Jan. 26, 1954 J. DUNGLER 2,666,994

TREATMENT APPARATUS FOR CLOTH AND LIKE SHEET MATERIAL AND EQUIPPED WITH MEANS FOR SHUTTING OFF THE TREATMENT FLUID

Filed June 7, 1950

2 Sheets-Sheet 1

Fig. 1

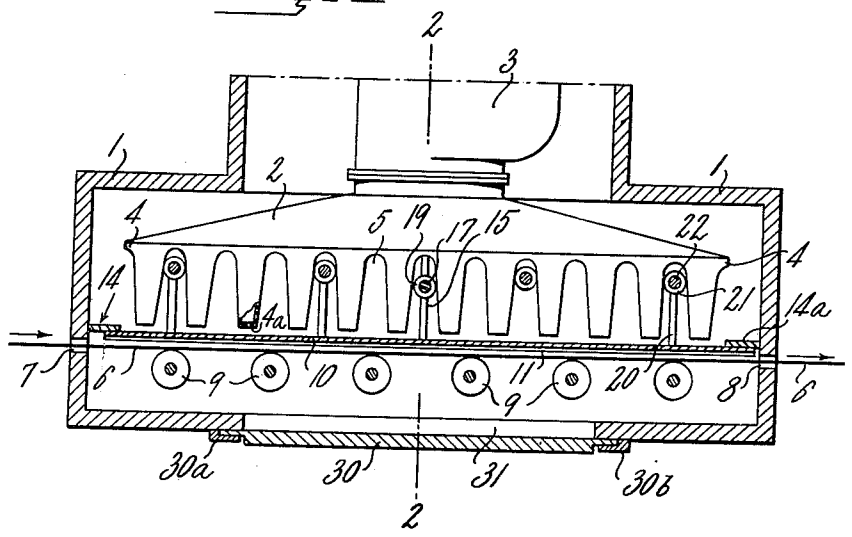
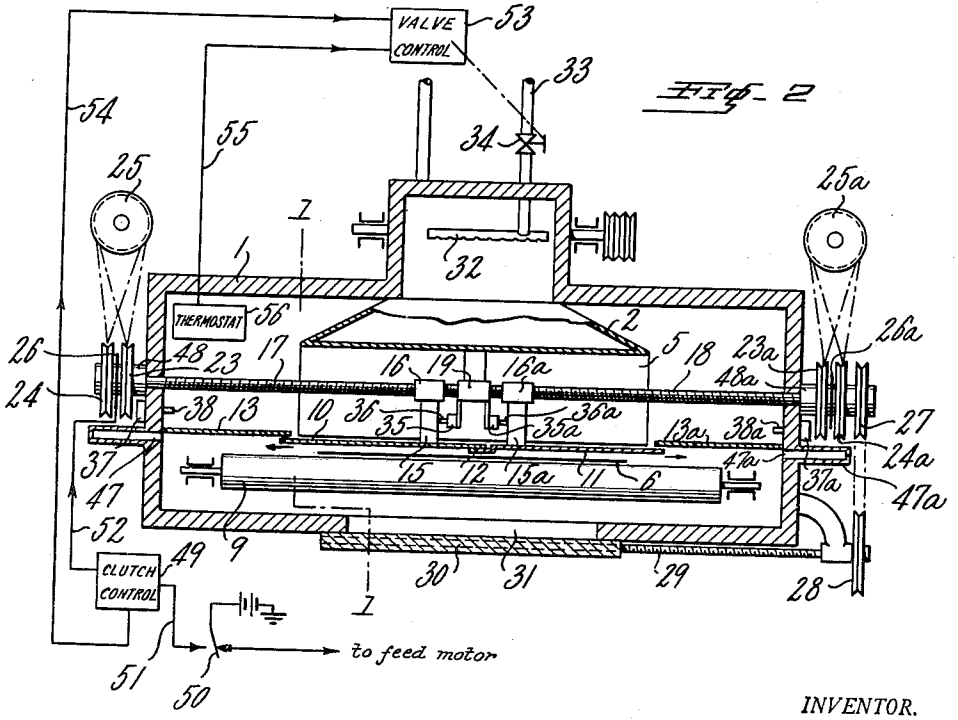


Fig. 2



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2 Sheets-Sheet 2

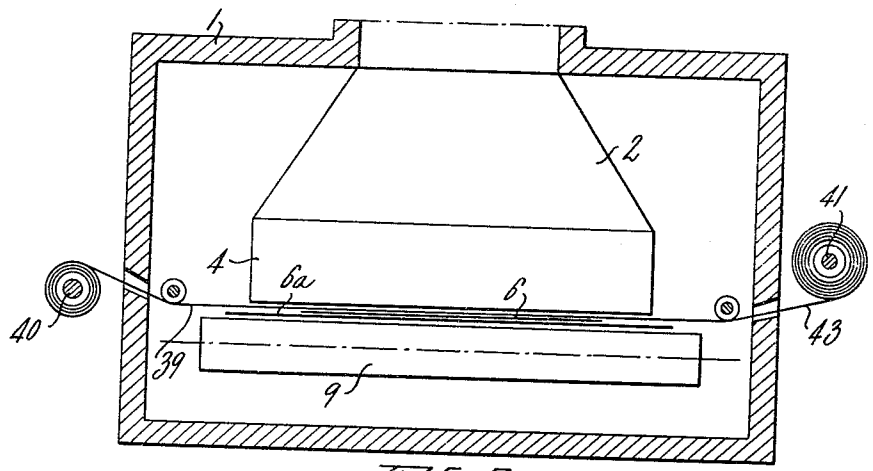


Fig. 3

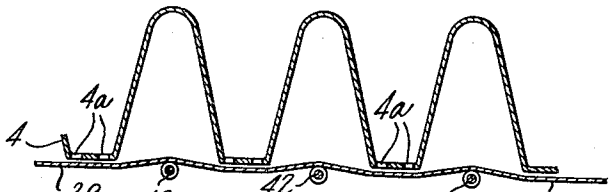


Fig. 4

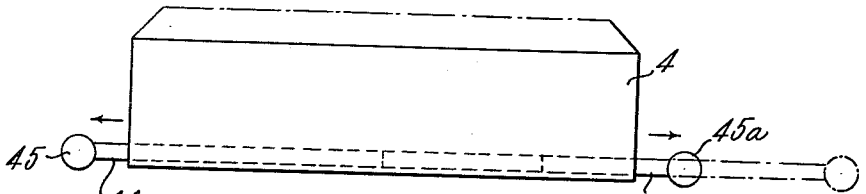


Fig. 5

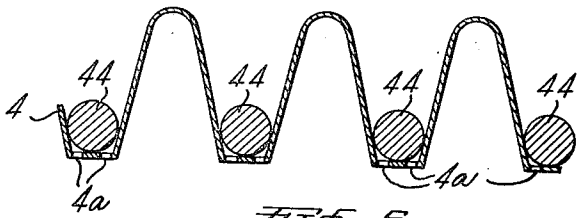
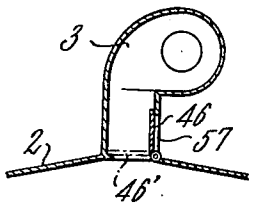


Fig. 6

Fig. 7



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Patented Jan. 26, 1954

2,666,994

UNITED STATES PATENT OFFICE

2,666,994

TREATMENT APPARATUS FOR CLOTH AND LIKE SHEET MATERIAL AND EQUIPPED WITH MEANS FOR SHUTTING OFF THE TREATMENT FLUID

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Application June 7, 1950, Serial No. 166,732

Claims priority, application France April 25, 1950

10 Claims. (Cl. 34—45)

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The present invention relates to machines for the treatment of elongated products, such as fabrics or other sheet or web materials, in open width and by a continuous process involving the discharge of a fluid upon the surface thereof, such as machines for the drying of fabrics, for the steaming and fixing of colors, etc.

It is an object of the invention to provide means preventing prolonged and harmful action of the treatment fluid upon the web material in the event of interruption of the feed thereof resulting in a temporary immobilization of the material during passage thereof through the machine.

Modern, high-efficiency machines of the character referred to, in particular, drying machines utilizing superheated steam as the treatment fluid, operate at such elevated temperatures that the treated web material, passing rapidly through the machine, is in danger of being damaged by any instantaneous interruption of feed prolonging the intense mechanical and thermal effect of the fluid thereupon. If the machine under consideration is, for example, a drier following a printing machine, interruptions of feed of the treated product are practically inevitable, since the printing machine will not be able to rotate continuously without necessitating adjustments or corrections. It becomes, therefore, imperative to take precautions whereby, in accordance with the object set forth above, harmful action of the treatment fluid upon the product will be prevented.

It may be thought that the simplest way of preventing such harmful action would be to arrest temporarily the operation of the fluid discharge means; such a course is, however, not economical and, moreover, quite unreliable inasmuch as both the de-activation and the reactivation of the fluid projecting means requires a certain time. Furthermore, even the interruption of fluid discharge will not insure the safety of the fabric or other material since the hot and humid atmosphere in the treatment chamber may suffice to work damage on prolonged exposure.

Accordingly, it is another object of this invention to provide means facilitating blocking of the passage of treatment fluid toward the sheet material or like product under treatment, thereby temporarily withholding this product from the action of the fluid discharge means, although the function of the latter is still continued.

It is also an object of the present invention

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to provide means enabling the rapid partial or total ventilation or evacuation of the working atmosphere from the treatment chamber simultaneously while the passage of further treatment fluid is blocked.

The invention further contemplates the provision of blocking means in the form of shutters adapted to be positioned at the desired time, between the discharge or blowing nozzles of the apparatus and the treated material or product.

According to another feature of the invention means are provided for actuating the fluid-blocking shutters and the disposition of the latter in certain of said exhaust channels, the discharge nozzles being arranged in spaced relation to each other and to said exhaust channel or channels.

It is still another feature of the invention to provide means affording the operation of the fluid-blocking shutters relatively to fixed partitions which contribute to the separation of the fluid blower means from the material or product under treatment.

It is still a further feature of the invention to provide means ensuring automatic actuation of the blocking shutters and/or exhaust devices upon interruption of the feed of the material or product under treatment and return of said shutters and devices to inactive position upon the product resuming the movement along its path through the machine.

According to still another feature of the invention, the inactivation of the exhaust means may automatically cause the momentary injection of supplementary treatment fluid into the machine, for the purpose of driving any air (which has entered) therefrom and of compensating for fluid losses during the operation of the exhaust devices, this supplementary injection being preferably controlled by means responsive to the air content of the atmosphere inside the treatment chamber.

According to yet a further feature of the invention, the fluid blocking shutter or shutters may comprise a flexible strip impermeable to the fluid, the strip being normally wound up at a suitable location and adapted to be unwound, when desired, for interposition between the blower nozzles and the treated product.

According to a still further feature of the invention, the blocking devices may consist of individual shutters, respectively, associated with each blower nozzle, these individual shutters being preferably interconnected for actuation by a common control device.

According to yet another feature of the invention, the blocking shutters may be arranged in such manner as to be operable to stop the passage of fluid between the discharge nozles and the blower or blowers supplying fluid thereto while simultaneously opening a bypass so that circulation of the atmosphere inside the treatment chamber may continue and remain uninterrupted.

The above and other objects and features of the invention will become more fully apparent from the following description, reference being had to the accompanying drawings in which:

Fig. 1 is a longitudinal section through a drying machine according to the invention, taken on the line 1—1 of Fig. 2;

Fig. 2 is a cross-section taken along line 2—2 of Fig. 1;

Fig. 3 is a view similar to that of Fig. 1, showing a different embodiment of the invention;

Fig. 4 is a fragmentary detail view, in longitudinal cross-section, of the machine shown in Fig. 3;

Fig. 5 is a side elevation of an individual nozzle member provided with blocking means representing another embodiment of the invention;

Fig. 6 is a cross-section, similar to that of Fig. 4, through a plurality of nozzle members as shown in Fig. 5; and

Fig. 7 shows a modified arrangement including shutter means associated with a blower.

Referring now more particularly to the embodiment illustrated in Figs. 1 and 2, there is disclosed a drying machine using as treatment fluid superheated steam or vapor. This machine comprises a thermally insulated chamber 1 with a blower box 2 therein, which is supplied with said treatment fluid by a fan or blower 3, the latter discharging this fluid with high velocity by means of outlets 4a of individual nozzle members 4 upon an elongated sheet material, such as a fabric, cloth and like product, adjacent nozzle members 4 having elongated exhaust channels 5 therebetween.

The material or product 6 to be dried, for example a strip of fabric, moves continuously and in open width past the outlets 4a of the nozzles 4, the distance between these outlets and the material being relatively small. The aforesaid material enters the chamber 1 by an entrance slot 7 and leaves it by an exit slot 8. During its passage through the chamber 1 the fabric material 6 is guided by and past spaced supporting or guide roller means 9.

In accordance with the invention, shutters 10 and 11 (of sheet metal or any other suitable material) are adapted to be slid between the nozzles 4 and the fabric 6. The edges of the shutters 10, 11 facing each other overlap, as shown at 12, in closed position of the shutters (Fig. 2). In addition, the fluid blocking means or shutters 10 and 11 cooperate with fixed lateral partitions 13, 13a and end partitions 14, 14a, thus completely sealing off the chamber portion surrounding the nozzle members 4 and, which also contains the blower box 2, from the lower chamber portion containing the fabric and the guide means 9 therefor. Lodgements 47, 47a extending in and beyond the chamber walls adjacent the lateral partitions 13, 13a, are adapted to receive the ends of said fluid blocking means or shutters 10, 11 when the latter are retracted into inoperative position in the manner to be described hereinafter.

The slidable shutters 10 and 11 are connected by means of arms 15, 15a to operable means comprising a pair of tapped sleeves 16, 16a cooperating with oppositely threaded spindles 17 and 18, respectively. These spindles are journaled at their inner extremities in a common bearing 19 and at their outer extremities in bearings 48, 48a provided adjacent the side walls of chamber 1.

As seen in Fig. 1, the shutters 10 and 11 are additionally supported by guiding elements consisting of spaced arms 20 integral with internally smooth sleeves 21 which slide upon transverse rods 22. It will be noted that the aforesaid operable means such as 15, 16, 17 as well as the guide means 20, 21, 22 are located in certain of the exhaust channels 5 separating the discharge nozzles 4.

Control of the threaded spindles 17, 18 is effected by drive means for continuously rotating pulleys 25, 25a, respectively, a suitable motor (not shown) serving to constitute such drive means connected, by means of belts or the like, with pairs of oppositely rotating pulleys 23, 24 and 23a, 24a, respectively. Pulleys 23, 24 normally rotate idle on the spindle 17, pulleys 23a, 24a rotating in similar manner on the spindle 18. One or the other pulley of each pair may be selectively coupled to the respective spindle by means of magnetic clutch means 26, 26a controlled from a clutch control circuit 49 as shown for the clutch 26 connected thereto over a lead 52. A switch 50, used to disconnect power from the feed motor (not shown) whenever necessary, also actuates the control circuit 49 via a lead 51, in such manner that sleeves 16, 16a are driven toward each other when the motor circuit is broken and are driven away from each other when power is again connected to the feed motor.

The threaded spindle 18 also carries a pulley 27 entraining, by means of a belt or the like, another pulley 28 fixed to a threaded spindle 29 for rotation therewith; spindle 29 cooperates with a tapped bore provided in a panel 30 which normally closes an opening or vent 31 provided in the bottom of chamber 1. The panel 30 is laterally slidable in guide rails 30a, 30b (Fig. 1) fixed to the underside of chamber 1.

The chamber 1 also contains a jet tube 32 adapted to receive treatment fluid e. g. superheated vapor, from a conduit 33 which may be selectively closed by means of a valve 34. Valve 34 has been shown connected for automatic actuation to a valve control circuit 53 which in turn is controlled via a lead 54 from clutch control circuit 49 and via a lead 55 from a thermostat 56 positioned inside the chamber. This arrangement operates in such manner that upon reclosure of the opening 31 by the panel 30 the valve 34 is temporarily, for instance, by means of time delay relay (not shown), opened as soon as a predetermined temperature in chamber 1 is reached to which the thermostat 56 is set.

Valve 34 may also be temporarily opened in the aforesaid manner by means of a suitable connection (not shown), as soon as the fabric material starts to move again through chamber 1 or when the shutter means are being closed and under the condition that the temperature prevailing in chamber 1 has passed a critical minimum which is above the boiling point of the impregnating agent contained in the fabric material.

The open position of valve 34 for the admission of superheated steam or of saturated steam which is capable of being transformed to a superheated steam within the chamber is continued due to the function of a timer or time delay relay, as aforesaid, so that the remainder of the air in

the chamber may be more rapidly pushed out of the latter.

The superheated steam as it has been more clearly set forth in co-pending U. S. patent application No. 66,159, filed December 21, 1948, acts as the drying or like treatment fluid in the air-free chamber in such a way that during the travel of the fabric material through the chamber the moisture of or impregnating liquid contained in the material is rapidly transformed into vapor. This is accomplished through partial condensation of the superheated steam which impinges under high velocity (when discharged through outlet means 4a) upon the fabric material 6 introduced at a relatively low temperature into the chamber, whereby the aforesaid condensation causes the liberation of calories sufficient to raise the temperature of the impregnating liquid or agent to its boiling point.

Thus, through rapid rise of the temperature of the impregnating liquid to its boiling point the moisture of the fabric material is removed by expansion substantially instantaneously and not by less speedy capillary action. Vapors emanating from the impregnating liquid can be further used and recirculated in the ensuing drying and like treatment process together with said superheated steam.

After the superheated steam and/or vapor replaces again the air in the chamber, the supply of such steam through conduit 33 is automatically shut off by the timer (not shown) which closes valve 34.

The displacement of the sleeves 16, 16a on the threaded spindles 17 and 18 is furthermore regulated by control means or limit switches 35, 35a which upon contact of the arms 15, 15a with their abutments or fingers 36, 36a stop inward movement of the shutters, and by limit switches 37, 37a which upon contact of these arms with their fingers 38, 38a, interrupt the outward movement of the shutters. The operation of such limit switches is well known and has been omitted for the sake of clarity of the drawings.

The operation of the machine described above is as follows:

During normal functioning, the shutters 10 and 11 are laterally withdrawn (in a plane substantially parallel to that of the fabric, but in a direction transverse to that of the travel of the fabric) into slots 47, 47a, thereby establishing free communication between the nozzles 4 and the fabric 6 so as to enable a drying fluid, such as superheated vapor, to freely impinge upon the surface of the fabric. The panel 30 obstructs the opening 31, thereby hermetically closing the bottom of chamber 1.

If the movement of the fabric is stopped, for example for the purpose to make adjustments on a printing machine connected to the drying machine, any prolonged exposure of a given portion of fabric to the action of the blowing nozzles would be liable to damage the fabric. In order to overcome this effect, the clutches 26, 26a are actuated in the manner described above to rotate the spindles 17, 18 in such directions as to displace the sleeves 16 and 16a toward each other, thereby placing the shutters 10 and 11 in their operative position as illustrated in Fig. 2.

As will be seen in Fig. 2, the upper chamber portion containing the nozzles 4, the box 2 and the blower 3 is completely separated from the lower chamber portion which contains the fabric 6 and the guide rollers 9. As a result, the fabric 6 is cut off from the action of the drying fluid

discharged by the orifices of the nozzles 4 and also of the fluid present in the atmosphere of the upper chamber portion. It will also be noted that the presence of fixed partitions 13, 13a as well as 14, 14a reduces the necessary dimensions and length of travel of the movable shutters. The movement of the shutters toward each other is stopped by the limit switches 35, 35a as described above.

Although the fabric 6 has thus been removed from the direct action of fluid discharging nozzles 4 by the closure of the shutters 10 and 11, it would still remain surrounded by the hot atmosphere prevailing in the lower portion of chamber 1, a fact that might prove detrimental to the finished product, were it not for the action of spindle 29 which is rotated through pulleys 27 and 28 from spindle 18 which is associated with shutter 11. Spindle 29 rotates in such sense as to cause withdrawal of the venting means or panel 30 from the opening 31, this opening being sufficiently large to effectuate virtually the instantaneous evacuation of the superheated vapor from the lower portion of chamber 1 so that any overheating of the fabric will be avoided.

When the movement of fabric 6 is resumed, as by restoring switch 50 to the position shown, control circuit 49 reverses the direction of rotation of spindles 17 and 18 to effect the lateral withdrawal of the shutters 10 and 11. This outward movement of the shutters is stopped by the operation of limit switches 37 and 37a, as previously set forth. The simultaneous rotation of spindle 29 realigns the panel 30 with the opening 31.

The machine is now again ready to function normally. In order to drive out e. g. by way of slots 7, 8 the air previously admitted into the chamber 1 through the opening 31 and to replace the portion of the drying fluid that has escaped through this opening, the valve 34 is temporarily opened, preferably automatically by means of the control arrangement shown, so as to admit superheated steam into the chamber 1 by way of the jet tube 32.

It should be noted that the interposition of the shutters 10 and 11 to remove the fabric 6 from the action of the drying fluid does not affect the operation of the blower 3 which continues to rotate, this continuity of functioning allowing the interruption and resumption of treatment to be carried out with a minimum loss of time. In order to reduce to a minimum the inertia of the system, it is advantageous to make the clutches 26, 26a of the magnetic type described in co-pending application Ser. No. 150,975, filed March 21, 1950.

In the modification shown in Figs. 3 and 4, the blocking means for temporarily removing the treated fabric from the action of the circulating fluid comprises a band or strip 39, which is flexible and impermeable to the treatment fluid. This strip 39 may be unwound from a drum 40 by means of a take-up drum 41 placed adjacent the opposite end of the machine, whereby the strip 39 may be interposed between nozzles 4 and the fabric 6. In this instance fabric 6 has been printed on one surface and is supported by a conveyor cloth 6a, which is generally of greater width than that of the printed fabric and may carry on its outer free surface portions parts of the printed matter reaching beyond the printed fabric surface to be dried.

Strip 39 is supported within the machine by rollers or rods 42 and terminates in cables 43 the

extremities of which are fixed to the drum 41; when the strip 39 is rewound upon the drum 40, these cables extend in its place across the machine so as to reestablish communication between the nozzles 4 and the fabric 6.

In the embodiment of Figs. 5 and 6 there are provided individual shutter means for each nozzle 4, shown as pairs of rods 44, 44a slidably lodged in the end walls of the nozzle assembly. These rods may be moved inwardly into contact with one another, as shown in solid and broken lines in Fig. 5, or may be withdrawn as indicated in dot-dash lines. Bars 45, 45a, common and connected to all the rods 44, 44a, respectively, serve for the simultaneous displacement of all the shutter rods.

In the modification of Fig. 7 blower 3 is provided with a shutter in the form of a pivoted flap or damper 46. This damper normally obstructs an opening 57, forming a bypass for the circulating fluid, which is uncovered when the damper is rotated into its alternative position, shown in dotted lines at 46', to block the admission of fluid to the box 2.

It is to be understood that the embodiments described hereinabove and shown in the drawings have been given merely by way of illustration and not limitation, and that the shape, character, positioning and mounting of the various elements may be modified in numerous ways without for this reason exceeding the scope of the invention. Thus, it will be understood that the displacement of the shutters 10 and 11 and of the panel 30 may be independent from one another, that different means may be used to control such displacement, or that plates rather than rods may be used to obstruct the nozzles in the arrangement shown in Figs. 5 and 6. Also, the principles of the invention are applicable to machines other than driers. The discharge opening 31 may communicate with a space other than the outer atmosphere, such as, for example, a condenser, and control of the shutter, venting and fluid admission means in dependence upon the feeding movement and fluid contents of the chamber may be affected by means other than those specifically illustrated.

While the invention has been shown and described in several embodiments, it will be understood that the same is capable of modification without departure from the 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. In a drying apparatus equipped with a treatment chamber for lengthy sheet, web and like material; a plurality of nozzle means provided with discharge orifices for treatment fluid directed against said material, exhaust channel means disposed between each two adjacent nozzle means, guide means arranged to space said material a predetermined distance from and move same past said nozzle means and said exhaust means, shutter means disposed for movement above said material and adjacent said nozzle means, means located adjacent said exhaust channel means for operating said shutter means to closing position between said material and said nozzle means and to retracted position away from said material, and means for opening and closing said chamber at a location below said material.

2. In a treatment apparatus for sheet and like lengthy web material: a plurality of nozzle means

having orifices for the discharge of jets of treatment fluid against spaced areas of said material, exhaust channels intermediate adjacent nozzle means for evacuating spent fluid from said material, means for guiding said material past said nozzle means and said exhaust channels, shutter means extending substantially parallel to and spaced from the plane of movement of said material and slidably operable to closing position between the latter and said nozzle orifices to tightly obstruct the jets of fluid therefrom against said material, and means accommodated in said exhaust channels for guiding and supporting said shutter means during sliding movement thereof to said closing position and from the latter to retracted position, said shutter means being positioned remote from and clearing said nozzle orifices thereof in said retracted position.

3. An apparatus for treating sheet, web and like lengthy material in open width comprising in combination, nozzle means having orifices adapted to discharge treatment fluid against said material, exhaust channel means intermediate adjacent nozzle means for evacuating spent treatment fluid, guide means for moving said material along a predetermined path opposite said orifices for impingement of said treatment fluid on said material, shutter means disposed to slidably move in a plane substantially parallel to that of said material and in a direction substantially transverse to said predetermined path to thereby obstruct said orifices and prevent said material from further fluid impingement, and means responsive to stoppage and movement of said material and for actuating said shutter means in said transverse direction for obstructing and opening said orifices, respectively.

4. In a machine for the treatment of an elongated product by impingement of a treatment fluid upon the surface of said product; the combination of a chamber in which an atmosphere of fluid of super-atmospheric pressure prevails, with discharge means for said fluid against said product, guide means for said product and positioned below said discharge means, fluid blocking means adapted to be slidably moved in a plane substantially parallel to said product to retracted and to side-by-side positions, respectively, whereby in the latter position said blocking means are interposed between said discharge means and said guide means and are disposed remote from said discharge means and said product in said retracted position, exhaust channels, said discharge means comprising a set of nozzles separated by said exhaust channels, and control means for operating said fluid blocking means and disposed in certain of said exhaust channels.

5. In a machine for the treatment of an elongated fibrous product by impingement of a treatment fluid upon the surface thereof; the combination of a treatment chamber, discharge means for said fluid in said chamber, guide means for said product in said chamber, with movable fluid blocking means adapted to be interposed between said discharge means and said guide means, and vent means operable simultaneously with said fluid blocking means, said fluid blocking means being operable to divide said chamber into a first portion containing said discharge means and into a second portion containing said guide means, said vent means being operable to open a passage for the evacuation of treatment fluid from said second chamber portion.

6. The combination according to claim 5, including fluid admission means operable follow-

ing the operation of said vent means to compensate for fluid removed from said chamber through said vent means.

7. The combination according to claim 6, including control means for said fluid admission means, said control means being sensitive to the proportion of treatment fluid contained in said chamber.

8. The combination according to claim 5, including feed means for moving said product through said chamber, and control means responsive to interruption of movement of said product and operating said fluid blocking means and said vent means.

9. In a machine for the treatment of an elongated fibrous product by impingement of a treatment fluid upon the surface thereof; the combination, with a treatment chamber, discharge means for said fluid arranged within said chamber, first guide means located within said chamber and adapted to guide said product during movement of the latter through said chamber, of displaceable fluid blocking means arranged to be moved in a plane substantially parallel to that of said product and in transverse direction of the latter, said blocking means being positioned above said first guide means and being adapted

to be substantially completely removed from above said product when the latter is moved past said first guide means, power-driven operable means operatively connected to said fluid blocking means to move the same, and second guide means for said fluid blocking means and positioned intermediate said fluid blocking means and said operable means.

10. In a machine according to claim 9, including control means actuated by said operable means and responsive to interruption to the movement of said product through said chamber.

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