July 13, 1926. 1,592,659

G. H. GILMAN

MACHINE FOR HEAT TREATING METALLIC BODIES

Original Filed Jan. 9, 1920 4 Sheets-Sheet 1

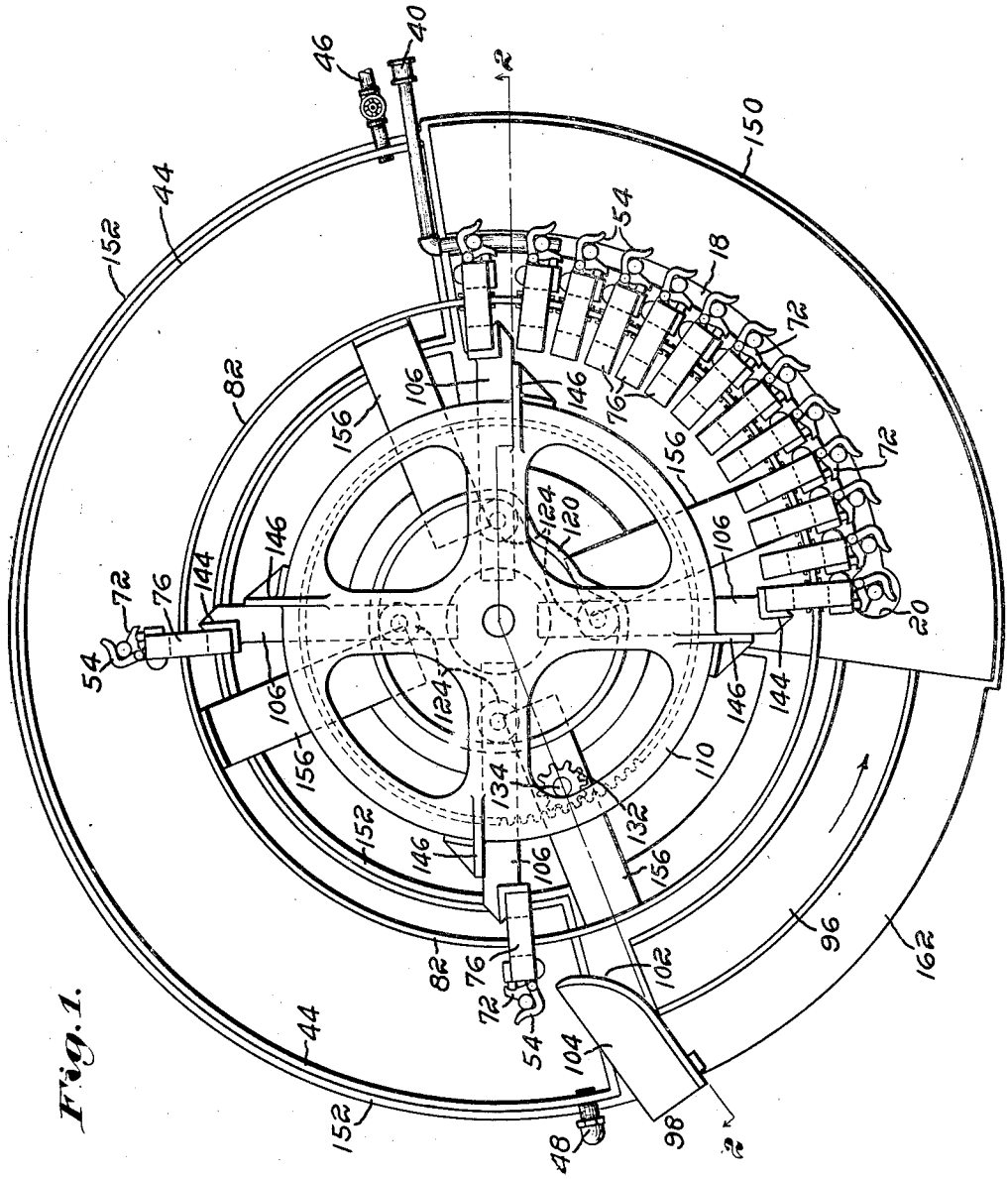



Fig. 1.

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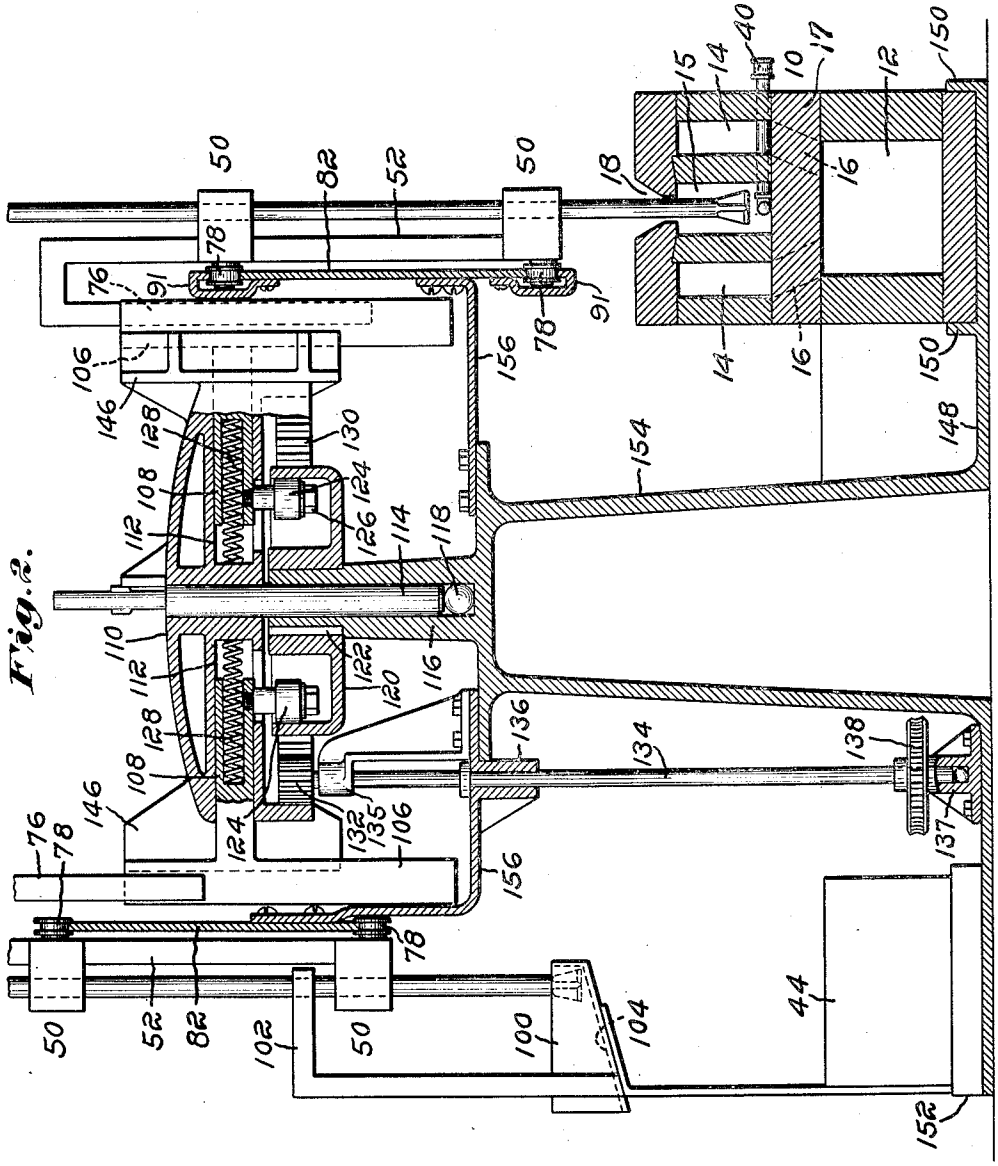



Fig. 2.

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Original Filed Jan. 9, 1920 4 Sheets-Sheet 3

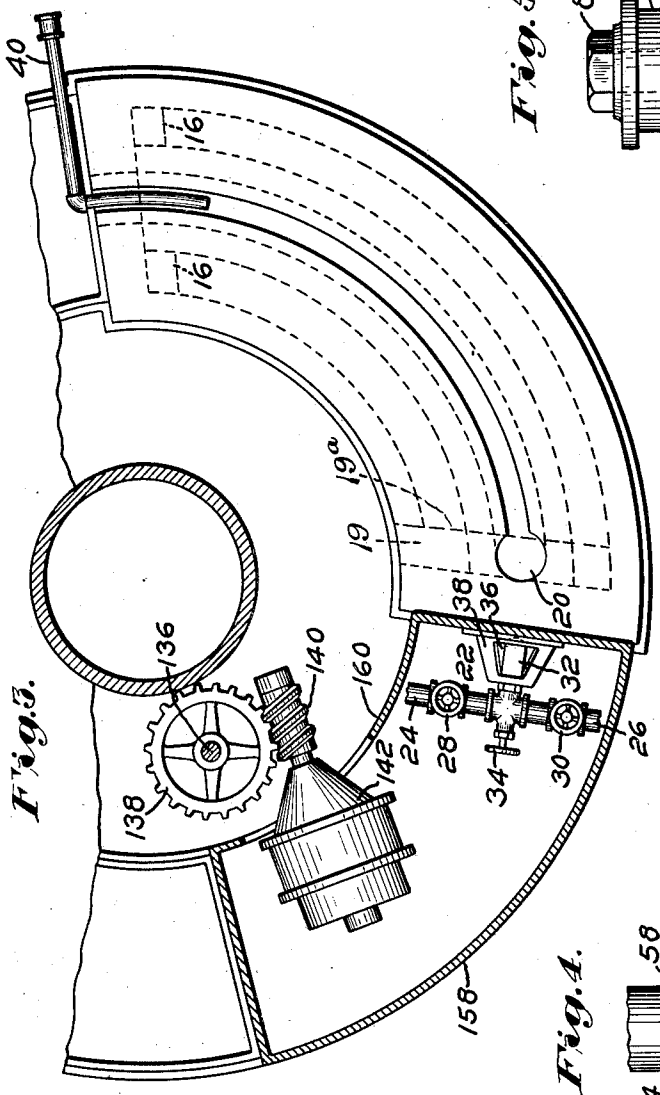



Fig. 3.

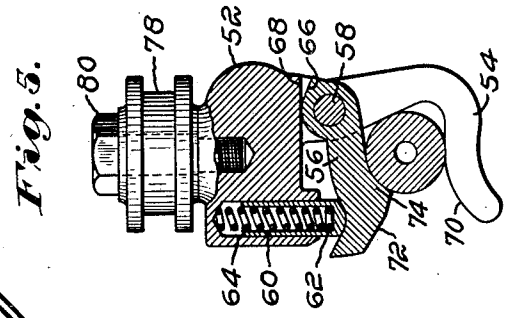



Fig. 5.

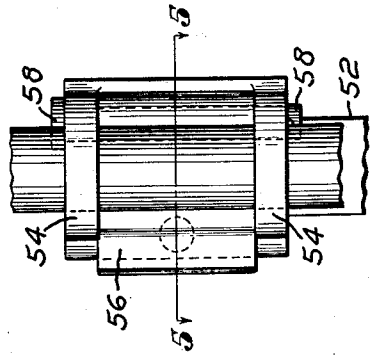



Fig. 4.

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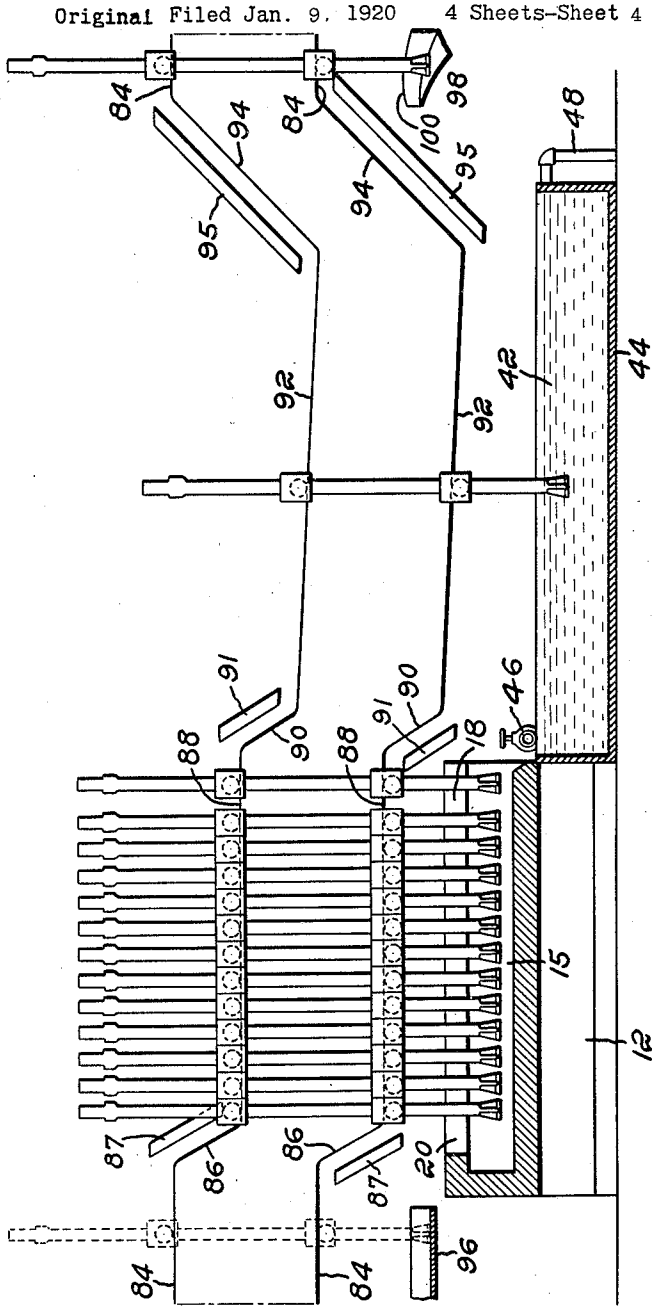



Fig. 6.

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Patented July 13, 1926. 1,592,659

# UNITED STATES PATENT OFFICE.

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## MACHINE FOR HEAT TREATING METALLIC BODIES.

Application filed January 9, 1920, Serial No. 350,436. Renewed December 24, 1925.

This invention relates to machines for heat-treating metallic bodies, such as rock drill steels, and the invention aims to provide an automatic machine which shall heat the ends of the drill steels to a requisite temperature, and then quench them to secure a predetermined metallic structure.

My invention will be best understood by reference to the following description, when taken in connection with the accompanying drawings of one illustrative embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a plan of a heat-treating machine exemplifying my invention;

Fig. 2 is a sectional view on line 2—2 of Fig. 1;

Fig. 3 is a plan section of a portion of the machine taken in a plane just above the top of the furnace;

Fig. 4 is a detail elevation on an enlarged scale of a portion of one of the drill steel carriers, and illustrating the jaws which receive the drill steel;

Fig. 5 is a sectional view on line 5—5 of Fig. 4; and

Fig. 6 is a diagrammatic view, partly in elevation and partly in section, illustrating the course of the drill steels through the machine.

Referring to the drawings, and to the embodiment of my invention which I have selected for exemplification, I have shown a heat-treating machine comprising a furnace 10 (see Fig. 2), having a lower chamber 12, upper outer chambers 14, and an upper inner chamber 15. The chamber 12 at one end is connected to the corresponding ends of the chambers 14 by passages 16 formed in the wall 17 (Fig. 2) separating the chambers 12 and 14, the passages 16 being shown in dotted lines in Figs. 2 and 3. The chamber 14 at the concave side of the furnace is provided at its end opposite the passage 16 with an opening 19 for connection to a stack or other exhausting apparatus, while the corresponding end of the other passage 14 is connected to the end of the first passage 14 by a passage $19^a$ passing beneath the end of the chamber 15. Communicating with the inner chamber 15 is a slot 18, which affords entrance thereto from the top of the furnace. The furnace walls may be made of suitable refractory material, such as commonly employed in the construction of heat-treating furnaces. In the present example, the chamber 15 forms a muffle, which protects the drill steels from the direct action of the flame, although the use of the muffle is not essential.

In the present embodiment, the machine is circular, and the furnace is built on an arc of a circle, as shown in Fig. 3. The slot 18 is arc-shaped to accommodate the drill steels in their circular course. Preferably the slot 18 is provided with an enlarged portion 20, whose dimensions are greater than the bit of the drill-steel (compare Figs. 2 and 3), while the body of the slot is of relatively smaller dimensions approximating those of the body of the drill steel, thereby to prevent the escape of an undue amount of heat from the muffle.

The furnace may be provided with suitable heating means, herein a well-known commercially used burner 22 (see Fig. 3) for atomizing the fuel oil, mixing the same with air, and spraying the combustible mixture into the chamber 12, whence it passes through the passages 16 into the outer chamber 14 about the muffle. The burner herein shown receives its supplies of oil and compressed air through pipes 24 and 26, controlled by valves 28 and 30, respectively, while an atomizer 32 is controlled by a main valve 34. Additional air, to promote combustion, is taken through openings 36 in a tuyère 38. In practice, the furnace will be maintained at a uniform temperature by the aid of temperature-responsive means, usually a pyrometer, a portion of which is shown at 40 in Figs. 2 and 3, entering the chamber 15 of the muffle. In operation the products of combustion formed in the chamber 12 pass through the passages 16, 14 and $19^a$ and out of the opening 19 heating the walls of the chamber 15 to incandescence.

The drill steels, after passing through the furnace and being heated to a proper predetermined temperature, are cooled or quenched by plunging them into a body of suitable liquid 42 (see Fig. 6), preferably circulating water in a quenching tank 44 having a constantly open inlet 46 located at the end of the tank adjacent the furnace and an overflow outlet 48 located at the opposite end of the tank and of such size and so disposed as to maintain the water at a uniform level. In this manner I cause the water at the end of the tank adjacent the furnace to be colder than that in the other portions of the

tank, so that when the drill steel enters the tank it is first immersed in water at a low temperature and then gradually subjected to water at a progressively increasing temperature. In operation of the machine, in which the water is continuously being changed. each drill steel will be subjected to water of substantially the same temperature conditions.

During the process of heating and quenching the drill steel, the latter is carried by a suitable carrier in which the drill steel is held preferably non-positively, that is to say, in a yielding manner, so that it may be discharged therefrom merely by the application of sufficient force in the proper direction. In the present example, I have provided a series of drill-steel carriers 50, each comprising a body 52, disposed in upright position and provided with upper and lower pairs of jaws 54 and a swinging jaw 56 interposed therebetween, the latter mounted on a pivotal pin 58. A spring 60 and spring-pressed plunger 62 enclosing the spring and mounted to slide axially in a chamber 64 in the body 52 constantly tend to urge the swinging jaw 56 toward the fixed jaws 54 and clamp the drill steel therebetween. Swinging motion of the jaw 56 under the influence of the spring 60 may be limited by a suitable stop, herein a corner 66, formed on the jaw 56, and adapted to bring up against a flat face 68 on the carrier body 52.

The jaws 54 and 56 are herein provided with opposed converging surfaces 70 and 72, forming between them a passage whose entrance is greater in width than the cross-sectional dimensions of the body of the drill steel, whereby the latter may be introduced into the space between the jaws by simply crowding the latter apart in opposition to the spring. Inwardly beyond its flared throat, or entrance, the space between the jaws is narrowed and suitably shaped normally to prevent the escape of the drill steel, and in the present example, the movable jaw 56 is to this end provided with an arc-shaped portion 74, which follows the contour of the cross-section of the drill steel to a sufficient distance, so that accidental escape of the latter is impossible. In other words, the passage between the jaws at this point is narrower than the diameter of the drill steel, and hence the latter cannot be removed from its place between the jaws without exerting sufficient force to compel the spring 60 to yield, and the jaw 56 to recede from the jaws 54.

The body 52 of each drill steel carrier is herein extended in an upward direction (see Fig. 2), then horizontally, then vertically in a downward direction, thus presenting a depending shank 76, which may be engaged by a suitable propeller to carry the same in a generally horizontal direction. The drill steel carriers may be suitably mounted and guided, as by providing them with upper and lower wheels 78 mounted to turn on studs 80 and engaging upper and lower edges of a suitable track 82 (see Fig. 2). This track (see Fig. 6) is suitably shaped to guide the drill steel carrier during its progress, and to carry the drill steel at various heights, whereby it is first carried into the furnace, maintained there a suitable length of time, then removed from the furnace, plunged into the bath of cooling water, and gradually deeper into the latter, and finally lifted out of the water and discharged. To these ends, the track employed in the present embodiment has an initial level 84, at which the drill steel is placed in the carrier, a first downward incline or drop 86 to cause the lower end of the drill steel to be introduced into the furnace, a second level 88 to cause a fixed length of the drill steel to remain in the furnace, a second drop 90 to cause the drill steel to be plunged into the water, a third gradual drop 92 to cause the drill steel to be gradually lowered deeper and deeper into the water, and finally an abrupt rise 94 to cause the drill steel to be elevated to the initial level 84. Auxiliary tracks 87, 91 and 95, associated with the inclines 86, 90 and 94, respectively, assist in maintaining the carriers in upright position when traversing the inclines. This track, therefore, provides means for utilizing the forward feeding movement of the carriers to impart to the latter vertical movements at appropriate times in the progress of the drill steels through the machine.

It is, of course, evident that the drill steel must first be placed in its carrier at a certain predetermined vertical position with relation to the latter,—otherwise, the cutting end would not be carried to the proper depth into the furnace, and the cooling water. To assist the operator in placing the drill steels at the proper height, I have herein provided a height gage 96 (see Fig. 6), consisting of a plate arranged in a horizontal plane beneath the initial level 84 of the track 82. In introducing the drill steel into the carrier, the operator simply rests the cutting end of the drill steel on the height gage 96, and then forces the body of the drill steel into its proper place in the jaws of the carrier. The drill steel is firmly held by the jaws of the carrier as the latter is advanced along the track. When, during the operation of the machine, each drill steel has been carried through the furnace, heated, plunged into the quenching tank and finally elevated to the initial level of the track, it is automatically ejected by suitable means, herein a stationary ejector 98, comprising a vertical flange 100 inclined in an outward direction with respect to the path of the drill steel, so that the latter in encountering said flange is for

a moment held stationary, while the carrier moves on, the result being that the spring-pressed jaws of the carrier open and allow the drill steel to be withdrawn therefrom in an outward direction under the influence of the curved, cam-like flange 100, as will be evident from an inspection of Fig. 1. Preferably, the ejector comprises also an upper, similarly shaped cam-like flange or arm 102 (see Fig. 2), to engage the upper portion of the shank of the drill steel, and assist in the removal of the latter from its carrier. Preferably, also, the lower part of the ejector is provided with a downwardly and outwardly inclined floor 104 (see Fig. 2), on which the cutting end of the drill steel may slide toward a suitable receptacle, after the drill steel has been ejected from its carrier.

The machine is provided with suitable feeding or propelling mechanism, by which the drill steel carriers are moved along the track 82. In the present example, as already intimated, the machine is circular. It follows that the track 82 is circular, and that the carrier propelling mechanism operates about a vertical axis.

The propulsion of the drill steel carriers may be accomplished by one or more, herein a plurality of pushers, or propellers 106 (see Fig. 1), and in the present example, I have shown four such propellers, each provided with a horizontal plunger 108 (see Fig. 2), carried by a rotating turret 110, the latter being provided with suitable radial guides 112, in which the plungers are mounted to slide radially in and out. This turret is suitably mounted, as by providing the same with a vertical shaft 114 mounted in an appropriate bearing 116, and having a step bearing 118.

In and out motion is imparted to the plungers 108 by suitable means, herein a fixed cam 120, secured to the bearing 116, as by a key 122. Preferably, the plungers 108 are provided with cam rolls 124, mounted on studs 126 and cooperating with the cam 120. The latter in the present embodiment moves the plungers positively in an inward direction, while said plungers are moved in an outward direction and held against the cam path by springs 128 mounted within the plungers 108, which are made hollow to receive them, as clearly shown in Fig. 2.

Rotation of the turret 110 may be accomplished by suitable driving mechanism, herein comprising an internal gear 130 formed on the internal surface of the turret and meshing with a driving pinion 132 shown at the upper left-hand portion of Fig. 2. This pinion may be suitably driven, as by a vertical shaft 134, journaled in appropriate bearings 135, 136 and 137, and carrying at its lower end (see Fig. 3) a worm gear 138, meshing with a worm 140 driven by a suitable motor 142. The speed of the motor and the ratio of the described gearing will be such as to cause the drill steel to be maintained in the furnace a proper length of time, usually about four minutes, and subsequently maintained in the quenching bath a suitable length of time. The speed at which the driving mechanism is operated may be varied to suit the requirements of the work by changing the speed of the motor, or by changing the ratio of the gearing.

By referring to Fig. 1, it will be observed that the shape of the cam 120 is such that a carrier having just received the drill steel is propelled forward along the track, and is brought up against the rear end of a previously fed row of drill steel carriers, as exemplified by the group at the lower right-hand side of Fig. 1. The motion of the carrier thus added to the rear end of the row should be continued until the row is advanced a predetermined distance,—that is to say, herein the space of one carrier. The propeller should then be withdrawn from engagement with the carrier, advanced along the row to a point just behind the leading carrier of the row, introduced at this point, and thus caused to propel the leading carrier away from the remaining carriers in the row. This is well illustrated in Fig. 1, which shows one propeller about to be withdrawn under the influence of the cam from engagement with the rearmost carrier, while another propeller has been introduced behind the leading or foremost carrier, and has started to advance the latter. The propeller is suitably shaped to engage the depending shank 76 of the carrier, and in the present example is provided with a tapered nose 144, enabling it to be introduced between the leading carrier and the one next behind it. Preferably, the rotating turret is provided with a plurality of laterally projecting flanges 146 (see Fig. 1), to reinforce the outwardly projecing portions of the plungers 108 to a point as near as possible to the tapered noses 144.

It must now be evident from the foregoing that a suitable number of drill steels is maintained in the furnace during an appropriate period of time by utilizing each carrier as a pusher, which is brought up to the rear end of the row, the latter being advanced the space of one carrier, and the leading carrier then advanced beyond the row. Thus carriers are one by one added to and subtracted from the row, and the latter is moved forward step-by-step with each addition of a carrier. Each leading carrier, as it is removed from the row, is advanced from that point until it is finally ejected in the manner hereinbefore described.

The machine is provided with a suitable frame, herein comprising a base 148 having a pair of flanges 150 between which the fur-

nace 10 is received, and a pair of similar flanges 152, between which the tank 44 is received. Rising from the base 48 is a column 154, which supports the entire driving mechanism of the machine, as well as the track which is mounted on the column by a plurality of brackets 156 (see Figs. 1 and 2). The bearing 116 for the rotating turret 110 is herein formed as an integral upward extension of the column 154. The base is herein further provided (see Fig. 3) with a pair of deep flanges 158 and 160, connected across the top by a web 162 (see Fig. 1) forming a box-like structure which encloses the burner 22 and motor 142 and provides a support for the height gage 96.

The general operation of the machine hereinbefore specifically described is as follows: The operator takes his position at a point adjacent the height gage 96 (at the lower left-hand side of Fig. 1). The drill steels come to him properly forged to finished shape, and he places them one by one in the drill steel carriers, as the latter pass along the gage. As the carrier is caused to move contra-clockwise (see Fig. 1), the drill steel is carried along the gage, and then into the inlet end of the furnace, where it is allowed to remain, and is advanced step by step by the continued addition of carriers to the row, as hereinbefore explained. The drill steels in their passage through the furnace are heated by the heat radiated by the incandescent walls of the chamber 15, it being observed that the end faces of the bit portions of the steels face the bottom wall of this chamber, with the result that these comparatively bulky portions of the steels are effectively heated. After the drill steels have remained in the furnace for a time sufficient to heat them to the proper temperature for quenching the carriers are engaged by the propeller and moved along the track toward the downwardly inclined portion 90. When a carrier reaches this portion of the track it drops to the level of the track above the quenching tank by gravity and remains stationary until the propeller advances sufficiently again to engage it. As heretofore has been explained, only a short portion of the length of the heated portion of the steel, viz. the cutting and reaming edges, is immersed at this time, and as it is subjected to relatively cold water this part of the steel will be hardened. The drill steel is then advanced, and is simultaneously lowered gradually into the quenching fluid until it reaches the outlet end of the quenching tank, at which point the steel has been immersed to a proper depth, in practice approximately four and one-quarter inches. By gradually immersing the drill steel in the water a tough backing is formed for the part hardened during the first operation. The drill steel is then elevated from the quenching tank, and is carried along to the ejector, where it is automatically disengaged from its carrier, and is thrown off into a box, car, or other receptacle.

I have found that when a drill steel is heated to the critical temperature for hardening and then removed from the heater the temperature of the heated portion of the steel slightly rises for an instant, which phenomenon I believe is due to the oxidizing effect of the oxygen of the air coming in contact with the heated portion. It is of importance that after the steel is heated to the proper temperature it be plunged into the cooling liquid at that temperature, and I have found that with a machine constructed according to my invention the substantially abrupt removal of the steel from the heater and presentation of its heated end to the cooler results in the cutting and reaming portions of the bit being plunged at substantially the same temperature as that to which they were raised by the heater, which I explain is due to the temperature increasing effect of oxidization compensating for the loss of heat by radiation.

It will be observed that I have herein provided a heater and a cooler for the ends of the drill steels, the latter being moved relative to the heater and cooler by means which presents the ends of the drill steels successively to the heater and cooler. Herein the presenting means is movable so as to approach the heater for presenting the ends of the steels thereto, then to leave the heater abruptly to approach the cooler for hardening the cutting ends of the bits, thereafter gradually to approach the cooler for gradually quenching the remainder of the heated portions, and finally to leave the cooler.

Having thus described one embodiment of my invention, but without limiting myself thereto, what I claim and desire by Letters Patent to secure is:

1. A machine for predeterminately heat treating the ends only of a group of drill steels comprising, in combination, heating means, cooling means, drill-steel-end-presenting means for moving drill steels relative to said heating and cooling means for presenting said ends thereto; said presenting means being movable to approach said heating means, then to leave said heating means and to approach said cooling means, and finally to leave said cooling means.

2. A machine for predeterminately heat treating the ends only of a group of drill steels comprising, in combination, heating means, cooling means, drill-steel-end-presenting means for moving drill steels relative to said heating and cooling means for presenting said ends thereto; said presenting means being movable to approach said heating means, then to leave said heating

means and abruptly to approach said cooling means and thereafter gradually to approach said cooling means, and finally to leave said cooling means.

3. A machine for predeterminately heat treating the ends only of a group of drill steels comprising, in combination, heating means, cooling means, separate drill-steel-end-presenting means each for moving drill steels relatively to said heating means and cooling means for presenting said ends thereto; each presenting means being movable to approach said heating means, then to leave said heating means and abruptly to approach said cooling means and thereafter gradually to approach said cooling means, and finally to leave said cooling means.

4. A machine for predeterminately heat treating the ends only of a group of drill steels comprising, in combination, heating means, cooling means, drill-steel-end-presenting means for moving drill steels relative to said heating means and cooling means for presenting said ends thereto, said presenting means being movable to traverse said heater and cooler and while traversing said cooler first to move nearer to and then away from said cooling means.

5. A machine for predeterminately heat treating the ends only of a group of drill steels comprising, in combination, heating means, cooling means, drill-steel-end-presenting means for moving drill steels relative to said heating means and cooling means for presenting said ends thereto, said presenting means being movable to traverse said heater at a relatively slow speed and thereafter to traverse said cooler at a relatively faster speed and while traversing said cooler first to move nearer to and then away from said cooling means.

6. A machine for predeterminately heat treating the ends only of a group of drill steels comprising, in combination, heating means, cooling means, separate drill-steel-end-presenting means each for moving drill steels relative to said heating means and cooling means for presenting said ends thereto; and means to cause each drill-steel-end-presenting means to traverse said heating means, then abruptly to approach said cooling means and thereafter gradually to approach said cooling means, and finally to leave said cooling means.

7. A machine for predeterminately heat treating the end portions only of drill steels comprising, in combination, heating means, cooling means comprising a quenching liquid, drill-steel-end-presenting means for moving drill steels relative to said heating means and cooling means for presenting said end portions thereto, said presenting means being movable substantially abruptly to remove drill steels from said heating means and to plunge the tips of said end portions into said liquid to a predetermined depth with said steels in vertical position.

8. A machine for predeterminately heat treating the end portions only of drill steels comprising, in combination, heating means, cooling means comprising a quenching liquid, drill-steel-end-presenting means for removing drill steels from the presence of said heating means and presenting them to said cooling means, said presenting means being movable substantially abruptly to remove drill steels from said heating means and to plunge the tips of said end portions into said liquid to a predetermined depth with said steels in vertical position.

9. A machine for predeterminately heat treating the end portions only of drill steels comprising, in combination, heating means, cooling means comprising a quenching liquid, drill-steel-end-presenting means for moving drill steels relative to said heating means and cooling means for presenting said end portions thereto; said presenting means being movable substantially abruptly to remove drill steels from said heating means to plunge the tips of said end portions into said liquid to a predetermined depth with said steels in vertical position, and thereafter gradually to lower said end portions into said liquid.

10. A machine for predeterminately heat treating the end portions only of drill steels comprising, in combination, heating means, cooling means comprising a quenching liquid, drill-steel-end-presenting means for removing drill steels from the presence of said heating means and presenting them to said cooling means; said presenting means being movable substantially abruptly to remove drill steels from said heating means and to plunge the tips of said end portions into said liquid to a predetermined depth with said steels in vertical position, and thereafter gradually to lower said end portions into said liquid.

11. A machine for predeterminately heat treating the end portions only of drill steels comprising, in combination, heating means, cooling means comprising a quenching liquid, drill-steel-end-presenting means for moving drill steels relative to said heating means and cooling means for presenting said end portions thereto; said presenting means being movable substantially abruptly to remove drill steels from said heating means and to plunge the tips of said end portions into said liquid to a predetermined depth with said steels in vertical position, and thereafter gradually to lower said end portions into said liquid while moving said steels laterally through said liquid.

12. A machine for predeterminately heat treating the end portions only of drill steels comprising, in combination, heating means, cooling means comprising a quenching liq-

uid, drill-steel-end-presenting means for removing drill steels from the presence of said heating means and presenting them to said cooling means; said presenting means being movable substantially abruptly to remove drill steels from said heating means and to plunge the tips of said end portions into said liquid to a predetermined depth with said steels in vertical position, and thereafter gradually to lower said end portions into said liquid while moving said steels laterally through said liquid.

13. A machine for predeterminately heat treating the bit ends only of a group of drill steels comprising, in combination, a heating means comprising a wall maintained at a high temperature, a cooling means comprising a quenching liquid, drill-steel-end-presenting means for moving drill steels relative to said heating means and cooling means for presenting said ends thereto, said presenting means being movable to cause said ends to move through said heating means with the end faces of the cutting portions of said bits facing said wall and to remove said ends from said heating means and abruptly to plunge said cutting portions into said liquid.

14. A machine for predeterminately heat treating the ends only of a group of drill steels comprising, in combination, heating means, cooling means, drill-steel-end-presenting means for moving drill steels while in vertical position relative to said heating and cooling means for presenting said ends thereto; said presenting means being movable to approach said heating means, then to leave said heating means and to approach said cooling means, and finally to leave said cooling means.

15. A machine for predeterminately heat treating the ends only of a group of drill steels comprising, in combination, heating means, cooling means, drill-steel-end-presenting means for moving drill steels while in vertical position relative to said heating and cooling means for presenting said ends thereto; said presenting means being movable to approach said heating means, then to leave said heating means and abruptly to approach said cooling means and thereafter gradually to approach said cooling means, and finally to leave said cooling means.

16. The method of moving rod-like articles through a heat treating apparatus which is characterized by mounting said articles on carriers of greater width than said articles, successively adding carriers to a previously formed row and moving the new row so formed by using the rearmost of the newly added carriers as a pusher, and after such movement removing carriers from the front of the new row.

17. In a machine for feeding articles, the combination of a series of carriers for the articles, a propeller, and means to cause said propeller to propel a row of carriers by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier of the row away from the remainder of the row.

18. In a machine for feeding articles, the combination of a series of carriers for the articles, a propeller, and means to cause said propeller to propel a row of carriers by utilizing the rearmost carrier as a pusher to advance the row by the space of one carrier and subsequently to propel the leading carrier of the row away from the remainder of the row.

19. In a machine for feeding articles, the combination of a series of carriers for the articles; carrier supporting means; a propeller; means to move said propeller in a forward direction to propel a row of articles along said supporting means by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier away from the row; and means to cause said propeller to execute a lateral movement to withdraw from engagement with the rearmost carrier and to engage the leading carrier.

20. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; means to move said propeller in a forward direction to propel a row of articles by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier away from the row; means to cause said propeller to execute a lateral movement to withdraw from the rearmost carrier and to engage the leading carrier; and means for utilizing the forward movement of said carriers to cause the latter to move in a direction transverse to such forward movement.

21. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; means to move said propeller in a forward direction to propel a row of articles by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier away from the row; means for utilizing such forward movement to cause said propeller to execute a lateral movement to withdraw from the rearmost carrier and to engage the leading carrier; and means for utilizing the forward movement of said carriers to cause the latter to move in a direction transverse to such forward movement.

22. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; means to cause the propeller to propel a row of carriers by uti-

lizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier of the row away from the remainder of the row; and means to cause the discharge of the articles from their respective carriers.

23. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; means to cause the propeller to propel a row of carriers by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier of the row away from the remainder of the row; and means for utilizing the advancing movement of said carriers to cause the discharge of the articles from their respective carriers.

24. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; and means to cause said propeller to swing and to propel a row of carriers in a circular path by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading article of the row away from the remainder of the row.

25. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; and means to cause said propeller to swing and to propel a row of carriers in a circular path by utilizing the rearmost carrier as a pusher to advance the row by the space of one carrier and subsequently to propel the leading carrier of the row away from the remainder of the row.

26. In a machine for feeding articles, the combination of a propeller; means to move said propeller in a circular path to propel a row of articles in a circular path by utilizing the rearmost article as a pusher to advance the row a predetermined distance and subsequently to propel the leading article away from the row; and means for utilizing such forward movement to cause said propeller to execute a radial movement to withdraw from engagement with the rearmost carrier and to engage the leading carrier.

27. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; means to move said propeller in a forward circular direction to propel a row of articles in a circular path by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier away from the row; means to cause said propeller to execute a radial movement to withdraw from engagement with the rearmost carrier and to engage the leading carrier; and means to cause each carrier to execute a movement in the same general direction as the axis of said propeller.

28. In a machine for feeding articles; the combination of a series of carriers for the articles; a propeller; means to move said propeller in a forward circular direction to propel a row of articles in a circular path by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier away from the row; means to cause said propeller to execute a radial movement to withdraw from engagement with the rearmost carrier and to engage the leading carrier; and means for utilizing the forward movement of each carrier to cause each carrier to execute a movement in the same general direction as the axis of said propeller.

29. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; means to move said propeller about an axis to cause said propeller to propel a row of carriers in a circular path by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier of the row away from the remainder of the row; and means to cause the discharge of the articles in a radial direction from their respective carriers.

30. In a machine for feeding articles, the combination of a series of carriers for the articles; a propeller; means to move said propeller about an axis to cause said propeller to propel a row of carriers in a circular path by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier of the row away from the remainder of the row; and means for utilizing the circular movement of said carriers to cause the discharge of the articles in a radial direction from their respective carriers.

31. In a machine for feeding bodies, the combination of means to guide the bodies in a generally circular path, and means to propel a row of the bodies by utilizing the rearmost body as a pusher to advance the row a predetermined distance and subsequently to propel the leading body of the row away from the remainder of the row, the last mentioned means including a rotating turret, a radially movable propeller carried thereby, and means to cause said propeller to move radially into and out of the circular path of the bodies.

32. In a machine for feeding articles, a plurality of carriers for the articles, means to guide said carriers in a predetermined path, and means to propel a row of said carriers by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier of the row away from the remainder of the row, the last mentioned means including a rotating turret, a radially movable propeller carried thereby, and

means to cause said propeller to move radially into and out of the path of said carriers.

33. In a machine for treating the end portions of metallic bodies, the combination of heating means; cooling means; means to impart a feeding movement to the bodies to cause them to traverse said heating means and said cooling means successively; and means to impart a movement transverse to the direction of feeding to the bodies to cause their ends to be brought into the presence of said heating means and said cooling means during said feeding movement.

34. In a machine for treating the ends of rod-like metallic bodies, the combination of heating means; cooling means; means to impart a feeding movement to the bodies to cause them to traverse first said heating means at a relatively slow speed and then to traverse said cooling means at a relatively higher speed; and means to impart a lengthwise movement to the bodies to cause their ends to be brought into the presence of said heating means and said cooling means during said feeding movement.

35. In a machine for treating the ends of metallic bodies, the combination of heating means; cooling means; feeding means to cause the bodies to execute first an intermittent feeding movement along said heating means and then a feeding movement along said cooling means; and means to cause said bodies to execute a movement to bring their ends into the presence of said heating means and said cooling means during their progress under the influence of said feeding means.

36. In a machine for heat treating drill steels, the combination with heating and cooling means, of means to cause the ends of said drill steels to be brought into the presence of said heating means, maintained there for a predetermined time, then to be brought into the presence of said cooling means, and finally to be removed from the presence of said cooling means.

37. In a machine for treating metallic bodies, the combination of heating means, a cooling liquid, and means to cause a portion of said articles to be brought into association with said heating means, maintained there for a predetermined period of time, and then plunged into and removed from said cooling liquid.

38. In a machine for treating metallic bodies, the combination of heating means, a cooling liquid, and means to cause the articles to be brought into association with said heating means, maintained there for a predetermined period of time, plunged into said cooling liquid, and then gradually immersed deeper into said cooling liquid.

39. In a machine for treating metallic bodies, the combination of heating means, a cooling liquid, and means to cause the articles to be brought into association with said heating means, maintained there for a predetermined period of time, plunged into said cooling liquid, and then gradually immersed deeper into and finally removed from said cooling liquid.

40. In a heat treating machine, a heating means, a cooling means, means for imparting movement to articles to be treated to cause them to traverse said heating and cooling means, and means to impart motion relative to the direction of feed to cause an end of such articles to be brought into the presence of said heating means and afterwards into the presence of said cooling means.

41. In a machine for heat treating a limited portion of articles, a plurality of heat treating instrumentalities, and means to cause such portion of said articles to be successively moved into and out of the presence of said instrumentalities.

42. In a machine for treating the ends of drill steels, a heater, a quenching medium, and means for causing said ends of said steels to be subjected to the action of said heater and afterwards to be subjected to the action of said quenching medium.

43. The combination with a heat treating instrumentality, of means for causing rod-like articles to be treated to move in a path traversing said instrumentality, and means responsive to such feeding movement for moving the ends only of said articles longitudinally into and out of the presence of said instrumentality.

44. The combination with a heat treating instrumentality, of means for causing rod-like articles to be treated to move in a path traversing said instrumentality, and means for automatically giving said articles a motion relative to said path to cause their ends to move into and out of the presence of said instrumentality.

45. In a machine of the character described, a heat treating instrumentality, a carrier for rod-like articles to be treated, means for moving said carrier to cause said articles to traverse said instrumentality, and means for imparting to said articles a motion transverse to the direction of the first mentioned motion to move their ends into and out of the presence of said instrumentality.

46. In a machine of the character described, a heat treating instrumentality, a carrier for the articles to be treated, means for causing said carrier to traverse said instrumentality, and an undulating track for causing said articles to move into the presence of said instrumentality.

47. In a machine of the character described, an article carrier, a continuously moving propeller for said carrier, and means

causing said carrier to at times advance faster than said propeller and then remain stationary until said propeller again moves into operative relation therewith.

48. In a heat treating machine, a cooler for previously heated articles, means to cause a limited portion of said articles to be brought into the presence of said cooler for a predetermined time and afterwards progressively to subject other portions of said article to said cooler.

49. In a heat treating machine, a quenching liquid for previously heated articles, means for causing a limited portion of said articles to be immersed in said liquid for a predetermined time and afterwards other portions to be immersed progressively in said liquid.

50. In a heat treating machine, a tank for quenching liquid, said tank having an inlet at one portion thereof and at another portion an outlet, means for immersing to a predetermined depth the tip of a previously heated end of a drill steel in said liquid adjacent said inlet and for a predetermined time, and means for moving said steel toward said outlet and for progressively immersing the remainder of said heated portion during such motion.

51. In a heat treating machine for drill steels, a heater, a quenching medium, means for subjecting the ends of said steels to said heater and for withdrawing them therefrom, and means for subjecting the tip of said ends to said medium for a predetermined time, and afterwards progressively subjecting the remainder of said ends to said medium.

52. In a machine of the character described, a quenching medium, and means for progressively subjecting previously heated ends of articles to said medium at a variable rate of speed.

53. In a machine for heat-treating the end portions only of drill steels, a heater, a tank containing a quenching liquid, means for presenting said ends successively to said heater and tank, said means immersing said ends in said liquid at a variable rate of immersion.

54. In a machine for treating metallic bodies, the combination of a furnace for heating the bodies, said furnace being provided with a heated chamber and an arc-shaped slot communicating therewith; a quenching tank to contain a liquid for cooling said bodies; a series of carriers for said bodies, each carrier being provided with a pair of spring-actuated jaws for yieldingly holding the body carried thereby; a gage to determine the positioning of the bodies in their respective carriers; a series of carrier propellers each comprising a radially movable plunger, a rotating turret carrying said plungers; springs tending to urge said plungers radially outward into engagement with said carriers; means for rotating said turret; a stationary cam cooperating with said plungers to move the latter radially inward in opposition to said springs, said cam having provision to cause said propellers to propel a row of carriers by utilizing the rearmost carrier as a pusher to advance the row a predetermined distance and subsequently to propel the leading carrier of the row away from the remainder of the row, a carrier supporting and guiding track having provision to cause the bodies to be lowered through said slot into said chamber and maintained in said row therein during a predetermined period of time and each body, when propelled away from said row, lowered into said tank, and finally lifted out of the cooling liquid; and an ejector for causing the ejection of said bodies from said carriers after said bodies have been thus cooled.

55. In a machine of the class described, a carrier having means to grasp a rod-like article to be carried at a plurality of spaced points intermediate its length, in combination with a gage independent of said means to determine the position of the tip of the article relatively to said carrier.

56. In a machine of the class described, a carrier having means to hold a drill steel in vertical position with an end disposed below said carrier and to permit movement of said drill steel while being positioned, in combination with a gage for the end of said steel independent of said holding means to determine the position of said end of said steel relatively to said carrier.

57. In a machine of the class described, a carrier having a pair of relatively movable jaws, in combination with a gage independent of said jaws to determine the position of a rod-like article to be placed vertically in said jaws and to be grasped thereby intermediate its length.

58. In a machine of the class described, a carrier having a pair of relatively movable jaws one of which is yieldably movable toward the other, means to cause the insertion of an article to open said jaws, and a gage to determine the position of the article being placed therein.

59. In a machine of the class described, a carrier having a pair of relatively movable jaws having a vertically disposed space in which the article is received, in combination with a gage to determine the vertical position of the article therein.

60. In a machine of the class described, a movable carrier having means to hold a rod-like article to be carried in vertical position, in combination with fixed gaging means independent of the first named means and contacting the tip of said article to determine the position of said tip with relation to said carrier.

61. In a machine of the class described, the combination of a carrier having means to hold rod-like articles of different length, a gage contacting the tip of the articles to determine the position of the tip of the articles with relation to said carrier, and means to move said carrier into and out of cooperating relationship with said gage.

62. In a machine of the class described, the combination of a track, a carrier travelling on said track, said carrier having a holding portion presented at one side of said track and a propelling portion presented at the other side of said track, and a propeller engaging said propelling portion and propelling said carrier along said track.

63. In a machine of the class described, the combination of a track, a carrier travelling along said track, said carrier having two arms disposed on opposite sides, respectively, of said track, one of said arms having means for carrying an article, and means engaging the other arm to propel said carrier along said track.

64. In a machine of the class described, the combination of a track, a carrier travelling along said track, said carrier being generally U-shaped and presenting two depending arms, one having article-holding means, and means engaging the other arm to propel said carrier along said track.

65. In a machine of the character described, a heat treating instrumentality, a carrier, a track for said carrier, means for propelling said carrier along said track, and undulations formed in said track to cause said carrier to move toward and away from said instrumentality.

66. In a machine of the character described, a plurality of heat treating instrumentalities, a carrier, a track for said carrier, means for propelling said carrier along said track, and undulations formed in said track to cause said carrier to move successively toward and away from said instrumentalities.

67. In a heat treating machine, a heater, a tank for quenching fluid, a track having the portions 88 and 92, a carrier for articles to be treated mounted on said track and means for causing said carrier to move along said track.

68. In a heat treating machine, a heater, a tank for quenching fluid, a track having the portions 88 and 92, a carrier having the portion 76 for articles to be treated mounted on said track and a propeller 144 for causing said carrier to move along said track.

69. The method of heat treating drill steels which consists in first heating the end portion thereof and then suddenly plunging a predetermined portion of the tip of such end in quenching fluid, allowing said portion to remain immersed in said fluid to a constant depth for a predetermined time, and in finally progressively subjecting the heated portion to quenching fluid.

70. The method of heat treating drill steels which comprises first heating the end portion thereof and then immersing the tip of such end in quenching fluid and in finally progressively subjecting the heated portion to quenching fluid at a progressively rising temperature.

71. The method of heat treating drill steels which comprises first heating the end portion thereof and then immersing the tip of such end in quenching fluid, holding said steel stationary with said tip immersed at a constant depth for a predetermined time, and in finally giving the steel a lateral movement in said fluid and progressively subjecting the heated portion thereto.

72. The method of heat treating drill steels which comprises first heating the end portion thereof and then immersing the tip of such end in quenching fluid and in finally giving the steel a lateral movement in said fluid and progressively subjecting it to fluid at a progressively rising temperature.

73. The method of heat treating drill steels which comprises first quenching the tip of the previously heated end thereof in a quenching fluid and after said tip is quenched quenching the remainder of the heated end by subjecting the entire heated end to a quenching fluid having a different characteristic while effecting relative motion between said last named quenching medium and said heated end laterally of said steel.

74. The method of heat treating drill steels and the like which comprises first quenching the tip of the previously heated end thereof in a quenching medium and after said tip is quenched finally quenching the remainder of the heated end by progressively subjecting said end to a quenching medium having a progressively varying characteristic.

75. In a machine for heat treating the ends of drill steels, a heater, a quenching tank, an endless track passing by said heater and quenching tank, said track having a portion at a higher level at said heater than at said tank and a connecting incline, carriers on said track for holding said drill steels, means for causing said carriers to move along said track, and said means being arranged to cause a row of carriers to be maintained on said track at said heater and intermittently to push carriers down said incline to said tank.

76. In a machine for heat treating the ends of drill steels, a heater, a quenching tank, an endless track passing by said heater and quenching tank, said track having a portion at a higher level at said heater than at said tank and a connecting incline, carriers on said track for holding said drill steels, means for causing said carriers to move along said

track; said means being arranged to cause a row of carriers to be maintained on said track at said heater and intermittently to add a carrier to the end of said row remote from said tank and intermittently push the row toward said tank, and said means further intermittently causing the carrier of said row nearest said tank to run down said incline to said tank and to remain there stationary for a predetermined time and then to travel by said tank.

77. In a machine for heat treating the ends of drill steels, a heater, a quenching tank, an endless track passing by said heater and tank, carriers for said steels on said track, means on said carriers for holding said drill steels, said track being so shaped as to raise and lower the ends of the drill steels into and out of said heater and tank, and means for causing the carriers to move along said track and to travel by said heater at a slower rate than by said tank.

78. In a machine for heat treating the ends of drill steels, a heater, a quenching tank, an endless track passing by said heater and tank, carriers for said steels on said track, means on said carriers for holding said drill steels, said track being so shaped as to raise and lower the ends of the drill steels into and out of said heater and tank, means for causing the carriers to move along said track, and said means being constructed to disengage a carrier after the latter reaches said heater and pushes a row of carriers at said heater in front of it for a predetermined distance and then to engage the last carrier of the row and move it out of said heater.

79. In a machine for heat treating drill steels, a heater, a tank; a track passing by said heater and tank and having portions at different levels connected by inclines at the ends of the heater and tank, the level at said tank being lower than at said heater and the level adjacent the end of the heater remote from the tank being higher than the level at said heater; carriers for the drill steels and mounted on said track, means for moving said carriers along said track, said means being constructed to maintain a row of carriers at said heater and to cause a carrier to run down the incline to said heater to be added to said row and further to push the row toward said tank and cause a carrier to be removed from said row and to run down the incline to said tank.

80. In a machine for heat treating drill steels, a heater, a tank; a track passing by said heater and tank and having portions at different levels connected by inclines at the ends of the heater and tank, the level at said tank being lower than at said heater and the level adjacent the end of the heater remote from the tank being higher than the level at said heater; carriers for the drill steels and mounted on said track, means for moving said carriers along said track, said means being constructed to maintain a row of carriers at said heater and to cause a carrier to run down the incline to said heater to be added to said row and further to push the row toward said tank and cause a carrier to be removed from said row and to run down the incline to said tank, said means further causing the carrier after it reaches said tank to remain stationary for a predetermined time and then to move by said tank, the level of the track at said tank being gradually inclined to cause the end of said steel to be gradually lowered therein as the steel passes the tank, and said means finally causing the carrier to move up the incline of the track at the end of the tank remote from the heater.

81. In a heat treating machine for drill steels a heater, a tank having an inlet adjacent the heater; a circular track passing by said heater and tank, said track having a portion of highest level, a portion of intermediate level at said heater, a portion of lowest level at said tank and inclines connecting said levels, carriers for said drill steels and mounted on said track, rotary members for pushing said carriers around said track, and means for giving said rotary members an inward radial movement for disengaging a carrier after said member has passed by the first portion of the track at the intermediate level and an outward radial movement to engage a carrier at the end of said intermediate level.

82. In a heat treating machine for drill steels an arcuate heater and an arcuate quenching tank arranged in alignment, a circular track above said heater and tank and having a portion above said heater at a higher level than its portion above said tank and an incline connecting said portions, carriers for drill steels on said track, feeding means for said carriers arranged to maintain a row of carriers at said heater, and said feeding means being arranged to add a carrier to the end of said row remote from the tank and to push said row toward the tank and to cause the carrier of said row adjacent said tank to run by gravity down the incline to said tank.

83. In a heat treating machine for drill steels an arcuate heater and an arcuate quenching tank arranged in alignment, a circular track above said heater and tank and having a portion above said heater at a higher level than its portion above said tank and an incline connecting said portions, carriers for drill steels on said track, a plurality of members for engaging said carriers and rotating about the center of said circular track, means for causing said members to engage and disengage said carriers, and said means being so timed as to cause a

row of carriers to be maintained at said heater and to be fed toward said tank step by step and further to add carriers to said row one by one and to cause carriers one by one to run by gravity down said incline to said tank.

84. In a heat treating machine for drill steels an arcuate heater and an arcuate quenching tank arranged in alignment, a circular track above said heater and tank and having a portion above said heater at a higher level than its portion above said tank and an incline connecting said portions, carriers for drill steels on said track, feeding means for said carriers arranged to maintain a row of carriers at said heater, and said feeding means being arranged to add a carrier to the end of said row remote from the tank and to push said row toward the tank and to cause the carrier of said row adjacent said tank to move down the incline to said tank.

85. In a heat treating machine for drill steels an arcuate heater and an arcuate quenching tank arranged in alignment, a circular track above said heater and tank and having a portion above said heater at a higher level than its portion above said tank and an incline connecting said portions, carriers for drill steels on said track, a plurality of members for engaging said carriers and rotating about the center of said circular track, means for causing said member to engage and disengage said carriers, and said means being so timed as to cause a row of carriers to be maintained at said heater and to be fed toward said tank step by step and further to add carriers to said row one by one and to cause carriers one by one to move down said incline to said tank.

86. In a heat treating machine for drill steels a circular vertically undulating track, a heater and a quenching tank beneath said track, carriers for said drill steels mounted on said track, means for moving said carriers along said track, and said undulations of said track being so arranged and said means being so timed that drill steels are arranged in a row with their ends in said heater and are fed one by one from said row to said tank where their heated ends are immersed in the quenching liquid at a constant depth for a predetermined time and then are progressively immersed.

87. In a heat treating machine for drill steels a circular vertically undulating track, a heater and a quenching tank beneath said track, carriers for said drill steels mounted on said track, means for moving said carriers along said track, and said undulations of said track being so arranged and said means being so timed that drill steels are arranged in a row with their ends in said heater and are fed one by one from said row to said tank where they are allowed to remain stationary with their heated ends immersed to a predetermined depth in the quenching liquid for a predetermined time and are then moved through said tank and simultaneously with this movement are progressively immersed.

88. In a heat treating machine for drill steels a circular vertically undulating track, a heater and a quenching tank beneath said track, carriers for said drill steels mounted on said track, means for moving said carriers along said track, and said undulations of said track being so arranged and said means being so timed that drill steels are arranged in a row with their ends in said heater and are fed one by one from said row to said tank where their heated ends are progressively immersed in the quenching liquid.

89. In a heat treating machine for drill steels a circular vertically undulating track, a heater and a quenching tank beneath said track, carriers for said drill steels mounted on said track, means for moving said carriers along said track, and said undulations of said track being so arranged and said means being so timed that drill steels are arranged in a row with their ends in said heater and are fed one by one from said row to said tank, where they are moved through said tank with their heated ends first immersed to a constant depth in the quenching liquid for a predetermined time and then are progressively immersed.

90. In a heat treating machine for drill steels a circular vertically undulating track, a heater and a quenching tank beneath said track, carriers for said drill steels mounted on said track, means for moving said carriers along said track, and said undulations of said track being so arranged and said means being so timed that drill steels are arranged in a row with their ends in said heater and are fed one by one from said row to said tank, where their heated ends are immersed in the quenching liquid at a variable rate of immersion.

91. In a heat treating machine for drill steels a circular vertically undulating track, a heater and a quenching tank beneath said track, carriers for said drill steels mounted on said track, means for moving said carriers along said track, and said undulations of said track being so arranged and said means being so timed that drill steels are arranged in a row with their ends in said heater and are fed one by one from said row to said tank, where their heated ends are moved through said tank and immersed in the quenching liquid at a variable rate of immersion.

92. In a machine for heat treating drill steels, a heater and a quenching tank, means for conveying said drill steels to present

their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to said tank where their heated ends are immersed in the quenching liquid at a constant depth for a predetermined time and then are progressively immersed.

93. In a machine for heat treating drill steels, a heater and a quenching tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to said tank where they are allowed to remain stationary with their heated ends immersed to a predetermined depth in the quenching liquid for a predetermined time and then are moved through said tank and simultaneously with this movement are progressively immersed.

94. In a machine for heat treating drill steels, a heater and a quenching tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to said tank where their heated ends are progressively immersed in the quenching liquid.

95. In a machine for heat treating drill steels, a heater and a quenching tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to said tank where they are moved through said tank with their heated ends first immersed to a constant depth in the quenching liquid for a predetermined time and then are progressively immersed.

96. In a machine for heat treating drill steels, a heater and a quenching tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to said tank where their heated ends are immersed in the quenching liquid at a variable rate of immersion.

97. In a machine for heat treating drill steels, a heater and a quenching tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to said tank where their heated ends are moved through said tank and immersed in the quenching liquid at a variable rate of immersion.

98. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet for quenching fluid at its end nearest said heater through which cold quenching fluid continuously enters said tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where their heated ends are immersed in the quenching liquid at a constant depth for a predetermined time and then are progressively immersed.

99. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet for quenching fluid at its end nearest said heater through which cold quenching fluid continuously enters said tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank, where they are allowed to remain stationary with their heated ends immersed to a predetermined depth in the quenching liquid for a predetermined time and then are moved through said tank and simultaneously with this movement are progressively immersed.

100. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet for quenching fluid at its end nearest said heater through which cold quenching fluid continuously enters said tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where their heated ends are progressively immersed in the quenching liquid.

101. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet for quenching fluid at its end nearest said heater through which cold quenching fluid continuously enters said tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said

means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where they are moved through said tank with their heated ends first immersed to a constant depth in the quenching liquid for a predetermined time and then are progressively immersed.

102. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet for quenching fluid at its end nearest said heater through which cold quenching fluid continuously enters said tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank, where their heated ends are immersed in the quenching liquid at a variable rate of immersion.

103. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet for quenching fluid at its end nearest said heater through which cold quenching fluid continuously enters said tank, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where their heated ends are moved through said tank and immersed in the quenching liquid at a variable rate of immersion.

104. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet at its end nearest said heater through which cold quenching fluid continuously enters the tank and having an outlet at its opposite end, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank, where their heated ends are immersed in the quenching liquid at a constant depth for a predetermined time and then are progressively immersed.

105. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet at its end nearest said heater through which cold quenching fluid continuously enters the tank and having an outlet at its opposite end, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where they are allowed to remain stationary with their heated ends immersed to a predetermined depth in the quenching liquid for a predetermined time and then are moved through said tank and simultaneously with this movement are progressively immersed.

106. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet at its end nearest said heater through which cold quenching fluid continuously enters the tank and having an outlet at its opposite end, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where their heated ends are progressively immersed in the quenching liquid.

107. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet at its end nearest said heater through which cold quenching fluid continuously enters said tank and having an outlet at its opposite end, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where they are moved through said tank with their heated ends first immersed to a constant depth in the quenching liquid for a predetermined time and then are progressively immersed.

108. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet at its end nearest said heater through which cold quenching fluid continuously enters the tank and having an outlet at its opposite end, means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where their heated ends are immersed in the quenching liquid at a variable rate of immersion.

109. In a machine for heat treating drill steels, a heater and a quenching tank, said quenching tank having an inlet at its end nearest said heater through which cold quenching fluid continuously enters the tank and having an outlet at its opposite end,

means for conveying said drill steels to present their ends to said heater and quenching tank, said means being so arranged and timed that drill steels are maintained in a row with their ends in said heater and are removed from said row one by one to the inlet end of said tank where their heated ends are moved through said tank and immersed in the quenching liquid at a variable rate of immersion.

In testimony whereof, I have signed my name to this specification.

GEORGE H. GILMAN.