April 2, 1935. H. G. CHATAIN 1,996,364

PROTECTIVE HOOD FOR PAPER MAKING MACHINES

Filed March 4, 1931 2 Sheets-Sheet 1

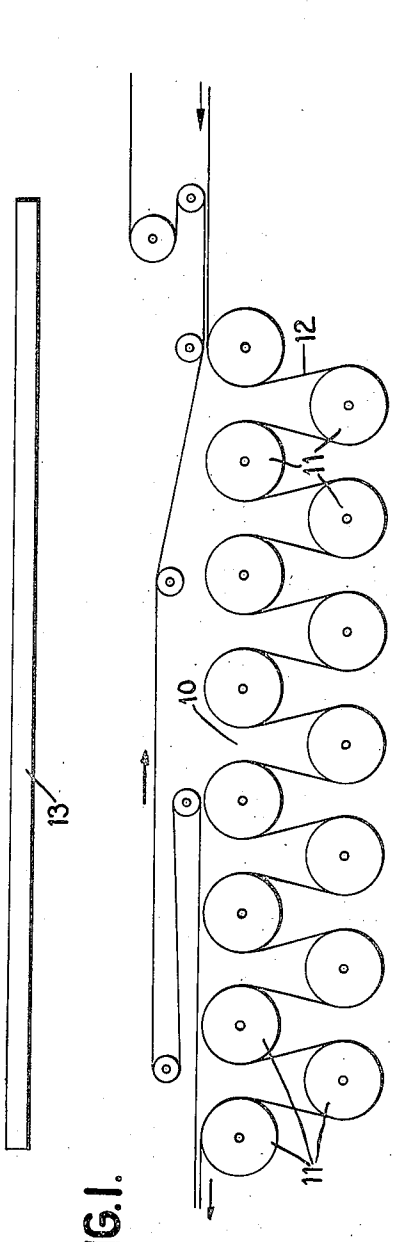


FIG. 1.

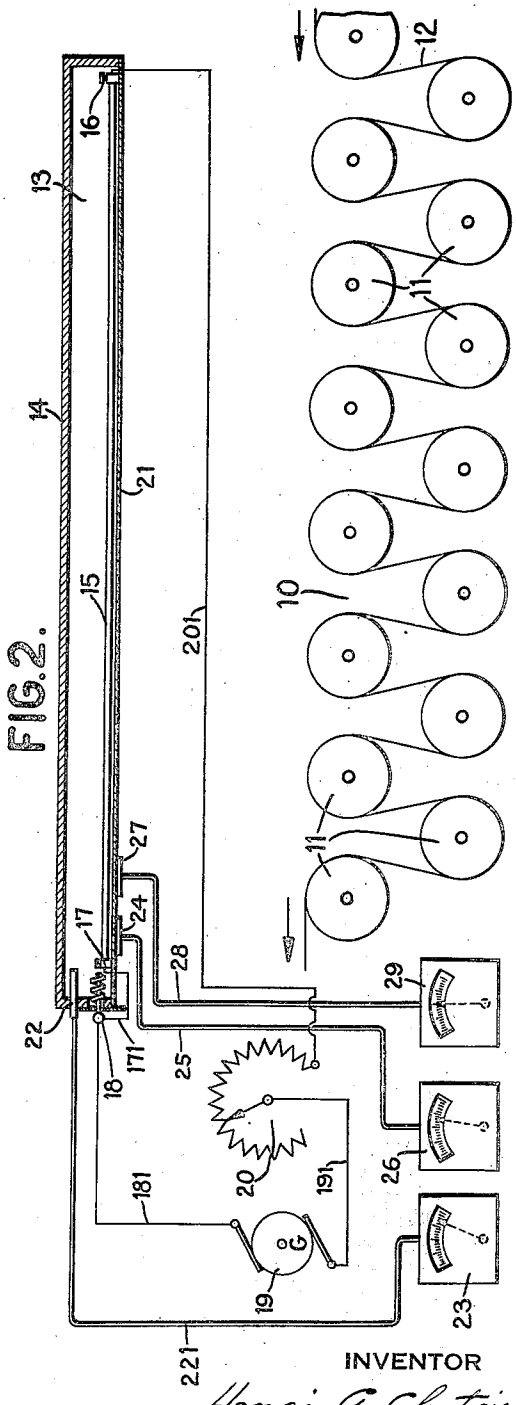


FIG. 2.

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FIG.3.

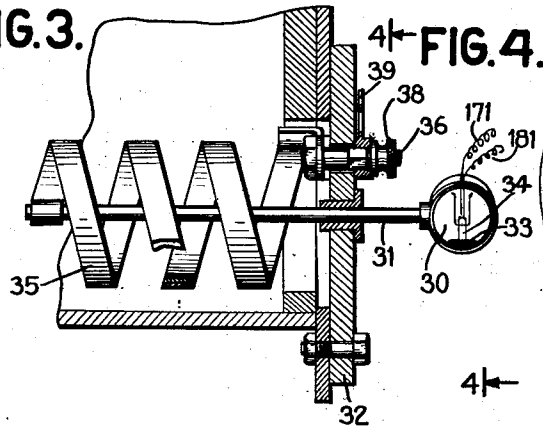
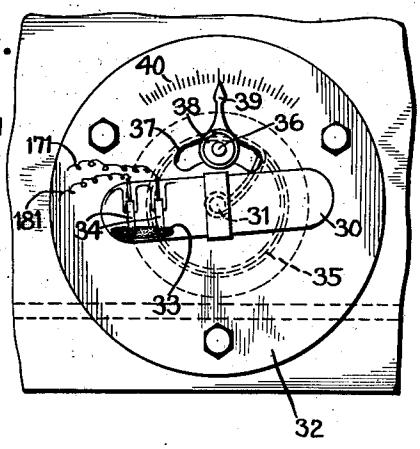


FIG.4.



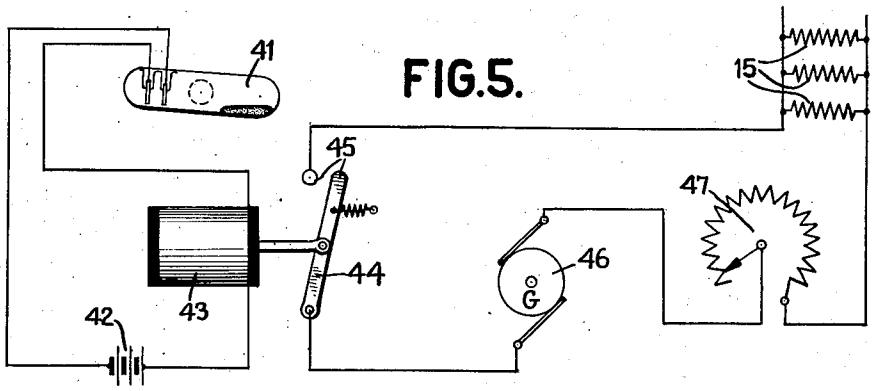
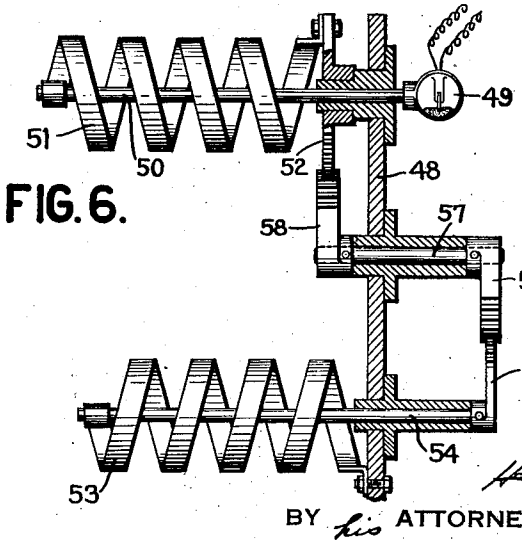


FIG.5.

FIG.6.



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UNITED STATES PATENT OFFICE

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PROTECTIVE HOOD FOR PAPER MAKING MACHINES

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Application March 4, 1931, Serial No. 520,059

7 Claims. (Cl. 34—48)

This invention relates to improvements to be applied to paper making machines and the like and particularly to the drying portions thereof to prevent damage to the paper in the course of manufacture. It frequently happens where protective provisions are not made that damage to the paper passing through the drying rollers of the machine results from the dripping of condensate from above the machine to the exposed portions of the sheet. Due to the fact that the moisture content of the paper is being driven off as it passes over the drying rolls, the air at this point is almost, if not quite fully, saturated. Therefore any drop in temperature which might be encountered, as by the contact of the air with some cooler surface above the machine, will result in condensation and drops of water will alternately fall upon various parts of the machine. If it should happen to ultimately reach some exposed portion of the paper sheet, this moisture would cause a tearing of the paper or cause damage to its surface in some similar way.

It has been a primary object of the present invention to prevent the formation of condensate directly above the drying rolls of the machine by the provision of a shield above this portion of the machine and the regulation of the temperature of this shield in such a way as to insure against the deposition of moisture. This is accomplished by maintaining the temperature of the shield just a few degrees above the temperature of the air beneath the shield. In this way cooling of the air below the dew point is prevented.

In the accomplishment of the desired result it has been an important consideration of the present invention to minimize the expense involved in the maintenance of the required temperature of the shield. Toward this end the present improvements have in view the provision of electrical heating means for supplying heat to the shield with the control of this heating means either by hand or by automatic means, in accordance with the temperature conditions existing beneath the shield and at its surface. Just sufficient current need be passed through the heating elements to maintain the desired temperature differential of a few degrees between the surface of the shield and the air beneath it. Further economy may be effected by the provision of a hygrometer beneath the hood to give an indication of the degree of saturation of the air. If the air above the machine is not fully saturated, it is not necessary to provide as high a temperature at the surface of the shield as when the air is completely saturated; in fact the shield under such conditions may, without causing difficulty, have a temperature slightly below that of the air beneath it.

By proper application of suitable insulation to all of the surfaces of the shield except the underside facing the machine, the only heat loss to be compensated for by the electrical heating elements is the small quantity which will be dissipated through this insulation. As will be apparent, the temperature differential between the shield and the air beneath it will be so slight that little or no heat will be lost in this direction.

With the foregoing and other incidental objects and advantages in view, all of which will be made more clear from the detailed description of the invention, the latter will now be more fully explained in conjunction with the accompanying drawings, in which:

Figure 1 is an elevational view largely schematic of a paper drying machine provided with a protective hood and embodying the features of the present invention.

Figure 2 is a diagrammatic view illustrating the relation of the hood and the various instruments associated with it.

Figure 3 is a detail view in side elevation partly in section of a thermostatic control device employed.

Figure 4 is a front view of the device shown in Figure 3.

Figure 5 is a diagrammatic view of a modified system of control circuits, and

Figure 6 is a detail view of a modified form of control employing a plurality of thermostatic elements.

Referring now to the drawings, there is shown in a conventional way the drying section 10 of a paper-making machine involving a plurality of rollers 11 over which the continuous web of paper 12 produced by the machine is fed to effect the drying operation. It will be understood that the web of paper is received by the drying section of the machine from the right, as shown in Figures 1 and 2 and is discharged at the left end of the drying section to suitable calendering or finishing rollers and is then wound and cut as desired.

Above the drying rollers there is provided a hood or shield 13 which in the preferred form constitutes a hollowed or chambered member having a dead air space within it. This hood is preferably covered by heat insulation 14 on all of its sides, with the exception of the under surface which faces the drying rolls. This sur-

face of the shield may suitably be formed of metal, such as sheet iron or steel.

Within the chamber of the hood there may be provided a plurality of electrical heating elements 15 extending lengthwise of the hood and connected at opposite ends to suitable contact elements or binding posts 16 and 17. The contact 17 may be connected by a suitable wire 171 to one contact of a mercury switch 18. The other contact of this switch may be connected by a wire 181 to one terminal of a source of electric current, such as a generator 19. The opposite terminal of this generator may be connected to one side of a rheostat 20 by a connection 191 while the opposite element of the rheostat may be connected by a wire 201 to the contact element 16. By the proper adjustment of the rheostat the amount of current transmitted to the heating elements 15 may be readily regulated. The adjustment may be such that just enough current will be supplied to maintain a temperature within the chamber of the hood a few degrees above that of the air beneath the hood. In this way the under surface 21 will be carried at such a temperature that no moisture will be deposited on it even though the air beneath it may be completely saturated. As will be explained more fully hereinafter the rheostat may be so adjusted, if desired, as to supply current slightly in excess of that actually required and the switch 18 may be made to effect the final control.

In order to permit proper regulation of the rheostat 20, means may be provided for indicating or recording the temperature within the chamber of the hood and just beneath the hood. For this purpose a thermocouple 22 may, for example, be inserted into the hood chamber and may be connected by a cable 221 to a suitable indicating or recording pyrometer 23. In a similar way a thermocouple 24 carried at or just below the surface 21 may be connected by a cable 25 to an indicating or recording pyrometer 26. In this way the two temperatures, within and below the hood, may be noted at all times and the rheostat 20 may be adjusted to provide the necessary current input for the heaters 15 to maintain a few degrees higher temperature within the hood than below. If desired, means may be provided for disclosing the degree of saturation of the air beneath the hood. For this purpose any suitable form of hygrometer 27 may be placed directly beneath the hood and may be connected by a cable 28 to an indicating or recording instrument 29, which will disclose the degree of saturation of the air. Should the air be somewhat below the state of complete saturation, the amount of current passed through the heating elements 15 may be reduced to a corresponding degree.

The control of the rheostat 20 in accordance with the readings of the instruments 23, 26 and 29 may be effected manually or, if desired, some suitable form of automatic control may be employed. In the preferred mode of operation of the system the rheostat is so adjusted as to deliver a current slightly in excess of that actually required to maintain the desired temperature within the hood. The mercury switch 18 may then be relied upon to completely cut off the supply of current at intervals to reduce the amount of energy actually delivered over a given period to that required. For the purpose of making this final control automatic the mercury switch may be operated by or under the control of a thermostatic or temperature responsive member. The switch may comprise an elongated tube 30 (Figures 3 and 4) suitably mounted on the end of a rod 31. This rod may be rotatably supported by a plate 32 which is secured to the hood at any suitable point. Within the tube there may be carried a quantity of mercury 33 which will flow to one end or the other of the tube depending upon the direction of inclination of the latter. When the mercury is shifted toward the left end of the tube (Figure 4) due to tilting of the tube in that direction it will serve to bridge the gap between a pair of electrodes or contact members 34. These electrodes are connected with the conductors 171 and 181 of Figure 2. It will thus be seen that the supply of current from the generator 19 to the heating elements 15 may be made to pass between the electrodes through the mercury and that the current may be completely cut off by shifting of the mercury to the opposite end of the tube.

Now for the purpose of controlling the switch in response to the temperature within the hood a thermostatic element such as a bi-metallic, helical member 35, may be connected at one end to the rod 31 and at its opposite end to the plate 32. This member may be inserted into the hood and become responsive to the temperature therein. The arrangement is such that as the temperature within the hood rises the rod 31 and tube 30 will be rocked in a clockwise direction (Figure 4) and if the temperature rises sufficiently the mercury will be shifted toward the right end of the tube thus cutting off the supply of current to the heating elements. A subsequent drop in the temperature of the hood will cause the member 35 to rock the tube in the opposite direction to close the circuit between the contacts. The member 35 need not be bi-metallic but may be formed of any suitable material which will be responsive to changes in temperature. For example, a spiral of the type shown, formed of a single metal, will tend to twist at its ends due to a change in temperature.

In order that the temperature range at which the tube will be rocked to opposite sides of a strictly horizontal position may be varied the connection between the member 35 and the plate 32 may be made adjustable. For this purpose the end of the member may be attached to a bolt or stud 36 adapted to be passed through an arcuate slot 37 in the plate 32. A knurled nut 38 or any other suitable means may be employed for clamping the bolt in any adjusted position. A pointer 39 attached to the bolt may cooperate with a scale 40 on the plate to designate the temperature at which the switch will assume a strictly horizontal position. In the use of the equipment this temperature may be made to correspond with that of the air beneath the hood or when this air is saturated the temperature at which the pointer 39 is set should be, say, 5 degrees higher than that of the air under the hood. A few degrees variation in the neighborhood of the temperature at which the pointer is set will then cause the mercury to be shifted from one end of the tube to the other.

The capacity of a mercury switch is limited and if it should be found necessary to employ currents in excess of that which may be reasonably transmitted through a single switch a number of them may be employed. These may be arranged in parallel and each may be connected with a separate heating element if desired. In this way a current equivalent to the total capacity

of the group of mercury switches may be supplied to the heating elements. This should normally be sufficient for the purposes inasmuch as the heat losses are quite small, as previously explained. Should it be necessary or desirable, however, to supply a greater current than can conveniently be provided in this way the mercury switch may be made to simply control a relay which would serve to throw in and out of the heating circuit a current of any required magnitude. For example, referring to Figure 5, the tube 41 under the influence of the thermostatic element may simply control the flow of current from a source of supply 42 through a solenoid 43 which may be connected to the arm 44 of a switch capable of controlling a current supply of any desired magnitude. When the solenoid is energized a circuit may be completed between the contacts 45 of the switch which may be in circuit with a generator 46, a rheostat 47 and the heating elements within the hood.

If desired the adjustment of the temperature responsive member 35 of Figure 3 may be automatically effected in accordance with the temperature beneath the hood. An arrangement for this purpose is illustrated in Figure 6. As here shown a supporting plate 48 may be secured to the hood at any convenient point and may extend below the hood a convenient distance. A mercury switch 49 carried by a rod 50 may be rotatably mounted in the plate 48 and may have secured at its inner end an end of the helical, thermostatic element 51. At its forward end the latter may be attached to a disc 52 freely mounted upon the rod 50 or a bushing surrounding the same. The disc 52 provides for adjustment of the end of the element 51 so that the tube 49 may be disposed horizontally at any desired temperature. For automatically adjusting the disc 52 so that it will assume a position depending upon the temperature beneath the hood it may be placed under the control of a second thermostatic element 53. This element may be supported by the plate 48 at a point beneath the hood and may be attached at one end directly to the plate and at its opposite end to a rod 54 rotatably carried by the plate. Any suitable means may be provided for the transmission of the rotary movements of the rod 54 to the disc 52 in such a way that if the two elements 51 and 53 are affected equally by the simultaneous rise or drop in temperature to the same extent both inside of and below the hood there will be no rotation imparted to the rod 50 and no change in the position of the tube 49. However, if a change takes place in the temperature differential between the inside of the hood and beneath the same, rotation of the rod 50 and tube 49 will result and the current to the heating elements will be correspondingly controlled. The connections between the rod 54 and the disc 52 may include a segment 55, secured to the rod, cooperating with a segment 56 carried by a rod or shaft 57. At its opposite end the rod 57 carries a segment 58 which meshes with teeth formed on the disc 52. In view of the interposition of the idler connection 56, 57 and 58 between the disc and rod 54 the elements 51 and 53 should be arranged in opposite sense. Thus while the rods 50 and 54 will have a tendency to rotate together and in the same direction under the influence of the element 53 the rod 50 will be rotated in the opposite direction by the element 51 in response to the same temperature change.

While an illustrative embodiment of the invention and certain modifications have been described in considerable detail it is to be understood that various changes may be made, in addition to those suggested, in the construction and arrangement of the parts without departing from the general spirit and scope of the invention as defined by the appended claims.

What I claim is:

1. In apparatus of the class described paper feeding and drying means, a shield above said means, means for heating the air above said shield, and means jointly responsive to the temperatures above and below the shield for controlling said heating means in accordance with the difference in the temperatures above and below said shield.

2. In apparatus of the class described paper feeding and drying means, a chambered hood above said means, electrical heating means within said hood, means responsive to the temperature below said hood, and means controlled by said temperature responsive means for controlling the current input into said heating means.

3. In apparatus of the class described paper feeding and drying means, a chambered hood above said means, electrical heating means within said hood, means responsive to the temperatures within and below said hood, and means controlled by said temperature responsive means for controlling the current input into said heating means.

4. In apparatus of the class described paper drying means, a completely enclosed chambered hood above said means enclosing a still, gaseous medium, means for insulating said hood on all but its under side, electrical means for heating the interior of said hood, and temperature responsive means adjustable in accordance with the temperature below said hood and operable in response to the temperature within for controlling said electrical means to maintain a temperature within said hood only slightly above that of the air beneath it.

5. In apparatus of the class described paper drying means, a completely enclosed chambered hood above said means enclosing a still, gaseous medium, means for insulating said hood on all but its under side, electrical means for heating the interior of said hood, a switch for controlling said electrical means, and temperature responsive means adjustable in accordance with the temperature below said hood and operable in response to the temperature within for controlling said switch to maintain a temperature within said hood only slightly above that of the air beneath it.

6. In a paper drying machine adapted to feed a continuous web of paper, a metallic shielding surface above said web of paper, and electrical means including heat responsive means above and below said surface for automatically maintaining said surface at a temperature only slightly above that of the air beneath it.

7. In apparatus of the class described paper feeding and drying means, a hollow shield above said means enclosing a still body of air, means for heating the air within said shield, temperature responsive means within and below said shield, and means operatively connected with said temperature responsive means for controlling said heating means in accordance with the temperatures within and below said shield.

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