

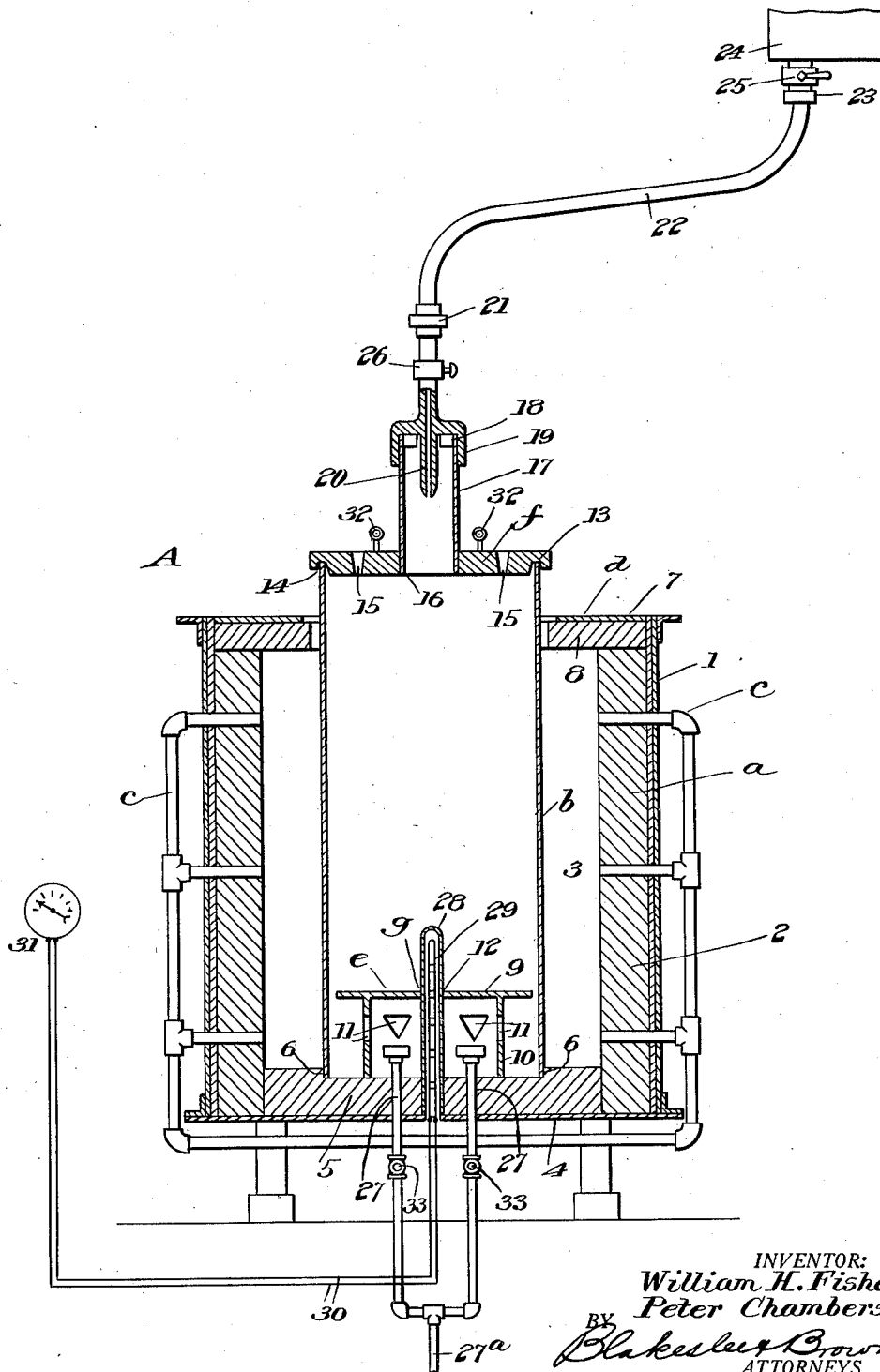
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W. H. FISHER ET AL

FURNACE

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UNITED STATES PATENT OFFICE.

WILLIAM H. FISHER, OF LOS ANGELES, AND PETER CHAMBERS, OF REDONDO,
CALIFORNIA.

FURNACE.

Application filed May 15, 1923. Serial No. 639,081.

To all whom it may concern:

Be it known that we, WILLIAM H. FISHER and PETER CHAMBERS, both citizens of the United States, residing at Los Angeles and Redondo, respectively, in the county of Los Angeles and State of California, have jointly invented new and useful Improvements in Furnaces, of which the following is a specification.

10 This invention relates to furnaces and method of utilizing the same for the carbon treatment of iron and its alloys. The invention contemplates an improvement over our invention disclosed in application for
15 U. S. patent for apparatus for treating iron alloys and process thereof, Serial No. 382,290, filed in the U. S. Patent Office May 17, 1920. The invention has for an object the provision in a furnace of means for causing
20 a uniform deposit of carbon on the work contained therein.

In practicing the invention we may provide a furnace consisting of an outer refractory wall and an inner retort wall spaced
25 therefrom, with means for supporting combustion in the space between said walls whereby the inner retort wall may be heated for the purpose of heating any work confined within said inner retort and means associated with said inner retort and particularly
30 the cover thereof, for admitting a liquid hydro-carbon such as set forth in our U. S. Letters Patent No. 1,405,678, dated February 7, 1922, for composition for treating iron and its alloys.

35 With the above and other objects in view, the invention consists in the novel and useful provision, formation, construction, association and relative arrangement of parts, members and features, all as set forth in the following statement and shown in the drawing.

The drawing is a vertical sectional view of a furnace incorporating the invention.

45 Referring with particularity to the drawing, the improved furnace as an entirety is designated by A, and we do not wish to be

particularly limited to the type of furnace shown, as the features about to be described are adaptable to many types and forms of
50 furnaces, other than the one shown for the purpose of carbonizing iron and its alloys. In particular the said furnace A includes an outer wall 1 which may be formed of sheet steel or any other material, with a re-
55 fractory wall *a* formed of slabs 2 and an inner retort wall *b* spaced from the wall *a*, with suitable pipes *c* passed through the walls 1 and *a* and to the space 3 between the wall *b* and the inner surface of the wall
60 *a*. The pipes *c* in turn are connected to a suitable gas supply main, and when the supply of gas is passed through the pipe *c* the said gas may be ignited in the space 3, whereby the wall *b* may be heated by the
65 combustion of said gas. The furnace is provided with a base member 4 which may carry a heat-resisting slab or slabs 5, and upon which slabs 5 the bottom of the retort may rest. In this particular the slab or
70 slabs are provided with shouldered portions 6 which act to confine the retort wall *b* to a definite location within the wall *a*. A top member *d* is provided which may consist of two parts as 7 and 8, the part 7 being
75 formed of sheet metal or other material with the part 8 comprising slabs formed about the retort wall *b*. In the showing the retort wall *b* projects through the cover *d* and beyond said cover *d*, and adapted to
80 be received within the retort *b* and to rest upon the slabs 5 is a work-holding table *e* comprising a top plate 9 supported by an annular member 10 formed with a series of
85 openings 11. The top plate 9 is provided with a central opening 12, the purpose of which will be described later. A cap member *f* is formed with a groove 13 adapted to have received therein the upper end as
90 14 of the retort wall *b*. Said cap *f* is provided with a series of transverse openings 15, and said cap is likewise formed with a central bore, as shown at 16, and adapted to be attached to said cap *f* and received

within the bore 16 is an annular member 17. The annular member 17 is provided with an annular end-piece 18 and an annular flange 19 fits over the member 17 with a nozzle member 20 adapted to be passed through the opening in the end-piece 18 and projecting within the member 17. The said nozzle 20 is evenly spaced from the inner wall of the member 17. A union 21 connects an end of the member 20 with a tube 22, which tube in turn is connected through the medium of a union 23 with a container 24 adapted to receive and hold a liquid hydro-carbon such as described in the above mentioned U. S. Letters Patent No. 1,405,678. Interposed between the union 23 and the container 24 is a stop cock 25 whereby flow of liquid from the container 24 may be regulated and likewise there is provided a second stop cock 26 associated with the member 20. It is thus possible to regulate the flow of any liquid from the container 24 through the nozzle 20 by means of the stop cocks or valves 25 and 26.

In operation, assuming that the liquid hydro-carbon as above identified is used and is placed within the container 24, and the furnace is being heated by means of combustion of gas within the space 3, with work stacked upon the support *e*, at proper temperature the cocks 25 and 26 are opened and the liquid hydro-carbon will flow from the container through the tube 22 and thence into the nozzle 20 and there drop from said nozzle, the said cocks being so arranged that the nozzle feeds the said liquid hydro-carbon in a series of drops. The nozzle being spaced from the inner wall of the member 17 does not allow carbon to form on the inner wall of the member 17, that is to say, carbon will not form there, for the reason that the liquid drops free of the member 17 and therefore will not adhere to its sides. If the liquid did not drop free but were allowed to contact with the inner surface of the member 17 the heat within the furnace by immediately gasifying the liquid would tend to cause carbon to deposit on said inner surface and stop operation of the device. The liquid hydro-carbon upon dropping from the nozzle 20 will gasify under influence of the heat within the retort *b*. The carbon separated from the hydrogen then satisfies its affinity for absorption by the surface of metal exposed to it.

We provide a thermo-couple protector tube designated generally by *g* which projects through the opening 12 of the top plate 9, and in the showing the element 28 of such thermo-couple is a protective cover for an element 29, said element 29 comprising a bent wire to which are connected leads 30 associated with a recording pyrometer 31 calibrated in degrees, whereby when the re-

tort *b* is heated through the medium of the combustion of gas within the space 3 the wire 29 will become heated and thus vary the electrical resistance and consequently actuate the recording galvanometer 31 to indicate degrees of heat within the retort *b* and particularly at the lower level thereof. After the heat within the retort has become approximately uniform the stop cocks 25 and 26 are opened so that the hydro-carbon liquid or carbonaceous gas is allowed to pass from the nozzle 20, in the case of liquid in drop form, within the retort *b*, and, due to the heat within said retort the liquid is immediately gasified and gaseous pressure is uniformly maintained from the top of the retort to the bottom thereof. This ensures an even distribution of carbonaceous gas within the retort and consequently produces a remarkable evenness in the results obtained in the absorption of carbon. The openings 11 in the member *e* allow heat within the retort *b* to enter within the annular member 10 and tend to heat the same. When it is desired to remove the work from the retort the cover may be removed by using suitable hooks in engagement with eye-bolts 32 carried by the cover *f*, and before removing said cover a fixed gas is admitted by turning suitable cocks 33 through the supply pipes 27, in turn associated with the pipe 27^a connected to mains delivering gas that does not contain air, the said gas being passed through the pipes 27 under its own pressure.

Our invention involves the conception of injecting a liquid directly into the work-holding chamber without substantially pre-vaporization thereof. It is old in the art to utilize hydrocarbon gases for the cementation of steel, and these gases have in some cases been formed from hydrocarbon oils by injecting these oils into a hot vaporizing chamber, the resulting gases being then conducted to a separate work-holding chamber. Our invention differs from all such prior attempts, in that the hydrocarbon or carbonhydrate used is actually injected in liquid form directly into the work-holding chamber, being broken up in that chamber probably almost wholly into hydrocarbon gas and free carbon. We believe that the presence of this free nascent carbon greatly promotes cementation, as we have found, in the operation of a considerable number of these furnaces, that by dropping an oil of preferably organic origin directly into the work-holding chamber, we can produce results far superior to those produced by the use of gas alone.

We also find that the apparatus above described is particularly adapted to the use of organic oils, such as pine tar or other pyroligneous products, or fish, or vegetable oils. These oils are all much less stable

than petroleum, breaking up into fixed gases and solid and semi-solid substances, at temperatures far below those necessary to decompose petroleum.

5 By locating the inlet nozzle 20 at the top of the vertical pipe 17, we keep it far enough away from the heat of the furnace to prevent its becoming sufficiently hot to break up the oil flowing therethrough, and thus prevent solids from depositing in and clogging the opening. The pipe 17 also forms an accelerating chamber through which the drops of oil fall, and it is of sufficient length to allow the drops to attain a considerable velocity before they strike the hot gases inside the work chamber. The drops moving rapidly downward into the hot gases are vaporized by the heat, and on account of the initial velocity of the drops, the solid and gaseous resultants of the vaporization are thoroughly distributed upon and around the material being treated.

While some of the substances used by us as cementation agents are complex carbon hydrates, we wish the term "hydrocarbon" as used by us herein to include such substances, and, in fact, all substances of a suitable character containing hydrogen and carbon.

30 It is obvious that various changes and modifications may be made in practicing the invention, in departure from the particular showing and description, without departing from the true spirit of the invention.

Having thus disclosed our invention, we claim and desire to secure by Letters Patent:

1. In a device of the character disclosed, the combination of: a retort having a work-holding chamber adapted to receive the work to be treated; means for heating said retort; and means for introducing a hydrocarbon liquid into said work-holding chamber without substantial vaporization of such hydrocarbon liquid outside said work-holding chamber.

2. In a device of the character disclosed, the combination of: a retort having a work-holding chamber adapted to receive the work to be treated; means for heating said retort; and means for introducing a hydrocarbon liquid into said work-holding chamber without substantial vaporization of such hydrocarbon liquid outside said work-holding chamber, said liquid being introduced into said work-holding chamber at a sufficient velocity to produce a dispersion of the products of vaporization over and around the work.

3. In a device of the character disclosed, the combination of: a retort having a work-holding chamber adapted to receive the work to be treated; means for heating said retort; and means for introducing a hydrocarbon liquid into said work-holding chamber without substantial vaporization of such hydro-

carbon liquid outside said work-holding chamber, said liquid being introduced into said work-holding chamber at a sufficient velocity induced by gravity to produce a dispersion of the products of vaporization over and around the work.

4. In a device of the character disclosed, the combination of: a retort having a work-holding chamber adapted to receive the work to be treated; means for heating said retort; a cover for said retort; walls forming an accelerating chamber extending above said cover and forming a continuous vertical passage in open communication at its lower end with said work-holding chamber; and means for feeding a hydrocarbon liquid into the upper end of said passage.

5. In a device of the character disclosed, the combination of: a retort having a work-holding chamber adapted to receive the work to be treated; means for heating the outside of the walls of said retort; a cover for said retort; walls forming an accelerating chamber extending above said cover and forming a continuous vertical passage in open communication at its lower end with said work-holding chamber; and means for feeding a hydrocarbon liquid into the upper end of said passage.

6. In a device of the character disclosed, comprising a retort adapted to receive and confine work, a cover member for said retort, said cover member being formed with openings therein, there being an annular member received within one of said openings, and a nozzle within said annular member.

7. In a device of the character disclosed, comprising a retort adapted to receive and confine work, a cover member for said retort, said cover member being formed with openings therein, there being an annular member received within one of said openings, and a nozzle within said annular member; said nozzle being provided with a flanged member for attachment to the annular member.

8. In a device of the character disclosed, comprising a retort adapted to receive and confine work, a cover member for said retort, said cover member being formed with openings therein, there being an annular member received within one of said openings, and a nozzle within said annular member; said nozzle being provided with a flanged member for attachment to the annular member; there being means for conducting a hydro-carbon liquid from a source of supply to said nozzle.

9. In a device of the character disclosed, comprising a retort adapted to receive and confine work, a cover member for said retort, said cover member being formed with openings therein, there being an annular member received within one of said open-

ings, and a nozzle within said annular member; said nozzle being provided with a flanged member for attachment to the annular member; there being means for conducting a hydro-carbon liquid from a source of supply to said nozzle, and means for regulating the flow of hydro-carbon liquid through said nozzle.

In testimony whereof, we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM H. FISHER.
PETER CHAMBERS.

Witnesses:

WILLIAM P. FISHER.
JAMES ALLAN.