

Jan. 24, 1928.

1,657,212

H. K. HITCHCOCK

FLUID COOLED ROLL

Filed Jan. 14, 1927

3 Sheets-Sheet 1

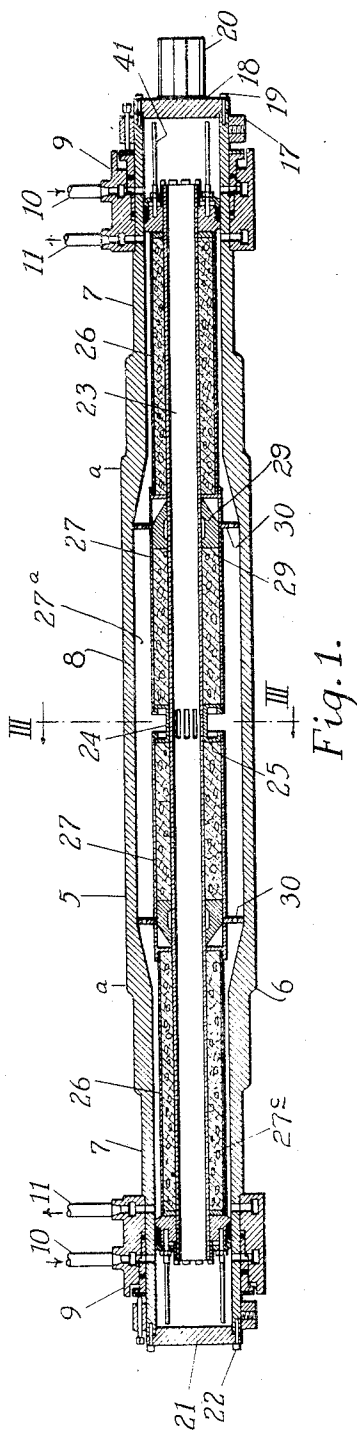


Fig. 1.

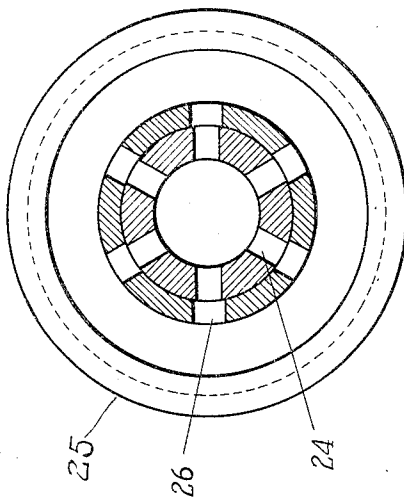


Fig. 3.

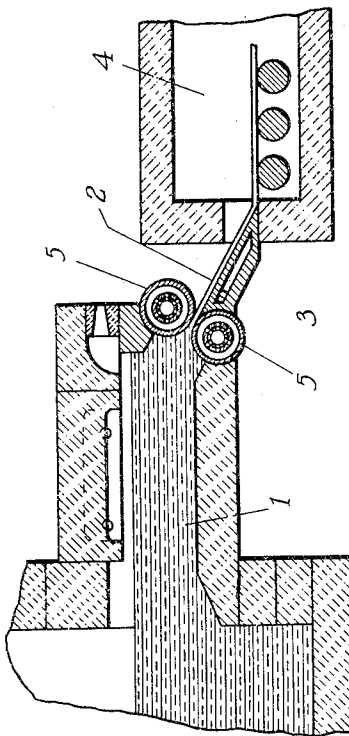


Fig. 2.

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3 Sheets-Sheet 2

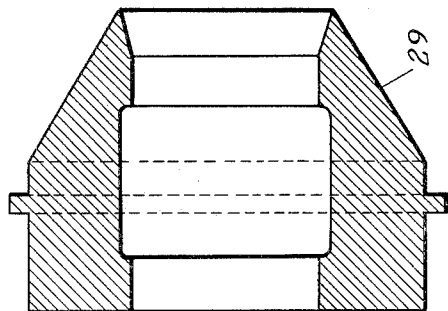


Fig. 6.

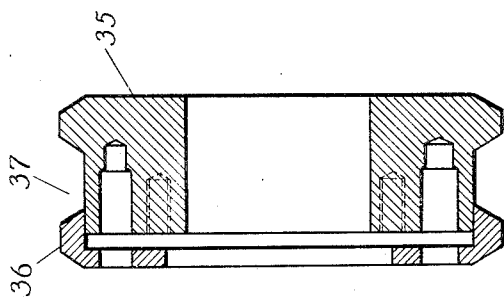


Fig. 5.

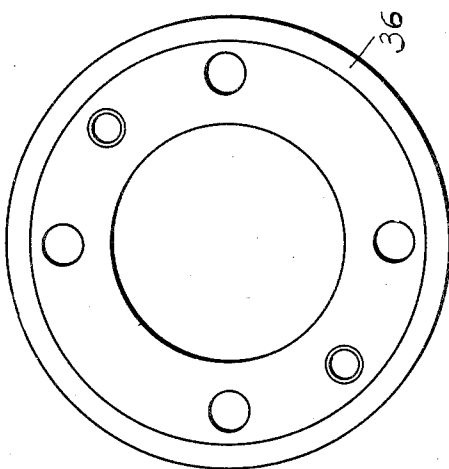


Fig. 4.

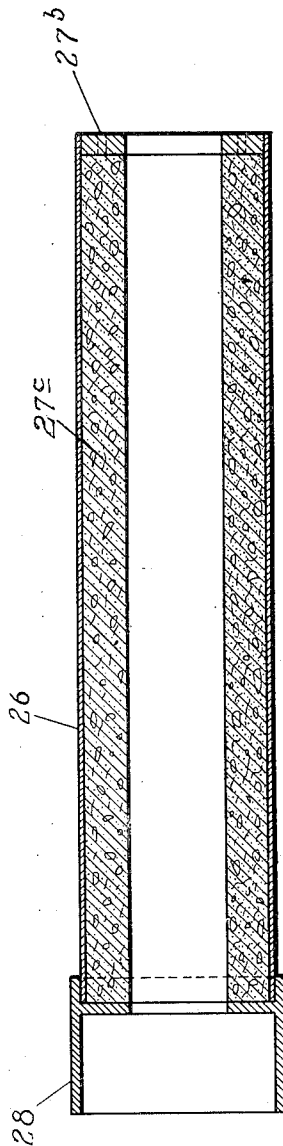


Fig. 7.

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Fig. 8.

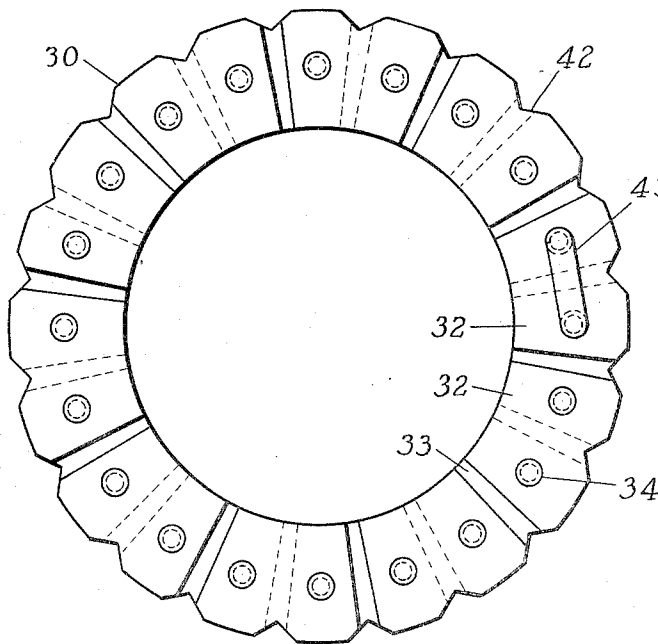


Fig. 9

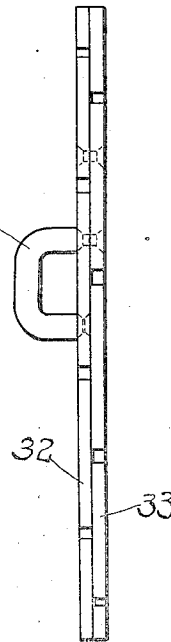
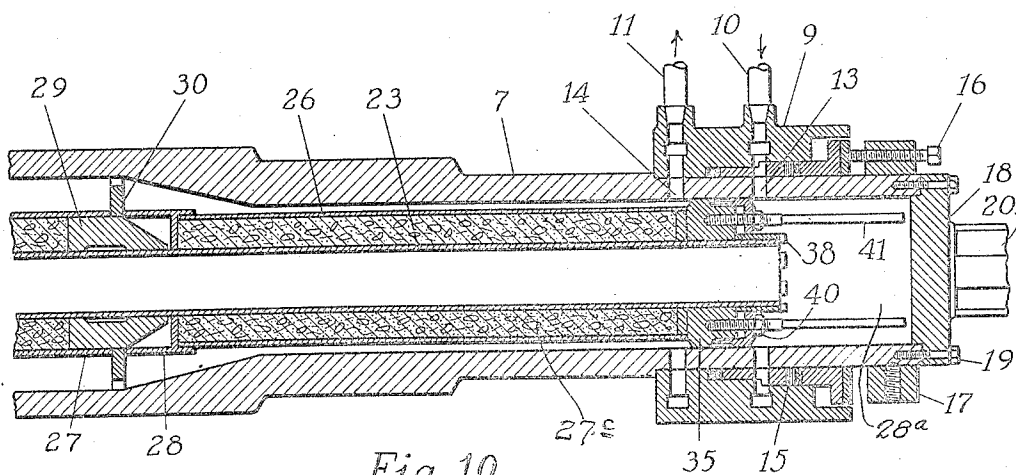


Fig. 10.

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1,657,212

UNITED STATES PATENT OFFICE.

HALBERT K. HITCHCOCK, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO PITTSBURGH PLATE GLASS COMPANY, A CORPORATION OF PENNSYLVANIA.

FLUID-COOLED ROLL.

Application filed January 14, 1927. Serial No. 161,105.

The invention relates to fluid cooled rolls for use in glass rolling or drawing apparatus, such as that shown in the patent to Frederick Gelstharp No. 1,560,079 of November 3, 1925, or that shown in my Patent No. 1,538,327 of May 19, 1923, although not limited to use in the particular apparatus of said patents. The invention has for its principal objects; the provision of a roll which will not warp when exposed to the unusually severe conditions met in rolling glass; the provision of a roll in which there is no opportunity for uneven heating, due to the maintenance of air or steam pockets on the upper side of the roll; the provision of a roll wherein the cooling water may be delivered at the center of the roll with a minimum reduction in temperature therein incident to its travel from the ends to the center of the roll; the provision of a construction in which the temperature of the portion of the roll contacting with the glass is under control from the center of such portion to its ends, and may, therefore, be maintained uniform, and may be increased and decreased at will to meet varying temperature requirements incident to variations in speed in rolling the glass ribbon or sheet. The arrangement is such that by varying the volume of flow of the cooling liquid and the temperature of such liquid, the temperature conditions along the roll may be made uniform and increased or decreased to meet all requirements.

Briefly stated, the foregoing results are secured by insulating the conduit which carries the cooling liquid to the center of the roll, and by the use of baffles located in the annular passageway surrounding the conduit and having passages or ports adjacent their peripheries of a combined area less than that of the inlet conduit. An increased cooling capacity is also secured by counterboring the working section of the roll, so that the walls of such section are greatly reduced in thickness, thus increasing the rapidity of heat transfer from the glass to the water correspondingly. 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 sectional view showing the relation of the rolls to the glass tank with which they are used. Fig. 3 is a section on the line III-III of Fig. 1. Figs. 4 and 5 are enlarged details showing the

packing glands at the ends of the roll, Fig. 4 being an end view, and Fig. 5 a transverse section. Fig. 6 is another enlarged sectional detail. Fig. 7 is a longitudinal section through one part of the inlet tube. Figs. 8 and 9 are detail views of the expansible baffles used, Fig. 8 being a face view of the baffle and Fig. 9 an edge view. And Fig. 10 is a section through the end of the roll.

Fig. 2 illustrates the application of the rolls to a tank structure 1, such as that shown in the Gelstharp patent heretofore referred to, the glass sheet 2 being withdrawn over a water cooled platen or table 3 into the roller leer 4. The sheet is withdrawn continuously through the leer, where it is annealed and its temperature reduced so that it may be cut into sections as it emerges from the leer. 5, 5 are the rolls to which the present invention is directed.

Referring to Fig. 1, 6 is the casing of the roll which is formed of any suitable material, such as cast iron, or cast steel and which has its central portion, which is in contact with the glass sheet 2, of larger diameter than the end portions 7, 7, which are engaged by the bearings supporting the roll. The central portion of the roll is counterbored between the points *a, a* in order to give a relatively thin wall at 8 and thus facilitate a rapid cooling of the glass from the water which is circulated through the casing, as later described. The ends of the casing carry the swivels 9, 9, each of which is provided with a pair of pipes 10, 10 and 11, 11, the pipes 10, 10 being the inlet pipes for the supply of cooling liquid, and the pipes 11, 11 being the outlet pipes. The swivels are provided with suitable grooves and passages adapted to register with suitable passages 13, 13 through the walls of the casing and packing 15 is provided for preventing any leakage of liquid past the swivel, these details of construction corresponding to those in my Patent No. 1,598,721, so that no detailed description is necessary. The packing is pressed inward by means of the bolts 16 carried by the ring 17 held rigidly upon the casing by means of set screws. The casing is closed at its right hand end by means of the plate 18 secured by the bolts 19 and having integral therewith the tumbler shaft end 20 for rotating the roll. The other end of the casing is closed by the plate 21 similarly held in place by the bolts 22.

Extending longitudinally of the casing from one end to the other is the inlet tube 23. This pipe is perforated at its central portion, as indicated at 24 in Fig. 3 and is surrounded at this point by the casting 25 having perforations 26 corresponding to the perforations 24 so that cooling fluid which is circulated inward through the tube 23 from its ends will flow outward at this central portion into the annular space 27^a. The outer ends of the tube 23 are open and in communication with the chambers 28^a, 28^a at the ends of the casing, and these chambers are supplied with water under pressure from the pipes 10, 10. The annular chamber 27^a is in communication at its ends with the outlet passages 11, 11, so that provision is made for a circulation of water between the pipes 10 and 11, such water passing inward through the tube 23 to the central perforations 24, and then outward into the chamber 27^a and longitudinally of the casing in both directions to the outlets 11, 11. Surrounding the tube 23, and concentric therewith is a second casing made up of the sections 26, 26 and 27, 27. Each section 26 has a plate 27^b brazed to its outer end and a sleeve 28 brazed to its inner end and the space between the tubes 23 and 26 is filled with a suitable insulating medium, such as asbestos cement. Each of the sections 27 has brazed in its outer end, the casting 25 heretofore referred to. The space between the tube 23 and the casing 27 is also filled with an insulating medium 27^c, such as the asbestos cement. The plug 29 also has its tapered end brazed to the tube 23 and the tubes 27 are also brazed to the casting 25.

Interposed between the opposing ends of the sections 26 and 27 are the baffle plates 30, 30, shown in detail in Figs. 8 and 9. When these plates are positioned, as indicated in Fig. 1, they fit around the plugs 29 and are clamped between the edges of the sections 26 and 27. These baffle plates, in order to be positioned, must be made so that they can expand and contract, otherwise, they could not be gotten through the end sections of the casing 6, which are of less diameter than the annular chamber 27^a. The baffles are preferably made of two sets of overlapping plates 32 and 33 hinged together by the rivets 34. The ends of this flexible annular ring merely overlap so that by pressing the edges inward and causing still more overlapping, the devices may be contracted so that they will squeeze through the reduced end sections of the casing 6 and rest upon the inclined faces of the plugs 29. They are then pushed to the position shown by the ends of the sections 26, 26, which are slipped over the tube 23 and moved inward until the parts are brought to the position shown in Fig. 1.

Fitting over the extreme outer ends of the

tube 23 are the gland members 35, 35, whose inner faces engage the plates 27^b brazed to the ends of the sections 26, 26. A presser member 36 (Fig. 5) fits over the outer end of each member 35 for compressing the packing in the groove 37. The members 35 are pressed inward against the plates 27 by means of the lock ring 38, screw threaded upon the ends of the tube 23. This lock ring or nut is provided with suitable projections, as shown in Fig. 1 for engagement with a wrench, so that by the application of turning power at this point, the sections 26, 26 are moved inward, clamping the plates 30, 30 in position. The presser member 36 is moved inward to compress the packing in the groove 37 by means of the nuts 40 on the studs 41, such studs being threaded into the members 35 at their inner ends. The studs are positioned so that their outer ends come about one-fourth inch from the plates 18 and 21. They thus act as spacing devices to prevent any substantial longitudinal movement of the tube 23 and the parts carried thereby.

In order to permit the passage of liquid past the baffle plates 30, 30, and to insure a uniform flow of the liquid around the periphery of the roll, these plates are preferably notched around their peripheries, as indicated at 42 in Fig. 8. The outward flow of water through the annular chamber 27^a is thus distributed uniformly past the edges of the peripheries of the plates 30. This is of advantage, since any air or steam which might tend to accumulate in the annular chamber 27^a will normally lie adjacent the upper side of the chamber and will, therefore, be swept out freely by the high velocity through the notches 42. This is important, in the case of the lower roll where the formation of an air or steam pocket along the upper side of the chamber 27^a would normally cause an overheating of the roll opposite the pocket with a resultant tendency to warp the roll and chill the glass passing thereover unevenly. The total cross sectional area of the notches 42 of each baffle is made somewhat less than the cross sectional area of each pipe 10, which insures a uniform flow of cooling liquid through each of the notches and also insures that the annular chamber 27^a shall always be completely filled with water. In order to remove the plates 30, they are each provided upon their outer sides with a loop 43 so that after the sections 26 have been removed, the loops may be engaged by suitable hooks and the plates pulled out through the ends of the casing 6.

The insulating of the water supply tube 23 is an important feature of the invention, as it permits a supply of water to the central portion of the casing without any substantial rise in the temperature of such water be-

fore it reaches the center of the casing. Without such insulation, the water would be heated to a substantial degree by the out-flowing water from the center of the casing, which is heated to a considerable degree by the time it reaches the end of the casing. It is desirable that the casing receive its greatest cooling effect at its center, where the heating effect of the glass passing over the roll is greatest. By regulating the temperature of the water as it enters the ends of the casing, any desired degree of cooling of the glass sheet may be secured and this control is still further increased by varying the quantity of water which is supplied through the pipes 10, 10. This permits a wide variation in the speed of rolling to meet requirements, the degree of cooling increasing as the speed of rolling is increased, such increase in cooling being required by the passage of a larger quantity of glass over the roll. The provision of the insulated supply tube in conjunction with the baffles 30, 30 notched at their outer ends has been found to secure a very uniform cooling of the portion of the roll with which the glass contacts, so that any tendency of the glass to warp due to unequal cooling across its width is avoided and all warping of the roll is avoided so that a sheet of uniform thickness from edge to edge is secured. This result has been found to obtain in operating the roll at varying speeds. Other advantages incident to the construction, some of which have been referred to in the statement of the invention, will be apparent to those skilled in the art. While the same results might be obtained by having the baffles 30, 30 smaller in diameter than the inside of the casing, thus providing annular spaces between the baffles and the casing, the notched arrangement is preferred as giving the most accurate and certain results.

What I claim is:

1. In combination in a glass roll, an outer cylindrical casing, a liquid supply tube extending through the roll and comprising a pair of concentric pipes with an insulating medium therebetween, with the outer pipe spaced away from the inner wall of said casing to provide an annular chamber and with ports giving communication between the central portion of the inner pipe and said annular chamber, and means for supplying a cooling fluid to the inner pipe under pressure, outlets being provided from the ends of said annular chamber.

2. In combination in a glass roll, an outer cylindrical casing, an insulated tube concentric with the casing and discharging at the central portion thereof into the space between the roll and the casing, means for supplying a cooling fluid under pressure to said tube and means for withdrawing the fluid from the ends of the casing.

3. In combination in a glass roll, an outer cylindrical casing, a tube having a hollow wall with insulating material therein concentric with the casing and discharging at the central portion thereof into the space between the roll and the casing, means for supplying a cooling fluid under pressure to said tube and means for withdrawing the fluid from the ends of the casing.

4. In combination in a glass roll, an outer cylindrical casing, a supply tube concentric with the casing and discharging at the central portion thereof into the space between the tube and the casing, means for supplying a cooling fluid under pressure to the tube, means for withdrawing the fluid from the ends of the casing, and baffles in the annular space between the casing and tube at points intermediate the center and ends of the casing, each of said baffles having discharge means around its outer periphery.

5. In combination in a glass roll, an outer cylindrical casing, a supply tube concentric with the casing and discharging at the central portion thereof into the space between the tube and the casing, conduit means for supplying a cooling fluid under pressure to the tube, means for withdrawing the fluid from the ends of the casing, and baffles in the annular space between the casing and tube at points intermediate the center and ends of the casing, said baffles having discharge means around their outer peripheries of a total cross sectional area less than that of said conduit means.

6. In combination in a glass roll, an outer cylindrical casing, a supply tube concentric with the casing and discharging at the central portion thereof into the space between the tube and the casing, means for supplying a cooling fluid under pressure to the tube, means for withdrawing the fluid from the ends of the casing, and baffles in the annular space between the casing and tube at points intermediate the center and ends of the casing, said baffles each having a series of discharge ports spaced around its outer periphery.

7. In combination in a glass roll, an outer cylindrical casing, a supply tube concentric with the casing and discharging at the central portion thereof into the space between the tube and the casing, conduit means for supplying a cooling fluid under pressure to the tube, means for withdrawing the fluid from the ends of the casing, and baffles in the annular space between the casing and tube at points intermediate the center and ends of the casing, said baffles each having a series of discharge ports spaced around its outer periphery, the total cross sectional area of both sets of ports being less than that of said conduit means.

8. In combination in a glass roll, an outer cylindrical casing, a supply tube concentric

with the casing and discharging at the central portion thereof into the space between the tube and the casing, means for supplying a cooling fluid under pressure to the
5 tube, means for withdrawing the fluid from the ends of the casing, and baffles in the annular space between the casing and tube at points intermediate the center and ends of the casing, each of said baffles having a series
10 of discharge notches formed in its outer periphery.

9. In combination in a glass roll, an outer cylindrical casing of greater diameter externally and internally at its central section
15 than at its end sections, a supply tube concentric with the casing and discharging at the central portion thereof into the space between the tube and the casing, means for supplying a cooling fluid under pressure to the tube, means for withdrawing the fluid
20 from the ends of the casing, baffles provided with passages therethrough located between the tube and casing adjacent the ends of said central section of the casing, each of said
25 baffles being formed of a plurality of plates secured together for relative movement so that the baffle may be reduced in diameter

to allow it to be inserted through the end section of the casing, and means for clamping the baffles in position upon the tube. 30

10. In combination in a glass roll, an outer cylindrical casing of greater diameter externally and internally at its central section than at its end sections, a supply tube concentric with the casing and discharging at
35 the central portion thereof into the space between the tube and the casing, means for supplying a cooling fluid under pressure to the tube, means for withdrawing the fluid from the ends of the casing, baffles provided
40 with passages therethrough located between the tube and casing adjacent the ends of said central section of the casing, each of said baffles being formed of a plurality of plates, hinged together into an annular strip
45 with overlapping ends, so that the baffle may be reduced in diameter to allow it to be inserted through the end section of the casing, and means for clamping the baffles in position upon the tube. 50

In testimony whereof, I have hereunto subscribed my name this 14th day of December, 1926.

HALBERT K. HITCHCOCK.