

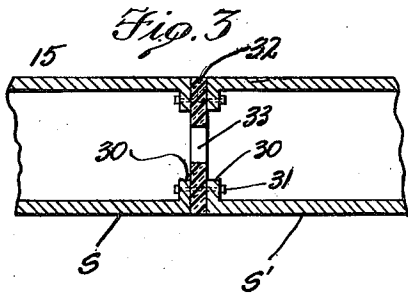
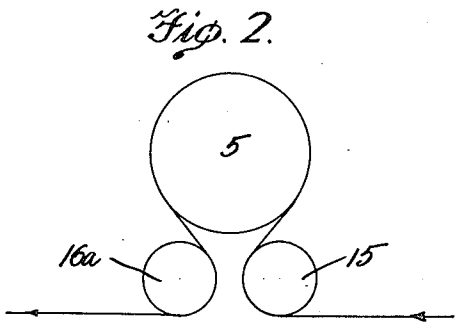
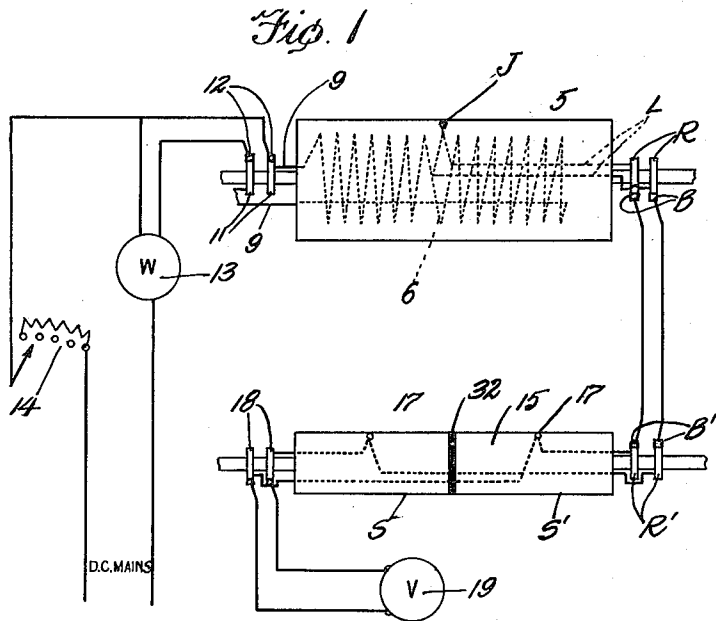
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A. R. HARVEY

INSTRUMENT FOR THE AUTOMATIC DETERMINATION OF MOISTURE IN PAPER OR TEXTILES

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INSTRUMENT FOR THE AUTOMATIC DETERMINATION OF MOISTURE IN PAPER OR TEXTILES.

Application filed December 13, 1923. Serial No. 680,478.

To all whom it may concern:

Be it known that I, ARTHUR R. HARVEY, citizen of the United States, residing at Middletown, in the county of Butler and State of Ohio, have invented certain new and useful Improvements in Instruments for the Automatic Determination of Moisture in Paper or Textiles, of which the following is a specification.

This invention relates to certain new and useful improvements in instruments for the automatic determination of moisture in paper or textiles, and has particular reference to an improvement upon and modification of the structure described and claimed in my co-pending application, Serial No. 650,810, filed July 11, 1923, upon instrument for the automatic determination of moisture in paper or textiles.

As in my above mentioned application, the purpose of the present invention is to provide greatly improved means to indicate, and if desired, to record graphically the per cent of moisture contained in paper while it is in the process of manufacture, the instrument being designed as to be placed in such a position as to determine the moisture content of the paper before it passes into the dryer or at any subsequent time in the manufacture thereof before it is cut into sheets.

Other and specific objects of the improvement will appear as the nature of the same is better understood, and the invention consists in the novel form, combination, and arrangement of parts, hereinafter more fully described, shown in the accompanying drawing, and claimed.

In the drawing, wherein like reference characters indicate corresponding parts throughout the several views:

Figure 1 is a plan view showing a wiring diagram for the heating and temperature measurement rolls.

Figure 2 is a diagrammatic side elevational view showing the roll arrangement, and

Figure 3 is a fragmentary longitudinal sectional view of the temperature measurement roll.

Referring to Figure 2, the paper passes over the roll 15 and then around the heating roll 5, which contains the heating unit

6 as is the case and is clearly explained in my above mentioned application.

In accordance with the present improvement, the roll 5 also contains the hot junction J of a thermo-couple that is mounted in the face of said roll 5 and has compensating leads L running back through slip rings R and R' and brushes B and B' to the roller 15 as shown in the wiring diagram, Figure 1. The roll 16 shown in my above mentioned application is dispensed with entirely, the roll 16^a appearing in Figure 2 replacing said roll 16 and serving only as an idler roll or pulley to insure sufficient contact of the paper with the heating roll 5.

The leads 9 from the heating unit are brought out through the shaft of the roll 5 and are adapted to be connected with the source of current supply by means of slip rings 11 and suitable brushes 12 having wires connected thereto. The heating circuit as shown in Figure 1 must contain the heating element 6, a wattmeter 13, and a suitable rheostat 14 for controlling the heat input. The roll 15 contains cold thermo-couple junctions 17, the electrical connections to which are made through slip rings 18 to a milli-voltmeter or potentiometer 19, as shown in Figure 1. As the cold junctions both terminate in the face of the roll 15, the latter roll must consist of two electrically insulated sections S and S', each containing one of the thermo-coupled wire terminals. A convenient means of fastening the roll sections together is shown in Figure 3, and consists in the provision of annular inturned flanges 30 upon the adjacent ends of the roll sections S and S' which flanges are bolted together as at 31 against opposite sides of a disc 32 of insulating material, the diameter of which is equal to the diameter of the roll and the central portion of which is formed with an opening 33 to permit the passage of the wires therethrough. The bolts at 31 will have insulating tubes and washers to insulate them from the flanges 30.

With the device shown in my above mentioned application, the heat capacity of the paper is determined by its temperature rise when a known quantity of heat is supplied to it. The present device provides means whereby the heat capacity may be deter-

mined indirectly by measuring the temperature of the heating roll surface.

It is well known that temperature difference is one of the factors influencing the rate of heat flow between two surfaces in contact with each other. Thus, the rate of heat flow from the heating roll surface to the paper passing over it is proportional to the difference between their temperatures. For a given set of conditions, we will assume that the paper contains ten per cent moisture. This being the case, the heat input to the heating roll will be equivalent to the heat absorbed by the paper passing over it plus the heat lost by radiation and otherwise. If the moisture content of the paper drops to five per cent, the total weight of paper and also its specific heat will decrease. The result is that the same amount of heat cannot be carried away from the heating roll as before, unless its temperature rises. Since the heat input remains unaltered, the temperature of the heating roll will rise until the transfer of heat to the paper becomes equal to the heat supply. The temperature of the heating roll 5 thus serves to indicate the per cent moisture in the paper through millivoltmeter 19 when the latter is properly calibrated and when the proper heating current is supplied to the heating roll 5 as indicated by the wattmeter 13.

In cases where the temperature difference between two rolls is being measured as in my above mentioned application with respect to the rolls 15 and 16 thereof, a high temperature difference corresponds to low moisture content in the paper. When a "break" occurs in the paper, the second roll 16 gradually cools off, and the indicator approaches a reading of 100% which is finally reached when the temperatures of rolls 15 and 16 are equal.

In the present modified construction, where the temperature of the heating roll is being measured with respect to the roll 15, a break causes the temperature of roll 5 to very quickly rise to a point where the indicator of the milli-voltmeter 19 reads 0% moisture. The advantage here is two fold, namely, the more rapid response to a break, and the movement of the indicator or recording pin to the zero position instead of 100% both of which are preferable and desirable.

In either case, whether the temperature of the heating roll or the actual rise in temperature of the paper is the means of obtaining the result, it is desirable to place some sort of protection on the heating roll so that the temperature cannot become excessive when a break occurs. In the present modified construction, where the temperature of roll 5 is desired, this can be accomplished very readily thru the medium of the thermo couple leads already installed in that roll, by incorporating a temperature controlling

mechanism in the circuit of the indicating or recording apparatus. Otherwise, such as in the case of the construction shown in my above mentioned application, it would be necessary to run separate thermo-couple wires into the roll 5 for the express purpose of temperature control.

Another advantage is that for a given range of moisture content, say from zero to fifteen per cent over which the device may be sensitive, the temperature differences between the rolls 5 and 15 will extend over a greater range than the temperature differences between the rolls 15 and 16 of my above mentioned application. While the difference between the rolls 15 and 16 aforesaid can be measured, it is, at best, a small difference, and necessitates several thermocouples in series to accomplish the measurement with accuracy. Such construction involves material and weight which tends to increase the heat capacity of the roll, and thus make it less sensitive to rapid changes in temperature of the paper.

From the foregoing description, considered in connection with my above mentioned co-pending application, it is believed that the construction and operation of the invention, as well as the advantages thereof will be readily understood and appreciated by those skilled in the art.

What I claim as new is:

1. In an instrument for the automatic determination of moisture content in a web while moving during its course of manufacture, means for supplying heat to said web, means sensitive to the difference between the temperature of the heat supplying means and that of the web before being heated by said heating means, and an indicator under the influence of said heat sensitive means for indicating the moisture content of said web.

2. An instrument for the automatic determination of moisture in a web while moving during its course of manufacture comprising a heating roll about which the web is adapted to be moved, a second roll about which the web is adapted to pass before passing around the heating roll, means carried by said heating roll sensitive to the heat thereof, means carried by the second roll responsive to the heat of the web indicating means and electrical connections between the heat sensitive means carried by the heating roll and the second roll and the indicating means for indicating the moisture content of the web.

3. An instrument for the automatic determination of moisture in a web while moving during its course of manufacture comprising a heating roll about which the web is adapted to be moved, a second roll about which the web is adapted to pass before passing around the heating roll, an in-

indicator, means sensitive to the heat of the heating roll carried thereby, and means carried by the second roll sensitive to the heat of the paper while passing around the second roll actuating said indicator.

4. An instrument for the automatic determination of moisture in a web while moving during its course of manufacture comprising a heating roll about which the web is adapted to be moved, a second roll about which the web is adapted to pass before passing around the heating roll, an indicator, thermo couples mounted in each of said rolls for actuating said indicator, the thermo couples in the heating roll forming a hot junction at the surface of the heating roll, and the thermo couple in the second roll forming the cold junctions at the surface of the second named roll.

5. An instrument for the automatic determination of moisture in a web while moving during its course of manufacture comprising a heating roll about which the web is adapted to be moved, a second roll about which the web is adapted to pass before

passing around the heating roll, an indicator, thermo couples for operating the indicator mounted in the heating roll and second roll respectively having a hot junction at the surface of the heating roll and cold junctions at the surface of the second named roll, said second named roll comprising electrically insulated sections arranged and connected in end to end relation, and one of said cold junctions being carried by each of said roll sections.

6. A device of the class described comprising means for supplying heat to a movable web, means sensitive to the difference between the temperature of the heat supplying means and that of the web at a point spaced from said heat supplying means, an indicator and connections between the indicator and the heat sensitive means, said indicator being operable by said heat sensitive means for indicating the moisture content of the web.

In testimony whereof I affix my signature.

ARTHUR R. HARVEY.