guide roller means, that fluid will impinge on said material at portions thereof out of contact with said roller means so as to produce tensioning of said material over surface portions of said roller means thereby maintaining said material against lateral displacement from said predetermined path.

9. An apparatus according to claim 8, wherein said discharge ends are symmetrically arranged with respect to the vertical plane passing through the horizontal axis of said roller means.

10. An apparatus according to claim 8, wherein both said discharge ends extend unilaterally of the vertical plane passing through the horizontal axis of said roller means, whereby part of said roller means is embraced by said material thereby retaining the same against transverse movement on said roller means and increasing the contact surface between said material and said roller means.

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