Jan. 25, 1944. H. L. GRAPP 2,340,120

PRESSURE HEATING DEVICE

Filed Nov. 8, 1940 2 Sheets-Sheet 1

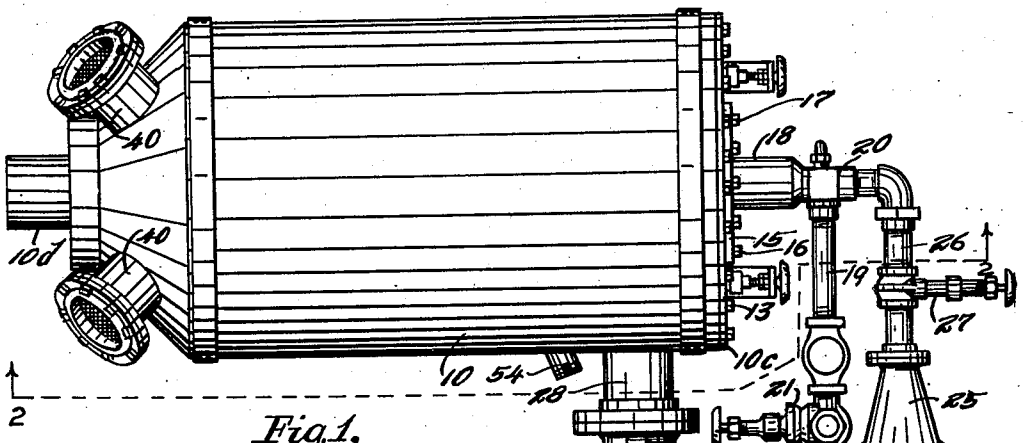


Fig. 1.

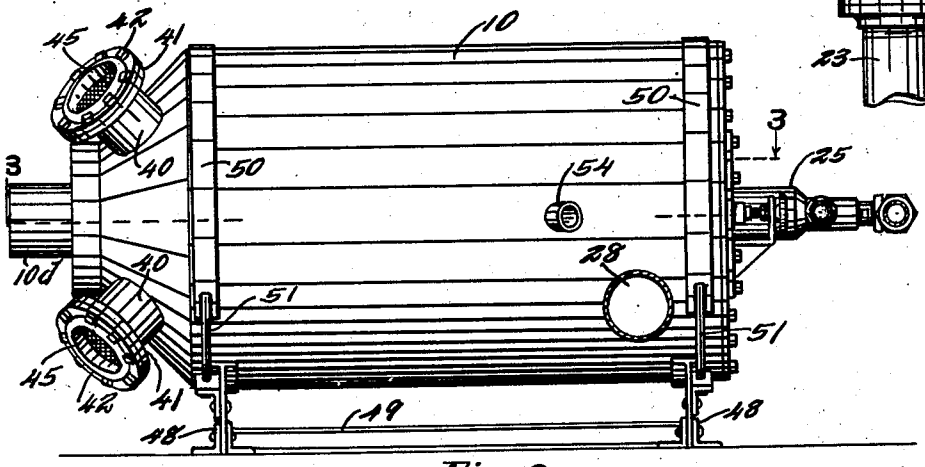


Fig. 2.

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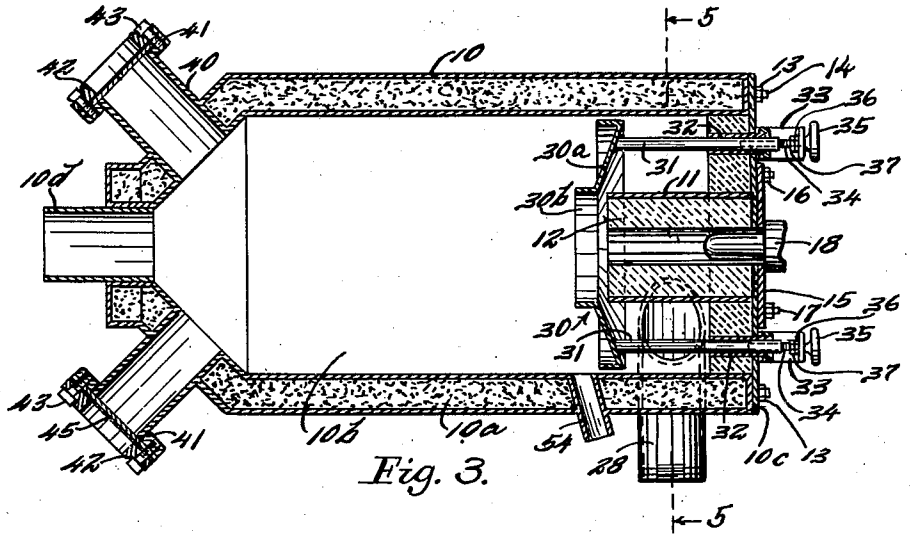


Fig. 3.

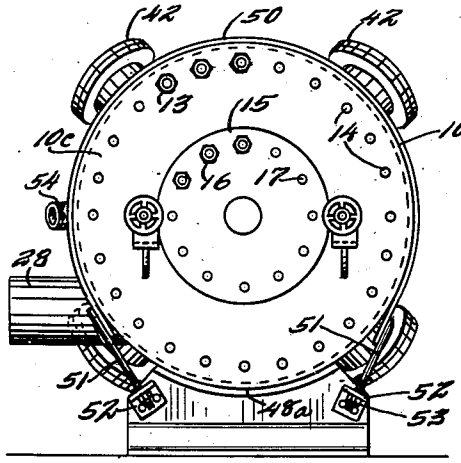


Fig. 4.

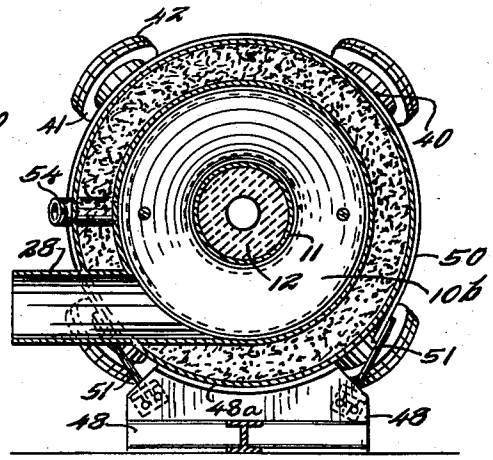


Fig. 5.

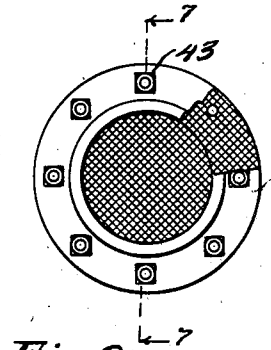


Fig. 6.

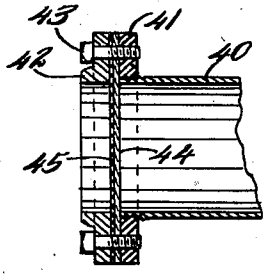


Fig. 7.

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UNITED STATES PATENT OFFICE

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PRESSURE HEATING DEVICE

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Application November 8, 1940, Serial No. 364,838

4 Claims. (Cl. 263—19)

This invention relates to an air heating device and particularly to an air heating device where the fuel such as a gaseous fuel is burned under pressure and the heated air is maintained under pressure. By thus having the air to be heated and the fuel as well as the air of combustion under pressure, much higher efficiency is secured in the heating process. By having the air at ten pounds pressure it is possible to get substantially ten times the B. t. u.'s in one cubic foot of air that can be had at atmospheric pressure. The effect of burning gas under pressure is to increase the flame temperature and shorten the distance from particle to particle, or the distance of flame travel. Consequently the velocity of combustion is increased and more fuel can be burned in a given space. While air has been previously heated in chambers by means of fuel burners it is believed new to confine the air under pressure and heat the same by burning the fuel under pressure.

It is an object of this invention to provide an air heating device comprising a casing with a chamber therein, means for supplying air to said chamber under pressure, means for heating said air by burning the fuel under pressure, together with means for regulating the pressure on the burner to prevent back pressure thereon and to secure the desired character of flame.

It is more specifically an object of the invention to provide a casing preferably of cylindrical form having a chamber therein, a member projecting into said chamber usually lined with refractory material, a burner in said passage for burning gas under pressure and supplied with air under pressure, means for supplying air under pressure to said chamber adjacent said member and a baffle member surrounding said member and extending therefrom in said chamber movable toward and from said member for regulating the air pressure at said burner.

It is also an object of the invention to provide an air heating device comprising a casing having a chamber therein in which air under pressure is heated, said chamber being provided with explosion means comprising a passage leading from said chamber having a screen thereacross and a diaphragm of frangible material overlying said screen.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings in which like reference characters refer to similar parts throughout the several views and in which:

Fig. 1 is a plan view of the device;

Fig. 2 is a view in side elevation thereof, some parts being omitted, and some being shown in section on line 2—2 of Fig. 1;

Fig. 3 is a horizontal section taken substantially on line 3—3 of Fig. 2;

Fig. 4 is a view in rear elevation, some parts being omitted;

Fig. 5 is a vertical section taken substantially on line 5—5 of Fig. 3 as indicated by the arrows;

Fig. 6 is a view in front elevation of one of the explosion heads, some parts being broken away; and

Fig. 7 is a vertical section taken on line 7—7 of Fig. 6.

Referring to the drawings an air heating device is shown comprising a casing 10. While this casing might take various forms, in the embodiment of the invention illustrated it is shown as of cylindrical form having a contracted outlet end, the same being shown with a thick insulated wall 10a. At the inlet end of the chamber a member 11 is provided shown as disposed in or projecting into chamber 10b of casing 10, member 11 being lined with firebrick 12 or other suitable refractory material. A rear cover 10c is provided for casing 10 which will be held in place by nuts 13 placed on projecting studs 14, only a few of nuts 13 being shown. Another plate 15 is secured to plate 10c, plate 15 also being held in place by a plurality of nuts 16 placed on projecting studs 17. Plate 15 has secured thereto a burner casing 18, a portion of which projects into the passage in member 11. A pipe 19 is connected to a coupling 20, in turn connected to member 18, the same being provided with a control valve 21 and said pipe 19 will be connected to a suitable supply of gas under pressure. A conduit 23 is provided which will be supplied with air under pressure, said conduit being shown as having therein a T coupling 24 which coupling has secured to one end a reducing coupling 25 from which extends a pipe 26 which is connected to coupling 20. Pipe 26 has a regulating valve 27 therein. A conduit 28 is connected through suitable couplings to T member 24 and the same projects tangentially into casing 10 and communicates with chamber 10b therein. It will thus be seen that the air under pressure supplied through conduit 23 is supplied both to the burner 18 and to chamber 10b. A baffle or regulating member 30 is provided which in the embodiment of the invention illustrated is shown as having a frusto-conical portion 30a

and a short cylindrical portion 30b projecting therefrom, portion 30b having its internal diameter equal substantially to the external diameter of member 11. Member 30 thus extends from the outer side of member 11 to a line which is closely adjacent the wall of chamber 10b. A pair of rods 31 are connected to the concave side of member 30 and these rods project outwardly through the end wall of casing 10 and through members 32 therein which surround said rods and provide a tight joint. Small brackets and have journaled therein rods 34 provided at 33 are secured to the outer side of cover 10b their outer ends with hand wheels 35. A collar 36 is secured to each rod 35 at the inner side of bracket 34 and engaged by a nut 37. The inner ends of rods 34 are threaded and thus form screws and extend into the threaded ends of rods 31. It will thus be seen that by turning hand wheels 35 rods 31 will be moved inwardly or outwardly, thus moving baffle member 30 toward or away from the inner end of member 11. It will be noted that conduit 28 extends into chamber 10b between member 30 and the rear end of said chamber.

The contracted end of casing 10 is provided with a plurality of outwardly extending conduits 40, the passages therethrough communicating with chamber 10b. Said conduits 40 are shown as four in number and each has its outer end threaded to have screwed thereon a collar 41. Another outer collar 42 is secured to collar 41 by a plurality of circumferentially spaced screws 43. A diaphragm 44 is placed between collars 41 and 42 and a screen 45 disposed at the outer side of diaphragm 44 is also disposed between said collars. Members 44 and 45 are thus tightly clamped between the collars 41 and 42. While diaphragm 44 might be made of various material, in practice it has been found suitable to have this made from a sheet of asbestos.

The casing 10 is supported upon spaced brackets 48 having concave or segmental supporting surfaces 48a. Said brackets are disposed adjacent the ends of casing 10 and are preferably connected by one or more tie rods 49 extending therebetween. A band 50 extends over the top and around casing 10 at each end thereof and said band has connected to its ends rods 51 which project downwardly and toward the center of brackets 48 and through the outwardly extending flanges 52a of small angle brackets 52 secured to the outer sides of brackets 48. The ends of rods 51 are threaded and equipped with nuts 53 underlying flanges 42a so that the bands 50 can be tightened about casing 10 to hold the same firmly in place. As shown in Figs. 1, 2 and 3 casing 10 has a cylindrical outlet conduit 10d projecting centrally from the contracted end of casing 10a. Casing 10 is also shown as having a conduit 54 extending therethrough having a passage communicating with passage 10b. Conduit 54 is adapted to have connected thereto a control apparatus, such as a photoelectric cell, for shutting off the gas supply should the flame of the burner be extinguished.

In operation the gas will be supplied to burner 18 through the pipe 19 and air under pressure will be supplied to said burner through pipe 26. Air under pressure will also be supplied to chamber 10b by the conduit 28. The air supplied through conduit 28 will be given a whirling or helical motion in casing 10 due to the tangential disposition of conduit 26. The air in chamber 10b will be maintained at considerable pressure. In one embodiment of the invention the air was maintained at 10 pounds pressure and the device was designed to heat the air to 1000 degrees F. With the air in chamber 10b under such pressure there is a possibility of having a back pressure on burner 18. To prevent this and to properly regulate the pressure in the chamber 10b relative to the pressure in the passage of member 11, the baffle member 30 will be adjusted. This member 30 can be adjusted by the operator turning the hand wheels 35. The operator will adjust member 30 until the proper and desired flame from burner 18 is secured. When this flame is secured the pressure is properly equalized in the passage of member 11 and in chamber 10b. The burner can thus operate properly burning the gaseous fuel under pressure and the air in chamber 10b can also be maintained under pressure. A high degree of heating efficiency is thus obtained.

With such heated air and gas there is always the possibility of an explosion in chamber 10b and for this purpose the explosion heads comprising conduits 40 and the structure thereon are provided. Should an explosion occur the diaphragms 44 will be fractured and the gases can escape through the same and screens 45. It may be that both the diaphragm 44 and screen 45 will be blown out by the explosion. A relief is thus provided for the excess pressure so that there is no danger of injuring casing 10.

From the above description it will be seen that I have provided a simple and efficient device for burning fuel under pressure and heating air under pressure. It is believed that such a device has not heretofore been successfully operated in this country. Such devices are used for heating air to be used in oil refining plants. The Houdry oil-refining process makes use of such heated air at high temperature. The device has been amply demonstrated in actual practice and will soon be in commercial production.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts, without departing from the scope of applicant's invention, which generally stated, consists in a device capable of carrying out the objects above set forth, in the parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:

1. A device for heating air under pressure by burning liquid or gaseous fuel under pressure having in combination, a cylindrical casing having a chamber therein, a member projecting into said casing and chamber at one end thereof having a passage therethrough, a burner projecting into said passage, means for supplying fuel to said burner, means for supplying air under pressure to said burner, a frusto-conical baffle member extending from said first mentioned member to adjacent the wall of said chamber, means for moving said baffle member toward and from the end of said first mentioned member and means for supplying air tangentially to said chamber between said baffle member and said end of said chamber.

2. A device for heating air under pressure by burning liquid or gaseous fuel having in combination, a casing having a chamber therein in which air is heated, a burner disposed at one end of said chamber, a passage extending into said chamber from said burner through which the products of combustion are delivered to said chamber, means for supplying fuel to said burner, means for sup-

plying air under pressure to said burner, means for supplying air under pressure to said chamber, a regulating member within said chamber beyond said passage and having a periphery spaced from the wall thereof, the same extending transversely in said chamber and having a central opening aligned with said passage and means for moving said member toward and from said passage longitudinally of said chamber toward said means for regulating the pressure in the zone of combustion beyond said burner relative to that in said chamber.

3. The structure set forth in claim 2, said means for supplying air under pressure to said chamber being disposed between said end of said chamber and said regulating member.

4. A device for heating air under pressure by burning liquid or gaseous fuels under pressure having in combination, a casing having a chamber therein in which air is heated, a burner disposed adjacent one end of said chamber, means for supplying fuel and air to said burner, means for supplying air under pressure to said chamber disposed adjacent said end of said chamber, a baffle disposed in said chamber beyond said burner and beyond said last mentioned means, said baffle extending transversely of said chamber and being spaced from the wall of said chamber, means for moving said baffle toward and from said last mentioned means and burner for regulating the pressure in said chamber, preventing a back pressure on said burner and to secure good combustion by said burner.

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