March 7, 1933. H. K. HITCHCOCK 1,900,556

ROLL FOR MOLTEN GLASS AND THE PROCESS OF COOLING THE SAME

Filed Jan. 17, 1928 3 Sheets-Sheet 1

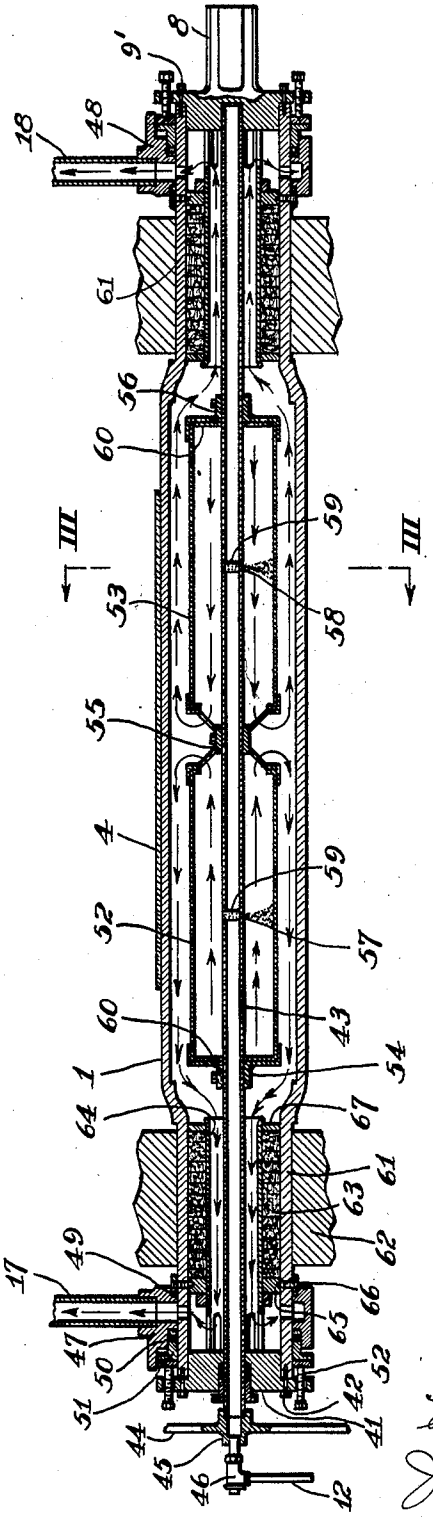

Fig. 1.

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Fig. 2.

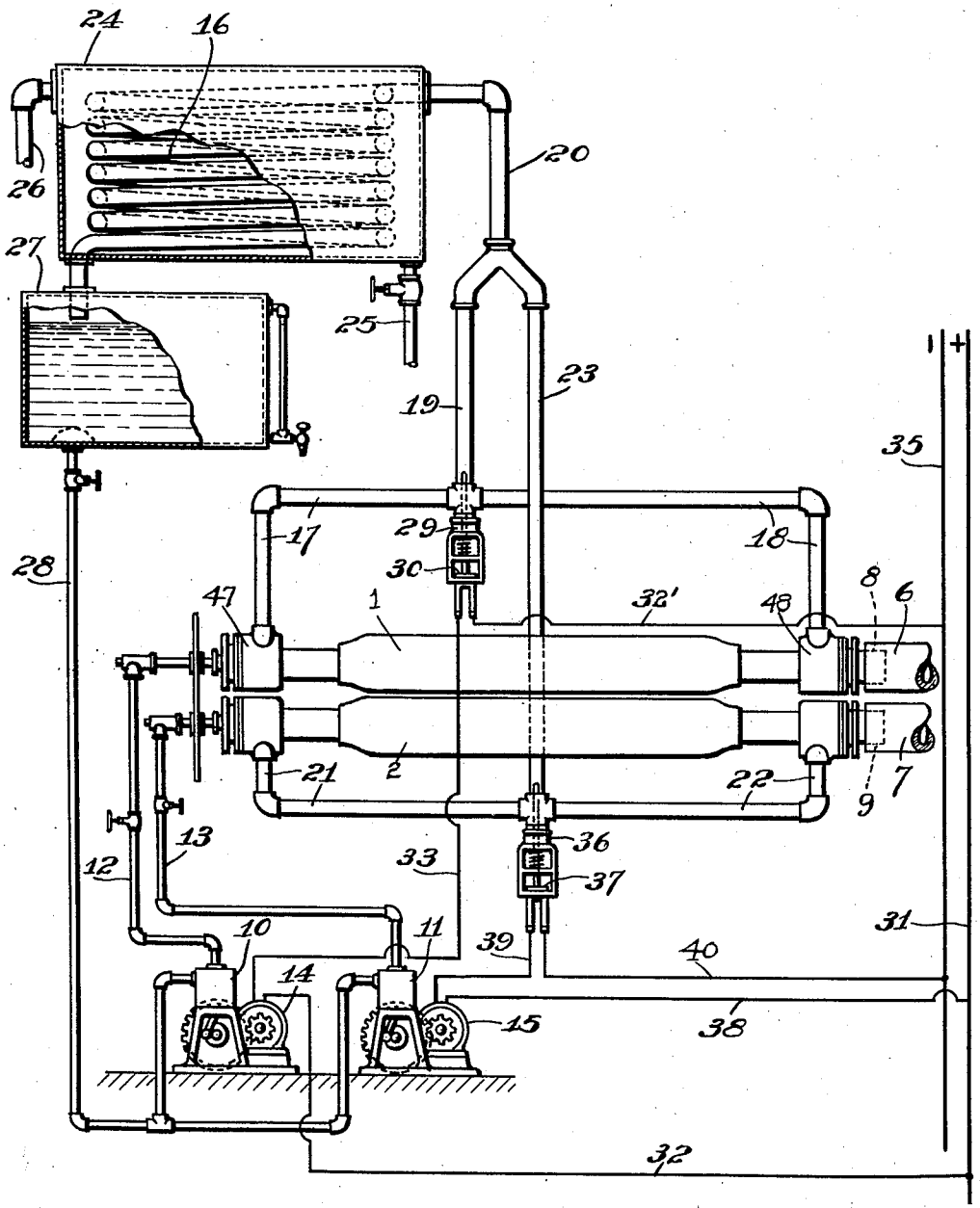

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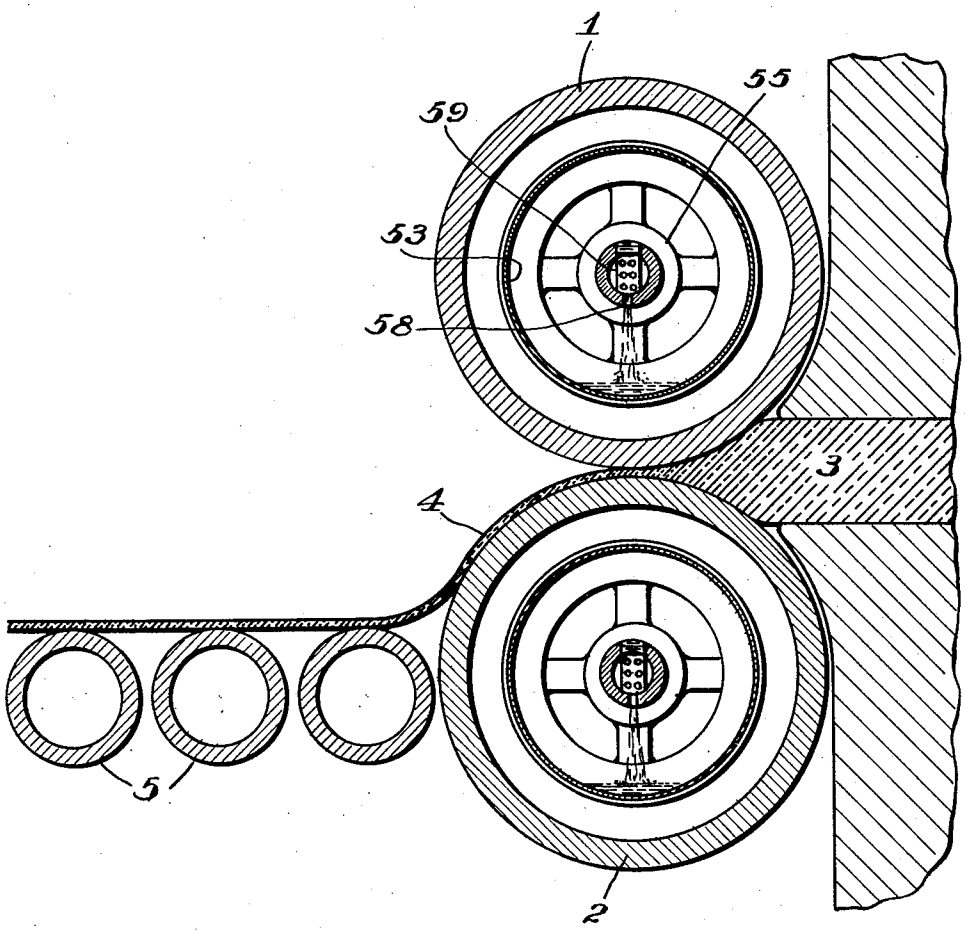
Fig. 3.



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UNITED STATES PATENT OFFICE

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ROLL FOR MOLTEN GLASS AND THE PROCESS OF COOLING THE SAME

Application filed January 17, 1928. Serial No. 247,368.

The invention relates to fluid cooled rolls, designed particularly for use in forming glass into a sheet or series of sheets, although not limited to use in such relation. The invention has for its principal objects the provision of a roll and a process for cooling it in which water can be used to the best advantage as a cooling fluid; which can be cheaply constructed with a relatively thin wall, so that any tendency to warp under widely diverging temperatures inside and outside the casing is reduced to a minimum; which has a cooling capacity over a wide range of temperatures; which can be closely adjusted to give any desired cooling effect, and which can be maintained substantially uniform in temperature throughout its length. One embodiment of the invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a longitudinal section through one of the rolls. Fig. 2 is a general arrangement showing the circulation system. And Fig. 3 is a vertical section through a pair of the rolls in position of use, such section being taken at the position III—III of Fig. 1.

Referring to the drawings, 1 and 2 are the casings of a pair of rolls located opposite the slot 3 of a melting tank, the glass being sized by the rolls and formed into the sheet 4 which passes over a runway 5 and through an annealing leer, not shown. The rolls are similar in construction and are driven from the tumbler shafts 6 and 7 (Fig. 2), such shaft fitting over the squared connections 8, 9 on the ends of the rolls. These connections are flanged, as indicated in Fig. 1, and form the closures of the roll casings 1 and 2, being secured in position by means of the stud bolts 9'.

Water is supplied to the ends of the casings 1 and 2 by means of the pumps 10 and 11 connected to the left hand end of the rolls by means of the pipes 12 and 13, the pumps being driven from the electric motors 14 and 15, which are automatically controlled, as hereinafter described. The water which is supplied to the rolls is converted into steam and is conducted from the ends of the rolls to the condenser coil 16 through the connections 17, 18, 19, 20, 21, 22 and 23, as indicated in Fig. 2. The coil 16 is cooled by circulating water through the tank 24 by means of the supply pipe 25 and the overflow pipe 26. The water condensed in the coil 16 is supplied to the tank 27, and it is from this tank that the pumps 10 and 11 are supplied through the pipe 28.

A system is thus provided for steam cooling the rolls and continuously reusing the water so as to reduce the amount of waste to a minimum. The steam which passes from the pipes 17 and 18 to the pipes 19 flows past a sylphon regulator 29, which in turn controls a pressure rheostat 30, and this pressure rheostat is located in the circuit 31, 32, 33, 32' and 35 which also includes the armature of the motor 14, so that an automatic control of the speed of this motor is secured. If the temperature of the steam supplied from the roll 1 rises above a given point, the sylphon regulator expands, applying greater pressure to the discs of the compression rheostat 30, so that the flow of current through the armature of the motor is increased and the motor speeds up, thus supplying more water to the roll and reducing its temperature and also the temperature of the steam flowing from the roll. In a similar manner, the steam flowing from the pipes 21 and 22 to the pipe 23 passes a sylphon regulator 36, which controls a pressure rheostat 37 lying in the circuit 31, 38, 39, 40 and 35, which includes the armature of the motor 15.

The construction of the rolls will be seen by reference to Fig. 1, the casing 1, as heretofore pointed out, being closed at one end by the tumbler connection 8, and at the other end by the plate 41 secured in position by means of the stud bolts 42. Extending through the plate 41 is the water supply pipe 43, such pipe being closed at its other end and extending into the tumbler shaft connection, as indicated in the drawings. This tube is held against rotation by means of the bracket 44, which has its hub 45 screw threaded to the end of the pipe 43. The bracket 44 is secured to some part of the fixed framework of the machine, not shown. A connection is made to the pipe 43 from the water supply pipe 12

(Fig. 2) by means of the angle connection 46. The outlet pipes 17 and 18, by means of which the steam formed in the casing is conducted back to the condenser coil, are connected to the swivels 47 and 48 mounted upon the casing and made tight by means of the packing 49 and 50, the latter being engaged by the gland 51, which is tightened by bolts 52 extending through the flange of the plate 41. The swivel 48 is made tight by similar means. Secured upon the tube 43 intermediate its ends are the flash tubes 52 and 53, preferably of relatively thin copper held in position by means of the spiders 54, 55 and 56. The walls of the pipe 43 are perforated, as indicated at 57 and 58, so that the water carried by the pipe is projected in the form of sprays against the walls of the flash tubes, 52 and 53. Two of these spray openings are shown, but any number may be provided and screens 59 are preferably provided in opposition to the spray openings in order to prevent solid matter from being carried to the interior of the roll casing.

The roll casing is heated to a relatively high temperature by the glass passing thereover, so that the flash tubes 52 and 53 become heated to a point such that the water which impinges upon them from the sprays 57 and 58 is converted into steam. The outer ends of the flash tubes are preferably closed by means of plates 60, 60 so that the steam which is formed upon the interior of the flash tubes flows toward the center of the roll, as indicated by the arrows, passing outward at the ends thereof and then circulating to the ends of the rolls and emerging through the pipes 17 and 18. The steam as formed in the flash tubes is saturated and in its passage from the center of the roll to the ends thereof outside of the flash tubes, it provides a cooling effect upon the casing 1 and by the time it reaches the pipes 17 and 18 is converted into dry, superheated steam. By regulating the amount of water vaporized in the flash tubes, the temperature of the casing 1 in contact with the glass sheet may be regulated to give the temperature most suitable and one which will chill the glass to the desired extent. The use of the flash tubes prevents the water supplied to the roll from coming directly into contact with the casing 1 and this is desirable, as the direct contact of the water with the highly heated casing 1, would cause an uneven chilling and tend to cause cracking and warping. Since saturated steam is used as a cooling medium for the casing 1 instead of water, this casing may be made relatively thin, so that the difference in temperature between the outer surface of the casing and the inner surface is reduced to a minimum and this also reduces any tendency to warping, since a thick wall with widely diverging temperatures upon the two sides provides a condition which has been found most conducive to warping the roll, so that its outer surface no longer constitutes a true cylinder and glass of an uneven thickness is produced, as the rolls will be closer to each other at certain points than at others when warped.

In order to protect the portions 61 of the casing, at which point the bearings 62 are employed, the insulation 63 is preferably employed, such insulation being supported upon the shells 64 carried by the rings 65, such rings being secured in place by means of the screws 66. This insulation may be of any suitable kind, such as asbestos discs which are relatively non-conducting, so that the high temperature inside the shells 64 is not communicated to the portions 61 of the casing which contact with the bearings. The insulation is protected from the steam at the inner ends of the shells by the plates 67.

What I claim is:-

1. In glass rolling apparatus, the combination with a cylindrical casing adapted to contact with molten glass, of a spray pipe extending longitudinally of the casing with spray openings leading laterally therefrom, a pump driven by an electric motor for supplying water under pressure through said pipe, outlet means at the end of the casing for withdrawing therefrom the steam formed in the casing, means for condensing the steam and returning the water of condensation to the pump, and means regulated by the temperature of said steam for governing the speed of the electric motor driving said pump.

2. In glass rolling apparatus, the combination with a cylindrical casing adapted to contact with molten glass, of a spray pipe extending longitudinally of the casing with spray openings leading laterally therefrom, a pump driven by an electric motor for supplying water under pressure through said pipe, outlet means at the end of the casing for withdrawing therefrom the steam formed in the casing, means for condensing the steam and returning the water of condensation to the pump, and means regulated by the temperature of said steam for governing the speed of the electric motor driving said pump, said means comprising a thermostatically operated pressure rheostat.

3. In a cooling roll for molten glass, the combination with a cylindrical casing, of a spray pipe extending longitudinally of the casing with spray openings leading laterally therefrom, means for supplying water under pressure through said pipe, a thin metal shell interposed between the spray pipe and the inner surface of the casing, and outlet means at the end of the casing for withdrawing therefrom the steam formed when the water is sprayed into the casing and such casing is heated to a relatively high temperature.

4. In a cooling roll for molten glass, the combination with a cylindrical casing, of a

spray pipe extending longitudinally of the casing with spray openings leading laterally therefrom, means for supplying water under pressure through said pipes, a thin cylindrical shell or baffle of metal interposed between the spray pipe and the inner surface of the casing, closed adjacent the ends of the casing and open adjacent the central portion thereof, and outlet means at the ends of the casing for withdrawing therefrom the steam formed in the casing.

5. In a cooling roll for molten glass, the combination with a cylindrical casing, of a spray pipe extending longitudinally of the casing with spray openings leading laterally therefrom, means for supplying water under pressure through said pipe, and outlet means at both ends of the casing for withdrawing therefrom the steam formed in the casing, journal portions near the ends of the casing, and heat insulating means carried by the casing inside said journal portions.

6. In a cooling roll for molten glass, the combination with a cylindrical casing, of a spray pipe extending longitudinally of the casing with spray openings leading laterally therefrom, means for supplying water under pressure through said pipe, and outlet means at both ends of the casing for withdrawing therefrom the steam formed in the casing, journal portions near the ends of the casing, and heat insulating means carried by the casing inside said journal portions, said means comprising in each case a metal shell spaced away from the casing, and insulating material between the shell and the inner surface of the casing.

7. A process of cooling a hollow roll employed in rolling molten glass, which consists in conducting a supply of water to the interior of the roll, dividing the water into a plurality of streams and converting it into steam by the heat imparted to the roll from the glass preliminary to permitting such water to come into contact with the inner surface of the roll, causing the steam thus formed to contact with such inner surface, and withdrawing the steam from the end of the roll.

8. A process of cooling a hollow roll employed in rolling molten glass, which consists in conducting a supply of water to the interior of the roll, dividing the water into a plurality of streams and converting it into steam by the heat imparted to the roll from the glass preliminary to permitting such water to come into contact with the inner surface of the roll, causing the steam thus formed to contact with such inner surface, at the central portion thereof, and withdrawing the steam from the ends of the roll.

In testimony whereof, I have hereunto subscribed my name this 13 day of January, 1928.

HALBERT K. HITCHCOCK.