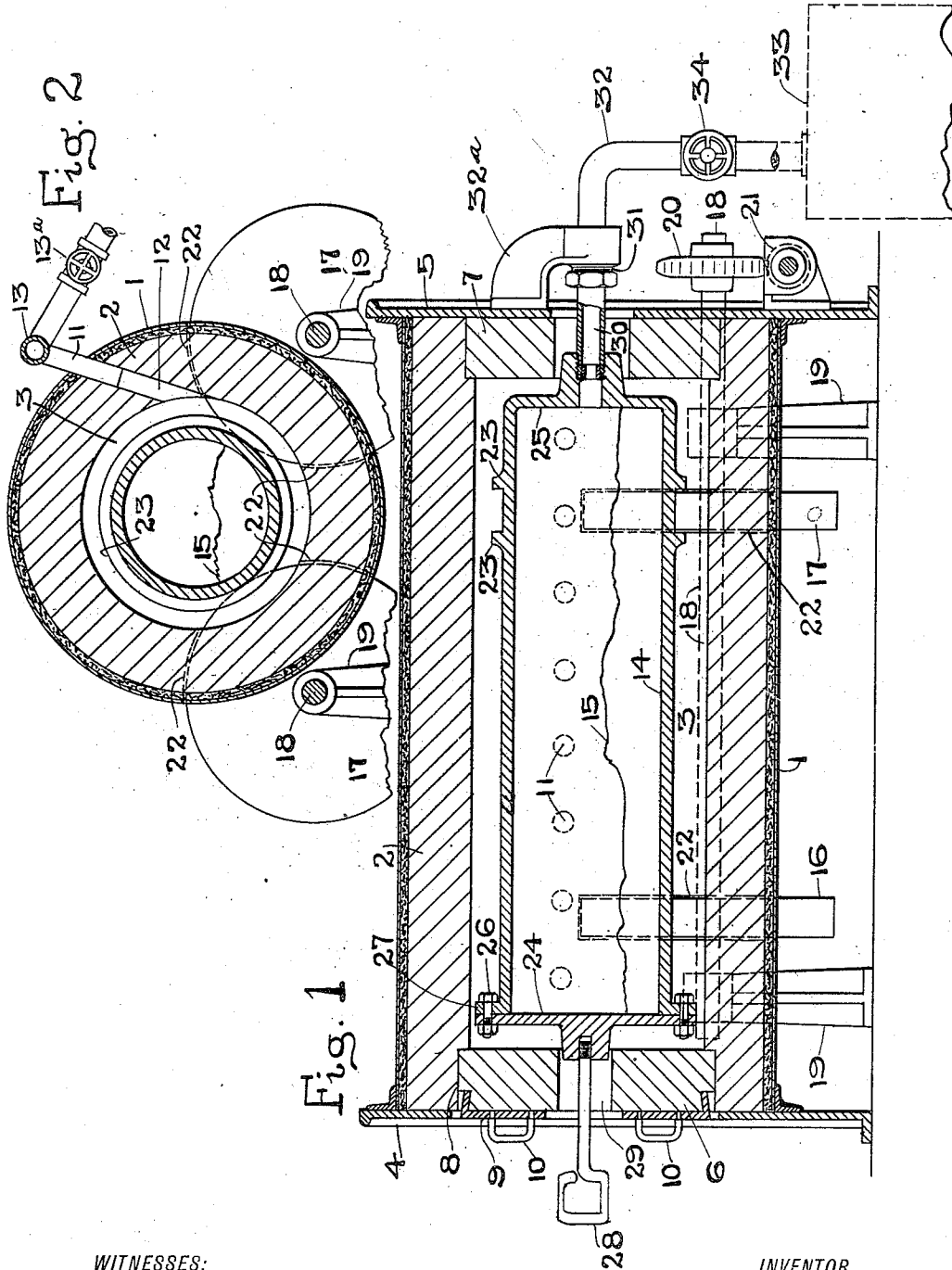


A. W. MACHLET.
 APPARATUS FOR CASE HARDENING AND OTHER METAL TREATMENT.
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WITNESSES:
Philip C. Osterman
Geo. L. Firtzelle

INVENTOR
Adolph W. Machlet
 BY *P. Stickney*
 ATTORNEY

UNITED STATES PATENT OFFICE.

ADOLPH W. MACHLET, OF ELIZABETH, NEW JERSEY.

APPARATUS FOR CASE-HARDENING AND OTHER METAL TREATMENT.

1,033,815.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ADOLPH W. MACHLET, a citizen of the United States, residing in Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Apparatus for Case-Hardening and other Metal Treatment, of which the following is a specification.

This invention relates to the heating of metal articles, simultaneously with other treatment thereof, so as to anneal or otherwise change the condition of the articles.

The object of the invention is to provide simple, inexpensive and easily operated means for subjecting articles to a high degree of heat, and securing uniformity of heat throughout all portions of the articles; and further to provide means for simultaneously subjecting the articles to the action of any desired gas.

In carrying out the invention, I provide a furnace, preferably employing mixed air and gas as a fuel, and mount wholly within the furnace a cylindrical retort or barrel, to contain the articles to be heated; and I provide means for effecting rotation of the retort during the heating thereof. The retort is mounted wholly within the flame chamber of the furnace, so that it is evenly heated throughout during its rotation, and hence the articles are uniformly heated, which is a feature of importance in many processes. The retort is provided with ends, one of which is in the form of a lid; and in the form of the invention herein illustrated, both said ends are confined between the ends of the furnace. One of the furnace ends is in the form of a removable plug, adjacent to the lid of the retort; thus giving access to the latter, for charging or discharging the retort. The retort is also removably mounted within the furnace, so that when worn out it may readily be replaced. In the form of the invention herein shown, the retort is revolvably mounted upon rolls which are mounted outside of the furnace, but which extend through openings formed in the walls of the furnace, so that the retort rests upon the rolls. Upon the retort peripheral flanges are provided, engaged by the rolls, to prevent endwise displacement of the retort.

In the accompanying drawings, Figure 1 is a longitudinal sectional elevation of one form of apparatus for carrying out my im-

provements. Fig. 2 is a cross-section of the main portion of the apparatus.

The form of furnace illustrated is cylindrical comprising a tubular metal cover 1, and a thick cylindrical lining 2 of refractory material; the flame chamber being seen at 3. The framework of the furnace also comprises ends 4, 5, having thick linings 6, 7. The lining 6 is in the form of a cylindrical plug fitted in a seat 8 in the left hand end of the furnace, and having a metal cap 9 to which are attached handles 10 for removing the plug. The heat is supplied by a series of burners for mixed air and gas, said series extending the entire length of the furnace, as indicated diagrammatically at 11, and directed downwardly and tangentially of the cylindrical fire chamber. The burners are inserted in tangential holes 12 in the side wall of the furnace, and are connected to a feed pipe 13, which extends the length of the furnace.

A cylindrical retort 14 containing the articles 15 to be heated, is mounted within the retort upon two pairs of rolls 16 and 17. The rolls are fixed upon shafts 18, extending along the under sides of the furnace and supported upon standards 19. The retort nearly fills the flame chamber, so that only a narrow annular space is left between the retort and the lining of the furnace. The burners 11 and the holes 12 are so placed as to direct the flames around said annular space instead of causing them to impinge directly against the retort, thereby securing even heating of the latter. Each of the shafts 18 extends beyond the end of the furnace, and is provided with a worm wheel 20 engaged by a power-driven worm 21 for rotating the rolls 16, 17 upon each shaft, and thereby causing the retort to turn. The walls of the furnace are provided with openings as at 22, through which the rolls 16, 17 extend into the furnace. Upon the retort, which is preferably of cast iron are cast a pair of flanges 23, between which the rolls 17 ride, and by which endwise displacement of the retort is prevented. The rolls 16 ride directly upon the periphery of the retort and permit slight endwise movement of the left hand end of the retort due to its gradual permanent elongation. The ends of the retort 24, 25, are in this instance confined between the ends 6, 7, of the furnace; the end 25 being cast upon the retort, and the end

24 being in the nature of a lid which is secured by any suitable devices, as for instance bolts 26 engaging a flange 27 upon the retort. This lid 24 is adjacent to the cover 6 of the furnace, and is provided with a handle 28, which protrudes through an opening 29 formed in the cover 6. From the opposite end of the furnace extends a pipe 30 connected by a gland 31 to a supply pipe 32; a bracket 32^a secured upon the end 5 of the furnace being provided to support said gland. The pipe 32 is connected to a tank, holder, or boiler, for inert gas or steam, the passage of which into the retort is controlled by a valve 34.

The described structure may be employed for the uses set forth in my co-pending applications Nos. 244,244 filed Feb. 4, 1905, 255,355, filed April 13, 1905, 292,515, filed Dec. 19, 1905, 292,626, filed Dec. 20, 1905, and 317,315, filed May 17, 1906. Some of the claims herein broadly cover what is shown in said applications, but the claims in the latter do not cover the specific form of the invention herein illustrated.

When the apparatus is to be used for case-hardening, as set forth in certain of said applications, a vent may be provided in the end 24 of the retort, so that the carburizing gas may flow constantly through the retort during the carburizing operation, the spent gas being thus constantly renewed. When large, bulky articles are to be cemented, they may first be brought to carburizing heat in a separate furnace, and then inserted into the retort, and the latter closed and the carburizing gas circulated therethrough; the retort having first been brought to a carburizing heat. In this manner the cementing operation may be hastened. Moreover, heating the articles in an ordinary heating furnace is more economical of fuel than heating them in the retort itself, besides which there is less deterioration of the retort in proportion to the quantity of case-hardening done therein. Moreover, cheaper fuel, as for instance coal, may be employed for pre-heating the articles. This process is also suitable for small articles, viz., pre-heating them and then introducing them into a heated retort; and the latter may be kept in operation almost uninterruptedly effecting the cementation of repeated charges of articles, without delaying to heat up the articles from a cold state.

In case-hardening by the apparatuses shown in this and said other applications, it is also practicable to secure a very tough shell upon the case-hardened articles. They are first cemented by placing them in the retort, and exposing them to a current of carburizing gas while they are at carburizing heat. They may have been preheated or not, according to requirements; and they may be cemented either by means of their own pre-

viously acquired heat, or the furnace may be kept in operation during the carburization, until shells or cases of high-carbon steel incase the articles, as explained in said applications. Preferably, however, the cementation is done while the articles are at red heat, that is, at the lowest heat at which they can be cemented; this degree of heat being accurately secured and maintained by the use of said apparatuses. If, however, the articles are cemented while at white heat, they are allowed to cool gradually until they are at red heat. The articles being at red heat, are quenched in oil (preferably fish oil). They are then again passed through the cementing operation; or the described operation is repeated, the articles being again quenched in oil. During this second cementing operation, the cementation may be allowed to proceed to a greater depth upon the articles, or only to the original depth, as may be desired. The second quenching, as well as the second cementation, may be done while the articles are at red heat. If desired, the operation may be repeated again, thus making three cementations, and the depth of the cementation may be increased at each repetition, or it may remain the same as by the first operation. In this manner, very tough cases are formed upon the articles, which is a great advantage for certain classes of articles, which are to be subjected to repeated heavy shocks, as well as surface wear. Preferably at each operation the articles are re-heated in the retort while exposed to the carburizing gas, so as to avoid loss of carbon from the surfaces of the articles, or other deterioration thereof. Articles quenched and re-cemented in this manner show a very fine fracture, and are very tough. They may be otherwise quenched; and it is not necessary in all cases to quench them, as they may cool slowly before re-heating.

The apparatus may also be employed for oxidizing steel, iron, copper and other articles. For this purpose, the part 33 may be regarded as a steam boiler. The cover 6 is removed together with the lid 24 and the articles 15 inserted. Then the lid 24 is replaced loosely, and steam is admitted from the boiler 33 through the pipes 32 and 30, the displaced air escaping between the lid 24 and the end of the retort. Then the burners are lighted and the lid 24 is secured tightly, and the furnace is closed by means of the cover 6. The retort is heated until the steam decomposes, whereupon the oxygen of the steam unites with the surface portions of the metal articles, oxidizing them. During the heating and oxidizing operations, the retort is kept in slow rotation by means of the worm 21 and worm wheel 22, so that the retort and the articles therein are uniformly heated and the articles uniformly

disposed to the oxidizing action of the decomposed steam. If desired, the articles may be allowed to cool before the retort is opened.

Many other variations may be resorted to within the scope of the invention, and portions of the improvements may be used without others.

Having thus described my invention, I claim:

1. In combination, a furnace having a flame chamber provided with closed ends, a closed retort confined wholly within said chamber between said ends, and means extending within said flame chamber for revolvably supporting said retort by both of its ends.

2. In combination, a furnace having a flame chamber, a closed retort wholly within said flame chamber, means extending within said flame chamber for revolvably supporting said retort, and means to conduct fluid into the revolving retort.

3. In combination, a furnace having a flame chamber, a closed retort wholly within said flame chamber, and means extending within said flame chamber for revolvably supporting said retort and preventing longitudinal displacement thereof; said retort being removably connected to said supporting means; and means to conduct fluid into the revolving retort.

4. In combination, a furnace having a flame chamber, a closed retort wholly confined within said chamber, means extending within said chamber for revolvably supporting the retort by both of its ends, power driven means for effecting rotation of the retort, and means to conduct fluid into the revolving retort.

5. In combination, a furnace having a flame chamber, a closed retort wholly within said flame chamber, rolls at each side of the flame chamber, the retort being revolvably supported upon said rolls, and means for turning one of the rolls, so as to cause the retort to rotate.

6. In combination, a furnace having a flame chamber provided with ends, one of which is removable, and a closed retort wholly confined within said flame chamber between said ends; rolls extending within the flame chamber to support said retort, and the latter being removably mounted for revolution upon the rolls.

7. In combination, a furnace having a flame chamber provided with ends, one of which is removable, a retort confined within said flame chamber between said ends; rolls extending within the flame chamber to support said retort, and the latter being removably mounted for revolution upon the rolls, and a lid for the end of the retort which is adjacent to said removable end.

8. In combination, a furnace having a flame chamber provided with ends, one of

which is removable, a retort confined within said flame chamber between said ends; rolls extending within the flame chamber to support said retort, and the latter being removably mounted for revolution upon the rolls, and a lid for the end of the retort which is adjacent to said removable end, the latter having an opening, and said lid having a handle projecting through said opening.

9. In combination, a furnace having a flame chamber, a closed retort wholly within said flame chamber, shafts mounted exteriorly of said furnace, and rolls on said shafts, and extending within the flame chamber to support revolvably said retort; the walls of the furnace having openings to receive said rolls.

10. In combination, a furnace comprising a body and ends and having a thick refractory lining for said body and ends, one of said ends being removable, a cast iron cylindrical retort within said furnace between said ends, and having a lid in said furnace adjacent to the removable end of the latter, and a series of burners for mixed air and gas let into the refractory lining of the body of the furnace, and directed tangentially to the retort.

11. In combination, a furnace having a flame chamber, a closed cast iron retort wholly within said chamber and having peripheral flanges, power-driven rolls upon which said retort is supported within said chamber, said rolls engaging said flanges to prevent longitudinal displacement of the retort, and having axles outside the body of the furnace.

12. In combination, a furnace having a flame chamber, a closed retort wholly within said flame chamber, means extending within said flame chamber for revolvably supporting said retort, and means for supplying gas to said retort.

13. In combination, a furnace having a flame chamber provided with ends, one of which is removable, a retort confined within said flame chamber between said ends; rolls extending within the flame chamber to support said retort, and the latter being removably mounted for revolution upon the rolls, a lid for the end of the retort which is adjacent to said removable end, and means connected to said retort at the end opposite said lid for supplying gas to the retort.

14. In combination, a furnace having a flame chamber, a closed retort mounted wholly within said flame chamber, rolls extending within the flame chamber to revolvably support said retort, a holder for inert fluid connected to said retort, and power-driven means for turning the retort during the heating thereof.

15. In combination, a furnace having a single flame chamber, a metallic retort 130

wholly within said chamber, and having supporting means extending to and revoluble upon supports which are provided upon the exterior of the furnace, said retort being removably mounted at its ends upon said supports, and having a lid at one of said ends, a set of burners for mixed air and fuel within said flame chamber, the walls of the latter cooperating with said burners to direct the flames with substantial uniformity beneath and around said retort, and a holder for inert fluid connected to said retort.

16. In combination, a furnace having a single chamber in which the flames originate, a closed metallic retort wholly within said chamber, and a holder for inert fluid connected with said retort; said furnace being provided with rolls extending within the furnace and upon which the retort is mounted; the retort having at one end a normally closed opening through which the articles may be removed; and means for turning the retort during the heating thereof.

17. In combination, a furnace having a body and ends, and having a refractory lining for said body and ends, said lining forming a single chamber in which the flames originate, a revoluble metallic retort wholly within said chamber, a holder for inert fluid connected with said retort; said furnace being provided with rolls extending within the furnace and upon which the retort is so mounted that the flames may envelop the retort throughout its length, said retort having at one end an opening to permit removal of the articles, said opening having a removable cover; and means for rotating said retort.

18. In combination, a furnace provided with a refractory lining, a metallic retort having ends and mounted wholly within said lining, numerous burners for mixed air and fuel, said burners forming a set extending the entire length of the retort in such a manner as to cause the retort to be heated throughout with evenness independent of the heat of said refractory lining; means being provided for subjecting the articles in the retort to the action of inert gas during the heating of the retort; and means independent of the ends of the retort for effecting rotation of said retort.

19. In combination, a furnace having a flame chamber provided with closed ends, a closed metallic retort wholly within said chamber between said ends and having a removable cover at one end, means being provided for revolvably supporting said retort during the heating thereof, said sup-

porting means including rolls to engage the body of the retort between its ends, and a holder for inert fluid connected to one end of said retort, said furnace having an opening through which said cover may be removed, and also provided with a lid for said opening.

20. A cast barrel forming a retort and having one end integral with the body and the other end provided with a removable cover, and a single pair of flanges cast upon the body near one end to form a track, a pair of supporting rolls for said track, a second pair of rolls supporting the other end of the body, and a furnace in which said retort is mounted.

21. A cast barrel forming a retort and having one end integral with the body and the other end provided with a removable cover, and a single pair of flanges cast upon the body near one end to form a track, a pair of supporting rolls for said track, a second pair of rolls supporting the other end of the body, and a furnace in which said retort is mounted; said rolls mounted outside of the furnace and projecting through the walls thereof into the flame chamber.

22. A cast barrel forming a retort and having one end integral with the body and the other end provided with a removable cover, and a single pair of flanges cast upon the body near one end to form a track, a pair of supporting rolls for said track, a second pair of rolls supporting the other end of the body, and a furnace in which said retort is mounted; said rolls mounted outside of the furnace and projecting through the walls thereof into the flame chamber, a shaft supporting the rolls on one side of the furnace, and power driven gearing connected to said shaft.

23. The combination with a closed revoluble retort, of a furnace having a flame chamber within which the retort is wholly confined for revolution, said flame chamber having closed ends between which the retort is mounted, and a series of mixed air and fuel burners opening into said flame chamber, the latter closely confining the body and formed to direct the flames all around the same; said retort having a removable cover at one end, and the adjacent end of the furnace being removable; and means to supply fluid into the other end of the retort.

ADOLPH W. MACHLET.

Witnesses:

SAMUEL R. OGDEN,
PHILIP C. OSTERMAN.