Oct. 12, 1926. 1,603,092

C. W. MORDEN

CONDENSATION REMOVING MEANS

Filed June 6, 1923

Fig. 1.

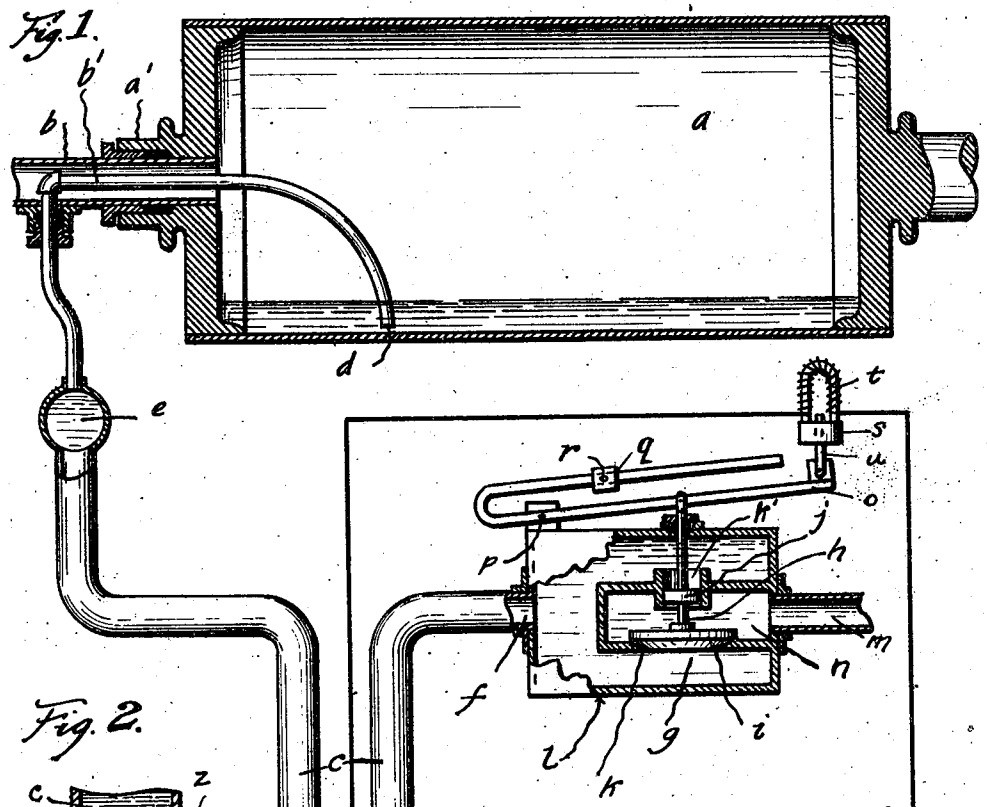
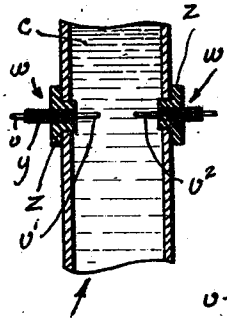


Fig. 2.



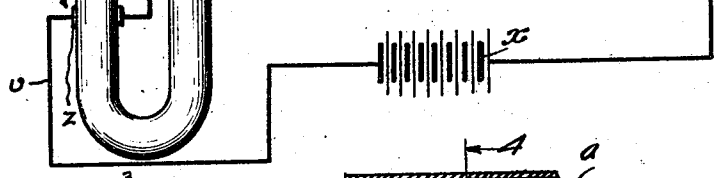
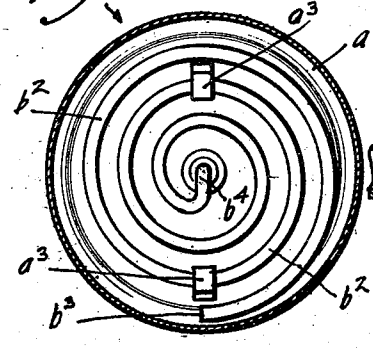


Fig. 4.



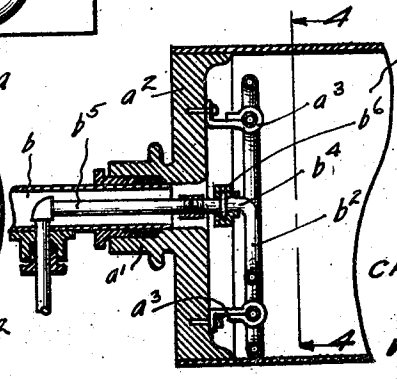


Fig. 3.

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UNITED STATES PATENT OFFICE.

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CONDENSATION-REMOVING MEANS.

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My invention has for its object the removal of condensation from the enclosed space of a chamber connected to a source of vapor under pressure, and particularly from a steam heated drier-roll of a paper making machine.

The steam is usually introduced into the drier-roll thru a hollow stub-axle. The steam will, of course, condense more or less, and a removing means, such as a siphon, is provided for removing the condensation, one end of which siphon is extended thru said hollow stub-axle into the drier-roll, and the discharging arm of which siphon is connected to a common header pipe. Since the steam pressure in the drier-roll tends to discharge the accumulated condensation thru the siphon, when the water is low enough to uncover the ends of the siphon the steam will also escape, if means are not provided to prevent the same.

The header pipe is therefore drained by a U-tube of the water-trap type. When the U-tube is made of sufficient length, the water column in the discharging arm of the U-tube has a sufficient static head to take care of the maximum steam pressure in the drier-roll, without breaking the water seal.

But cases frequently arise where the available space is insufficient in height, or the proximity of other machinery, or other conditions, render it impracticable to install a U-tube of sufficient length; and since, as well known, it takes approximately 2.3 feet of static head for every pound of pressure obtained thereby, it is apparent that a drier-roll which is heated by steam under any substantial pressure would require a very long U-tube, in order to accommodate probable variations in the steam pressure, without displacing the column of liquid in the discharging arm of the U-tube to such extent as to break the liquid seal, and thus allow the steam to escape.

The object of my invention is, therefore, to provide a valve controlling the emissions from the discharging arm of the U-tube, and furthermore to provide means for adjusting or varying the resistance of the valve to being opened, thereby relatively increasing the displacement resistance of the column of liquid in said discharging arm of the U-tube, so as to prevent the breaking of the liquid seal by a predetermined maximum increase in pressure of the heating steam.

I attain my object by combining with the discharging arm of the U-tube a valve controlling the emissions therefrom, and providing means for imposing a variable resistance to the opening of said valve, which means are adapted to be set so as to counteract a predetermined minimum pressure of said steam in the drier-roll; and the length of the U-tube is relatively proportioned so as to be sufficient to provide a static head capable of counteracting the probable maximum increase of the pressure above said minimum without breaking the liquid seal in the U-tube. In other words, the devices combined are so relatively arranged and proportioned that the summation of the resistance imposed against the opening of said valve and the static head is capable of taking care of a predetermined maximum steam pressure in the drier-roll without breaking the liquid seal.

Furthermore, I provide an auxiliary weight, adapted when unrestrained, to hold the valve shut, and electro-magnetic means adapted when energized to render said auxiliary force ineffective. And in order to operate these electro-magnetic means by variations in the level of the liquid in the intake arm of said U-tube, I extend insulated terminals of the electric circuit of said electro-magnet spaced apart, into the interior of the intake arm of said U-tube, thus making the circuit when the height of the liquid in said intake arm is sufficient to cover said terminals, and breaking said circuit, and in so doing causing the shutting of said valve as mentioned, when the water in said intake-arm falls to such extent as to uncover said terminals.

The details of construction and operation of my above mentioned devices and other incidental features of my invention are hereinafter fully described with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic representation of my condensation removing means attached to a drier-roll of a paper machine;

Fig. 2 is an enlarged sectional detail of the circuit breaking device in the electro-magnetic means by which the auxiliary force is held ineffective.

Fig. 3 is a fragmentary longitudinal section of a drier roll with a spiral type of collecting head in place; and

Fig. 4 is a sectional view taken on the line

4—4 of Fig. 3 and shows a spiral collecting head for removing the condensation from the drier-roll.

My device is adapted to be connected with a hollow drier-roll *a* of a paper machine and which is provided with a steam inlet pipe *b* which also serves as a journal on which the drier-roll rotates. In practice there are a number of these drier-rolls and each one is provided with condensation removing means, one type of which is the siphon pipe *b'* which has an inlet *d* positioned inside of the drier-roll, and close to the bottom, so that the inlet will not be uncovered except when the level of the condensation has reached a very low point. The siphon pipe *b'* is smaller in diameter than the steam pipe *b* and it extends axially thru the steam pipe until it is past the journal *a'* of the drier-roll and then extends vertically towards the bottom thereof. All of the sections of siphon pipe from the different drier-rolls are connected to a common header pipe *e*. This header is drained by a section of pipe *c* which forms the U-tube.

The outlet *f* of the U-tube is connected to a chamber in which is located an inner chamber *n* provided with a port *k* controlled by a valve *g* which is preferably a balanced valve which is made with a double headed valve member *h*, of which the larger head *i*, covers the port *k* in the bottom of the chamber 1; and the smaller head *j* is a piston reciprocating in the cylindrical port *k'* of sufficient length to accommodate the movement of the valve head *j* so that the port *k'* will never be uncovered and permit condensation to flow past the head *j*. The drain or carry off pipe *m* connects with the inner chamber *n*. The reason the valve *h* is preferably a balanced valve is because the device will not require such a heavy counterweight since the pressure within the valve *g* acts on both heads of the valve member *h* as opposed forces and thus the pressure acts against opposed heads which have a difference in area and the resultant force tends to open the port *k* and permit the condensation to escape. The valve *h* is pivotally attached to a bar *o* which pivots about the point *p*. This bar *o* is preferably U-shaped and is arranged horizontally. A balancing weight *q* is adjustably mounted on the upper portion of this bar *o* and said balancing weight is held in set position by the set screw *r*. Said weight *q* in one position exerts a force on the valve member *h* which tends to hold the valve head *i* seated on the port *k*, thus preventing the outflow of the condensation thru the inner chamber *n*. An auxiliary weight *s* is provided which is held in inoperative position by the electro-magnet *t*. Said auxiliary weight *s* is slidably mounted on the pivoted pin *u* and thus as the electro-magnet *t* becomes deenergized the auxiliary weight *s* will slide on the pivoted pin *u* and will act as an auxiliary medium to hold the valve *i* on its seat on the port *k*. The electro-magnet *t* is energized by the battery *x* which is connected by a wire *v*, the ends of which, *v'* and *v²*, are bare and extend into the U-tube *c* at a point *w* slightly above the predetermined lowest point of the column of water in the descending leg of the U-tube *c*. These termini are insulated from the said U-tube *c* as at *y* and are mounted in plugs Z and thus contact merely with the contents in the said U-tube. If the U-tube is full of water the circuit will be made from the battery thru the wire *v* and the winding of the electro-magnet and thru the contents of the U-tube back to the battery. If the U-tube is not filled to the said predetermined level the circuit will of course be broken and the electro-magnet will be deenergized permitting the auxiliary weight to fall and thus to hold the valve *h* shut. The valve will remain shut until the leved of the condensed vapor again reaches the point *w* and close the circuit again energizing the electro-magnet. The relation of the force exerted by the weight *q* and the length of the U-tube are so proportioned that the weight *q* will take care of the minimum steam pressure carried in the drier-roll, and U-tube will be of sufficient length to take care of any variations in the pressure. The summation of the two will therefore take care of the maximum pressure without breaking the water seal in the U-tube so as to permit the steam to pass from the heating system. As is well known, the U-tube does not exert any back pressure until the steam forces the water level in the descending leg of the U-tube below the water level in the ascending leg. The difference in the height of the liquid in these legs will cause a back pressure to be exerted which tends to overcome the pressure which is forcing the water in the descending leg downwardly. If the U-tube is long enough an equilibrium will be reached at a point at which the static head is equal to the pressure exerted against the water in the descending leg. This is approximately 2.3 feet for every pound of pressure obtained. Thus, if it is desired to counteract five pounds of steam pressure it is necessary to have a U-tube 11.5 feet long.

If, for example, with my improved device, I desire to take care of steam which varies in pressure from two pounds to seven pounds and I have not sufficient room to install a U-tube which would take care of seven pounds but will only take care of five pounds, I would set my weight *q* so as to exert a pressure of two pounds on the valve *h* and the remaining five pounds would be taken care of by the U-tube.

Figs. 3 and 4 show a spiral collector head

b^2 which may be employed in place of the siphon b' shown in Fig. 1. The inlet end b^3 of said spiral head is located at the bottom of the hollow drier roll a and is the outside coil of the spiral. The inside coil of the spiral constitutes the outlet end b^4 which connects with pipe b^5 to a header. This type of collector head operates to scoop up the condensation in the hollow drier-roll due to the high speed at which the latter rotates. The spiral pipe b^2 is fastened to the head a^2 of the drier-roll by brackets a^3. I provide a rotatable joint b^6 between the spiral section and the section b^5, to permit the latter which is stationary to be connected with the spiral pipe section which rotates with the head a tube of the drier roll. Both the siphon element b' or the collector head element b^2, illustrated in Figs. 1 and 3, respectively, are common to drier-rolls; and there are also variations of both, for example curved paddle wheels, which scoop the condensation from the bottom of the drier-roll. The siphon element b' is used on drier-rolls which rotate at a relatively low speed and the spiral element b^2 and similar types of collector heads, which depend upon high speed for scooping up the condensation are used on faster drier-rolls, preferably, since in the latter the condensation tends to travel with the rotation of the drier-roll due to centrifugal force.

I claim:

1. In a steam condensation removing means of the character described, the combination of a U-tube, a valve controlling the outlet of said U-tube, means for balancing said valve relatively to a minimum steam pressure in said condensation chamber, electrically operated means for imposing a supplemental closing pressure on said valve, and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

2. In a steam condensation removing means of the character described, the combination of a U-tube, a valve controlling the outlet of said U-tube, a weight imposed on said valve and adjustable to balance approximately a minimum steam pressure in said condensation chamber, electrically operated means for imposing a supplemental weight on said valve and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

3. In a steam condensation removing means of the character described, the combination of a U-tube, means for connecting the condensation chamber and delivering the condensation to the intake arm of the U-tube, a valve controlling the outlet of said U-tube, means for balancing said valve relatively to a minimum steam pressure in said condensation chamber, electrically operated means for imposing a supplemental closing pressure on said valve and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

4. In a steam condensation removing means of the character described, the combination of a U-tube having its intaking arm extended a substantial distance above the level of its outlet, means for connecting the condensation chamber and delivering the condensation to the intake arm of the U-tube, a valve controlling the outlet of said U-tube, means for balancing said valve relatively to a minimum steam pressure in said condensation chamber, electrically operated means for imposing a supplemental closing pressure on said valve and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

5. In a steam condensation removing means of the character described, the combination of a U-tube, means for connecting the condensation chamber and delivering the condensation to the intake arm of the U-tube, a valve controlling the outlet of said U-tube, a weight imposed on said valve and adjustable to balance approximately a minimum steam pressure in said condensation chamber, electrically operated means for imposing a supplemental closing pressure on said valve and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

6. In a steam condensation removing means of the character described, the combination of a U-tube, means for connecting the condensation chamber and delivering the condensation to the intake arm of the U-tube, a valve controlling the outlet of said U-tube, a weight imposed on said valve and adjustable to balance approximately a minimum steam pressure in said condensation chamber, electrically operated means for imposing a supplemental weight on

said valve and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

7. In a steam condensation removing means of the character described, the combination of a U-tube, a valve controlling the outlet of said U-tube, electrically operated means for imposing a supplemental closing pressure on said valve and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

8. In a steam condensation removing means of the character described, the combination of a U-tube, a valve controlling the outlet of said U-tube, means for balancing said valve relatively to a minimum steam pressure in said condensation chamber, electro-magnetic means for imposing a supplemental weight on said valve and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

9. In a steam condensation removing means of the character described, the combination of a U-tube, means for connecting the condensation chamber and delivering the condensation to the intake arm of the U-tube, a pressure chamber to which the outlet end of the U-tube is connected, an inner chamber in said pressure chamber and provided with the waste outlet, a port in one wall of said inner chamber, a balanced valve controlling said port and an electromagnetically controlled weight located for being imposed on the free end of said arm and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

10. In a steam condensation removing means of the character described, the combination of a U-tube, means for connecting the condensation chamber and delivering the condensation to the intake arm of the U-tube, a pressure chamber to which the outlet end of the U-tube is connected, an inner chamber in said pressure chamber and provided with the waste outlet, a port in one wall of said inner chamber, a valve controlling said port, the stem of said valve carrying a piston reciprocating in a cylindrical port provided in the opposite wall of said inner chamber, an arm pivoted on said pressure chamber with which arm the stem of said valve is connected, and an adjustable weight carried by said arm and an electromagnetically controlled weight located for being imposed on the free end of said arm and a circuit breaking device in the electrical circuit consisting of spaced terminals located in the interior of the intake arm of the U-tube at a predetermined level, whereby to resist the breaking of the liquid seal due to excessive steam pressure in the condensation chamber.

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