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J. W. NELSON

2,107,871

OIL BURNING FURNACE

Original Filed May 29, 1933

Fig. 1.

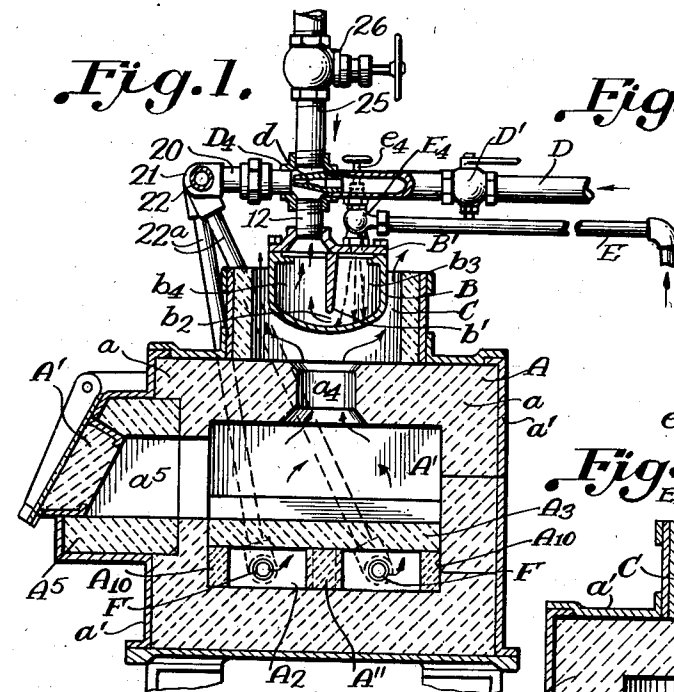


Fig. 4.

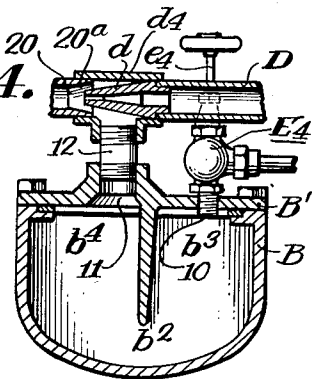


Fig. 3.

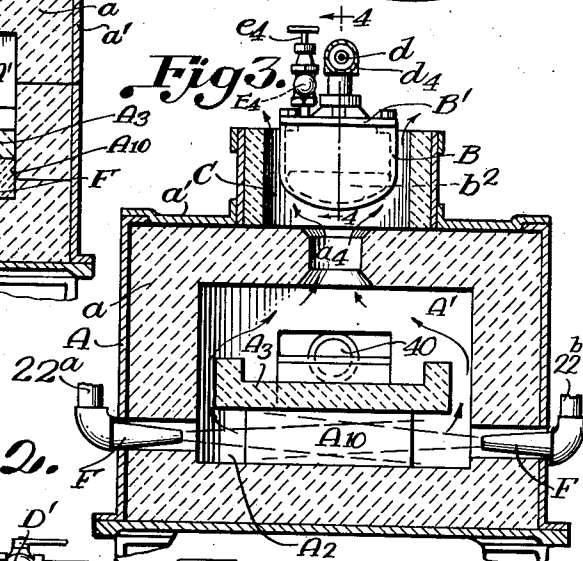
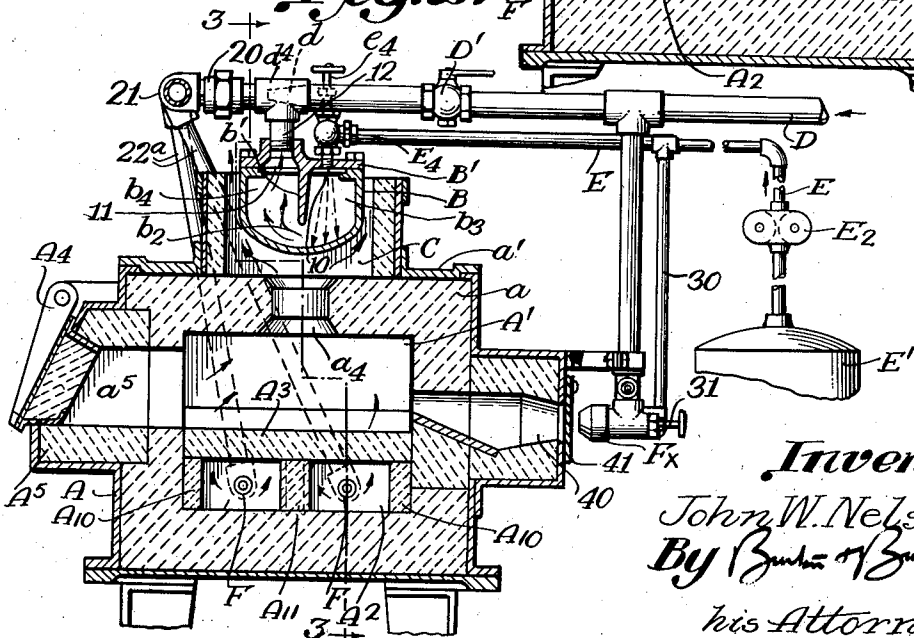


Fig. 2.



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UNITED STATES PATENT OFFICE

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OIL BURNING FURNACE

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4 Claims. (Cl. 158—5)

This application is a division of my co-pending application Serial No. 673,497, filed May 29, 1933.

The purpose of this invention is to provide an improved oil-burning furnace particularly adapted for use with a heat-treating apparatus for annealing, case-hardening and like processes. An object of the invention is to utilize waste heat from the heat-treatment chamber for gasifying fuel oil in a retort structure preparatory to feeding it to the burner means which serves the heat-treatment chamber. The invention consists in certain features and elements of construction in combination, as herein shown and described and as indicated by the claims.

In the drawing:

Figure 1 is a vertical section of an apparatus embodying this invention in one of its forms.

Figure 2 is a similar view of a slightly modified form.

Figure 3 is a transverse section taken substantially as indicated at line 3—3 on Figure 2.

Figure 4 is a detail section taken as indicated at line 4—4 on Figure 3.

Referring to the drawing in detail:

In the form shown in Figure 1, A is a casing made of refractory material, as fire brick, indicated at *a*, which may be molded integrally, and which is shown exteriorly provided with sheet metal surface covering indicated at *a*¹.

This casing contains an oven or heat-treatment chamber, A¹ which may be referred to as the flame chamber, the lower compartment of which, indicated at A², is separated from the upper part by means indicated at A³, for supporting in heat-treatment position the substance to be heat-treated. Said supporting means may be in different forms according to the form and character of the substance or article to be carried by it in the heat-treatment process. In whatever form it is made to suit the article or substance treated this member, A³, is removably supported and positioned in the chamber with clearance for passage between it,—with the article or substance supported by it,—and the chamber wall, of the heating current from the burner or burners hereinafter further referred to located below said supporting member.

This supporting member, A³, is shown in the form of a shelf which, as may be seen in Figure 3 extending across the chamber, A¹, at an intermediate point in the fore-and-aft chamber, said shelf being lodged at its ends on abutments formed by narrow vertical ribs, A¹⁰, projecting inwardly from the casing wall, and preferably supported at the middle part of its length by a

stool or post, A¹¹, which projects up from the bottom of the chamber. The casing is formed with an inlead member, A⁵, affording access to the heat-treatment chamber by way of the inlead passage, *a*⁵.

An upwardly swinging door, A⁴, at the entrance to the inlead passage, *a*⁵ affords access to the oven chamber for introducing and removing the supporting member, A³, and/or the heat-treated article or substance. An aperture, *a*⁴, at the upper side of the casing constitutes a vent passage for the heating current after it has done its work of heat-treatment in the heat-treatment chamber; and the waste heat remaining after the heating current has parted with the greater portion of its heat communicated to the heat-treated substance is utilized for heating a combustible-vapor-producing means comprising as the main element a retort indicated at B, mounted in a chamber member, C, which is shown erected on top of the oven casing, A. This retort member, B, may be made of metal and desirably thin for being quickly heated through, by the waste heat current from the heat-treatment chamber. Said retort member has a cover, B¹, bolted fluid-tight to the retort body, B, to make the retort chamber completely sealed except as to the oil inlet and gas outlet hereinafter described.

The retort chamber is partitioned at its upper part and nearly to the bottom by a partitioning web, b¹, which is shown formed integral with the cover, B¹, extending down into the retort chamber making a tight joint at its vertical edges with the inner surface of the chamber wall and terminating at its lower edge a short distance from the bottom of the retort chamber, leaving a passage, b², constituting the sole communication between the compartments, b³ and b⁴, of the retort chamber, and thereby between the oil inlet, 10, and gas outlet, 11, arranged as hereinafter described, at the upper ends of the chamber compartments, b³ and b⁴, respectively.

As shown in Figure 1, the retort, B, is supported from an air pipe line, D, provided for a further purpose hereinafter explained, leading from a source of air under pressure, not shown, but which may be understood to be a force fan or pump or compressed air chamber. A valve, D¹, controls the flow of air through said air pipe line. An oil pipe line, E, leads from a source of fuel oil which may be a tank, indicated at E¹, which is preferably for safety, against accidental fire, located, as shown, at a low level, the oil being fed from the tank through the pipe line, E, by a suitable pump, indicated at E².

The connection of the oil pipe line, E, with the retort chamber is made by means of a valve fitting indicated at E⁴, having its valve, e⁴, adapted to restrict the flow of oil into the retort chamber very closely, so that in fact the oil will be delivered at its emergence from the oil conduit into the retort chamber finely subdivided, and thereby adapted to be gasified upon exposure to the heat radiating from the retort wall, preferably without contact therewith in liquid condition, such gasification, whether upon contact or without contact of the liquid being effected by the heat communicated to the retort by the waste products of combustion emerging from the heat-treatment chamber, as above described.

The retort B, depending from the air pipe line, D, is connected to said air pipe line at the under side thereof at a four-way fitting, D⁴, by means of a pipe nipple, 12, connected at the gas outlet of the retort chamber. Said four-way fitting, D⁴, at the side opposite that at which it is connected to the air pipe line, is connected, as by the right-and-left threaded coupling, 20, to a three-way fitting, 21, having leading from each of the two opposite limbs of said three-way fitting, branch pipe lines, 22, having each two branches, 22^a, 22^b, leading to burners, F, F, F, F, located below the heat-treated-substance-supporting members, A³, of the heat-treatment chamber for ignition to produce a heating current which is directed against the under side of said supporting member and the material to be heat-treated thereon, and passes up at both sides of the heating member and is discharged through the vent aperture, a⁴, in the top of the casing, A.

The air pipe line, D, at its connection with the fitting, D⁴, terminates in an injector nozzle, d, which protrudes in the cavity of the fitting, D⁴, entirely across the same into the opposite limb of said fitting and slightly into the entrance of the coupling, 20, which coupling is interiorly reamed, as seen at 20^a, (see Fig. 5) to taper said entrance somewhat in conformity to the exterior taper of the nozzle terminal, d, of the air pipe line, so that the discharge of air from the nozzle directed into the passage of the coupling, 20, entrains the gas in the fitting and in the nipple, 21, which connects said fitting with the retort chamber, and sucks the gas from the retort chamber, reducing the pressure in that chamber below atmospheric and maintaining constant withdrawal of the gas from the retort chamber as fast as it is generated from the oil heated to the point of gasification in the manner described.

For initially heating the retort to gasify the oil to produce a combustible gas which may be ignited at its discharge from the burners, F, as described, in the construction shown in Figure 1, the four-way fitting, D⁴, is connected at its fourth limb opposite the nipple connection with the retort by a pipe line, 25, with a source of gas, as the public service gas system. A shut off valve, 26, is provided at any convenient point in the length of the pipe line preceding its connection with the fitting, D⁴, and upon opening the valve, 26, controlling said public service gas line, and the valve, D⁴, controlling the air pipe line, aerated gas is delivered to and may be ignited at all the burners, F. When by this means the retort is heated to the proper temperature for gasifying oil, the operator will open the oil control valve, e⁴, to admit oil at a properly restricted rate to the retort; and after the few seconds necessary for the gas generated from

the oil to be entrained by the injected air along with the gas from the public service gas line, the gas control valve, 26, will be closed and the burners will continue to be supplied by the aerated gas produced from the fuel oil in the manner described.

Referring to the form shown in Figure 2:

When public service gas is not available, or it is preferred not to use it for starting the furnace, there is substituted for the four-way fitting, D⁴, a three-way fitting, d⁴, and preliminary heating is effected by an oil burner shown at F^x, hereinafter called the starter burner, which may be of any familiar form for burning fuel oil, connected to the oil pipe line, E, by a branch line, 30, in which the flow of oil is controlled by a valve, 31, said starter burner, F^x, being mounted for discharge into the heat-treatment chamber through an air mixing passage, 40, formed in the rear wall of the heat-treatment chamber. A shutter for this air passage shown at 41, opened when the starter burner is to be put in service, will be closed when the retort is sufficiently heated to supply the burners, F, with the gas produced from the fuel oil by gasification and aeration as described, so that the starter burner may be shut off.

In actual practice of this invention when using commercial forms and qualities of fuel oil for producing the highly combustible gas or vapor desirable for the purpose indicated, and with the retort of the form and construction shown, a temperature of 1000° F., which is readily produced in the retort, is found to vaporize or gasify the oil promptly upon its emergence from the oil conduit into the retort during its descent through the vertical passage of the retort by the heat radiated from the retort wall; and it has been demonstrated that the temperature which is readily produced in the retort on the commercial form and quality of oil commonly used for heating industrial appliances, does not merely vaporize the oil, using that term in the common sense of rendering it lighter than atmosphere, but converts it into a true gas. But I do not limit myself to the use of oil of the quality indicated, nor to the means for producing in the retort the temperature for thus fully gasifying the oil as distinguished from vaporizing it. And it will be manifest to those skilled in the art that various modifications and minor rearrangements of the parts may be made without departing from the spirit and scope of the invention, and that the same is not limited to the particular forms herein shown and described, except in so far as indicated by the appended claims.

I claim:

1. An apparatus comprising in combination a heat-treatment chamber and a retort for developing gaseous fluid for heating the heat-treatment chamber, the retort consisting of a chamber having inlet and outlet connections respectively for passing into it liquid fuel and for delivering from it combustible gaseous fluid developed from the liquid fuel in its passage through the retort chamber, said chamber being otherwise sealed against entrance of the liquid fuel and discharge of the resulting gaseous fluid; a supply conduit leading from a source of liquid fuel to the retort chamber inlet; a discharge conduit connected to the retort chamber outlet; gas burner means positioned for heating the retort chamber and the heat-treatment chamber, the discharge conduit being connected to said

gas burner means, and a conduit leading from a source of air under pressure connected with said discharge conduit for aerating the fluid supplied to the burner from the retort chamber outlet.

2. An apparatus comprising in combination a heat-treatment chamber and a retort for developing gaseous fluid for heating the heat-treatment chamber, the retort consisting of a chamber having inlet and outlet connections respectively for passing into it liquid fuel, and for delivering from it gaseous fluid developed from the liquid fuel in its passage through the retort chamber, said chamber being otherwise sealed against entrance of the liquid fuel and discharge of the resulting gaseous fluid; a conduit leading from a source of liquid fuel to the retort chamber inlet; a discharge conduit leading from the retort chamber outlet; gas burner means positioned for heating the retort and the heat-treatment chamber, said discharge conduit supplying fuel to said gas burner means, the heat-treatment chamber being interposed between the burner means and the retort at a position for carrying the substance to the heat-treated and for passage of gaseous products of combustion from the burner means through said heat-treatment chamber and past the heat-treated substance therein, whereby the retort is exposed to said products of combustion from the burner after said products have parted with the heat communicated to the heat-treated substance.

3. An apparatus for the purpose indicated comprising in combination a retort for developing

gaseous fluid; a heat-treatment structure having a heat-treatment chamber; means for supplying liquid fuel to the retort; a conduit leading from the retort for discharge of the gaseous fluid developed in the retort; a conduit leading from a source of air under pressure, connected for discharge into the retort discharge conduit for aerating the gaseous fluid from the retort; burner means operatively associated with the heat-treatment chamber for discharging hot products of combustion from said burner means into heating relation to the heat-treated contents of said chamber, and a pipe connected with said retort discharge conduit to supply said burner with gaseous fluid, the heat-treatment structure having at its upper part an opening for outlet of the hot gaseous products of combustion passing through the heat-treatment chamber, the retort being located in the path of emergence of said hot gaseous products from said outlet; whereby the retort is heated for developing gaseous fluid by the waste heat of said products of combustion after heating the heat-treatment chamber.

4. In the combination defined in claim 3, an auxiliary burner positioned for discharging its products of combustion into the heat-treatment chamber, means for supplying liquid fuel directly to said burner, and a branch from the air conduit leading to the burner for aerating such liquid fuel at said burner to provide a combustible mixture for initially heating the retort by way of the heat-treatment chamber.

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