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TEMPERATURE CONTROL MEANS FOR CALENDER ROLLS

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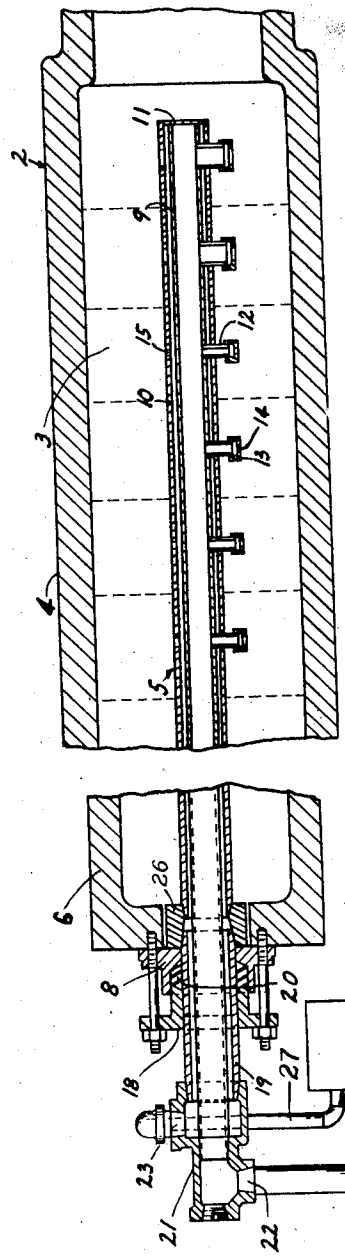


FIG. 1

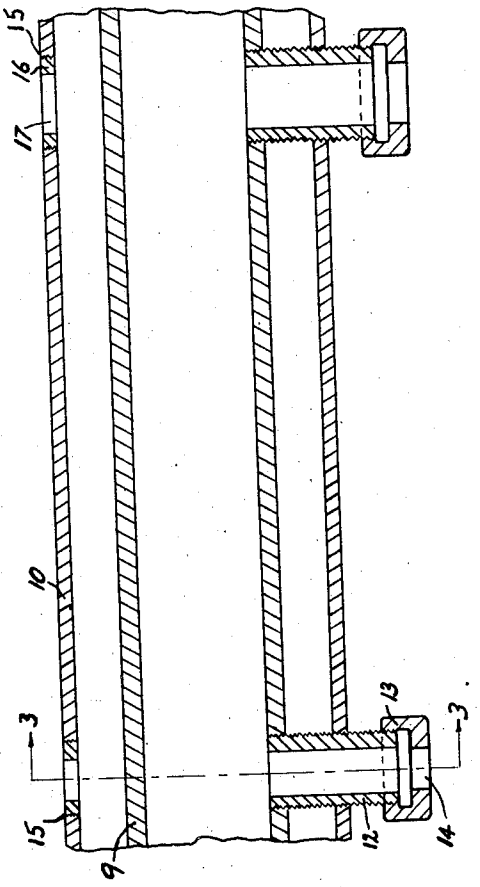


FIG. 2

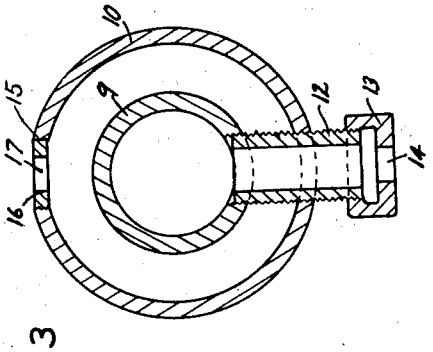


FIG. 3

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## TEMPERATURE CONTROL MEANS FOR CALENDER ROLLS

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8 Claims. (Cl. 257—95)

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This invention relates to temperature control means for calendar rolls. More specifically, it relates to a calendar roll having means combined therewith for controlling the temperature of its peripheral working surface and for maintaining the temperature throughout the area of the peripheral working surface substantially uniform and constant.

Various means have been provided heretofore for controlling the temperature of a cavity type calendar roll by the circulation of either a heating or cooling medium throughout the roll. Such devices, however, are unsatisfactory for they do not accurately control the temperature or maintain a desired temperature substantially uniform and constant throughout the area of the working surface of the roll.

In order to obtain a substantially uniform temperature throughout the area of the working surface of the roll, it is desirable to have each of a series of theoretical roll sections transversely of the length of the roll at the effective working surface served by a certain proportion of the total heating or cooling medium. In any such theoretical roll cavity section, it is likewise essential that the heat transfer medium be discharged as near as possible to the injection point in order to minimize temperature differentials longitudinally of the working surface of the roll.

The chief object of my invention is to provide a calendar roll having temperature control means which maintain the temperature of the working surface of the roll substantially uniform and constant. An object is to provide temperature control means for calendar rolls which maintain the temperature of the working surface of the roll substantially uniform and constant peripherally and longitudinally of the roll. A further object is to provide a simple and efficient temperature control means for cavity type calendar rolls. A still further object is to provide a calendar roll possessing means for cooling or heating the working surface thereof substantially uniformly throughout the area of the working surface. A still further object is to provide a device in which proportional amounts of temperature control medium are injected and circulated through sections of a roll cavity and are ejected from the sections of the cavity as closely as practical to the point of injection to prevent differential in temperature longitudinally of the working surfaces of the roll.

This invention relates to the combination with a calendar roll having a peripheral working surface and an internal cavity extending longitudinally thereof, of means for controlling the temperature of the peripheral working surface

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of the roll, said means comprising an inlet pipe having a closed end extending longitudinally of the calendar roll, an outlet pipe surrounding the inlet pipe, spaced passages connecting the inlet pipe with the roll cavity to permit injection of temperature control medium into the cavity of the roll, said outlet pipe having ports therein connecting the outlet pipe and the cavity of the roll, and means for circulating temperature control medium through the inlet pipe to the roll cavity and from the roll cavity to the outlet pipe, circulation of said temperature control medium maintaining the area of the working surface of the roll at a substantially uniform and constant temperature.

The attached drawing illustrates a preferred embodiment of my invention, in which

Figure 1 is a sectional view of a calendar roll provided with the temperature control means of my invention;

Figure 2 is an enlarged sectional view of a portion of the temperature control means illustrating the various inlets and outlets to the cavity of the calendar roll; and

Figure 3 is a sectional view taken on the line 3—3 of Figure 2.

Referring to the drawing, there is shown a calender roll 2 having an internal cavity 3 extending longitudinally thereof and provided with a peripheral working surface 4. The peripheral working surface 4 is maintained at a desired temperature by temperature control means designated generally at 5. The roll is maintained in desired position by means of bearings received at the ends 6 of the roll, and the bearings are carried in supports (not shown). A packing head 8 is bolted to one end of the calender roll 2.

The temperature control means 5 comprises an inner inlet pipe 9 extending longitudinally of the calender roll 2, and an outlet pipe 10 which surrounds inlet pipe 9. An end plate 11 closes an end of both inlet pipe 9 and outlet pipe 10. Threaded nipples 12 extend from inlet pipe 9 and open into the cavity 3 of roll 2 to form passages for the injection of heat transfer liquid into cavity 3. If it be desired to refrigerate the working surface of the roll, brine may be used or if it be desired to heat the working surface of the roll, hot water may be used. Caps 13 having orifices 14 therein are disposed over the open ends of nipples 12 as best shown in Figures 2 and 3. These orifice caps 13 are threadedly connected to nipples 12 and the orifices 14 therein provide passage for temperature control medium from pipe 9 to the cavity 3. The caps 13 are replaceable in order to increase or decrease the amount of temperature control medium supplied

to cavity 3. The orifices 14 in caps 13 are designed to compensate for drop in line pressure, thus assuring an adequate discharge of control medium from each orifice. It is for the same reason that the nipples 12 are of different sizes as shown in the drawing. Within a wide range, a change in medium pressure affords a reasonably equal and proportionate discharge from each orifice. It will be understood the rate of flow or the size of the orifice controls the amount of medium supplied to the cavity and hence controls the temperature of the working surface of the roll.

Ports 15 are provided in outlet pipe 10 and form an exit passage connecting the cavity 3 of roll 2 and the outlet pipe 10. Preferably, the ports 15 are threaded and received threaded orifice reducers 16 provided with orifices 17; this is desirable in order that reducers 16 may be removed and exchanged for similar reducers having larger or small orifices 17. The ports 15 are disposed substantially opposite the nipples 12. So disposing the inlets and outlets for temperature control medium divides the cavity, theoretically into sections, as indicated by the dotted lines in Fig. 1, for the circulation of control medium and assures that the smallest practicable portion of medium is circulated in any such theoretical cavity section and that it is discharged as near the injection point as practicable. Sufficient injection inlets and ejection outlets are provided to divide the working surface of the roll into desired sections, each of which is controlled by the medium injected through a nipple 12 and orifice cap 13 and ejected through a port 15 disposed substantially opposite thereto, to assure substantially uniform and constant temperature control throughout the area of the working surface of the roll.

A packing gland 18 is provided surrounding a pipe 19 which pipe forms, in effect, a continuation of the outlet pipe 10. Inlet pipe 9 extends longitudinally through pipe 19 as shown in Figure 1. The pipe 19 is fixed in place by means of a coupling 26 into which it is threaded. This coupling also receives the outlet pipe 10 which is threaded thereunto. A suitable packing 20 is positioned between the packing head 8 and gland 18 to prevent temperature control medium from seeping along the pipe 19 during rotation of the roll 2. The packing head 8, gland 18, and packing 20 rotate with the roll 2, the pipes 9 and 10 and associated equipment remaining stationary.

A compound two-way fitting 21 is connected to one end of pipe 19. Inlet pipe 9 extends through pipe 19 and into the fitting 21. Fitting 21 is provided with an inlet opening 22 opening into inlet pipe 9 and with an outlet opening 23 opening into pipe 19 and which receives the ejected temperature control medium and passes it to suitable means 24 for adjusting the temperature of the control medium to a desired degree through pipe 27 which is connected to the outlet 23, passing under fitting 21 as shown in Figure 1. A pump 25 is provided to force control medium from the temperature adjusting means 24 to the inlet opening 22 and to circulate the control medium throughout the cavity 3 of roll 2 returning it through ports 15, pipe 10, and outlet opening 23 to the temperature adjusting means 24.

To aid in a full and complete understanding of my invention, I will describe the operation of the device. The temperature adjusting means 24 controls the temperature of the temperature control medium. That is, it refrigreates or heats the temperature control medium as desired. Pump 25 forces temperature control medium from the adjusting means 24 to the inlet opening 22 from whence it passes into inlet pipe 9. From inlet pipe 9, the medium passes through nipples 12 and the orifices 14 in caps 13 into the cavity 3 of roll 2. The force of the stream of temperature control medium leaving the orifices 14 in caps 13 creates agitation against the wall of the cavity. The temperature control medium leaves cavity 3 through the ports 15 and enters outlet pipe 10. From outlet pipe 10, it passes through opening 23 and is returned to the temperature adjusting means 24 through pipe 27.

My invention provides an accurate and careful control of the temperature of the working surface of a calender roll. It provides uniform temperature throughout the area of the working surface of the roll and equal temperature changes throughout the area of the roll, depending upon varying temperature conditions. The device is simple, inexpensive, and easily and quickly installed. The device of my invention is efficient in operation and affords a constant temperature throughout the working surface of the roll. A particular advantage of my invention resides in the fact that the area of the working surface is maintained at a substantially uniform temperature whether or not such temperature is increased or decreased to a slight degree.

While I have described and illustrated a preferred embodiment of my invention, it will be understood my invention is not limited thereto since it may otherwise be embodied within the scope of the following claims.

I claim:

1. In combination with a rotatable roll having a peripheral working surface, the temperature of which is to be controlled, and an internal cavity extending longitudinally of the roll below the working surface, means for distributing heat transfer liquid within the cavity comprising inlet and outlet pipes extending longitudinally of the roll cavity and disposed one within the other, a plurality of longitudinally spaced inlet ports leading from the inlet pipe and opening into the roll cavity for the distribution of heat transfer liquid within the roll cavity at a plurality of spaced points longitudinally thereof, a plurality of longitudinally spaced outlet ports provided in the outlet pipe and opening into the roll cavity, said inlet and outlet ports being disposed in spaced pairs with the inlet port of each pair substantially opposite to the outlet port in a direction longitudinally of the cavity to provide for inlet and exhaust of heat transfer fluid in a plurality of longitudinally spaced zones throughout the roll cavity, and removable perforate end closures for the inlet ports, said end closures having openings therein which vary in cross-sectional area one from another to vary the supply of heat transfer fluid therethrough.

2. A heat-exchange roll having a peripheral working surface, the temperature of which is to be controlled substantially uniformly along its length, and having an internal cavity extending longitudinally of the roll below the working surface, means for distributing heat transfer liquid within said cavity comprising an inlet conduit disposed longitudinally of said cavity in spaced relationship with respect to the wall of said cavity, said inlet conduit having a plurality of longitudinally spaced inlet ports associated therewith, removable perforate members attached to

said inlet conduit and defining the opening in said ports, the cross-sectional area of the openings in said perforate members varying in different ports to adjust the flow of heat transfer liquid therethrough, and an outlet conduit disposed longitudinally of said cavity in spaced relationship with respect to the wall of said cavity, said outlet conduit having a plurality of longitudinally spaced outlet ports therein spaced above said perforate members in the inlet conduit.

3. A heat-exchange roll having a peripheral working surface, the temperature of which is to be controlled, and having an internal cavity extending longitudinally to the roll below the working surface, means for distributing heat transfer liquid within said cavity comprising an inlet conduit disposed longitudinally of said cavity in spaced relationship with respect to the wall of said cavity, said inlet conduit having a plurality of longitudinally spaced downwardly directed inlet ports associated therewith, removable perforate members attached to said inlet conduit and defining the openings in said ports, the cross-sectional area of the openings in said perforate members varying in different ports to adjust the flow of heat transfer liquid therethrough, and an outlet conduit disposed longitudinally of said cavity in spaced relationship with respect to the wall of said cavity, said outlet conduit having a plurality of longitudinally spaced upwardly directed outlet ports therein spaced above said perforate members in the inlet conduit, said inlet ports and said outlet ports being disposed as spaced pairs to provide for inlet and exhaust of heat transfer liquid in a plurality of longitudinally spaced zones throughout the roll cavity, whereby heat transfer fluid fed into the roll cavity through the inlet port of each pair may be exhausted through the outlet port of said pair to separately control the temperature of the roll in said spaced zones.

4. A heat-exchange roll having a peripheral working surface, the temperature of which is controlled, and an internal cavity extending longitudinally of the roll through which heat transfer liquid is circulated, means for distributing heat transfer fluid within said cavity by circulation of the same in a plurality of zones spaced longitudinally of the roll comprising an inlet conduit disposed within said cavity, a plurality of removable ports associated with said inlet conduit for supplying cooling fluid from said conduit to said cavity in different volumes in spaced zones longitudinally of said cavity, an outlet conduit disposed within said cavity, and a plurality of removable ports associated with said outlet conduit disposed above said inlet ports for discharging cooling fluid from said cavity in said zones at a rate substantially equivalent to the rate of charge of cooling fluid thereto in said zones, whereby the temperature in each of said zones may be individually controlled.

5. A fluid-injector mechanism for rolls and the like comprising an inlet conduit for heat transfer fluid having inlet passages provided therein at spaced intervals longitudinally thereof, removable perforate members restricting the openings in said passages, different passages having perforate members, the openings of which differ in cross-sectional area, an outlet for spent heat transfer liquid, and a coupling joining said inlet conduit and said outlet for insertion and removal from within a roll or the like as a unit, whereby the injector may be removed from the roll and the perforate members changed to provide for a substantially uniform temperature at the working surface of the roll under varying operating conditions.



6. A fluid injector for rolls and the like comprising an outlet conduit, an inlet conduit disposed within said outlet conduit in spaced relationship with respect thereto to provide a discharge passageway therebetween, a plurality of longitudinally spaced branch conduits leading from said inlet conduit passing through said passageway and opening through said outlet conduit, removable members attached to at least two of said branch conduits for restricting the openings therein, said removable means restricting the flow through said conduits in different amounts, said outlet conduit having a plurality of discharge openings therein disposed in general alignment with the branch conduits in the inlet conduit but displaced about 180° with respect thereto, and means joining said inlet and outlet conduits for insertion and removal from a roll or the like as a unit, whereby the injector may be removed from the roll and the perforate members changed to provide for a substantially uniform temperature at the working surface of the roll under varying operating conditions.

7. A fluid injector as recited in claim 6 in which two of said discharge openings in said outlet conduit are provided with removable orifice reducers restricting the flow through said discharge openings in different amounts.

8. A fluid injector for fluid-cooled rolls and the like comprising an outlet pipe, an inlet pipe received within said outlet pipe, means adjacent the ends of said pipe remote from the charging end of the inlet pipe and the discharging end of the outlet pipe for joining said pipes in spaced relationship with a passageway therebetween for the flow of fluid through said outlet pipe, hollow nipples provided at spaced intervals along said inlet pipe and passing through said outlet pipe in sealed relationship with respect thereto, and removable end caps having openings therein attached to said hollow nipples and defining the inlet openings therein, said caps having openings therein nonuniform one with respect to another, said outlet pipe having openings therein disposed in substantial alignment with the inlet nipples but circumferentially displaced with respect thereto, said outlet openings being nonuniform one with respect to another in the same relationship as the openings in the end caps whereby heat transfer fluid inlet through an end cap may be discharged through the corresponding opening in the discharge pipe to provide for the circulation of heat transfer fluid in a plurality of longitudinally spaced zones throughout the roll cavity in which said injector is installed.

LE ROY EABY.

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## Certificate of Correction

Patent No. 2,435,959. February 17, 1948.

LE ROY EABY

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 1, lines 2, 3, 11, 31, 35, 40, 41, and 54; column 2, lines 3, 18, and 24, in each occurrence, for the word "calendar" read *calender*; column 3, line 21, for "small" read *smaller*; line 24, for "cavity" read *cavity 3*; column 4, line 1, for "refrigreates" read *refrigerates*; column 5, line 14, claim 3, for "to the" read *of the*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of April, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
*Assistant Commissioner of Patents.*