Aug. 20, 1935. W. P. BOYD 2,011,748

THERMOSTATIC CALENDAR ROLL

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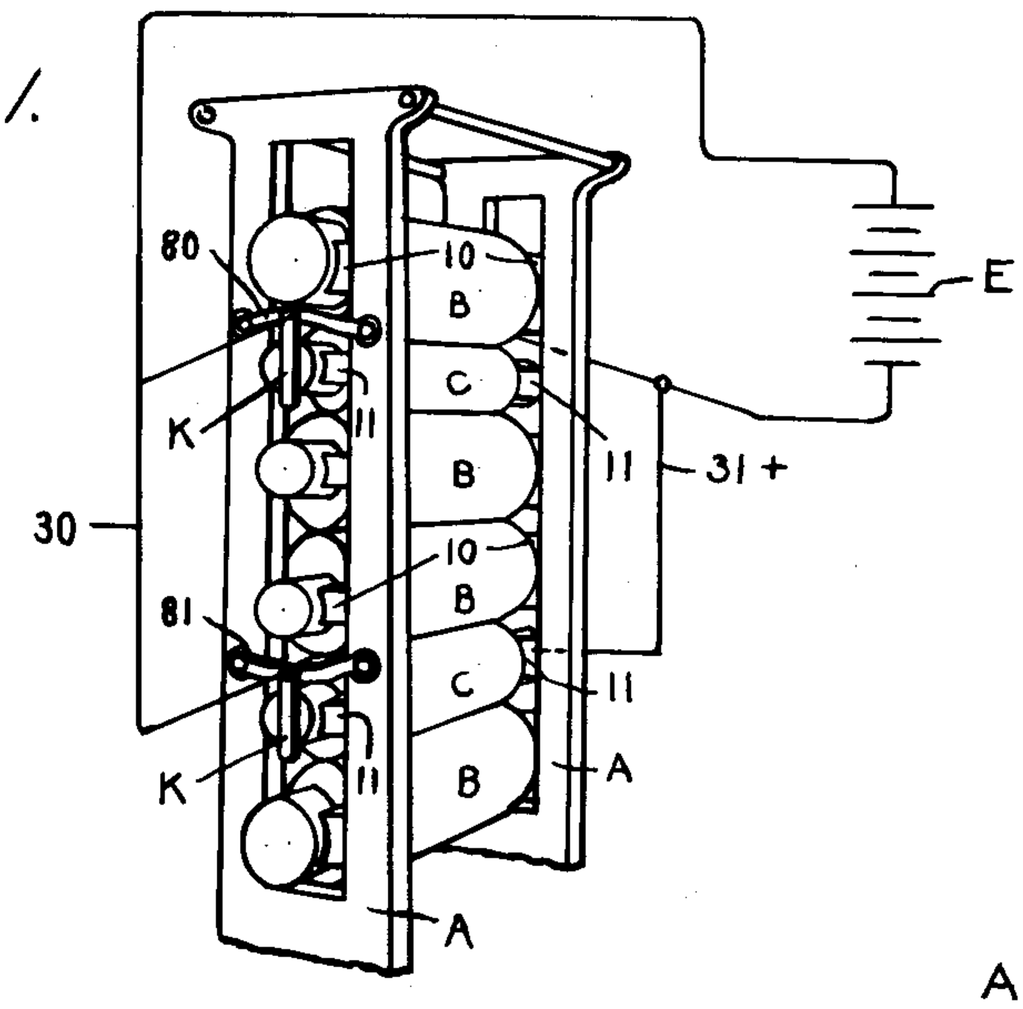
Fig. 1.



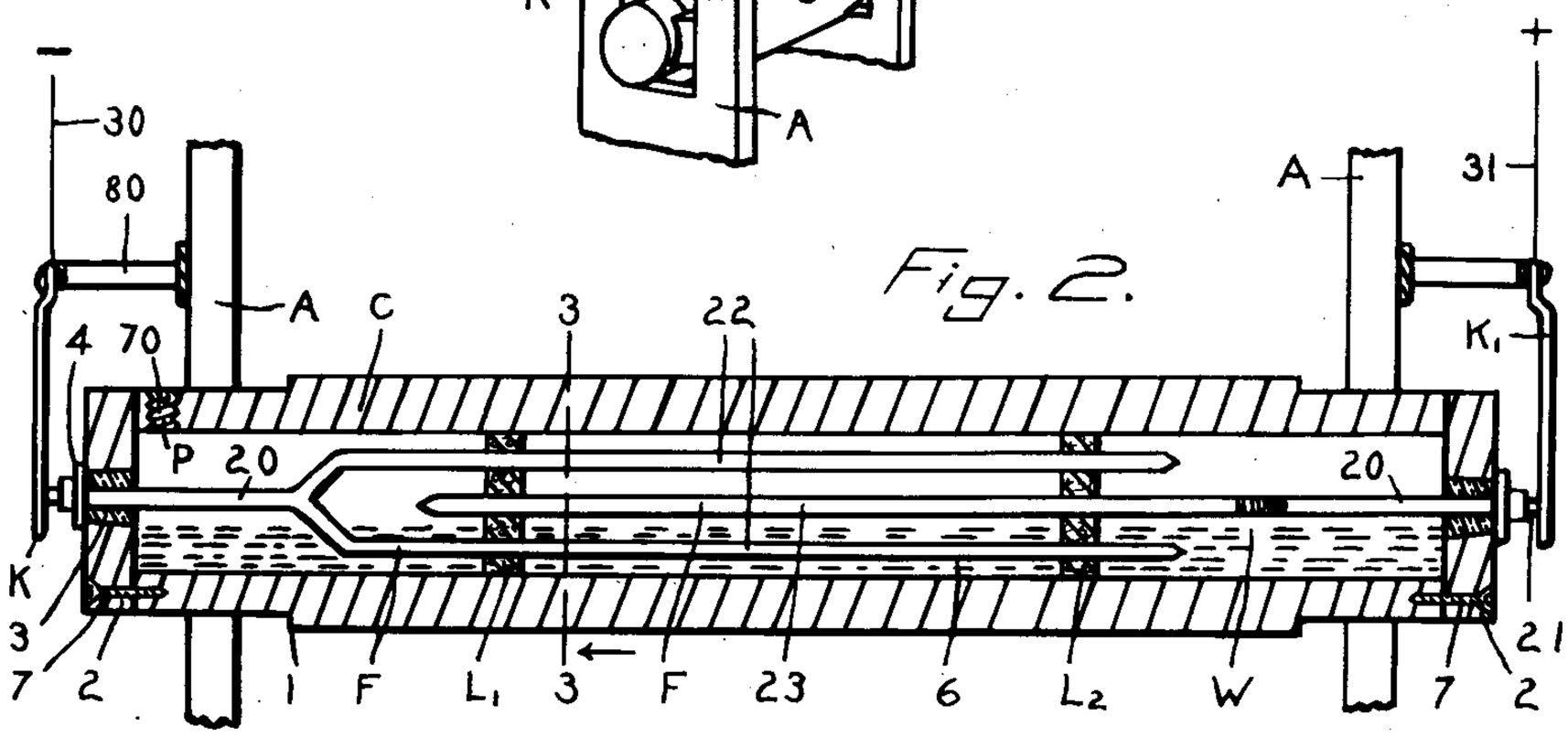


Fig. 2.

Fig. 3

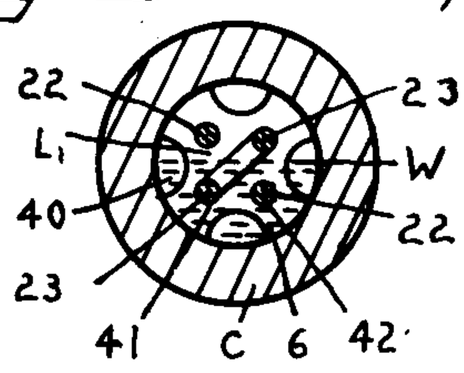


Fig. 4.

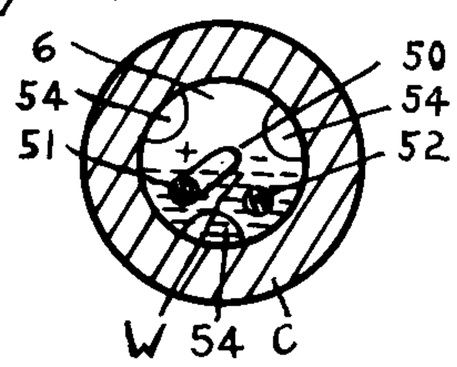


Fig. 5.

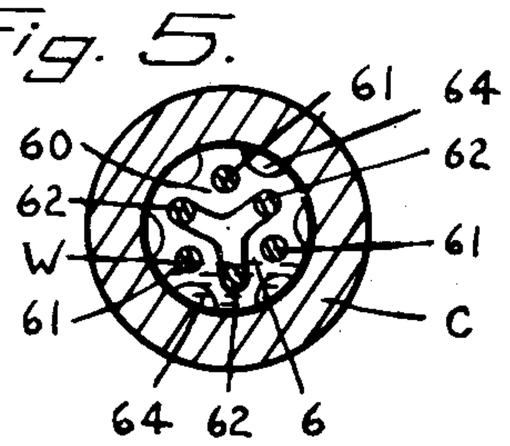


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Fig. 6.

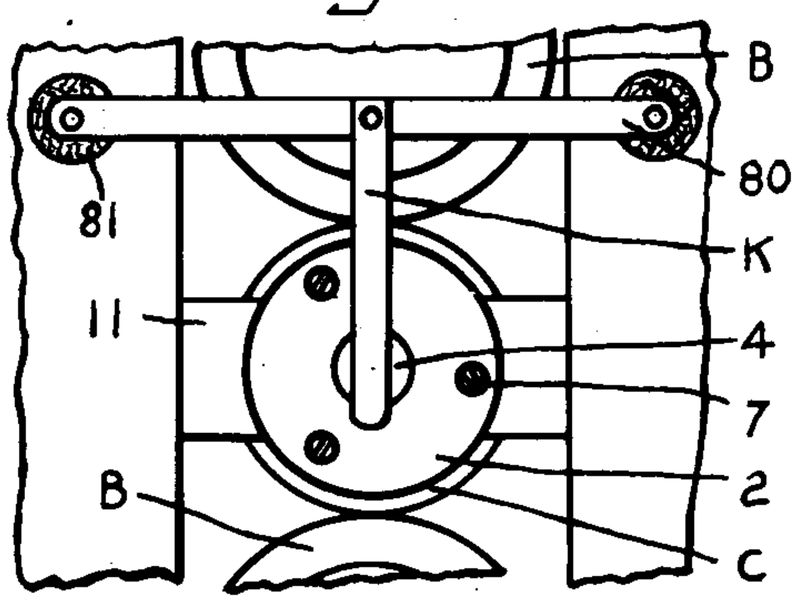
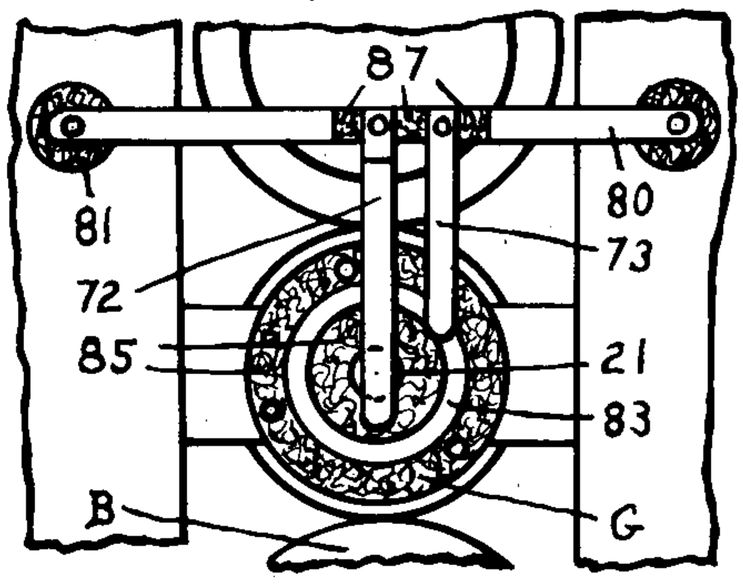


Fig. 7.



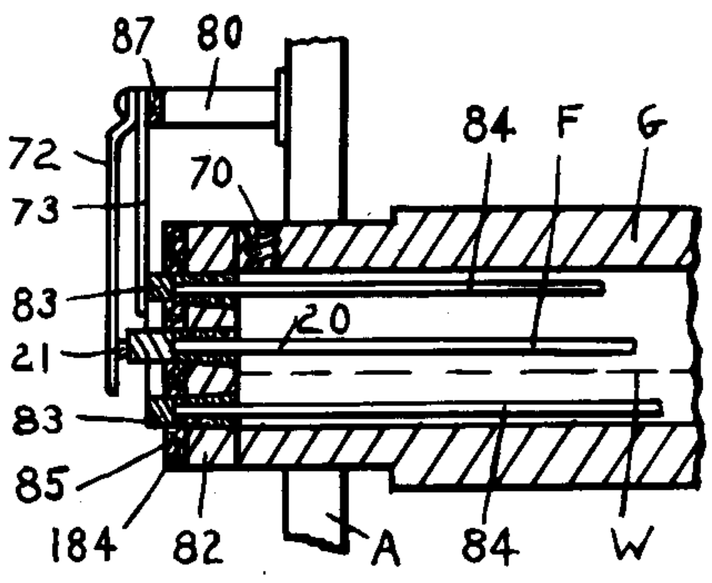


Fig. 8.

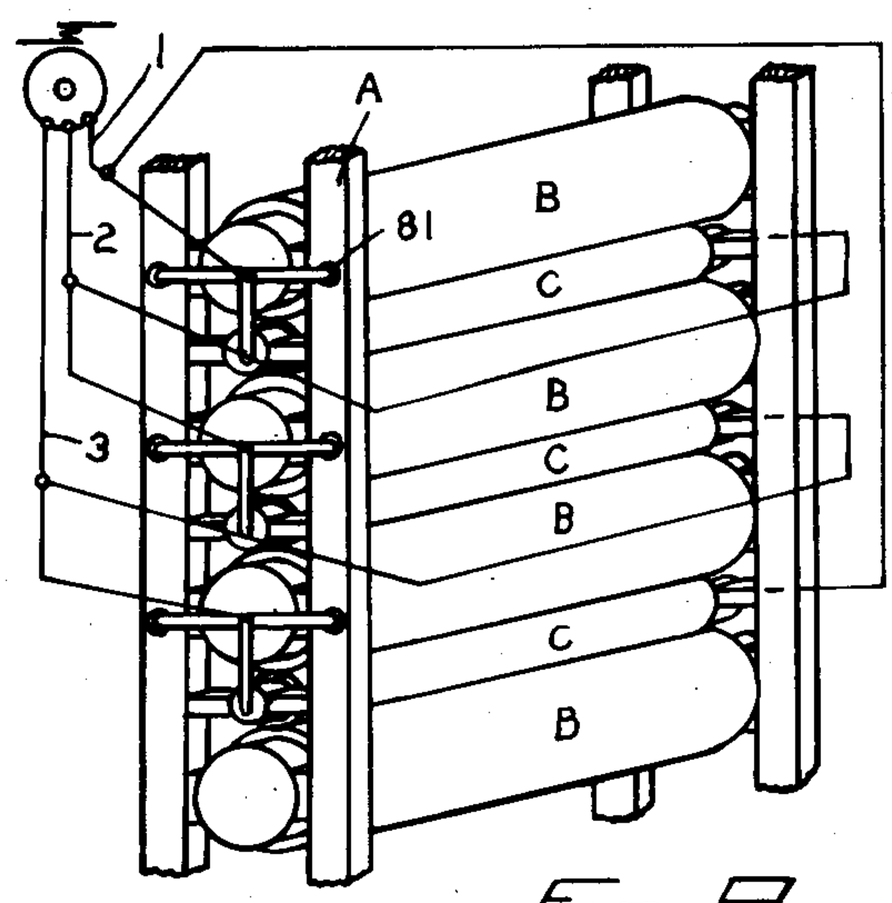


Fig 9

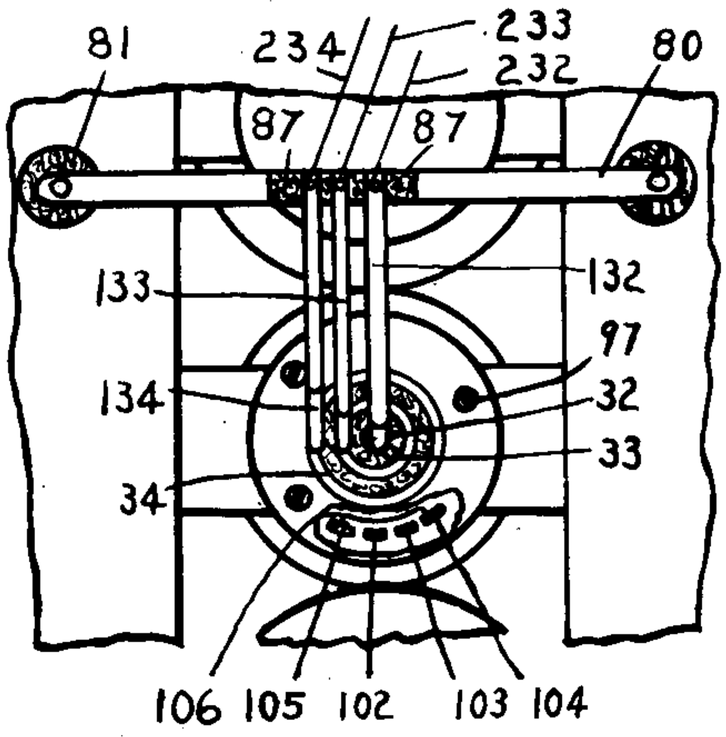


Fig. 10.

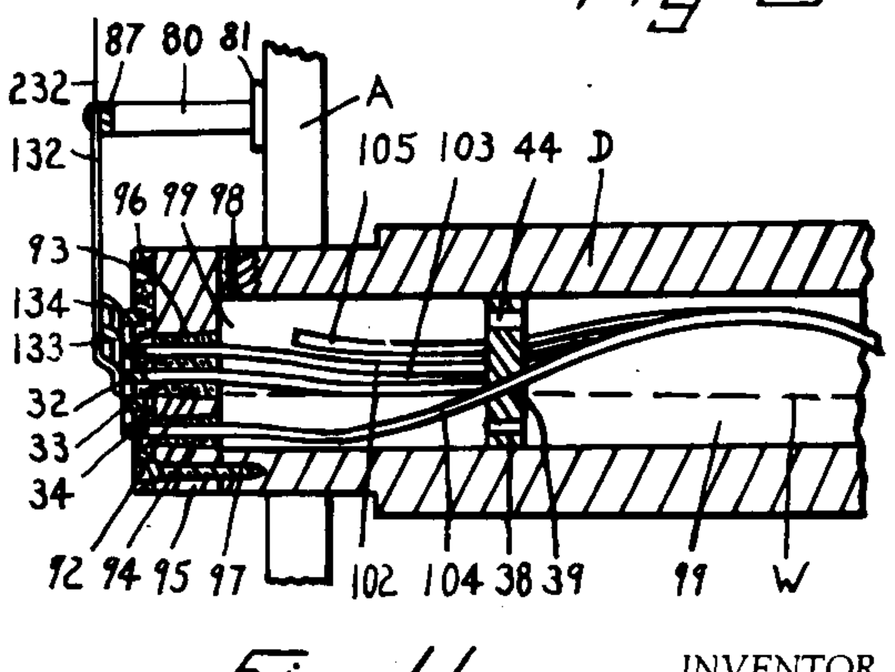


Fig. 11.

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THERMOSTATIC CALENDER ROLL

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Application April 12, 1935, Serial No. 16,011

6 Claims. (Cl. 26—39)

This invention relates to hot calender rolls such as are used especially in the finishing of cotton cloth, but it may be used for finishing woolen or any other kind of cloth, or for finishing paper or any material which for any purpose it is desired to pass over or under or around a hot calender roll.

Such rolls have been heated by steam which is passed into them through the bearings, and have also been heated by a gas flame and even by hot air, but the objection to such methods is that the steam leaks through the joints and other heating methods cannot be controlled.

The general idea of this device is to provide a roll, preferably of heat conducting material, in which there is a normally sealed compartment, preferably cylindrical and concentric with the roll, and to introduce into this compartment through an opening, which is afterwards sealed, a pre-determined amount of water or other liquid which is a conductor of electricity while liquid, but a non-conductor when turned to vapor.

By varying the amount of liquid introduced, the temperature at which it becomes vapor and breaks the circuit can be pre-determined and the device, therefore, acts like a thermostat and will maintain the heat of the roll at practically the same temperature, which can be pre-determined.

When the heat of the electric current, passing between the electrodes and through the liquid, has sufficiently vaporized it so that the circuit is broken, the pre-determined temperature will be maintained until it is gradually reduced to a point where the vapor becomes again liquid and again closes the circuit.

Preferably a pre-determined amount of liquid is inserted into the roll and the current is turned on until the compartment is wholly filled with vapor, such as steam, and the filling opening is then hermetically sealed so that when and if the vapor, such as steam condenses, there remains a liquid and a vacuum.

By the use of a suitable schedule, the ratio of the quantity of liquid introduced to the size of the compartment determines the temperature and pressure at which it will become sufficiently vaporized to break the circuit and shut off the current.

As all parts are completely sealed, I can secure a higher temperature, which also means a higher pressure, than is possible by the use of steam, because with steam, the greater the pressure, the more difficult it is to make a tight joint.

I am aware that liquid in which electrodes are immersed has been used in steam heating radiators to maintain a substantially even temperature, but I believe that I am the first to apply the idea of electrodes for vaporizing a liquid in a sealed compartment in a revolving roll for the purpose of heating that roll and maintaining it at a pre-determined high temperature, and for providing practical devices for producing the desired result.

In the drawings, Fig. 1 is an isometric view of a bank of rolls including two hot calender rolls of my construction and showing the brushes and electrical connections diagrammatically.

Fig. 2 is a vertical longitudinal section of a hot calender roll of my construction.

Fig. 3 is a vertical section on the line 3—3 of Fig. 2.

Fig. 4 is a view similar to Fig. 3 of a modification of the arrangement of electrodes.

Fig. 5 is a view similar to Fig. 3 of another modification of the arrangement of electrodes.

Fig. 6 is an end view of a calender roll such as shown in Figs. 1 and 2 with one brush and contact at one end.

Fig. 7 is an end view of a modification in which the circuit is completed through one end of a roll.

Fig. 8 is a vertical longitudinal section of one end of a roll, similar to that shown in Fig. 7, in which the circuit is completed through one end of a roll.

Fig. 9 is an isometric diagram showing four ordinary rolls with three hot calendar rolls, wired for a three-phase circuit in which one phase goes through each roll.

Fig. 10 is a view similar to Figs. 6 and 7 of one end of a roll heated by a three-phase alternating current with brushes at one end only.

Fig. 11 is a vertical longitudinal section of a three-phase current heated roll shown in Fig. 10.

In the drawings, A represents the frame of a typical calendering machine in which there are a series of rolls, such as B, B, between and adjoining which are hot calender rolls, such as C.

10, 10 represents the bearings of rolls B, and 11, 11, of rolls C.

Each roll C, as shown, has relatively thick walls made of metal and at each end 1, 1, is reduced in size forming a neck to fit its appropriate bearing 11, and to keep it in place therein.

As shown, each of these necks projects beyond its bearing and in one end is a threaded filling hole 70 for a threaded plug P by which a suit-

able electrolyte W, such as water, can be introduced and then sealed up.

At each end there is a metal cap 2, at the center of which is an insulating tube or sleeve 3, outside of which is an insulating washer 4, the ends 2, 2 being held in place and hermetically sealing the cylindrical inside chamber 6 by means of screws 7. The inside chamber should be completely and hermetically sealed after a pre-determined quantity of water or other electrolyte has been introduced.

F, F will represent electrodes of the two-prong variety, each having a shank 20 which passes through the center of a head and through the insulating washer and sleeve, each having outside a contact knob 21 which engages a spring brush, such as K or K—1, attached to the frame A and connecting with a source of electric current E, by means of a wire 30 or 31.

Each electrode F, as shown, has two arms 23, 22, which extend almost the entire length of the chamber in the roll, and pass through and are supported by insulators L^1, or L^2, preferably made of porcelain. These insulators must have one or more rim passages, such as 40, and the holes, such as 41 and 42 for the arms of the electrodes F, F, and must be so spaced and positioned that the electrolyte W, when liquid, will contact with a positive and a negative electrode, thus closing the circuit and heating up the electrolyte.

As shown in Fig. 4, I may use single-pronged electrodes such as 51 and 52, so arranged and spaced by the insulators such as 50 on each side of a passage, that as the roll revolves, there will be an appreciable time when the electrolyte will close the circuit.

The insulator 50 is shown as having three passages, 54, 54 and 54, to permit the electrolyte to circulate freely until it is turned into vapor.

In Fig. 5 are shown two triple-pronged electrodes 61 and 62 with their prongs alternately arranged and spaced near the outside of the chamber 6 supported by insulators such as 60 with passages 64 through which the electrolyte can pass.

Different depths of the electrolyte W are shown in Figs. 3, 4 and 5, indicating that with the same chamber such as 6, in the same roll C, different temperatures can be maintained by using different quantities of liquid.

In Figs. 7 and 8, there is shown an arrangement by which the heating electrical current can pass into a heating roll such as G provided with a cap 82, through the center of which passes the end 20 of an electrode F similar to one of those shown in Fig. 2, while other electrodes 84, 84 positioned at 90 degrees from the arms of electrode F, pass through suitable insulating collars 184, and thence through an insulating cap member 85 in the form of a disk with suitable holes which serves to insulate the shank 20 of electrode F and the shank of electrodes 84 from cap 82.

80 is a suitable supporting arm for insulation 87 for the brushes 72 and 73 which engage respectively with the end knob 21 of electrode F and the conductive ring 83, with which electrodes 84, 84 connect.

The circuit is, therefore, completed through suitable wire connections ending in insulated brushes 72 and 73, thence through electrode F, ring 83 and electrodes 84, 84 and electrolyte W.

As a three-phase alternating current is highly desirable, with the arrangements such as shown in Figs. 2, 6, 7 and 8, it becomes necessary to use four pressure rolls B, B, B, B, and three hot calender rolls C, C, C, each connected to a separate phase of a three-phase current. Therefore, in many cases, I prefer to arrange for a three-phase current which passes in and out at one end of a hot calender roll as shown in Figs. 10 and 11.

D is a calender roll preferably of heat conductive material provided with a cap 95 of a similar material through which pass three plugs 92, 93, 94 of electric insulating material for the ends of the electrodes 102, 103, 104. Cap 96, of electric insulating material, also has suitable holes for the ends of the electrodes 102, 103, 104, the parts being fastened together by screws 97, 97.

32 is a contact for electrode 102 at the center of the roll and engages the brush 132; 33 is a contact ring for electrode 103 and engages a brush 133 and 34 is another contact ring for electrode 104 and engages another brush 134, these brushes being the terminals of suitable wires 234, 233, and 232, or conductors of a three-phase alternating current.

38 and 38 are insulating supports of porcelain or similar heat resisting material, each having holes such as 39 for the passage of the electrodes 102, 103, 104, and other holes 44, 44 for the passage of the water or other electrolytic material.

These electrodes 102, 103, 104 are brought fairly close together and then wound spirally around the inside of the roll D but out of contact therewith, being supported by the supports 38, 38. With this arrangement, while there is any liquid such as W in the chamber 99, which is sealed by the plug 98, the circuit between some of the electrodes 102, 103, 104 will always be closed.

With the arrangement shown in Figs. 9, 10 and 11, each calender roll can be provided with connections at one end only, or with similar connections at each end.

I claim:

1. A calender roll of cylindrical form in which is a fluid-tight compartment partly filled with liquid, a normally closed filling opening into said compartment; said roll having bearings; a source of electric current through the roll to electrodes; such electrodes so positioned near one wall of the compartment that the electric circuit from said source is closed by the liquid as the roll revolves; and a quantity of such liquid in such compartment which when turned to vapor will open said electric circuit.

2. A calender roll of cylindrical form in which is a fluid-tight compartment partly filled with liquid, a normally closed filling opening into said compartment; said roll having bearings; a source of electric current through the roll to electrodes; such electrodes being so positioned near one wall of the compartment that the electric circuit from said source is closed by the liquid as the roll revolves.

3. A calender roll of heat conducting material of cylindrical form in which is a fluid-tight concentric cylindrical compartment partly filled with liquid, a filling passage with sealing means therefor, integral bearing necks at each end of the roll, an insulated electrical conductor which passes through an end, and a heating element in said compartment which is separated from the body of the roll and connects with said electrical conductor.

4. The combination in a hot roll calendering machine of a frame including a bearing for each end of a calender roll, each bearing being associated with a brush connected with the same

source of electric current; a calender roll of heat conducting material of cylindrical form shaped at each end to revolve in and being carried by a bearing, there being in the roll a fluid-tight concentric cylindrical compartment from which extends a normally closed filling opening, two forked electrodes, one extending in from each end, each having arms spaced circumferentially from the other, and being insulated from each other and from the roll, and each being electrically connected to one of said brushes; and a sufficient quantity of electrically conductive liquid to close the circuit between the electrodes while in liquid form, and to open said circuit when turned into vapor.

5. In a hot calendering machine, a frame having bearings for a calender roll; said calender roll being of cylindrical form in which is a fluid tight concentric cylindrical compartment partly filled with liquid and a filling passage with sealing means therefor; insulation through one end; an electrode positioned proximate to but ont of contact with the inside wall of the compartment and extending through the insulation in the end to the outside where it engages an outside contact member; such outside contact member; and a brush which is attached to and is insulated from the frame and is in engagement with said outside contact member and is connected with a source of electric current.

6. In a hot calendering machine, a frame having bearings for a calender roll; said calender roll in which is a fluid tight compartment being partly filled with liquid and having a filling passage with sealing means therefor; insulation through one end; an electrode positioned proximate to the inside wall of the compartment and extending through the insulation in the end to the outside where it engages a contact member; such contact member; and an outside brush attached to and insulated from the frame in engagement with said contact member and connected with a source of electric current.

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