Nov. 5, 1940. J. F. HIRTZ ET AL 2,220,603

HYDROCARBON BURNER

Filed May 31, 1938 2 Sheets-Sheet 1

Fig. 1.

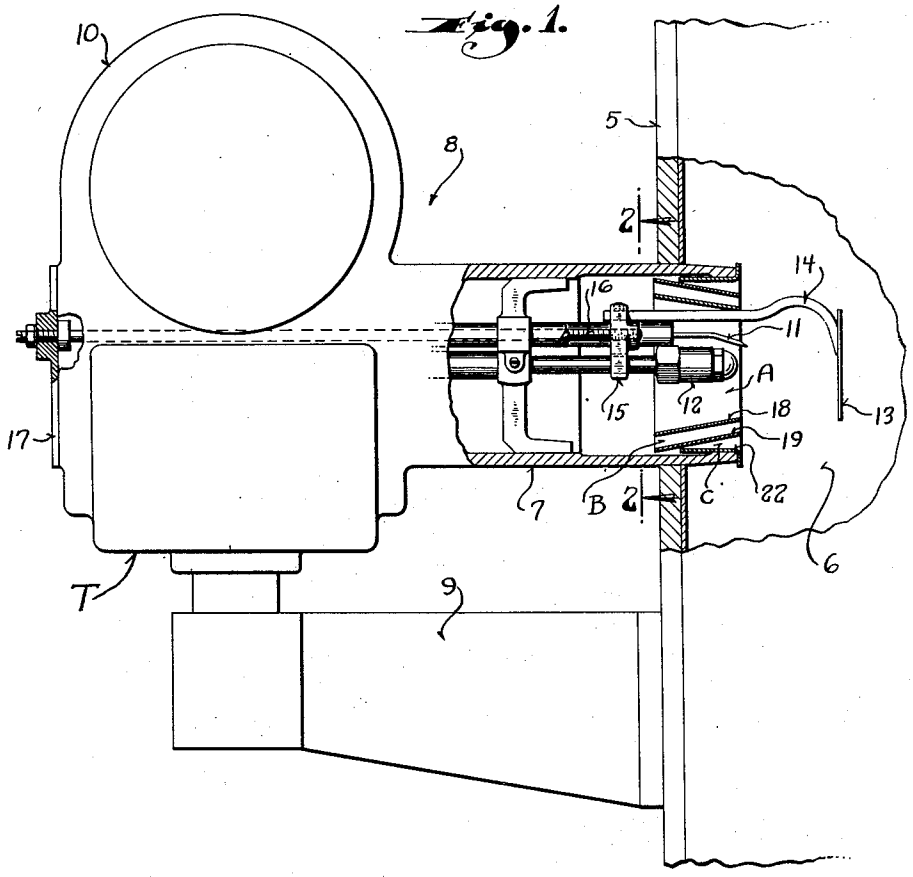
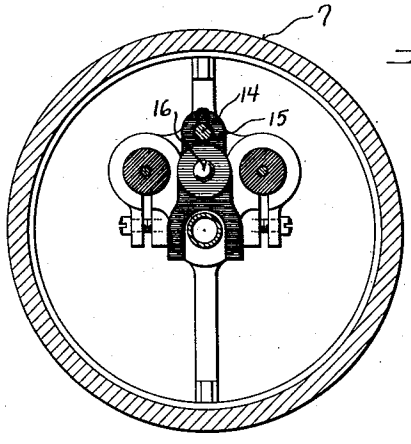


Fig. 2.



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Fig. 3.

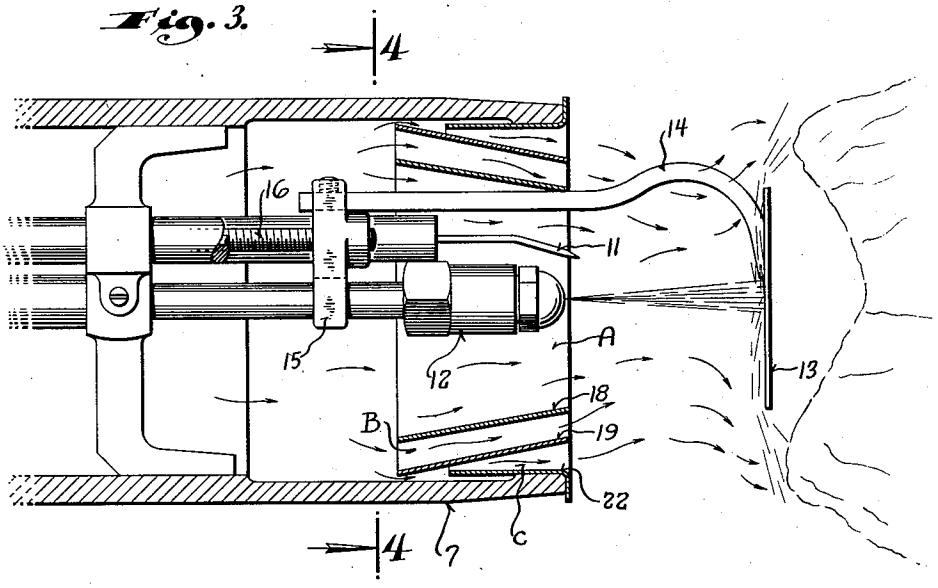
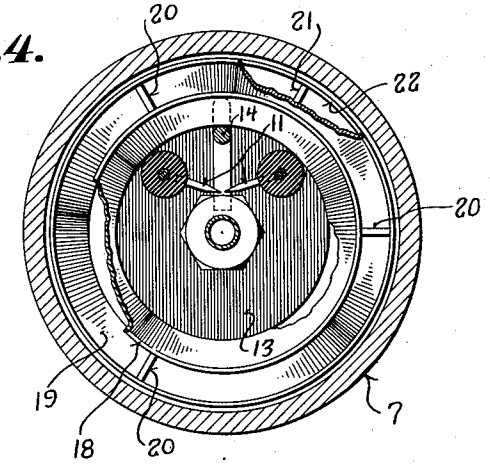


Fig. 4.



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UNITED STATES PATENT OFFICE

2,220,603

HYDROCARBON BURNER

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Application May 31, 1938, Serial No. 210,930

8 Claims. (Cl. 158—73)

This invention relates to hydrocarbon burners, and refers particularly to oil burners adapted for use in automatically controlled heating plants.

There are at present two types of burners used in oil burning equipment, one, the so-called gun type, and the other, the open pot type or hydroxylating type of gravity burner. The former is best suited for use in automatically controlled equipment, but the latter has certain advantages from the standpoint of assuring more complete mixture of the fuel and air.

The present invention has as one of its objects to provide a burner which combines the advantages of both of these existing types.

The maintenance of a proper fuel-air ratio is of utmost importance in burning oil, but with equipment heretofore available, this desideratum was constantly subject to the inevitable variables resulting from the required chimney draft.

It is therefore another object of this invention to provide a new manner of burning oil whereby chimney draft is obviated.

In other words, it is one of the objects of this invention to provide a burner which will operate better than burners heretofore in use entirely without the aid of chimney draft, and one, which in fact, is unaffected by back pressure in the combustion chamber.

Another object of this invention is to provide practical and simple means for vaporizing the liquid fuel spray ejected from the nozzle of a gun type burner, and for insuring complete admixture of the air with the vaporized fuel.

Another object of this invention is to so mount the means employed to vaporize the liquid fuel spray, which is in the nature of a metal target mounted to be impinged by the spray, that the flame of the burning combustible mixture is substantially anchored at a fixed point adjacent to the target so as to keep the same sufficiently hot to insure vaporization of the fuel.

Another object of this invention is to provide means at the mouth of the air discharge tube to divide the air into separated streams, and to provide means whereby a condition of back pressure within the combustion chamber may be relieved without altering the net volume of air supplied for combustion so as to insure a steady flame uninfluenced by changes in atmospheric conditions.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawings illustrate one complete example of the physical embodiment of the invention constructed in accordance with the best mode so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a side view of an oil burner constructed in accordance with this invention, parts thereof being broken away and in section;

Figure 2 is a cross sectional view taken through Figure 1 on the plane of the line 2—2;

Figure 3 is an enlarged sectional view through the front end of the burner, illustrating the manner in which the fuel spray is vaporized and the air for combustion is mixed with the vaporized fuel; and

Figure 4 is a cross sectional view taken through Figure 3 on the plane of the line 4—4.

Referring now particularly to the accompanying drawings in which like numerals indicate like parts, the numeral 5 designates a furnace or boiler having a combustion chamber 6 into which the "gun" 7 of an oil burner, indicated generally by the numeral 8, projects. The burner 8 is mounted on a suitable support 9 and besides the air duct which constitutes the body of the "gun" 7, it includes a blower (not shown) housed within the casing 10 and a transformer T.

The blower, as is customary, projects the air through the duct 7 into the combustion chamber, and the transformer supplies high tension current for maintaining a spark across electrodes 11 mounted adjacent to a nozzle 12 from which the liquid fuel issues in a fine atomized spray. The nozzle 12 is supported centrally within the air duct 7 and is connectible with a source of liquid fuel under pressure, in the customary manner.

Mounted ahead of the nozzle 12 in position to be impinged by the atomized spray issuing therefrom is a target 13. This target consists of a disc of suitable metal to resist the heat, preferably stainless steel. It is adjustably mounted by an arm 14 fixed to a cross head 15, which is slidably supported in the air duct for adjustment forwardly or backwardly by a screw 16, the rear end of which projects through the back plate 17 of the burner casing to be readily accessible for manipulation.

In the conventional gun type oil burner, admixture of the fuel and air is obtained by mechanically impinging the air on the atomized spray, and to this end, the mouth of the air duct usually is equipped with a head which imparts a whirling or twisting motion to the air current.

In this invention no attempt is made to impart a spiral formation to the discharging air, but instead, it is concentrated or converged toward the center of the target 13. This is done by means of two concentric frustro-conical sleeves 18 and 19, held in spaced relationship by bridging members or cross pieces 20 and 21, inside a mounting sleeve 22 which fits the mouth of the air duct 7.

This structure divides the mouth of the air duct into three discharge passages. The main or central passage A is defined by the inner sleeve 18. A secondary passage B is formed by the space between the two sleeves 18 and 19; and a third passage C is formed by the space between the sleeve 19 and the mounting sleeve 22. This latter passage, as will best be seen in Figure 3 has a restricted throat at its rear or inner end, but a comparatively large discharge area.

With this division of the mouth of the air duct, the air streams issuing therefrom through the three separate discharge passages have different velocities. That portion of the air which issues from the main or central passage A has a high velocity, while the air flowing through the secondary passage B has a lesser velocity, and the air passing through the outer or third passage C has a comparatively low velocity.

Operation

When the burner starts, the ignition is on and a spark is maintained across the electrodes 11. Consequently, combustion takes place at the spray nozzle. The target 13 is thus bathed in a flame and becomes sufficiently heated so that when the ignition goes off after a short period, the liquid fuel sprayed against the target is vaporized by the heat thereof.

The vaporized fuel, which is very much in the nature of a gas, is mixed with the air issuing from the main passage A to form a combustible mixture which is driven radially off the edge of the target where the air issuing from the secondary passage B strikes it crosswise to further improve the fuel-air mixture.

The conjoint action of the air streams issuing from the passages A and B causes the flame to assume a flat hollow cone-shape, and by virtue of the radially outward flow of gases at the edge of the target, a partial vacuum is formed back of the target which draws the flame toward the target, but without actually having the flame contact the target.

The flame is thus more or less anchored at a fixed point by the target and sufficiently close to the target to keep the same at a high enough temperature to insure vaporization of the liquid fuel.

Injurious heating of the target is precluded by the cooling effect of the liquid fuel striking the same, but it is important to note that the temperature of the target is sufficiently high to vaporize the liquid fuel so that at no time will the fuel drip from the target, and it is also important to note that inasmuch as there is no combustion directly at the target, it does not carbonize.

It has been found that with this construction, regular commercial grades of fuel oil can be burned with considerably higher efficiency than heretofore available, and that chimney draft is entirely unnecessary. Hence, the objectionable variables incident to inevitable variations in chimney draft are eliminated and uniformly good results are obtained regardless of differences in atmospheric conditions.

If a pressure develops in the combustion chamber due to back draft from the chimney, which heretofore has been one of the worst conditions to be contended with, it is absorbed or cushioned without change in the net volume of air supplied for combustion. This follows from the fact that the air flow through the outer or third air passage C has a very low velocity because of its restricted inlet and progressively larger discharge, so that any back pressure in the combustion chamber can expend itself at this point, which in effect reduces the discharge area of the duct. Thus the only effect it has on the air flow through the passages A and B is a slight increase in velocity.

In the event of an unusual back pressure exerted against the discharge mouth of the burner, the two outer passages B and C coact to absorb or cushion the back draft and further restrict the discharge area. A corresponding increase in the velocity of the air through the primary passage A is of course accompanied by such cushioning action.

Thus a steady flame of uniformly high efficiency is maintained even under severe back draft conditions.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides a substantial improvement in hydrocarbon burners by insuring uniformly high efficiency combustion at zero chimney draft and even under back draft conditions.

What we claim as our invention is:

1. A hydrocarbon burner of the character described comprising: a nozzle for ejecting a fine spray of liquid fuel; a target adjustably mounted ahead of the nozzle to be impinged by the spray; an air supply duct encircling the nozzle; and means for directing the discharge of the air from said duct to cause the same to converge toward the center of the target so as to commingle with the fuel vapor formed by the spray striking the target and cause the vaporous gases to envelop the target and burn in a flame adjacent to the target, whereby the target is kept sufficiently hot to vaporize the fuel spray as it strikes the same.

2. A hydrocarbon burner of the character described comprising: an air duct; means for forcing air through the duct; a nozzle inside the duct positioned to eject a fine spray of liquid fuel from a point adjacent to the mouth of the air duct; a target supported outside the duct and ahead of the nozzle to have the fuel spray impinge the same so that the heat of the target produced by the burning fuel vaporizes the fuel spray; and means in the mouth of the air duct forming a plurality of air discharge passages, one within the other, said means converging the air flowing through the inner passage upon the target.

3. A hydrocarbon burner of the character described comprising: an air discharge duct; a nozzle in the duct positioned to eject a spray of liquid fuel from a point adjacent to the mouth of the air duct; a target maintained hot by the flame produced by the burner; means mounting the target in position to be impinged by the spray of liquid fuel; and means at the mouth of the

air discharge duct for converging part of the air issuing therefrom toward the center of the target to commingle with the vaporized fuel and drive the same radially off the edge of the target, and for directing another part of the air past the edge of the target to strike the fuel-air mixture crosswise as it leaves the edge of the target to thereby effect further admixture of fuel and air.

4. In a hydrocarbon burner: an air duct adapted to have air forced therethrough to issue from the mouth of the duct; a nozzle in the duct positioned to eject a spray of liquid fuel from a point adjacent to the mouth of the air duct; a target mounted to be impinged by the fuel spray and heated by the flame when the burner is in operation so as to vaporize the fuel; and a tapered sleeve in the mouth of the air duct to divide the air issuing therefrom into an inner stream and an outer stream and to converge the inner stream toward the center of the target for mixture with the fuel vapor, and for driving the combustible mixture thus formed radially off the edge of the target; and means for directing the outer stream past the edge of the target to strike the fuel mixture leaving the edge of the target crosswise.

5. In a hydrocarbon burner: an air duct adapted to have air forced therethrough; a nozzle mounted inside the duct near the mouth thereof to eject a spray of liquid fuel from the duct; a disc of metal capable of withstanding high temperature; a supporting arm for said disc projecting rearwardly toward the air duct; and means fixed with relation to the air duct for adjustably mounting said arm to support the disc in position to be impinged by the liquid fuel spray issuing from the nozzle while allowing adjustment thereof between limits toward and from the nozzle.

6. In a hydrocarbon burner: an outer casing, part of which forms an air discharge duct; a nozzle mounted in the mouth of the discharge duct positioned to eject a spray of liquid fuel from a point adjacent to the mouth of the discharge duct; a metal target heated by the flame of the burner in operation; a supporting arm carrying the target; means inside the air duct for mounting the supporting arm for movement parallel to the axis of the air duct, said arm holding the target in position to be impinged by the liquid fuel spray so that the spray is vaporized upon striking the target; and target adjusting means extending rearwardly to the exterior of the burner casing.

7. A hydrocarbon burner of the character described comprising: an air duct; means for forcing air through the duct; a nozzle inside the air duct positioned to eject a fine spray of liquid fuel from a point adjacent to the mouth of the air duct; a target outside the mouth of the air duct; a supporting arm for said target having a portion projecting rearwardly beyond the inner end of the nozzle; means for adjustably mounting said arm to support the target in an adjustable position ahead of the nozzle where the fuel spray impinges it so that the heat of the target produced by the burning fuel vaporizes the fuel spray; and means in the mouth of the air duct forming a plurality of air passages, one within the other, said means converging the air flowing through the inner passage toward the target.

8. A hydrocarbon burner of the character described comprising: a nozzle for ejecting a fine spray of liquid fuel; a target adjustably mounted ahead of the nozzle to be impinged by the spray; an air supply duct encircling the nozzle; and means for converging air flowing through the duct toward the center of the target so as to commingle with the fuel vapor formed by the spray striking the target and cause the vaporous gases to envelop the target and burn in a flame adjacent to the target, whereby the target is kept sufficiently hot to vaporize the fuel spray as it strikes the same.

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