H. J. MASTENBROOK.

BURNER.

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1,241,135.

Patented Sept. 25, 1917.

Fig. 1

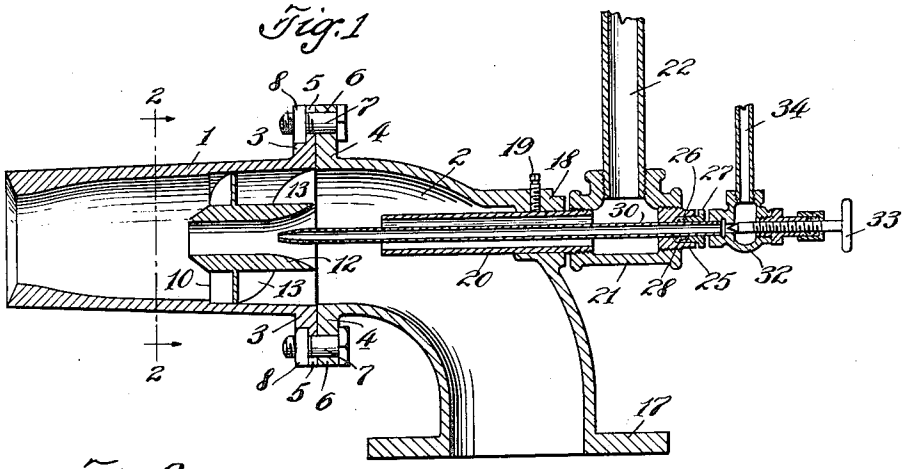


Fig. 3.

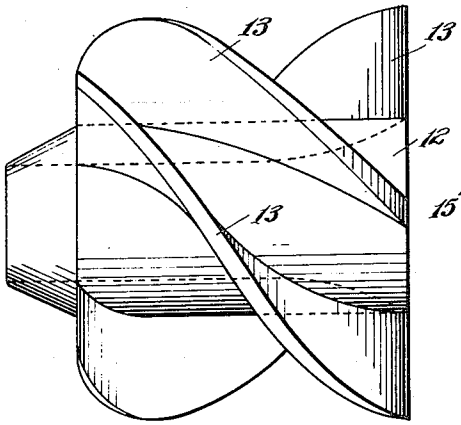


Fig. 2.

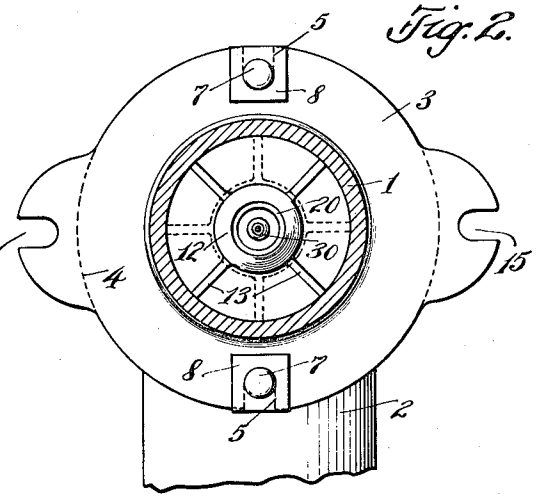
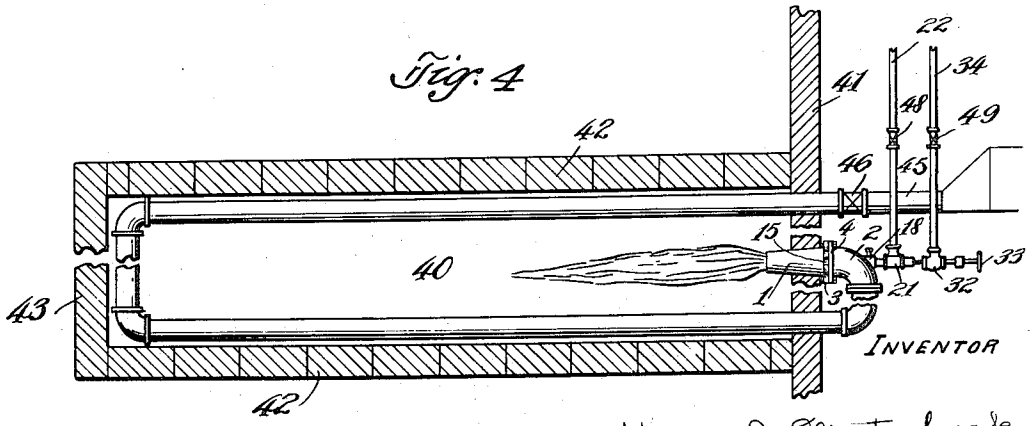


Fig. 4



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BY

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UNITED STATES PATENT OFFICE.

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BURNER.

1,241,135. Specification of Letters Patent. Patented Sept. 25, 1917.

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To all whom it may concern:

Be it known that I, HENRY J. MASTENBROOK, a citizen of the United States, residing at Lakewood, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Burners, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to a combined oil and gas burner, the primary object of the invention being the provision of a burner of this kind wherein the two kinds of fuels may be used with high efficiency separately or in combination as circumstances may require.

Further objects are the provision of a burner of the injector type wherein a thorough mixture of air and gas is assured and which delivers the mixture to the combustion chamber in such manner as to insure perfect combustion and placement of the flame; the provision of a burner of the aforesaid character wherein oil when used is thoroughly atomized or vaporized and mixed with and carried by the air into the combustion chamber in a manner and condition conducive of the highest efficiency; the provision of a burner of the foregoing character wherein one fuel may be instantly substituted for the other, or both may be simultaneously fed in accurate proportions; and to provide a burner of the above character which is easy of manipulation; convenient of installation; which is readily adjustable; comparatively simple of construction; economical of production; and wherein the parts may be readily assembled, or disassembled for inspection or replacement of parts.

In the drawing accompanying and forming a part hereof I have shown a burner constructed in accordance with my invention and wherein the foregoing objects are attained.

Figure 1 is a central section through the burner; Fig. 2 is a transverse section on the line 2—2 of Fig. 1, looking in the direction of the arrows; Fig. 3 is a side elevation of the air director; and Fig. 4 is a horizontal sectional view through the combustion chamber of a furnace, showing an installation of my improved burner.

What may be regarded as the burner casing is made up of a nozzle 1 and a casing member 2, the latter, in the present design constituting an elbow. Engaging ends of the nozzle and casing member are provided, respectively, with flanges 3 and 4, the former having notches 5, and the latter apertures 6, for the reception of connecting bolts 7. The notches 5 are enlarged at their outer ends to provide confining sockets or recesses for nuts 8 that are applied to the threaded ends of the bolts 7. The bore of the nozzle converges gradually from its inner toward its outer end. Except for a counter bored portion at its inner end, the inner end of the bore is substantially equal in diameter to the diameter of the bore of the casing member 2. The counter bored portion referred to, however, is somewhat greater in diameter than the bore of the member 2, and between such counter bored portion and the remaining portion of the nozzle bore there is a shoulder 10. While I have employed the term "counter bore," it will be understood that the portion so referred to may be formed by coring, or by any other suitable method.

An air director 12 is contained within the counter bored portion of the nozzle and, as shown clearly in Fig. 3, consists of a central sleeve that is surrounded by spiral vanes 13. The end of the sleeve beyond the forward ends of the vanes 13 tapers inward, and the opposite end of its bore flares outward. The dimensions are such that when the air director is dropped into the counter bored portion of the nozzle and the forward ends of its vanes 13 engage the shoulder 10, the opposite end of the air director is substantially flush with the rear end of the nozzle. Consequently, when the flanges 3 and 4 are drawn together by the bolts 7, the air director will be held snugly in place by the engagement of the forward end of the casing member 2 with the rear ends of the vanes 13.

At diametrically opposite points and on an axis substantially at right angles to the axis of the bolt receiving notches 5, the

flange 3 is provided with notches 15 for the reception of means, such as bolts or studs, for securing the burner to the furnace front. At its end opposite the nozzle 1, the casing member 2 is shown as provided with a flange 17 for connection with an air supply pipe. Between its ends the casing member 2 is provided with a boss 18 having a bore that is in axial alinement with the bore of said member at its nozzle receiving end.

Adapted to be secured in any adjusted position within the bore of the boss 18, by a set screw 19, is a gas injector pipe 20, to the rear threaded end of which is applied a T 21. The right angle branch of the T has connection with a gas supply pipe 22, and a plug 25 is screwed in the opposite end of the T and is bored to provide a stuffing gland 26 within the outer end of which is screwed the gland nut 27. Packing material 28 is shown within the packing gland.

An oil injector pipe 30 slidably fits within the bore of the plug 25 and is adapted to be held in any adjusted position therein by the packing material 28 when the gland nut 27 is "set up" sufficiently tight. The oil injector pipe is sustained central within the gas injector pipe 20, and its forward end is tapered inward and reposes centrally of the bore of the air director 12. Beyond the packing gland 26, the oil injector pipe has a valve 32 applied to it, the same being shown herein as a needle point valve having an operating handle 33. A pipe 34 supplies oil to the casing of this valve.

In Fig. 4 I have illustrated a very desirable installation of my improved burner wherein the combustion chamber 40 of an oven of some common sort is shown as inclosed within a front wall 41, side walls 42, and back wall 43. An air supply pipe 45 is shown as extending into the combustion chamber along one side wall, across the rear wall, and back along the opposite side wall where it leaves the oven through the front wall and has connection with a burner, the nozzle 1 whereof projects through the front wall and into the combustion chamber. Thus the portion of the air pipe within the combustion chamber constitutes an effectual preheating chamber for the air, and the pipe is shown as having a valve 46 through which the supply of air may be controlled. The respective gas and oil supply pipes 22 and 34 are shown as equipped with valves 48 and 49.

In the installation just described, the operation of the burner is as follows; Air is turned through the pipe 45 by opening the valve 46 and, after leaving the preheating portion of the pipe, a part of it passes through the bore of the air director and the remainder through the spiral passageways between the vanes 13. The air passing through the bore is increased in velocity by the reduced portion of the bore and issues from the outlet end of the sleeve in a restricted column which is emitted central of the discharge orifice of the burner. The air which passes between the vanes 13 is discharged in a whirling eddy into the forward end of the nozzle and about the former column of air, tending to maintain the formation of this column of air until it passes from the nozzle.

Upon opening the valve 48, gas is injected through the pipe 20 and is caught by the air as the latter approaches the director 12, a quantity of the gas being carried through the bore of the sleeve and a part through the spiral passageways. The action of the air already described results in a very thorough intermingling of the air and gas with the result that a highly combustible mixture issues from the nozzle.

When it is desired to burn oil, the valve 49 may be opened and the former valve 48 closed. The control of the oil supply must necessarily be much more accurate as to quantity than the supply of gas, and consequently the needle valve aforesaid is provided. The oil may be fed under sufficient pressure to discharge it from the outlet end of the injector pipe 30, and the air rushing through the bore of the sleeve picks up the oil and, by reason of the air's velocity, thoroughly atomizes it. This atomizing of the oil is greatly enhanced by the whirling air discharged from the spiral passageways between the vanes 13 until, by the time the mixture issues from the discharge orifice of the nozzle, a very intimate association prevails between the air and oil particles, resulting in the production of a mixture which is highly combustible and which is directed into the combustion chamber in such manner as to produce a flame having substantially the shape revealed in Fig. 4. The preheating of the air as it passes through the section of pipe within the combustion chamber greatly assists in vaporizing the oil.

It follows obviously from the foregoing description that, when it is desired to use oil and gas simultaneously, both valves 48 and 49 may be opened at the same time, it being understood that the needle point valve 32 is employed only for accurate adjustment, and that the supply is controlled by the valve 49.

To take care of the different grades or weights of oil, varying air pressures, etc., the injector pipes are made adjustable as aforesaid with respect to the casing.

I have already explained how the inner and outer surfaces of the air director sleeve converge to a thin edge at the forward end of the sleeve. This is to insure any oil which comes into contact with the inner sur-

face of the sleeve and is carried to the forward end thereof being picked up by the air issuing from the passageways between the vanes 13, obviating the accumulation of oil on the forward end of the sleeve which would be liable to occur if such end were of any material breadth.

Having thus described my invention, what I claim is:—

1. In a burner of the character set forth, the combination of a casing having a discharge orifice, an air director within the casing and comprising a sleeve the bore whereof is substantially in axial alinement with the outlet orifice, said director involving spiral vanes which extend outward from said sleeve, and a fuel injector pipe supported within the casing substantially central of and spaced from the aforesaid sleeve.

2. In a burner of the character set forth, the combination of a casing having a bore which terminates at one end in an outlet orifice, a fuel injector pipe having its discharge end spaced from the orifice and supported within the casing substantially central of the bore, and an air director within the bore of the casing between the discharge end of the injector pipe and outlet orifice and comprising a central sleeve and outwardly extending spiral vanes, the injector pipe being spaced from the sleeve.

3. In a burner of the character set forth, the combination of a casing having a bore which terminates at one end in a discharge orifice, a fuel injector pipe supported within the casing the axis whereof is substantially coincident with the central axis of the bore, a second fuel injector pipe supported substantially central of the first and projecting beyond the discharge end thereof into the casing, and an air director within the casing between the injector pipes and discharge orifice and comprising a central sleeve and outwardly extending spiral vanes.

4. In a burner of the character set forth, the combination of a casing having an inlet and a discharge orifice, and a plurality of fuel injection pipes severally adjustably supported and arranged to discharge within said casing with their discharge ends in operative relation to said orifice.

5. In a burner of the character set forth, the combination of a casing having a discharge orifice, a fuel injector pipe supported within the casing with its discharge end in operative relation to said orifice, a second fuel injector pipe supported substantially central of the first, and an air director within the casing between the injector pipes and discharge orifice, the fuel injector pipes being adjustable with respect to the casing.

6. In a burner of the character set forth, the combination of a casing having a bore which terminates at one end in a discharge orifice, a fuel injector pipe supported within the casing with its axis substantially coincident with the central axis of the bore, a second fuel injector pipe supported substantially central of the first and projecting beyond the discharge end thereof into the casing and an air director within the casing between the injector pipes and discharge orifice and comprising a central sleeve and outwardly extending spiral vanes, the fuel injector pipes being adjustable with respect to the casing.

7. In a burner of the character set forth, the combination of a casing having a bore terminating at one end in a discharge orifice and having also a hollow cylindrical boss whose longitudinal axis is substantially coincident to the axis of the discharge orifice, a fuel injector pipe adjustably supported within said boss and projecting into the casing, and a second fuel injector pipe extending through and adjustably supported substantially central of the first.

8. In a burner of the character set forth, the combination of a casing having a bore terminating at one end in a discharge orifice and having also a hollow cylindrical boss whose longitudinal axis is substantially coincident to the axis of the discharge orifice, a fuel injector pipe supported within said boss and projecting into the casing, a second fuel injector pipe extending through and supported substantially central of the first, and an air director supported in the casing between the ends of said pipes and the discharge orifice and comprising a central sleeve and outwardly extending spiral vanes.

9. In a burner of the character set forth, the combination of a casing member having an outlet, a nozzle for connection therewith and having a bore for communication with said outlet, the nozzle being provided with an internal circumferential shoulder, an air director adapted to be received by the bore of the nozzle and held with one end engaging said shoulder and its other end engaged by an opposed portion of the casing, and a fuel injector pipe supported within the casing.

10. In a burner of the character set forth the combination of a casing member having a bore and a flange at the outlet end thereof, a nozzle for application to said end of the casing and having a flange for coöperation with the former flange, one of said flanges having a bolt hole and the other a notch for the reception of a bolt, one side of said notch being enlarged to provide a nut retaining recess, a bolt extending through said hole and notch, a nut applied to said bolt and confined within said recess, an air director retained within the bore of the nozzle adjacent the end of the casing member,

and a fuel injector pipe supported within the casing.

11. In a burner of the character set forth, the combination of a casing having a discharge orifice, an air director within the casing and comprising a sleeve and vanes extending outward from said sleeve, the inner and outer surfaces of the sleeve converging to a comparatively thin edge at the discharge end of the sleeve, and a fuel pipe arranged to discharge into the sleeve.

In testimony whereof, I hereunto affix my signature.

HENRY J. MASTENBROOK.