

Jan. 17, 1933.

J. M. KING

1,894,618

RUBBER MILL COOLING DEVICE

Filed April 29, 1929

3 Sheets-Sheet 1

Fig. 1

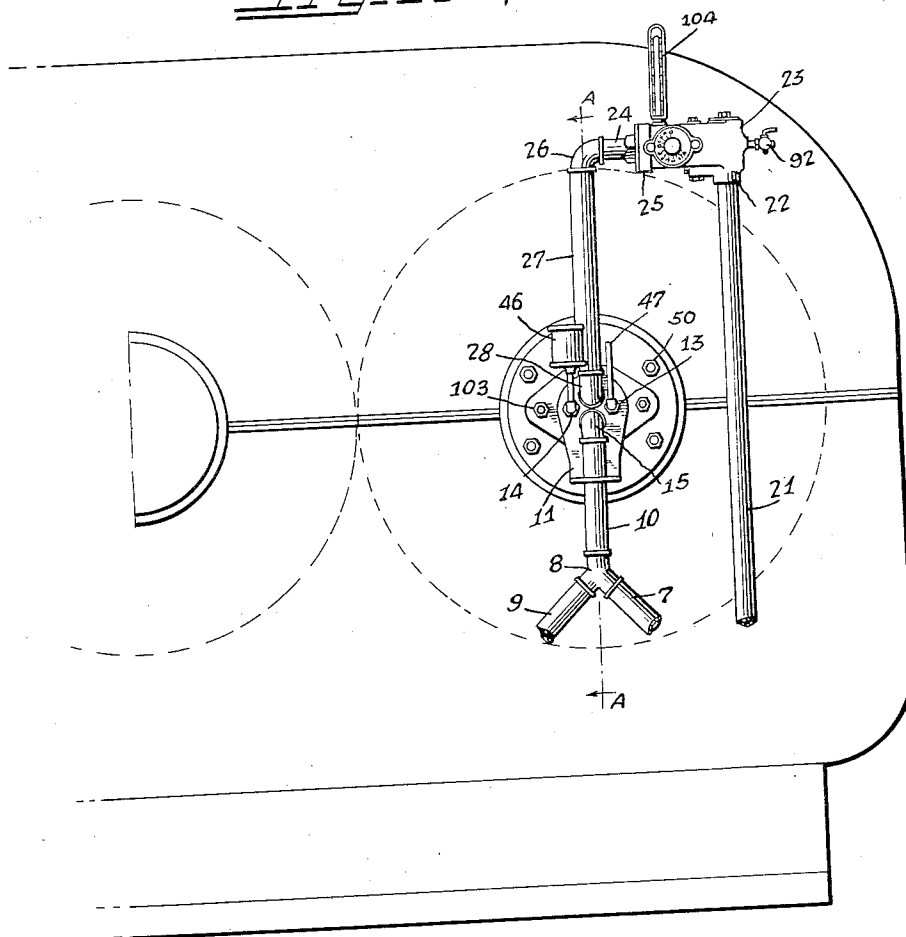
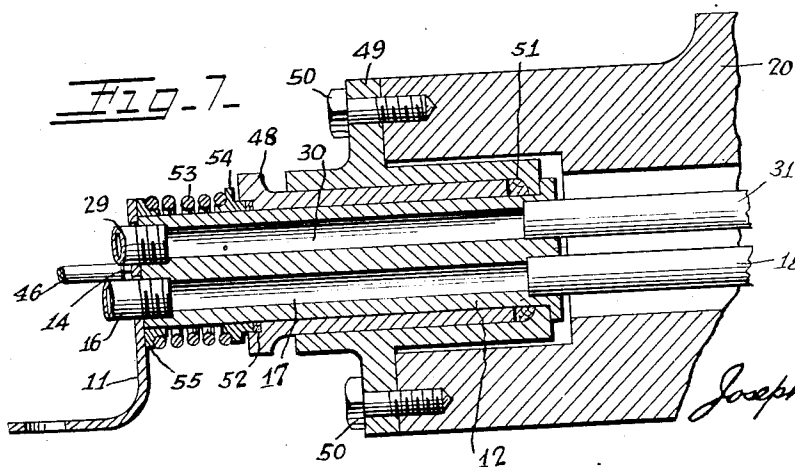


Fig. 7



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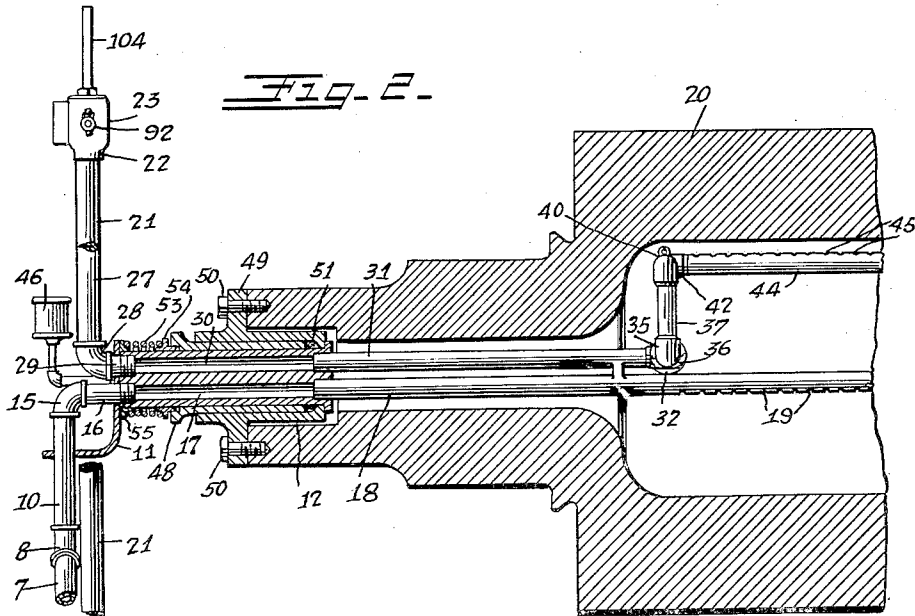
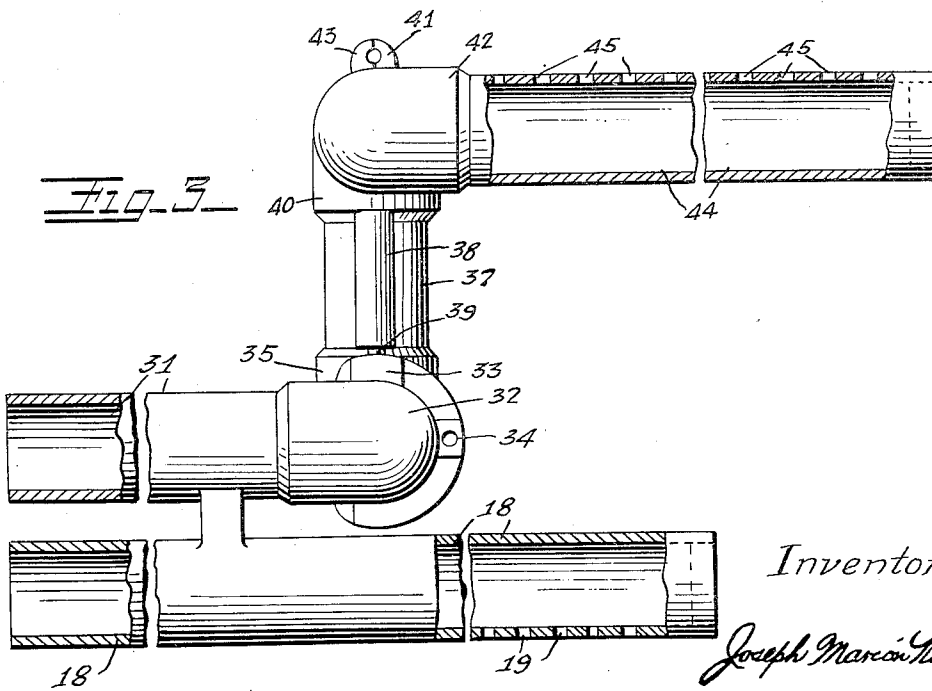
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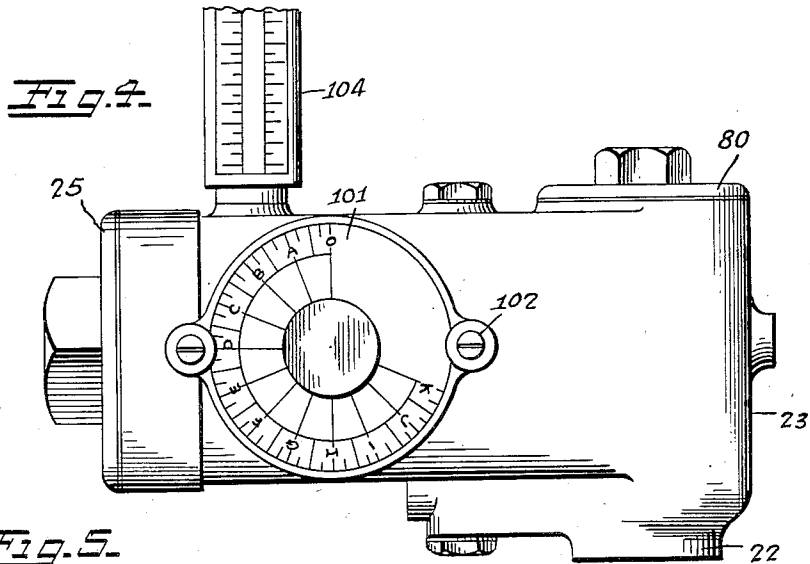
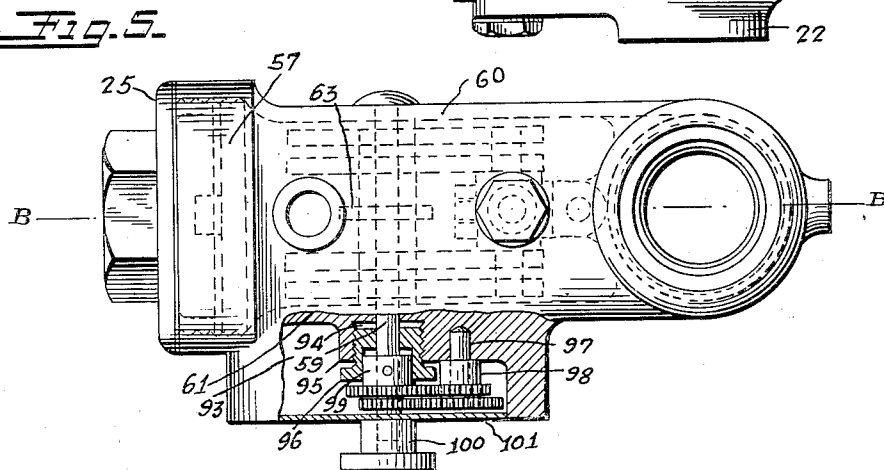
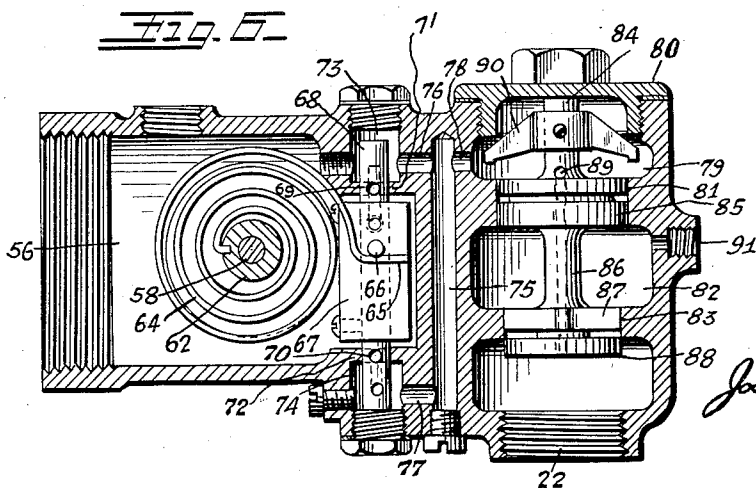
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3 Sheets-Sheet 3



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RUBBER MILL COOLING DEVICE

Application filed April 29, 1929. Serial No. 359,134.

My invention relates to temperature-regulating devices, especially for roller mills, that type employed in the manufacture of rubber and like resinous substances, for mechanisms used in rubber-coating, calendering fabrics, and the objects thereof are as follows:

The provision of a novel method of supplying and emitting the fluid cooling medium for rubber mills, whereby a great reduction in quantity of the fluid is effected;

An effective method of cooling which insures continuous operation of such rubber mills when atmospheric temperature is extremely high;

An installation of a cooling system, which by reason of the peculiar structure and organization of its members comprehends a long period of continuous operation without the necessity of repair or renewal of parts;

The automatic regulation and control of the temperature of the cooling fluid, whereby the usual manual service incident thereto is eliminated.

The invention contemplates the introduction of the cooling medium, water, under a fixed or variable pressure, to and along, horizontally, the interior center of the roller and the exit thereof from the inner top side of the roller, the inner roller-space being at all times substantially filled with water.

A novel design of flange, packing sleeve, and conduit cylinder is contemplated which provides a durable and efficient packing arrangement.

The invention further contemplates the automatic control of the water-pressure in the roller by means of the fluid temperature, which reciprocally, is affected by such pressure, by which a predetermined temperature of the mill-rollers is attainable.

That the newness and usefulness of my improvement may be readily observed, and that its distinguishing features may be emphasized, permission is sought to briefly describe the cooling method of rubber mills now universally employed. The common method comprehends a water conduit, mounted concentrically and longitudinally in the interior of the roller and made connective with an ex-

ternal source. An exit for the water, which is heated by the frictional operation of the mill, is provided also approximately concentrically with the roller, the passage being formed around and contiguous to the inlet conduit.

It will be noted that in the common method described, the interior of the roller cannot be filled with water because of the provision for its exit, that the upper half of the rotating roller is always out of contact with the cooling medium. An excessive quantity of water is therefore required, especially so, when atmospheric temperature is high, at which time it is found impractical to obtain continuous operation of the mill.

In the common method, the regulation of the temperature of the rollers is dependent on the manipulation of the water supply. Inasmuch as the quantity and character of the raw material fed to the mill varies, a correspondingly variable temperature is imparted to the cooling medium, which necessitates practically continuous adjustment of the water supply. Therefore, in large plants, corps of operatives, with trained hands to determine the heat of the rubber rollers are employed to manually regulate the water supply.

Now it is well known to the art to which my invention appertains, that a certain, uniform roller-temperature is essential to the ideal performance of a rubber mill, that under such preferred condition a superlative quality and maximum quantity are produced. It is believed such essential feature is attained in my invention, which herein-after is more particularly described and illustrated in the accompanying drawings.

Referring to the drawings:

Figure 1 is a broken view of an end elevation of a rubber mill, illustrating one of the rollers equipped with a novel cooling device, embodying the invention.

Figure 2 is a longitudinal section of a partly cut-away roller, on the line A—A of Fig. 1, disclosing the method of internal piping, the ingress and egress of the cooling medium.

Figure 3 is a detail view of a gravity lock.

Figure 4 is a side elevation of the temperature-regulating device.

Figure 5 is a plan view of the temperature-regulating device, partly in section, showing its internal members, its graduated disc and set-gears.

Figure 6 is a longitudinal section of the temperature-regulating device on the line B-B of Fig. 5 illustrating thermo-metal spirals mounted on a movable shaft, a compound valve and fluid passages leading therefrom to a pressure chamber. A piston-valve mounted in a seat and a final fluid exit.

Figure 7 is an enlarged sectional view of the water supply connections through the roller bearing.

Throughout the various drawings like numerals denote like parts.

Numeral 7 designates a water conduit equipped with a shut-off valve, not shown, leading from a water source, not shown, to a Y connection 8. A conduit 9 having a shut-off valve, not shown, leading from a steam source, not shown, also connects with the said Y. A conduit 10, communicable with the Y 8 leads vertically through a closely fitting opening in a steadying brace 11, which is held in rigid connection to a cylindrical member 12 by means of recessed cap screws 13 and 14.

An elbow 15 is mounted on the end of the conduit 10 and made connective by a nipple 16 with an outlet opening 17 machined longitudinally in and throughout the length of the cylindrical member 12. A conduit 18 having a series of outlet openings 19 formed in and along a portion of its bottom side, is fixedly mounted in horizontal position in the opposite end of the recess 17 of the said cylindrical member leading into the interior of a roller 20.

A drain conduit 21 leading, vertically, from a waste receptacle, not shown, is made connective with an outlet 22 of a temperature control device 23. A conduit 24 is horizontally mounted in the inlet end 25 of the device 23 and by means of an elbow 26 is made communicable with a conduit 27 leading downwardly therefrom to an elbow 28, which by means of a nipple 29 is made connective with an outlet opening 30 machined in and throughout the length of the cylindrical member 12, such opening being parallel with that of opening 17.

An out-flow conduit 31 is fixedly mounted in the opposite end of the opening 30 in horizontal position, leading into the interior of the said roller. On the end of the out-flow conduit 31 is rigidly positioned an elbow 32, provided with a lock-recess 33 and a stop 34. By means of a nipple the elbow 32 is movably connected with an elbow 35, having a stop 36, in which elbow is mounted a conduit 37, having a longitudinal recess 38 formed on its exterior surface, in which is carried a locking rod 39 adapted to move freely under the influ-

ence of gravity, and when in a vertical position to fall either to or from the recess 33 of the elbow 32, thus constituting a lock operable by the force of gravity.

An elbow 40 having a stop 41 is fixedly mounted on the opposite end of the conduit 37 and by means of a nipple is movably connected with an elbow 42 having a stop 43. A conduit 44 is fixedly positioned in the elbow 42 and adapted to remain in a horizontal position when the conduit 37 is vertical and the locking rod 39 is gravitationally held in the recess 33. A series of inlet holes 45 is formed in the top side of the conduit 44, for the ingress of heated water, the fixed position of the said conduit being always parallel with and adjacent to the inner top surface of the roller 20.

When in an upright position the locking rod 39 falls into the recess 33, thus maintaining a vertical, upright position of the conduit 37. The stop 36 of the elbow 35 contacts with the stop 34 of the elbow 32 when the conduit 37 assumes an upright position. The stop 41 of the elbow 40 and the stop 43 of the elbow 42 contact when the conduits 37 and 44 move 90° out of a straight line in relation to each other. Longitudinal oil-ways, not shown, are machined in the cylindrical member 12, parallel with the openings 17 and 30 and have each a lateral opening, not shown, to the surface of the cylindrical member, which is suitably grooved, not shown, to facilitate lubrication, the said oil-ways being connective with the recessed cap screws 13 and 14 respectively.

An oiling receptacle 46 is positioned in one of the recessed cap screws, and an air outlet stand-pipe 47 is mounted in the other. The cylindrical member 12 which is adapted to remain stationary, is inclosed by a packing sleeve 48, which is adjustably positioned in a housing flange 49, the said flange being held in fluid-tight relation with and to the end of the roller 20 by means of stud bolts 50, the said packing sleeve and housing flange being adapted to rotate with the said roller. A packing space 51 provided at the inner end of the packing sleeve 48 and surrounding the cylindrical member 12 is, when packed, designed to hold in leak-proof relation members 12, 48, and 49.

A recess 52 is formed in the exterior end of the packing sleeve 48 for the retention of packing, which is purposed to seal in fluid-tight relation the exterior adjoining surfaces of the said packing sleeve and cylindrical member 12, the said packing being held in position with yielding resistance by a helical spring 53 surrounding the cylindrical member 12 and mounted on spring carriers 54 and 55, the said helical spring serving also to hold the member 12 against the interior end of the housing flange 49.

The temperature-regulating device 23 com-

prises a receptacle, approximately parallelogrammatic in form, having an inlet cap 25, which is removably attachable to the main body 56 by means of screw-threads. A perforated disk 57 covered with a suitable wire screen, not shown, is removably positioned in the inlet end of the said body by screw-thread engagement. An outlet 22 is formed in the opposite end of the body 56 and provided for screw-thread engagement with a drain conduit. A bearing 58, for the reception of a set-rod 59 is machined laterally in the walls 60 and 61 of the body 56, such bearing being horizontal and approximately central with the longitudinal side of the said body. A spiral-shaft 62, centrally recessed in its length, is mounted on the set-rod 59 and held in fixed engagement therewith by means of a dowel pin 63 positioned laterally through the center of the said shaft and rod.

A plurality of thermo-metal spirals 64 are fixedly positioned on the spiral-shaft 62, the free ends 65 thereof being fashioned to contact with lifting rods 66 positioned in a stabilizing member 67, whose longitudinal center is drilled for the reception of a vertical, compound valve 68, comprising a cylindrical rod having apertures 69 and 70 machined near its top and bottom ends respectively. A suitable portion is cast integrally with the body 56 in which seats 71 and 72 are formed concentrically one above the other for the reception of the compound valve 68, the aperture 69 registering with the seat 71 and the aperture 70 registering with the seat 72. Recesses 73 and 74, communicable with the valve seats 71 and 72 respectively, are formed concentrically with the said valve seats and are made connective with a passage 75 formed vertically in the body 56, by openings 76 and 77. A passage 78 communicable with the passage 75 is made connective with a pressure chamber 79 inclosed by a removable threaded member 80, the said chamber being formed in the outlet-end portion of the body 56.

An annular piston-way 81 is vertically machined in the body 56 contiguous to the pressure chamber 79 and opening to the interior 82 of the said body. An annular valve seat 83 having like center with the piston-way 81 is machined in the said body, contiguous to the outlet 22 and opening to the said interior of the body. A piston-valve 84, comprising a spider 85, stem 86, guide 87, valve 88, and an escape vent 89, is mounted in the said piston-way and valve seat and adapted to form leak-proof relation therewith. A stop 90 is designed to limit the downward movement of the said piston-valve. The escape vent 89 provides a longitudinal opening in the stem 86 adapted to communicate with the pressure chamber 79 and the outlet 22. An opening 91 is formed in the end wall and made connective with the interior 82, the said open-

ing being suitably threaded for the reception of a stop-cock 92, adapted to serve as a pilot.

The compound valve 68 is of the balanced type. When moved upward out of its normal, closed position, an exudation of water from the aperture 69 near the top-end occurs, the water making its ingress through an opening in the valve rod to the said aperture, while an equal water-flow will enter the aperture 70 near the bottom-end and make its exit therefrom through an opening in the valve rod leading from the said aperture, the flow being to the pressure chamber 79. The set-rod 59 carrying the spiral-shaft 62 passes on through the wall 61 of the body 56 into a gear chamber 93 formed on the exterior of the said wall. An opening 94 surrounding the set-rod 59 is formed in a boss 95 positioned in the gear chamber 93, the said opening being threaded, and when packed, adapted by means of a packing nut 96 to maintain a leak-proof connection with the said set-rod and its bearing 58.

A spindle 97 is fixedly positioned in the boss 95, on which is mounted a hub 98 carrying a gear and a pinion. A hub 99 securely pinned to and positioned on the set-rod 59 is provided with a gear which meshes with the pinion attached to the hub 98. A hub 100, on which is fixedly positioned a graduated disk 101, and carrying a pinion, is also mounted on the set-rod 59, the said pinion meshing with the gear carried by the hub 98. Filister screws 102 are positioned at opposite sides of the gear chamber 93 as retaining guides for the said graduated disk. The purpose of the gear arrangement is to relatively multiply the movement of the graduated disk to make available close adjustments.

The area of the spider 85 of the piston-valve 84 is made greater than that of the valve 88; fluid under pressure, therefore, will exert more pressure on the piston than that applicable to the valve; the valve thus tends to remain closed. The flow of fluid to the pressure chamber 79 via the compound valve 68 when sufficient to overcome the fluid-loss through the escape vent 89, will build up a pressure in the said chamber greater than that which presses upwardly against the spider 85; the piston-valve 84 will then descend and unseat the valve 88 and permit a fluid-flow to the outlet 22.

Attention is especially directed to the gravity lock, which, because of the limited entrance-space to the roller, becomes, apparently, essential to the cooling method described.

The manner of installation is as follows:

The cylindrical member equipped with its conduits is introduced into the roller "upside" down and pressed inwardly until the conduit 44 contacts with the inside end wall. The said member is held with pressure in this position while the roller is rotated 180°, at

which point in the movement the locking rod 39 drops into the recess 33 and firmly locks the conduits 37 and 44 in a right angle position. The housing flange 49 is then passed over the cylindrical member and fastened to the end of the roller 20 by means of stud bolts 50, a concentric alignment first being assured by dowel pins, not shown. The packing sleeve 48 and packing for the packing space 51 are now mounted on the cylindrical member and the said sleeve adjusted tightly against the packing by means of stud bolts 103. Further proceedings of the installation are obvious.

Illustrating the manner of operation:

When initially starting the mill, the valve controlling the water supply is turned on in full and the pilot stop-cock 92 of the temperature-regulating device 23 is opened to set up a flow through the roller 20 and the said device. The steam valve is opened and kept so until the mill is sufficiently heated, when it is closed, the necessary heat thereafter being supplied by the friction incident to the manufacturing operation of the mill. The graduated disk 101 of the device 23 is set for the proper temperature, which is experimentally determined and noted by the registering of the thermometer 104. The functioning will then be as follows:

A diminutive water-flow is maintained by the pilot until the predetermined temperature is reached, when the thermo-spirals will begin to lift the compound valve. The exuding water from the compound valve then enters the pressure chamber and presses down the piston-valve. The flow from the opening of the valve seat 82 gradually increases until it becomes copious, and then suddenly diminishes to a small variable stream. This action is produced by the excessively hot water in the roller, which when passing the thermo-spirals causes pronounced expansion of the thermo-spirals and a corresponding elevation of the compound valve. The influx of the cold water, however, readily sets up a cooling process which causes rapid contraction of the thermo-spirals. The piston-valve, responding to the falling pressure in the pressure chamber, rises to a point of valve-opening when a small variable stream becomes constant, such variability of flow being the reciprocal of the varying temperature imparted to the cooling medium by the changing character and quantity of raw material being fed to the machine. The mercury in the thermometer, however, is but slightly affected by this condition, there being not more than two degrees fluctuation.

What I claim as new is:

1. A cooling device for roller-mills comprising a member mounted in an end-portion of a roller communicable via a passage with a fluid cooling-chamber formed in the said

roller, an external supply conduit communicable with the said member and fluid cooling-chamber, an internal emitting-conduit connective with the said member and an external drain-conduit, an upright inlet-conduit positioned in the top side of the said fluid cooling-chamber and made connective with the said emitting-conduit and means to hold the said conduits in releasable fixed position.

2. A cooling device for roller-mills comprising a member mounted in an end-portion of a roller communicable via a passage with a fluid cooling-chamber formed in the said roller, an external supply conduit communicable with the said member and fluid cooling-chamber, an internal emitting-conduit connective with the said member and an external drain-conduit, an inlet-conduit positioned along the top surface of the said fluid cooling-chamber and made connective with the said emitting-conduit by an upright-conduit and means to hold the said conduits in releasable fixed position.

3. A cooling device for roller-mills comprising a member mounted in an end-portion of a roller communicable via a passage with a fluid cooling-chamber formed in the said roller, an external supply conduit communicable with the said member and fluid cooling-chamber, an internal emitting-conduit connective with the said member and an external drain-conduit, an upright inlet-conduit positioned in the top side of the said fluid cooling-chamber and made connective with the said emitting-conduit and held in releasable fixed position therewith by means of a locking rod slidably mounted in a recess formed on the exterior surface of the said upright inlet-conduit and adapted to be gravitationally held in a lock-recess formed in a connecting part of the said emitting-conduit.

4. A cooling device for roller-mills comprising a member mounted in an end-portion of a roller communicable via a passage with a fluid cooling-chamber formed in the said roller, an internal influx-conduit positioned in the said fluid cooling-chamber and provided with openings along its lower side and made connective with the said member and an external supply-conduit, an internal emitting-conduit connective with the said member and an external drain-conduit, an inlet-conduit provided with openings along its upper side positioned along and adjacent to the top side surface of the said fluid cooling-chamber and made connective with the said emitting-conduit by an upright-conduit and means to hold the said conduits in releasable fixed position.

5. A cooling device for roller-mills comprising a conduit-member mounted in an end-portion of a roller communicable with a fluid cooling-chamber therein, the said conduit-member adapted to supply the said cooling-chamber with fluid and to emit the said

fluid from the top side surface of the said cooling-chamber; a receptacle having an inlet and an outlet, an outlet-valve, a balanced valve and a thermo-metal-member, the said outlet-valve adapted to open and close by internal fluid pressure in response to movement of the said balanced valve, the said balanced valve adapted to be moved by the said thermo-metal-member when subjected to heat.

6. A cooling device for roller-mills comprising a member mounted in an end-portion of a roller communicable via a passage with a fluid cooling-chamber formed in the said roller, an external supply conduit communicable with the said member and fluid cooling-chamber, an internal outlet-conduit connective with the said member and an external drain-conduit, an upright inlet-conduit positioned in the top side of the said fluid cooling-chamber and made connective with the said outlet-conduit and means to hold the said conduits in releasable fixed position.

7. A cooling device for roller-mills comprising a member mounted in an end-portion of a roller communicable via a passage with a fluid cooling-chamber formed in the said roller, an external supply conduit communicable with the said member and fluid cooling-chamber, an internal outlet-conduit connective with the said member and an external drain-conduit, an inlet-conduit positioned along the top surface of the said fluid cooling-chamber and made connective with the said outlet-conduit by an upright-conduit and means to hold the said conduits in releasable fixed position.

8. A cooling device for roller-mills comprising a conduit-member mounted in an end-portion of a roller communicable with a fluid cooling-chamber therein, the said member adapted to supply the said cooling-chamber with fluid and to emit the said fluid therefrom; interposed in the emitting passage a receptacle having an outlet-valve adapted to be actuated by pressure of the said cooling-chamber; and controlled and regulated by thermo-metal when subjected to heat.

9. A cooling device for roller-mills comprising a member mounted in an end-portion of a roller communicable via a passage with a fluid cooling-chamber formed in the said roller; an internal-supply-conduit mounted in the said member and positioned in the said fluid cooling-chamber, the said internal supply-conduit provided with openings along its lower side for the egress of fluid and made connective with an external-supply-conduit; an internal-drain-conduit mounted in the said member and made connective with an external-drain-conduit, an inlet-drain-conduit provided with openings along its top side for the ingress of fluid positioned along and adjacent to the interior top surface of the said fluid cooling-chamber and made con-

nective with the said internal-drain-conduit by an upright-conduit and means to hold the said conduits in releasable fixed position.

10. A cooling device for roller-mills comprising a conduit-member having a thrust-bearing end, the said conduit-member mounted in an end-portion of a roller and communicable with a fluid cooling-chamber formed in the said roller; an external supply conduit communicable with the said conduit-member and fluid cooling-chamber; an internal emitting-conduit connective with the said conduit-member and an external drain-conduit; an upright inlet-conduit positioned in the top side of the said fluid cooling-chamber and made connective with the said emitting-conduit; a housing-flange fixedly positioned to the end of the said roller for the reception of the said conduit-member, whose thrust-bearing end is adapted to form a ground-joint with the interior end of the said housing-flange.

11. A cooling device for roller-mills comprising a conduit-member having a thrust-bearing end, the said conduit-member mounted in an end-portion of a roller and communicable with a fluid cooling-chamber formed in the said roller; an external supply conduit communicable with the said conduit-member and fluid cooling-chamber; an internal emitting-conduit connective with the said conduit-member and an external drain-conduit; an inlet-conduit positioned along the top surface of the said fluid cooling-chamber and made connective with the said emitting-conduit by an upright-conduit; a housing-flange fixedly positioned to the end of the said roller for the reception of the said conduit-member, whose thrust-bearing end is adapted to form a ground-joint with the interior end of the said housing-flange, the said housing-flange adapted to rotate with the roller and the said conduit-member to remain stationary.

12. A cooling device for roller mills comprising a conduit-member mounted in an end-portion of a roller communicable with a fluid cooling-chamber formed in the said roller, the said conduit-member adapted to supply fluid to the said fluid cooling-chamber and to emit the said fluid therefrom; an outlet valve interposed in the emitting passage adapted to be actuated by pressure of the cooling medium and controlled and regulated by a thermostatic element in response to change of temperature.

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