Aug. 10, 1926.

1,595,139

H. BLOUNT

ANNEALING APPARATUS

Filed Dec. 9, 1924

3 Sheets-Sheet 1

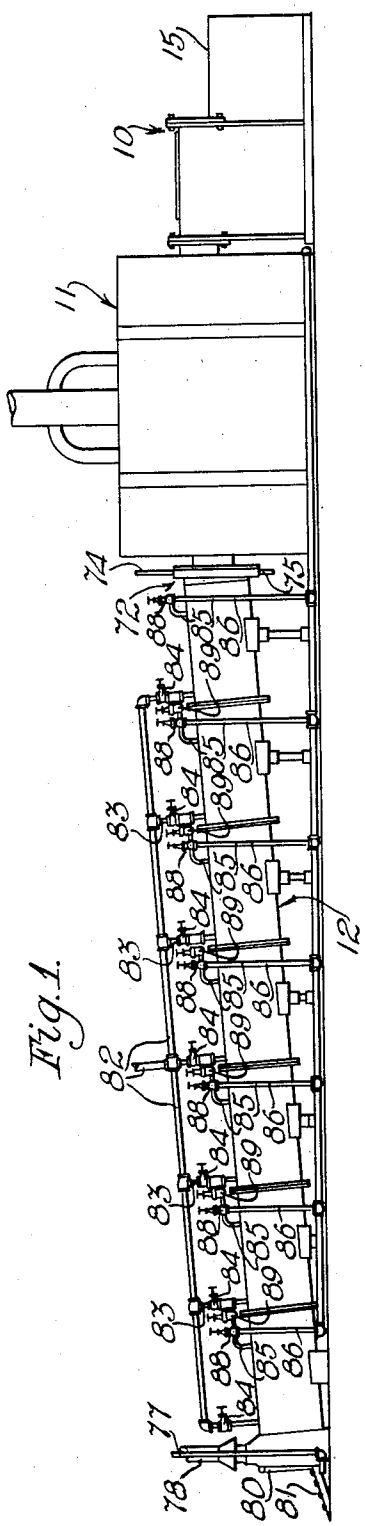


Fig. 1.

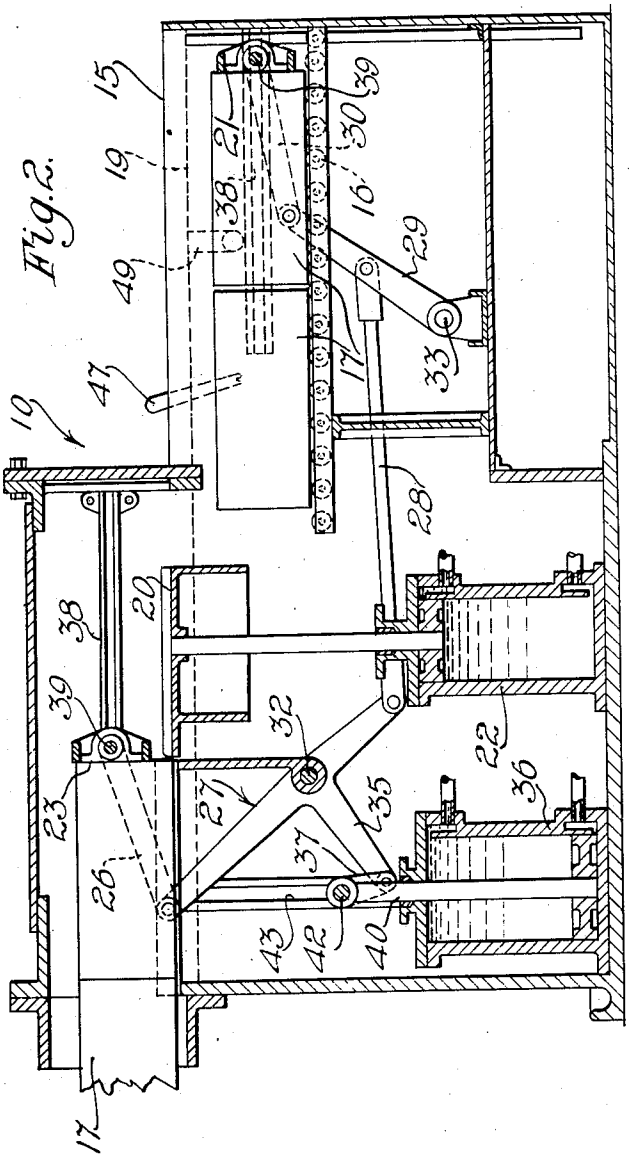


Fig. 2.

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Aug. 10, 1926. 1,595,139

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Filed Dec. 9, 1924 3 Sheets-Sheet 2

Fig. 3.

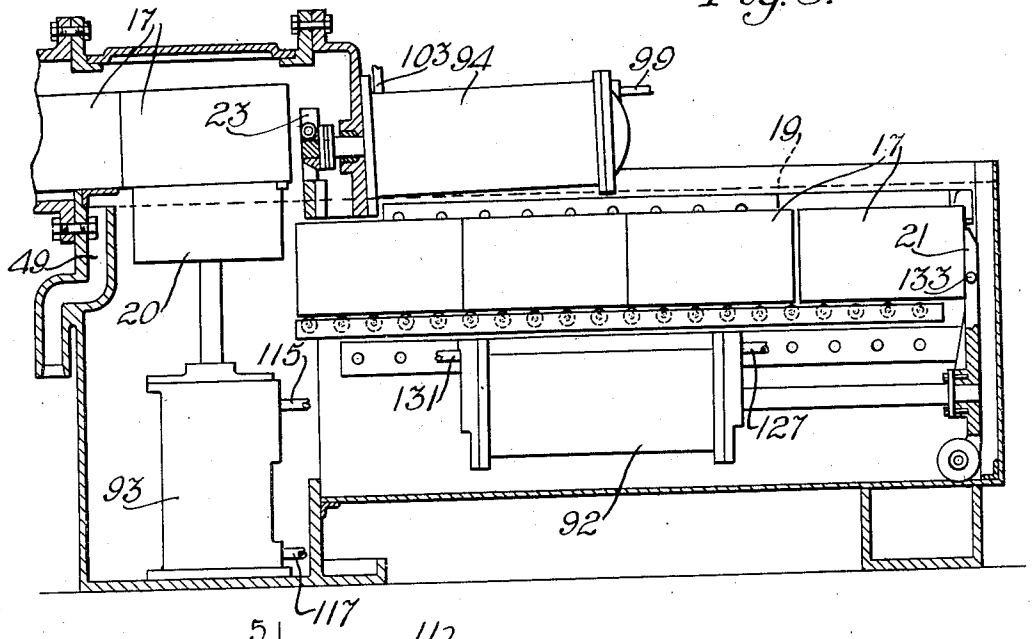


Fig. 4.

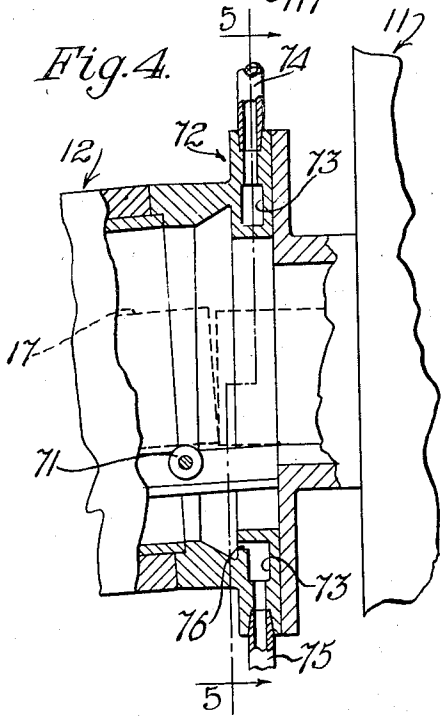
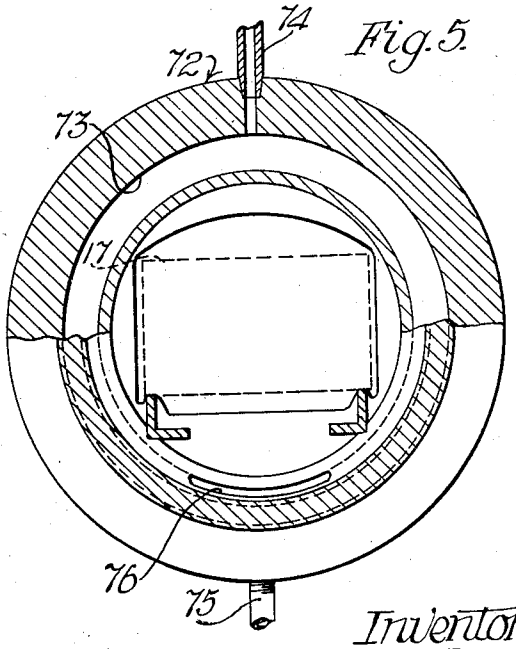


Fig. 5.



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3 Sheets-Sheet 3

Fig. 6.

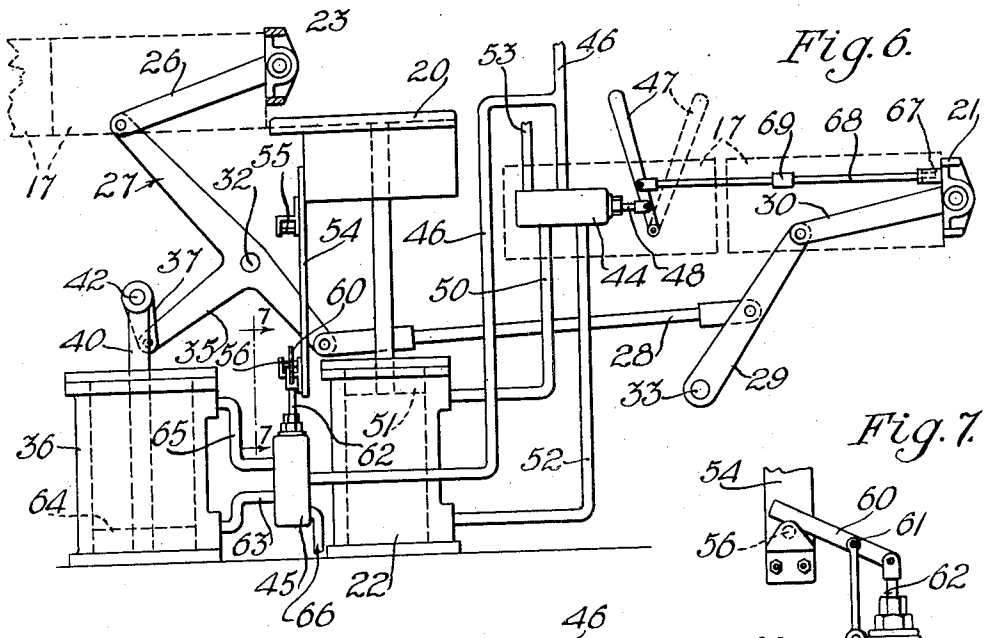
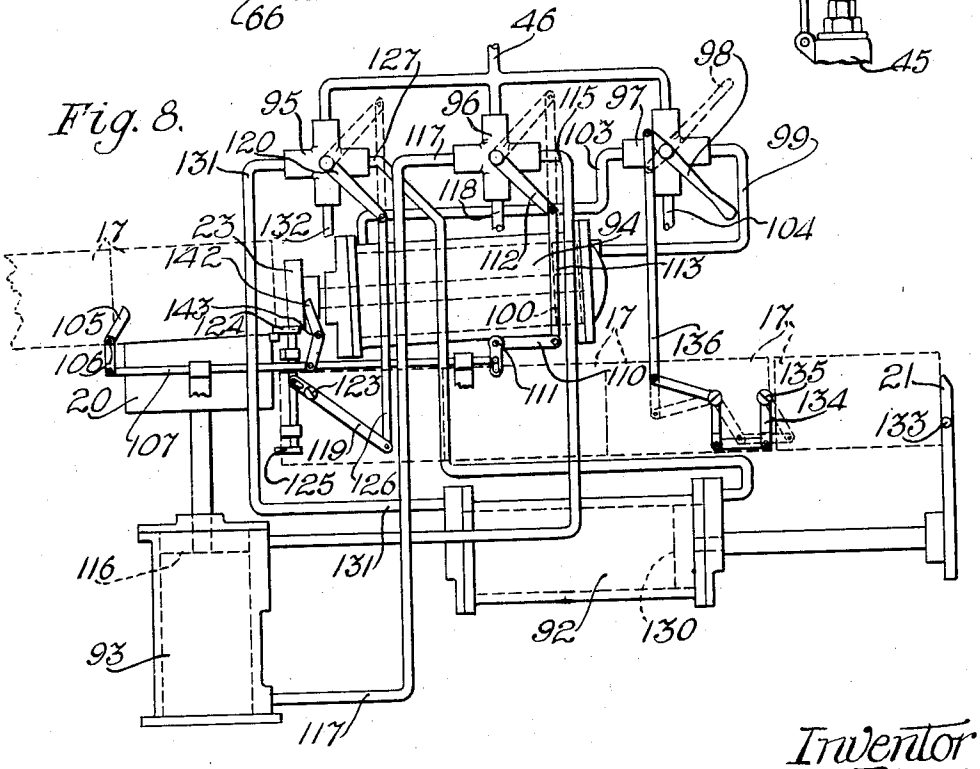


Fig. 7.

Fig. 8.



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UNITED STATES PATENT OFFICE.

HARRY BLOUNT, OF OAK PARK, ILLINOIS, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ANNEALING APPARATUS.

Application filed December 9, 1924. Serial No. 754,712.

This invention relates to annealing apparatus, and more particularly to an annealing apparatus for bright surfaced materials such as copper wire and the like.

The object of the invention is to provide an improved annealing apparatus by means of which the annealing of bright surfaced materials such as copper wire carried on spools, may be rapidly and efficiently accomplished without tarnishing the surfaces thereof.

In accordance with the general features of the invention, there is provided interconnected material receiving, annealing and cooling chambers, the inlet end of the annealing chamber being sealed by a liquid and the outlet end thereof as well as the inlet and outlet ends of the cooling chamber being sealed against the entrance of air by a vaporous medium which may be steam introduced at opposite ends of the cooling chamber. The steam is introduced through a steam chest at a point below the material being moved through the annealing apparatus by the successive charging thereof from the receiving chamber which chamber is provided with hydraulic material propelling and elevating means.

In one form of the charging apparatus a common hydraulic apparatus and an associated leverage system controls the propelling of the material onto an elevator and the removal therefrom and charging it into the heating chamber, a separate hydraulic apparatus controlling the movement of the elevator. In another form of the charging apparatus independent hydraulic apparatuses move the material to an elevator, raise it and charge it into the heating chamber. In both forms the hydraulic apparatuses are automatically operated in the proper sequence to charge the heating chamber and finally to return to their normal positions through a system of interconnected levers, links, and valves.

It is believed that the invention will be clearly understood from the following description taken in connection with the accompanying drawings illustrating one embodiment of the invention, in which—

Fig. 1 is a view in side elevation of an annealing apparatus embodying the features of the invention;

Fig. 2 is a fragmentary enlarged vertical sectional view of one type of charging apparatus which may be associated therewith;

Fig. 3 is a fragmentary enlarged vertical sectional view of a modified form of the charging apparatus;

Fig. 4 is an enlarged vertical sectional view of the steam inlet at the right hand end of the cooling chamber;

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 4 looking in the direction indicated by the arrows;

Fig. 6 is a schematic view of the valves, piping and controlling apparatus for the hydraulic apparatus illustrated in Fig. 2;

Fig. 7 is a side view of a portion of the controlling apparatus taken on the line 7—7 of Fig. 6 looking in the direction indicated by the arrows, and

Fig. 8 is a schematic view of the modified form of apparatus illustrated in Fig. 3.

As shown in the drawings, 10 designates the charging end of the annealing apparatus, 11 the heating chamber, and 12 the cooling chamber, all suitably connected together. The charging end, as clearly shown in Figs. 1 and 2, consists of a receiving chamber 15 equipped with a horizontally disposed roller track 16 upon which are cases 17—17 containing the material, such as spools or coils of copper wire, to be annealed. The chamber 15 contains water to a height as indicated by a dotted line 19, thus sealing the input end of the annealing apparatus against the ingress of air. At the left hand end of the roller track 16 is an elevator 20 which receives one at a time the cases 17 from the roller track 16, the cases being removed from the track 16 by a pusher 21, the operation of which will be described hereinafter. The elevator 20 is elevated and lowered by any suitable hydraulic apparatus indicated at 22. The elevator 20 in moving upwardly carries the case 17 to the level of the floor or track (not shown) provided in the heating chamber 11 and in front of a second pusher 23, which is operated simultaneously with the first pusher 21 only in a reverse direction to push the positioned case within the heating chamber 11. The two pushers 21 and 23 are interconnected by links 26, bell crank levers 27, links 28, levers 29 and links 30, the levers

27 and 29 being suitably pivoted as indicated at 32 and 33, respectively. One arm 35 of the bell crank lever 27 is connected to another hydraulic apparatus indicated at 36 through a link 37. Upon operation of the hydraulic apparatus 36 from the position indicated in the drawings it will be apparent that the bell crank lever 27 will be turned clockwise about its pivot 32, which movement, through the links 26, causes the pusher 23 to be returned to the right hand side of the elevator 20 in which position it will be ready to remove another case 17 from the elevator 20. It will also be apparent that with this movement to the right of the pusher 23 the pusher 21 through its connection with the lever 27 as hereinbefore described will push a case 17 upon the elevator 20, the elevator at this time being lowered with its floor portion in line with the roller track 16. Each of the pushers 21 and 23 is guided in its movement by a pair of guide plates or tracks, one of which is indicated at 38, supported upon either side wall of the chamber 15 and in which shoes (not shown) mounted upon either end of rods 39 suitably carried by the pushers 21 and 23 ride. It will be readily understood that the various links and levers interconnecting the pushers 21 and 23 are arranged in pairs, one being at either side of the chamber 15 although not shown in the drawings. Also that a piston rod 40 of the hydraulic apparatus 36 is connected to a cross head 42 which is guided in its movement up and down by a pair of guide plates or tracks, one of which is indicated at 43 within which ride shoes (not shown) carried by the cross head 42, the plates 43 being upon either side wall of the chamber 15.

The operation of the charging apparatus illustrated in Figs. 1 and 2 will be described with particular reference to the diagrammatic illustration of the controlling means shown in Fig. 6.

In Figs. 2 and 6 the pusher 21 has just been returned to its normal position and an attendant has positioned a case 17 indicated in dotted outline in front thereof. At 44 and 45 are indicated suitable hydraulic valves for controlling the flow of the hydraulic medium which may be water under pressure from the supply line 46 to the hydraulic apparatuses 22 and 36, respectively. The valve 44 is opened by moving a suitably pivoted lever 47 in a clockwise direction to the position indicated in dotted outline, the lever 47 being mounted upon the valve stem 48. The water will now flow through the passage or pipe 50 and above a piston 51 of the hydraulic apparatus 22 and cause the elevator 20 to be lowered, the water below the piston passing through a pipe 52, through the valve 44 and out of a pipe 53 into the receiving chamber 15, which chamber is provided with an overflow outlet indicated at 49 (Fig. 2). Depending from one side face of the elevator 20 is a plate 54 mounting suitably spaced pins 55 and 56 which alternately contact, upon the lowering and raising of the elevator 20, with opposite faces of one end of a lever 60 pivoted as indicated at 61 (Fig. 7) to the valve 45, the opposite end of this lever being pivotally connected to the valve stem 62. As the elevator 20 descends and near the bottom of its movement, the lever 60 engages the pin 55 which causes the lever 60 to be turned counter-clockwise about the pivot 61 and operate the valve 45 which will cause the water to flow through a pipe 63 and below a piston 64 of the hydraulic apparatus 36 which will cause the pusher 23 to be moved to the right through the links and levers as hereinbefore described, the pusher 21 simultaneously moving to the left and moving the case 17 positioned in front of the last case 17 mounted upon the roller tracks 16 into position upon the elevator 20.

The water above the piston 64 passes through a pipe 65, the valve 45 and out of a pipe 66 into the receiving chamber 15. Secured to one vertical end face of the pusher 21 is a bracket 67 reciprocably supporting in one arm thereof one end of a rod 68, the opposite end thereof being suitably connected to the lever 47. Suitably spaced and secured upon the rod 68 is a collar 69. As the pusher 21 nears the end of its loading stroke, the bracket 67 engages the collar 69 and through the rod 68 causes the lever 47 to be turned counter-clockwise to its initial position, thus operating the valve 44 and causing the water to flow through the pipe 52 and below the piston 51 which causes the loaded elevator 20 to move upwardly to position a case of material in front of the pusher 23. Upon the elevator 20 nearing the end of its upward stroke, the lever 60 engages the pin 56 which causes the lever 60 to be turned clockwise, thus operating the valve 45 and causing the water to flow through the pipe 65 and above the piston 64, thereby causing the pusher 23 to push the case 17 carried upwardly by the elevator 20, toward the left and against the case 17 which was previously moved toward the left. Thus the last mentioned case is to be moved further in its course through the chamber 11 when each successive case is charged into the heating chamber 11, and the train of cases is advanced through the annealing apparatus, each case finally emerging from the cooling chamber 12. During the movement of the pusher 23 to the position last described the pusher 21 through its interconnection therewith is being moved to its initial starting position as shown in the drawings. With the apparatus in this position another case 17 may be positioned in front

of the pusher 21, the lever 47 moved in clockwise direction and the same sequence of movements will take place as hereinbefore described to charge the heating chamber 11 with another case 17 of material to be annealed.

The heating chamber 11 may be of the type described and illustrated in Patent No. 1,508,135 issued September 9, 1924, and to which reference may be had for a more detailed description. At the point of connection between the outlet end of the heating chamber 11 and the cooling chamber 12 is an annular ring like member 72 (Figs. 1, 4, and 5), through the center of which the cases 17 pass during the annealing operation. Between the inner and outer circumferential walls of member 72 is an annular channel or steam chest 73 provided at its top with a steam inlet 74 and diametrically opposite thereto is an outlet 75 for draining purposes. As clearly shown in Figs. 4 and 5 an arcuate slot or channel 76 is formed in the left hand side wall of the chest 73 at the bottom thereof and through which the steam passes into the cooling chamber 12. The steam entering the chamber 12 at this point serves to seal the exit of the associated heating chamber 11 as well as to remove moisture from the material in the cases 17—17. The cooling chamber 12 along with the roller track 71 (Fig. 4) mounted therein upon which the cases 17 move is sloped downward toward its outlet end at such an angle as to reduce the power required by the pusher 23 to push the cases 17—17 therethrough. Steam is also introduced into the cooling chamber 12 adjacent the outlet end by an inlet pipe indicated by the numeral 77 which steam cooperates with that introduced through the inlet 74 at the opposite end of the chamber and the sloping chamber to form a steam pocket in the cooling chamber. This steam pocket serves to exclude air from entering at the outlet end of the cooling chamber, thereby preventing the discoloring of the material within the cases 17—17 by reason of the fact that the material is absolutely prevented from contact with the atmosphere until it has been cooled below a temperature at which it would ordinarily oxidize or discolor. An outlet pipe is provided as indicated at 78 adjacent the outlet end of the chamber 12 for the used steam. A horizontally hinged door 80 is mounted at the outlet end of the chamber 12 in such a manner that it is opened by the discharge of the moving case 17 and immediately closes through the action of gravity. A roller runway 81 is provided down which the cases 17 of annealed material roll upon being discharged from the chamber 12.

The cooling chamber 12 is water jacketed along its entire length and in the present embodiment is divided into seven separate sections, each of which is connected to a main water line or pipe 82 by a branch pipe 83, the passage of water therefrom to each of the separate jackets surrounding the chamber 12 being regulated by a valve 84. The outlet end of each of the jackets except the first one to the left of the annealing furnace 11 may be connected to the inlet end of the adjacent jacket by a pipe 85 or to a waste pipe 86 by manipulating suitably arranged valves 88 and 89. It will thus be readily understood that the water may be caused to flow first into the extreme left hand section of the jacket and thence through each of the jackets in succession by closing all the valves 84 except the one associated with this jacket and also closing all the valves 88 except the one associated with the section adjacent to the left hand end of the annealing furnace 11 through which the water will pass to the waste line 86 after passing through all the jackets. Each section of the water jacket may be supplied separately through the supply pipe 82 and connected to its respective waste pipe 86 by opening all the valves 84 and 88 and closing all the valves 89.

In the system of cooling the chamber 12 first discussed the water enters the first jacket and as it circulates successively through each of the jackets the temperature will rise due to its absorption of heat from the material being treated so that the material will be gradually cooled as it nears the discharge end of the chamber. By regulating the rate of flow of the water through the jackets in succession or by circulating water through each section separately from the supply pipe 82 by manipulating the valves 84, 88, and 89, the temperature within the cooling chamber may be regulated to a degree which has been found by practice to be best suitable for the material being treated.

Figs. 3 and 8 illustrate a slightly different type of charging apparatus in which separate hydraulic apparatuses 92, 93, and 94 are provided for respectively operating the pusher 21 to load a case 17 of material to be annealed upon the elevator 20, for raising the elevator with the case upwardly to a position in front of the pusher 23 and for operating the pusher 23 to remove the case from the elevator and charging it into the heating chamber 11.

In describing the operation of the charging apparatus illustrated in Figs. 3 and 8, particular reference will be made to the diagrammatic illustration of the controlling means shown in Fig. 8. The positions of the parts as shown in Figs. 3 and 8 are those obtaining at the end of a cycle of movements in which the pusher 21 has returned to its starting position and an attendant has positioned a case 17 in front thereof. Valves 95, 96, and 97 control the operation of the hydraulic apparatuses 92,

93, and 94, respectively. The valve 97 is operated by the turning of a handle 98 counter-clockwise to the position indicated in dotted outline (Fig. 8) whereupon water will flow from the supply line 46 through a pipe 99 and behind a piston 100 of the hydraulic apparatus 94 and cause the pusher 23 to push the case 17 from the elevator 20 and into the heating chamber 11. By the successive charging of the cases into the heating chamber, one case in contact with the one just previously entered, they are progressively moved through the heating and cooling chambers. The water in front of the piston 100 passes through a pipe 103, the valve 97 and out of a pipe 104 into the receiving chamber 15 which contains water to a height as indicated by the dotted line 19 (Fig. 3). As the pusher 23 reaches the end of its charging stroke it engages and turns a lever 105 counter-clockwise about a pivot 106. One end of the lever 105 is connected to one end of a link 107, the opposite end of the link being connected to one arm of a bell crank lever 110 pivoted at 111. The other arm of the bell crank lever 110 is connected to a valve operating lever 112 mounted upon the valve 96 by a link 113. Thus due to the movement given the lever 105 by the pusher 23 as it nears the end of its stroke and the links and levers interconnecting the lever 105 with the valve lever 112 the valve is operated, whereupon water will flow from the supply line 46 through a pipe 115 and above a piston 116 of the hydraulic apparatus 93 and thereby cause the elevator 20 to be lowered to a position where the pusher 21 may load another case of material thereon. As the piston descends, the water below it passes through a pipe 117, the valve 96 and out of a pipe 118 into the receiving chamber 15. Associated with the elevator 20 is a lever 119 pivoted at 123 and adapted at its ends as indicated at 124 and 125 to be engaged by the elevator 20 upon nearing the ends of its upward and downward strokes. One end of the lever 119 is connected by a link 126 to a valve operating lever 120 mounted upon the valve 95. Thus upon the elevator engaging the portion 125 of the lever 119 the valve 95 will be operated through the link 126 and water will flow from the supply line 46 through a pipe 127 and behind a piston 130 of the hydraulic apparatus 92 thus causing the pusher 21 to position another case upon the elevator 20. The water in front of the piston 130 passes through a pipe 131, the valve 95 and out of a pipe 132 into the receiving chamber 15. The pusher 21 near the end of its loading stroke causes the handle 98 to be turned clockwise to its initial position as indicated in the drawings, through a pin 133 engaging one arm of a bell crank lever 134 pivoted at 135, the movement of the lever 134 about its pivot in a clockwise direction being transmitted to the handle 98 by a link 136 connecting another arm of the lever 134. In this position of the handle 98 water flows through the pipe 103 and in front of the piston 100, thereby causing the pusher 23 to return to its initial position. As it nears the end of its return stroke the pusher 23 engages a lever 142 pivoted at 143 and connected at its lower end to the link 107. The lever is thus turned in a clockwise direction about its pivot and through the link 107, bell crank lever 110 and link 113 the lever 112 is returned to its initial position thereby allowing water to flow through the pipe 117 and below the piston 116, thereby raising the elevator 20 with the case 17 to a position in front of the pusher 23 ready for the next charging stroke of the pusher 23. Upon nearing the end of its upward stroke the elevator engages the portion 124 of the lever 119 and turns the lever in a clockwise direction about its pivot and through the connecting link 126 the valve operating lever 120 is returned to its initial position thereby allowing water to flow through the pipe 131 and in front of the piston 130, the movement of which to the right returns the pusher 21 to its initial position as illustrated in the drawings. In this position of the apparatus another case 17 may be positioned in front of the pusher 21 and upon moving the handle 98 counter-clockwise the same sequence of movements will take place as hereinbefore described to charge the heating chamber 11 with another case 17 of material to be annealed.

The introduction of steam at the outlet end of the cooling chamber along with the introduction of steam at the inlet end thereof provides a positive seal for the cooling chamber against the ingress of air and also a more uniform distribution of steam throughout the chamber. Thus oxidation or discoloring of the material being treated is positively avoided.

The feature of introducing the steam into the cooling chamber at a point below the material passing therethrough is mainly to insure the filling of the tube with steam to exclude air therefrom upon starting the apparatus up again after a period idleness.

An annealing apparatus of the hereinbefore described type embodying means for automatically controlling the operation of the material lifting, introducing and loading means in proper sequence results in a very efficient and rapid operation of the apparatus.

What is claimed is:

1. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a seal at the input end of the chamber, and means for in-

troducing a vaporous medium into the annealing chamber adjacent the inlet and outlet ends of the cooling portion thereof to form seals therefor.

2. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a water seal for the input end of the annealing chamber, and means for introducing steam into the annealing chamber adjacent the inlet and outlet ends of the cooling portion and in close proximity to the bottom thereof to form seals therefor.

3. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a chamber containing liquid located below the input end of the annealing chamber for receiving the material to be annealed and sealing said end against ingress of air, means for introducing a vaporous medium into the annealing chamber adjacent the junction of the heating portion and the cooling portion to form a seal, and means for introducing a vaporous medium within the cooling portion adjacent the outlet end thereof.

4. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a chamber containing liquid and located below the input end of the annealing chamber adapted to receive the material to be annealed and seal said end against ingress of air, means for lifting the material from said receiving chamber to said input end, means for loading said lifting means and moving it therethrough, and common means for controlling the operation of said material lifting, introducing and loading means in a predetermined sequence.

5. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a chamber containing liquid located below the input end of the annealing chamber adapted to receive the material to be annealed and seal said end against ingress of air, separate fluid operated means for lifting the material from said receiving chamber to said input end, loading the lifting means and introducing the material into the annealing chamber from the lifting means and moving it therethrough, and means for controlling the operation of said material lifting, introducing and loading means in a predetermned sequence.

6. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a chamber containing liquid and located below the input end of the annealing chamber adapted to receive the material to be annealed and seal said end against ingress of air, an elevator for lifting the material from said receiving chamber to said input end, means acting in a horizontal direction for loading the elevator, means acting in a horizontal direction for introducing the material into the annealing chamber from the elevator and moving it therethrough, and means for controlling the operation of said material elevating, introducing and loading means in a predetermined sequence.

7. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a chamber containing liquid and located below the input end of the annealing chamber adapted to receive the material to be annealed and seal said end against ingress of air, reciprocably mounted means for lifting the material from said receiving chamber to said input end, for loading said lifting means and for introducing the material into the annealing chamber from said lifting means and moving it therethrough, said material loading and introducing means interconnected in such a manner that said material loading and introducing means are simultaneously reciprocated in opposite directions, and means for actuating said reciprocably mounted lifting, loading and introducing means.

8. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a chamber containing liquid located below the input end of the annealing chamber adapted to receive the material to be annealed and seal said end against ingress of air, a plurality of fluid controlled reciprocably operating means for lifting the material from said receiving chamber to said input end, for loading said lifting means and for introducing the material into the annealing chamber from said lifting means and moving it therethrough, and a system of levers interconnecting said material loading and introducing means and actuated by one of said reciprocably operating means.

9. In an annealing apparatus, an annealing chamber comprising interconnected heating and cooling portions, a chamber containing liquid located below the input end of the annealing chamber adapted to receive the material to be annealed and seal said end against ingress of air, reciprocably mounted means for lifting the material from said receiving chamber to said input end, for loading said lifting means and for introducing the material into the annealing chamber from said lifting means and moving it therethrough, common fluid controlled means for actuating the loading and introducing means simultaneously in opposite directions, and fluid controlled means for actuating the lifting means.

In witness whereof, I hereunto subscribe my name this 26th day of November A. D., 1924.

HARRY BLOUNT.