

1,334,663.

3 SHEETS—SHEET 1.



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 HEAT TREATING APPARATUS.
 APPLICATION FILED MAY 10, 1919.

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Patented Mar. 23, 1920.
 3 SHEETS—SHEET 2.

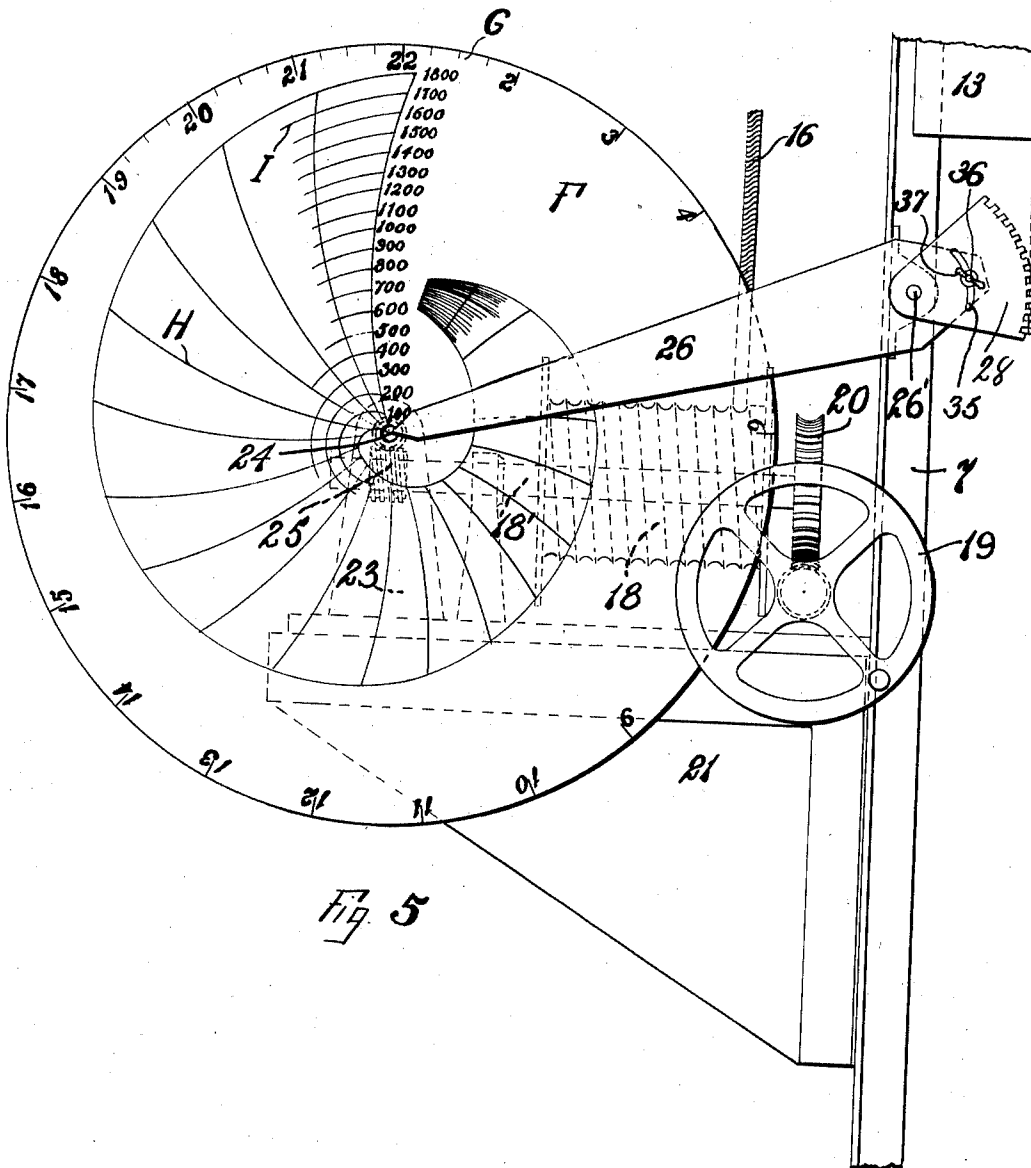


Fig. 5

WITNESS

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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

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HEAT-TREATING APPARATUS.

1,334,663.

Specification of Letters Patent. Patented Mar. 23, 1920.

Application filed May 10, 1919. Serial No. 296,217.

To all whom it may concern:

Be it known that we, ANGUS S. MACDONALD and EDWARD MELVILLE HUGGINS, both citizens of the United States, residing at Great Neck Station, in the county of Nassau and State of New York, and New York city, in the county of New York and State of New York, respectively, have invented certain new and useful Improvements in Heat-Treating Apparatus, of which the following is a specification.

This invention relates to improvements in apparatus for the heat treating, or heat treating and tempering of metallic articles, and it has for one of its primary objects the provision of simple and improved mechanism whereby the treating or tempering, or both, may be accomplished economically and expeditiously, and with uniform results. Another object resides in the provision of improved apparatus of the character specified for heat treating strips, sheets, plates, and similar fabricated metallic members in such manner as to prevent warping and distortion thereof during both the heat treatment and tempering operations. Our invention also contemplates the provision of improved temperature indicating mechanism for translating the expansion or contraction of the articles undergoing treatment into terms of temperature readings, such indicating mechanism automatically accommodating itself to variations in the dimensions of the articles to be treated.

The foregoing, together with such other objects as may hereinafter appear, or are incident to our invention, we have obtained by means of apparatus which we have illustrated in preferred form in the accompanying drawings, wherein:

Figure 1 is a diagrammatic side elevation and partial section of our improved apparatus; Fig. 2 is a cross-section taken on the line A—B of Fig. 1; Fig. 3 is a plan view of certain details of our improvements; Fig. 4 is a section taken on the line C—D of Fig. 1; Fig. 5 is a side elevation drawn on an enlarged scale of the indicating temperature mechanism; Fig. 6 is a perspective of another detail of our improvement; Fig. 7 is a fragmentary side elevation of a

modification of our improvement; and Fig. 8 is a partial plan and sectional view of the mechanism shown in Fig. 7.

This invention is applicable in general to that type of heating apparatus shown in U. S. Letters Patent to Macdonald and Huggins, Number 1,274,919, issued August 6, 1918.

The apparatus comprises a main frame 7 preferably composed of T-rails with which are associated a back plate 8 and a hinged door 9, both of which are composed of some suitable refractory insulating material such, for example, as asbestos fiber or the like. The T-rails extend downwardly into a tank or well 10 adapted to contain a quenching medium such, for example, as oil, and the back plate 8 and hinged door 9 are carried approximately from the level of the tank 10 to the top of the frame so that the upper part of the frame constitutes an inclosing box adapted to prevent radiation which would be particularly excessive where the article to be treated is a steel strip or plate. In the drawings, we have shown a steel sheet or strip 11 as the article undergoing heat treatment. This strip is suspended from an upper pair of jaws 12 and is also supported by a lower pair of jaws 13, such jaws also constituting the terminals for the leads 14 and 15. Each jaw comprises a pair of plate-like members, one of which is provided with means for slidably engaging the T-rails, the other being clamped to said first member, with the strip 11 therebetween, by suitable fastening means such, for example, as the bolts 14'. The plates comprising each pair of jaws conform to the shape of the article so as to prevent the article from becoming transversely distorted or warped, and while we have shown such jaws in the drawings in the form of plates, it will be readily understood that they may be shaped to suit any particular configuration of article. At various points intermediate the jaws 12 and 13, the article may be supported by clamps 15' which are adapted to slidably embrace the T-rails and are constructed so as to engage the article throughout its width. These clamps, however, have a relatively thin strip-engaging surface, so as to reduce

the liability of cold spots. It will, of course, be apparent that the jaws 12 and 13 and the clamps 15' support the article longitudinally and prevent warping or distortion.

5 The upper jaw or contact 12 is movably supported or suspended in the frame by the cable 16 which passes over the sheave 17 and is wound upon the drum 18 operated by the hand-wheel 19 through the gearing 20. 10 The drum is mounted on the bracket 21 secured to one of the T-rails 7.

The lower contact 13 is normally held in the position indicated in Fig. 1 by means of the treadle mechanism indicated as a whole 15 at E and to be hereinafter more particularly described. By suspending the article from the upper contact or jaws 12, it has a tendency to straighten out and remain in alignment during the heating and this advantageous result may be augmented by the provision of a weight 22 suspended from the 20 lower contact 13. Mounted in standards 23 carried by the bracket 21 is a shaft 24, with which is associated a temperature dial F, the shaft 24 being driven from the shaft 18' of the drum 18 by means of the gearing 25 (see Fig. 5). At the periphery, the dial F is provided with a linear scale G for indicating the length of the article being treated. The 25 dial is also provided with radial lines or markings H corresponding to the major dimensions of the scale G. The radial lines H are intersected by the lines I of a temperature scale. This scale may be readily worked 30 out from the principle that the volume of a metallic object is a function of the temperature. The article will expand as the temperature rises, and the lines I are obtained by pointing off on the radial line H the amount 35 of expansion for every rise of 100° and drawing the lines therethrough.

Pivoted to one of the T-rails 7, or some other suitable part of the apparatus, is an indicator arm 26 which is operated from the 40 lower contact 13 and the gear segment 28, the parts being so arranged that when the lower contact 13 is in its upper normal position as indicated in Fig. 1, the indicator arm 26 will point to zero temperature.

50 The mechanism E, by means of which the lower contact is held in upper position, will now be described, and it comprises a treadle 29 pivoted to one of the T-rails 7, a shaft 30 rotatably carried by such T-rail and having 55 at its inner end an arm 32 adapted to engage the lower face of the contact 13 and at its outer end, with another arm 31 connected to the treadle 29 by the link 33.

Normally, the treadle 29 is spring held in 60 upper position, in which position the arm 32 is free of the contact 13 and will permit the contact 13 to sink freely. When the treadle 29 is depressed the shaft 30 is locked, which will bring the arm 32 into engagement with 65 and maintain the contact 13 in upper position

until a new article has been placed in position and the operator releases the treadle.

The operation of the mechanism is as follows, assuming that the contact 13 is held in upper position by the treadle mechanism, as described:—A steel sheet, plate or other article is clamped in the upper jaws and the hand-wheel 19 is rotated to lower the upper contact and the article until its lower end is 70 in position to be engaged in and clamped by the jaws or contact 13. The dial operating mechanism is so arranged that the linear scale G will register zero with reference to the pointer when the upper contact 12 rests 75 upon the lower contact, and when the upper contact is raised or lowered from any given point as may be required to suit the length of the particular article to be treated, the dial will be correspondingly rotated until 80 the radial line H, corresponding to the length of the article, will be brought into (or approximately into) the vertical position indicated in Figs. 1 and 5. Thus, the 85 position of the dial will always correspond to the distance between the contacts. In Fig. 5, the radial line H, corresponding to an article having a length of 22 ft., has been brought to a vertical position. The end of the pointer will follow this radial line H, 90 when the pointer is rotated about its pivot point by the sinking of the contact 13, through the medium of the rack 27 and gear segment 28.

With the article thus positioned, the 100 switch 34 is closed and current, from suitable source of supply, passes through the article which becomes heated by its internal resistance to the passage of the current therethrough. As the article becomes 105 heated; it expands and the lower contact sinks causing the pointer (which is designed to greatly amplify the movement of the contact 13) to move upwardly following the radial line H and clearly indicate the 110 temperature of the article as it crosses the spiral intersecting lines I of the temperature scale. By following the movement of the pointer, the operator will thus be continuously advised as to the temperature of the 115 article and when this has reached the desired point, he can cut off the current. If the article being treated is to be tempered, the current is kept on until the article has been heated through the decalescent period 120 and the current is then turned off, after which the hand-wheel is rotated to lower the article into the bath. The apparatus is now ready for another operation.

The dial and its operating mechanism are 125 so arranged with reference to the lower contact that the latter can freely pass. It will also be apparent that the upper and lower contacts and the clamps 15 will prevent warping and distortion not only during the 130

heating and the quenching, but during transfer. The article is thus maintained in its original shape. When an article is in the apparatus for treatment, all of the parts will be held in upper position because the gearing will prevent rotation of the drum.

In order to compensate for variations in temperature in different seasons of the year, we prefer to form the pointer 26 and the segment 28 separately, as shown, so that the position of the pointer can be readily adjusted to suit the atmospheric temperature. As one means for accomplishing this result, we have pivotally mounted the segment 28 on the pivot point 26' and provided such segment with an arcuate slot 35 through which projects a bolt 36 carried on the pointer 26, and the gear segment and pointer are locked in adjusted position by means of the wing nut 37.

It will be seen from the foregoing that we have provided a simple means for indicating the temperature of the article being treated, such means automatically accommodating itself to variations in length within the capacity of the apparatus. By the use of an electric current as the heating medium, the articles are heated substantially uniformly substantially throughout their length, and the temperature indicating mechanism makes it possible to obtain absolute uniformity in the heat treatment of an indefinite number of articles, thus securing uniformity in physical properties which is of great importance, particularly in the heat treatment of fabricated members adapted to be placed under considerable strains, such, for example, as aeroplane parts. Furthermore, the operator is materially assisted in obtaining uniform results because of the fact that during the transformation periods, the pointer will temporarily pause or retrogress as the case may be. Thus, during the critical period in which the physical changes in the steel undergoing treatment take place, the pointer will pause in its movement.

It will, of course, be apparent that the linear and temperature scales may be altered or amplified to any degree that may be called for, depending upon the nicety of indication desired. It will also be apparent that considerable modification can be made from the particular form of apparatus shown, and it is to be further understood that the apparatus may be utilized for carrying out a variety of heat treating operations. The dial may be graduated for any definite starting temperature.

In the modification we have shown in Figs. 7 and 8, the temperature indicating mechanism is much simplified. In this arrangement, as before, the upper contact is supported by the cable passing over the drum 18, the shaft 18' of which is driven through the gearing 20. However, at the

inner end of the shaft 18' is a helical gear 40 engaging a helical gear 41 on a vertical shaft 42. Splined to the upper end of the shaft 42 is another helical gear 43 engaging helical gear 44 keyed to the threaded shaft 45, mounted in a movable frame 46, such frame slidably engaging the T-rail 7, in the manner indicated in Fig. 8. The frame 46, which carries the gear 43, rests upon an abutment on the lower contact 13, and by virtue of its weight moves with such contact, the movement being permitted by virtue of the splined mounting of the gear 43 on the shaft 42.

A stationary bracket 47 is bolted to the rail 7 and the indicator arm 26 is pivoted to such bracket, as indicated at 48 in Fig. 7. The indicator arm is provided with a slot 49 in which is slidably mounted the block 50, pivoted to a second block 51 which has threaded engagement with the threaded shaft 45 and is slidably supported in the frame 46 by means of the rod 52.

The dial F' in this construction is stationary and is provided with a single temperature scale, and because of this fact, and also because the pivot point 48 is fixed, it will be apparent that some means must be provided to compensate for variations in length of the articles being treated because the amount of expansion and contraction of such articles will be dependent upon their length. To state the matter in other words, the dial F' and the pivot point 48 are fixed factors, the length of the article is variable, and consequently, a variable factor must be employed to give the pointer 26 the proper amount of travel corresponding to the length of the particular article being treated.

This condition has been met by means of the movable blocks 50 and 51, such blocks imparting movement to the pointer 26 about its pivot point 48 because they in turn are movable with the frame 46, which, in turn, moves with the contact 13. The distance between pivot points 50' and 48 will determine the amplitude of the movement imparted to the pointer, and by virtue of the gearing employed, the distance between the two pivot points will always correspond to the length of the article, for the reason that the amount of cable fed out from the drum 18 corresponds to the length of the article, and the turns imparted to the drum 18 are also imparted to shaft 45, and consequently, to blocks 51 and 50. If the article is short, points 48 and 50' will be close together increasing the amplitude of the movement of the pointer; if the article is long, the points will be farther apart, decreasing the amplitude of movement.

The operation is as follows: Lower contact 13, as before, is elevated by the treadle mechanism described until the contact 13 is brought into engagement with the stop 130

53. Contact 13 will then have brought frame 46 to the position indicated in Fig. 7 in which position pointer 26 registers zero on the temperature scale. The article to be treated is then secured in the upper contact and the cable is fed out until the lower end of the article is brought into position to be engaged by the lower contact 13. When this adjustment is effected, the blocks 51 and 50 will be shifted in position until the distance between points 50' and 48 also correspond to the length of the article. The treadle is now released, the current turned on, and as the article expands as it becomes heated, the contact 13 will sink, as will the frame 46 and blocks 51 and 50, the latter block imparting movement to the pointer 26 about its pivot point 48. Stated in other words, the movement imparted to the pointer 26 will be such as to register proper temperatures regardless of the length and, therefore, of the amount of expansion of the article being treated. When the pointer indicates a temperature which is suitable for the particular heat treating operation being carried on, as above pointed out, current is turned off, and the article is submerged in the bath for quenching or removed from the machine, if raised only to the drawing temperature.

30 As before, the pointer 26 is made adjustable so that it may be accommodated to atmospheric conditions in order to obtain accuracy.

When the parts are being lowered into the bath, frame 46 and its associated parts continue to travel downwardly until stop 54 is engaged and further downward movement of the frame is limited. Stop 54, however, is so located as not to interfere with the movement imparted to the frame 46 when the article expands or contracts.

40 If desired the temperature indicating mechanism may be self recording, for which purpose a pencil 56 or other marking device may be mounted in the end of the pointer and a loose temperature card placed on the pins 55 (see Fig. 7). A record may thus be kept for every piece of material treated. Furthermore, the bar or rod 52 may be provided with a scale, as illustrated in Fig. 7 for indicating the length of each piece treated.

It is to be noted that the manner of suspending the sheet from the upper contact under the weight of the lower contact places the sheet under tension and this together with the clamping means for supporting the sheet assist in preventing warping or distortion during the quenching operation.

60 We claim:

1. An apparatus for heat treating metallic articles comprising in combination a bath, a supporting frame extending thereinto, means for movably supporting the article to be treated in said frame with freedom to

expand, means for transferring the article into the bath, and means for heating the article.

2. An apparatus for heat treating metallic articles comprising in combination a bath, a frame extending into the bath, a plurality of clamping elements slidably carried in the frame adapted to detachably receive the article to be treated and support it with freedom to expand, means for heating the article, and means for lowering the article into the bath.

3. An apparatus for heat treating metallic articles comprising in combination a bath, a frame extending into the bath, a clamping element slidably mounted in said frame and adapted to receive the article to be treated, and means for movably supporting the clamping element.

4. An apparatus for heat treating metallic articles comprising in combination a frame in which the article to be treated is adapted to be heated, a plurality of clamping elements adapted to embrace the article at a plurality of points intermediate its ends, said clamping elements being slidably guided on said frame, and means for heating the article.

5. An apparatus for heat treating metallic articles comprising in combination a frame adapted to receive articles of varying lengths, means for heating the article, means for supporting the article at an end thereof with freedom to expand, and indicating mechanism for translating the expansion of the article into terms of temperature reading, such means automatically accommodating itself to variations in the length of the articles to be treated.

6. An apparatus for heat treating metallic articles comprising in combination a frame adapted to receive articles of varying lengths, means for supporting the article at each end thereof with freedom to expand, and indicating mechanism translating the expansion of the article into terms of temperature reading, said means automatically accommodating itself to the distance between the said supporting means.

7. An apparatus for heat treating metallic articles comprising in combination a frame adapted to receive articles of varying lengths, a pair of contacts adapted to support the article undergoing treatment at the ends thereof with freedom to expand, and temperature indicating mechanism comprising an element operated by one of the contacts and a second element operated by the other contact adapted to translate the expansion of the article into terms of temperature reading.

8. An apparatus for heat treating metallic articles comprising in combination a suitable frame, a pair of article supporting members adapted to support the article in the

frame, both of said members being movable, a pointer operated by one of said members and a temperature indicating dial cooperating with said pointer and operatively associated with the other of said members.

9. An apparatus for heat treating metallic articles comprising in combination a suitable frame, a pair of members adapted to support the article to be treated in the frame, said members being movable, a pointer operated by one of said members, and a dial operatively associated with the other member, said dial having a linear scale adapted to indicate the distance between the said two members, and also having a temperature scale.

10. An apparatus for heat treating metallic articles comprising in combination a suitable frame, means for supporting the article to be treated movably mounted in said frame, a cable from which said means is suspended, a drum on which the cable is wound, a dial having a linear scale adapted to be operated from said drum, a second means for supporting the article in the frame, and a pointer operated by said second means and cooperating with said dial, said dial also having a temperature scale.

11. An apparatus for heat treating metallic articles comprising in combination a suitable frame, an article supporting member slidably mounted in said frame and from which the article is suspended, a second article supporting member adapted to support the article at the lower end thereof, a pointer operated by said second member, means for releasably fixing the position of said second member, a dial with which said pointer cooperates having a temperature scale and having a linear scale, and an operating connection between said first article supporting member and said dial.

12. An apparatus for heat treating metallic articles comprising in combination means for supporting the article at an end thereof with freedom to expand, and indicating mechanism for translating the expansion of the article into terms of temperature reading, such means being operable by the article as it expands.

13. An apparatus for heat treating metallic articles comprising in combination a suitable frame, a pair of article engaging members adapted to support the article in the frame, one of said members being movable relative to the other, and indicating mechanism operated by said movable member for translating the expansion of the article into terms of temperature reading.

14. An apparatus for heat treating metallic articles comprising in combination means for supporting the article, said means being adjustable to suit the length of the article, and indicating mechanism operated from said supporting means and having

graduations indicating the length of the article.

15. An apparatus for heat treating metallic articles comprising in combination means for supporting the article at an end thereof with freedom to expand, means for heating the article, a scale graduated to translate the expansion of the article into terms of temperature reading, and an element cooperating with said scale operable by the article as it expands.

16. In apparatus for heat treating metallic articles, the combination of means for heating the article, an adjustable dial having linear graduations for indicating the length of the article to be treated and intersecting temperature graduations for translating the expansion of the article into terms of temperature reading, and an indicator member cooperating with said dial and operable by the article.

17. An apparatus for heat treating metallic articles comprising in combination a frame in which the article is adapted to be suspended, an upper clamping element adapted to detachably engage the upper end of the article, a lower clamping element adapted to detachably engage the lower end of the article, both of said clamping elements being slidably mounted on the frame, and means for fixing the position of one of said clamping elements while the other clamping element is being adjusted to the length of the particular article undergoing treatment.

18. In apparatus of the character described, the combination of two relatively movable article engaging members, a graduated dial, a pointer actuated by the expansion of the article having a fixed center of pivot, and mechanism for modifying the amplitude of movement of the points in accordance with the distance between the said members.

19. An apparatus for heat treating metallic articles comprising in combination a bath, a frame extending into the bath, a plurality of clamping elements, slidably carried on the frame and adapted to detachably receive the article to be treated, means for heating the article and means for transferring the article into the bath while being held by the clamps.

20. In apparatus for heat treating metallic articles, the combination of means for supporting the article, and a self recording mechanism automatically translating and recording the changes in physical dimensions of the article undergoing treatment into terms of temperature.

21. In heat treating apparatus the combination of a pair of article supporting members relatively movable, a temperature indicating mechanism operated by change in physical dimensions of the article being

treated, and means associated therewith for indicating the length of the article.

22. In heat treating apparatus the combination of a pair of relatively movable members adapted to receive the article to be treated, means for accommodating said members to articles of different length, and

indicating means associated therewith for indicating the length of the article being treated.

In testimony whereof we hereunto sign our names. 10

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