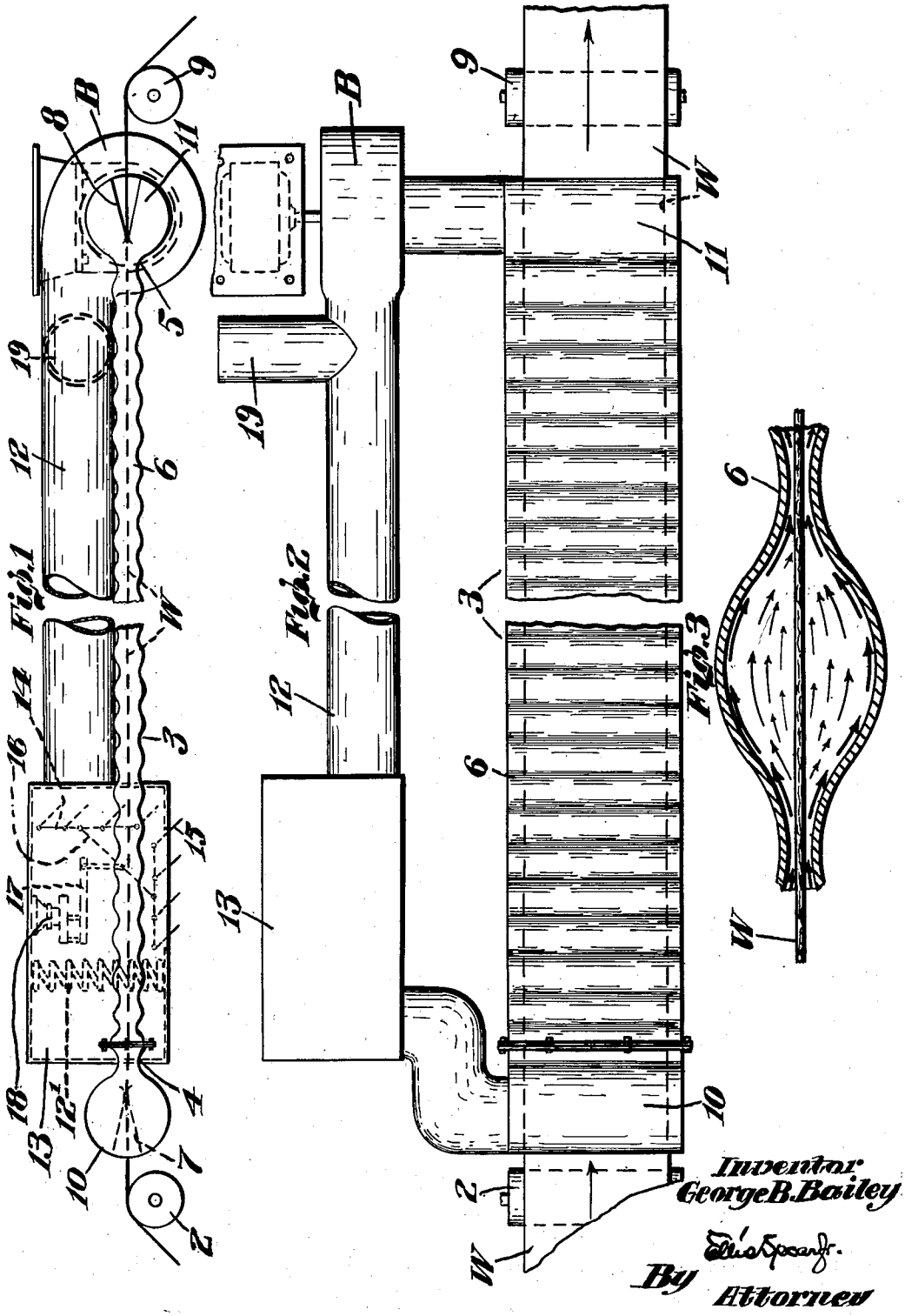
March 1, 1932. G. B. BAILEY 1,847,915

APPARATUS FOR DRYING PAPER AND THE LIKE

Filed March 8, 1930



Patented Mar. 1, 1932 1,847,915

UNITED STATES PATENT OFFICE

GEORGE B. BAILEY, OF SHARON, MASSACHUSETTS, ASSIGNOR TO THERMOX INCORPORATED, OF BOSTON, MASSACHUSETTS, A CORPORATION OF DELAWARE

APPARATUS FOR DRYING PAPER AND THE LIKE

Application filed March 8, 1930. Serial No. 434,325.

This invention relates to the drying of paper and the like, and particularly to such materials as have been coated or treated on one or both surfaces and which require drying before they can undergo handling by contact.

Taking coated paper as an illustrative example, it has been the usual practice heretofore to dry such papers by draping in festoons beneath air blasts. This was not satisfactory however, as the paper dried unevenly and tended to blow or sail and get out of control. Drying has also been attempted by floating the paper over upwardly directed jets of air which tended to support the paper and at the same time to dry it, but this apparatus was expensive and difficult to manage, particularly when run at high speed. Where paper was coated on both faces, a similar method was attempted by having jets blow from both sides, the lower or supporting jets having a slight preponderance of effect in order to support the paper.

My present invention contemplates a new method of drying and handling the paper and is capable of being practiced with apparatus of relatively inexpensive nature as well as of being operated at higher efficiency and with great economy. In accomplishing this result I utilize a change of static and velocity pressures developed on the principles of expanding and contracting a compressible fluid, as will be more fully explained hereinafter.

As illustrative of apparatus adapted for the practice of my invention and the method therein involved, I have shown in the accompanying drawings a drier system as follows.

In the drawings:—

Fig. 1 is a vertical longitudinal section in partial fragment of such a drier system.

Fig. 2 a plan view thereof partly broken away to expose underlying parts, and

Fig. 3 an enlarged section of one of the venturian chambers diagrammatically treated to illustrate the pressure velocities in relation to the web of paper or other material.

I have indicated at W a web of paper, fabric or other material to be dried, and at 2 a roll or the like for guiding such web to the drier.

The drier proper includes a duct or casing 3 having an intake and an outlet which as contemplated herein are formed as nozzle throats 4 and 5 designed to impart increased velocity to the flow of the compressible drying medium, as air from the plenum chamber 10. Such fluid enters the casing at its inlet end and leaves the same at its outlet end through plenum chamber 11. Intermediate of the nozzle throats 4 and 5 the duct or casing presents a series of spaced nozzles 6, one nozzle discharging into another.

The web is guided into the intake throat 4 as at 7, and from the outlet nozzle throat 5 as at 8, where a second roll 9 guides the dried web onto any suitable winder roll. (Not shown.)

The drying medium which may be air or any other suitable compressible fluid is introduced into the inlet nozzle throat 4 from plenum chamber 10 and is drawn through the duct 6 by any suitable blower B at the outlet end of the drier casing maintaining suction on plenum chamber 11.

The fluid stream is divided into two distinct streams due to the nozzle effect, thus forming a cushion which prevents the material from touching the sides of the duct 6. The air streams as they enter or leave the throat having a distinct directional velocity and prevent the material W from getting out of center relative to the duct. This results from the impingement of the drying medium on the material W, a small portion of the kinetic energy of the moving drying medium during such impingement being changed to potential energy, thereby overcoming the pull of gravity or other cause on the web W.

Such drying medium may be heated in any desired manner and by any desired means and the duct itself may be heated externally if desired. As here shown, the drying medium is heated adjacent the intake end of the drier casing by means of a steam coil 12′ which may be provided with any suitable automatic heat control whereby the temperature of the air may be regulated.

The duct 6 may be made in sections for

convenience of manufacture, shipment, assembly, and replacement, and the blower B may be driven in any suitable manner, as by a motor.

If desired, the air or other drying medium drawn through the duct 6 may be partially passed back into the intake end of the drier, thus providing for a continuous circulation thereof, as well as adapting the system more readily for the accurate control of the density, temperature and humidity of the air.

Such a system of circulation and control is shown herein, the air or other drying medium discharging from the blower B passing into a return conduit 12 connecting with the plenum chamber 10.

At some point in the conduit 12 is arranged a control box 13 within which is mounted one or more sets of automatic dampers. These may include a damper series 14 controlling the admission of the return air or other drying medium into the box 13 and a second series 15 controlling the admission of fresh air or other drying medium into the box 13 to give any desired proportion of recirculated air to fresh air. Where a double damper series is used, they may be connected to open and close in unison as by the rod 16 operated through the linkage 17 of an automatic damper control 18.

Between the blower and dampers, the return conduit 12 is provided with an outlet 19 through which the moisture given off by the web W may escape. The rate of escape is subject to the position of the dampers as determined by the automatic control 18.

The action of the air or other drying medium is diagrammatically illustrated in Fig. 3 wherein the web of material is shown as being maintained substantially in the center of the duct 6. This is due to the fact that the web W is in the division between two distinct air streams. It will be noted that the static pressure of the fluid on either side of the web at any given cross-section is the same, but the velocity pressure of the air streams will vary, due to the fact that the air streams alternately approach and leave the surfaces of the web on account of the alternate contractions and expansions of the duct.

If the web of material W has a tendency to leave its position between the two streams, due to the pull of gravity or any other cause, it immediately comes into the paths of one or the other of the air streams, such air stream immediately impinging upon the surface of the web, changing the energy of the air stream from kinetic on the part of the air stream to potential energy of the web, which overcomes the gravity or other force, thereby restoring the alinement of the web axially of the duct.

Although I have discussed my invention herein in its adaptation to the drying of paper, it will be understood that such treatment is purely illustrative and in no way limiting and that the principles thereof may be applied to the drying or dehydrating of any web or fabric. Similarly it will be understood that the relationship may be reversed, and the air blown in at one end of the drier instead of being sucked in as shown.

It will also be evident that I may if desired pass the web through the tube in counter flow relation to the drying medium current.

Various other modifications in method and apparatus may be resorted to within the spirit and scope of my invention as defined by the appended claims.

What I therefore claim and desire to secure by Letters Patent is:

1. A web drier comprising a tube, through which a web is adapted to be passed from end to end thereof, said tube presenting internally thereof a series of nozzles disposed at spaced intervals longitudinally of the tube and each nozzle discharging into the nozzle next in advance thereof, and means for causing a fluid drying medium to flow through said tube from end to end thereof in feeding and drying relation to the web whereby the web is floated along said tube without contact with the wall thereof and with both of its linear surfaces constantly exposed to the drying action of the fluid drying medium.

2. A web drier comprising a tube, through which a web is adapted to be passed from end to end thereof, said tube presenting internally thereof a series of nozzles disposed at spaced intervals longitudinally of the tube and each nozzle discharging into the nozzle next in advance thereof, and means for causing a fluid drying medium to flow through said tube from end to end thereof in feeding and drying relation to the web whereby the web is floated along said tube without contact with the wall thereof and with both of its linear surfaces constantly exposed to the drying action of the fluid drying medium, and means for reintroducing into the intake end of the drier a part of the fluid drying medium passed through the tube.

3. A web drier comprising a tube, through which a web is adapted to be passed from end to end thereof, said tube presenting internally thereof a series of nozzles disposed at spaced intervals longitudinally of the tube and each nozzle discharging into the nozzle next in advance thereof, and means for causing a fluid drying medium to flow through said tube from end to end thereof in feeding and drying relation to the web whereby the web is floated along said tube without contact with the wall thereof and with both of its linear surfaces constantly exposed to the drying action of the fluid drying medium, and means automatically

controlled by the moisture content of the recirculated portion of the drying medium for regulating the volume of drying medium returned to the intake end of the drier.

4. A web drier, comprising a tube having an inlet and an outlet throat at opposite ends thereof, said tube presenting internally thereof a series of nozzles disposed at spaced intervals longitudinally of the tube and each nozzle discharging into the nozzle next in advance thereof, means beyond said throats for guiding a web through said tube, and means for introducing a fluid drying medium into said inlet throat and for inducing the flow thereof through said tube in the same diretcion of travel as said web whereby the web is floated along said tube substantially centrally thereof and with both of its linear surfaces constantly exposed to the drying action of the fluid drying medium.

5. A web drier, comprising a tube having an inlet and an outlet throat at opposite ends thereof, said tube presenting internally thereof a series of nozzles disposed at spaced intervals longitudinally of the tube and each nozzle discharging into the nozzle next in advance thereof, means beyond said throats for guiding a web through said tube, and means for introducing a fluid drying medium into said inlet throat and for inducing the flow thereof through said tube in the same direction of travel as said web whereby the web is floated along said tube substantially centrally thereof and with both of its linear surfaces constantly exposed to the drying action of the fluid drying medium, and means connecting with the outlet throat of the tube for reintroducing into the inlet throat a part of the fluid drying medium passed through said tube.

6. A web drier, comprising a tube having an inlet and an outlet throat at opposite ends thereof, said tube presenting internally thereof a series of nozzles disposed at spaced intervals longitudinally of the tube and each nozzle discharging into the nozzle next in advance thereof, means beyond said throats for guiding a web through said tube, and means for introducing a fluid drying medium into said inlet throat and for inducing the flow thereof through said tube in the same direction of travel as said web whereby the web is floated along said tube substantially centrally thereof and with both of its linear surfaces constantly exposed to the drying action of the fluid drying medium, and means automatically controlled by the moisture content of the recirculated portion of the drying medium for regulating the volume of drying medium returned to the inlet throat of the drier.

7. A drying apparatus for webs of paper or the like, consisting of a chamber having a series of transverse restrictions and enlargements, through which the web is adapted to be passed, said restrictions affording a series of nozzle effects at spaced intervals longitudinally of the chamber, each nozzle discharging into the nozzle next in advance thereof, means for inducing a drying current through said chamber in the direction of movement of the web whereby to float the web along said chamber without contact with the wall thereof and with both of its linear surfaces constantly exposed to the drying action of the drying current, and means for regulating the drying current as to velocities and humidities.

In testimony whereof I affix my signature.

GEO. B. BAILEY.