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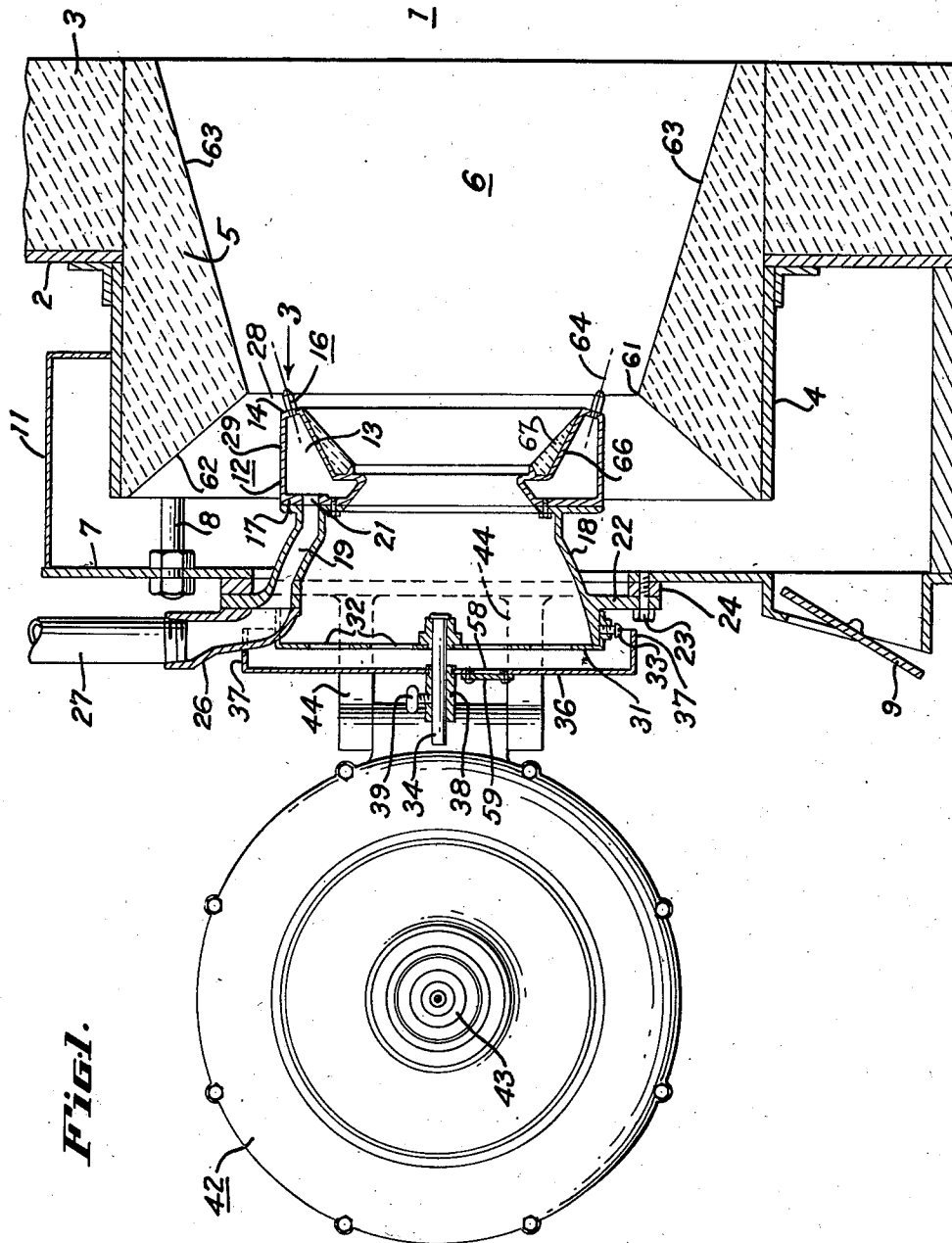
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2,259,818

BURNER

Filed Aug. 29, 1939

3 Sheets-Sheet 1



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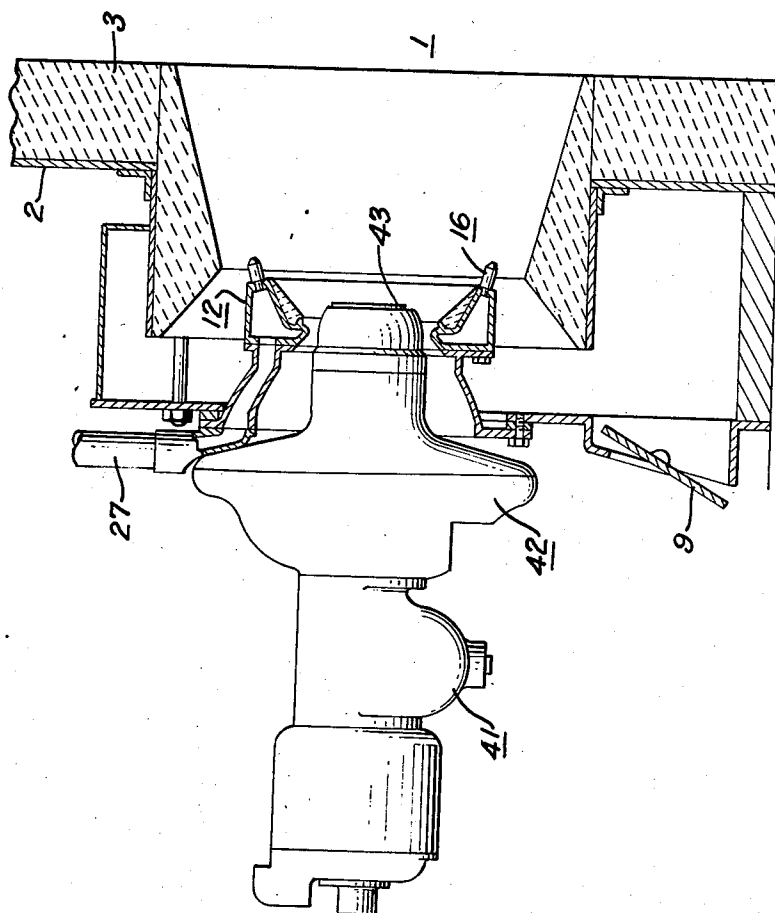
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Fig. 2.



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Fig. 4.

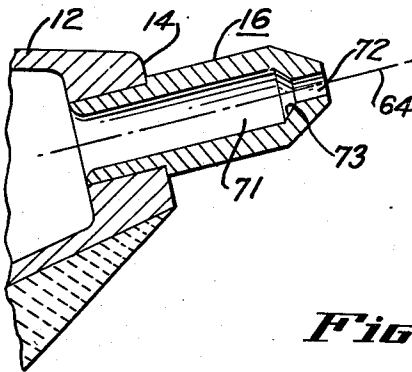


Fig. 3.

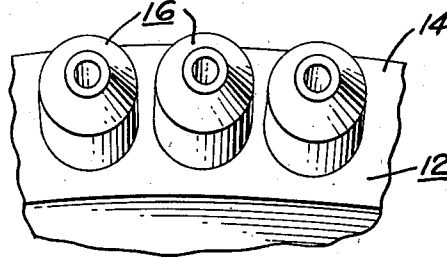


Fig. 5.

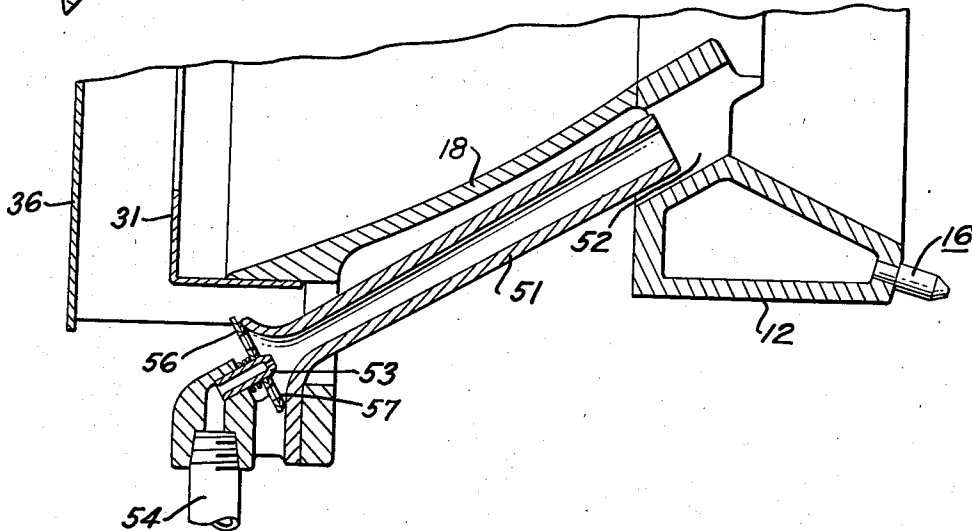
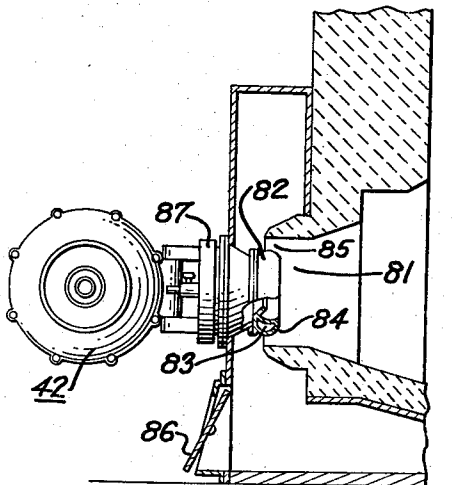


Fig. 6.



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UNITED STATES PATENT OFFICE

2,259,818

BURNER

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Application August 29, 1939, Serial No. 292,420

5 Claims. (Cl. 158-7)

My invention relates to burners, and more particularly to commercial gas burners of the ring type.

For efficient and consequently economical burner operation, it is desirable to have proper and thorough intermixing of gas and air at the proper location, and without force feeding of air whereby undesirable noise and the cost of fan equipment are obviated. My invention is designed to accomplish this and has as its objects, among others, the provision of an improved commercial ring type gas burner construction in which air is introduced at both the inner and the outer sides of the burner discharge orifices to enhance mixing of the air and the gas; the furnace opening is of such character and the location of the burner orifices are such that the pressure and the velocity of the issuing gas create an inductive effect to draw in the air, thereby also enhancing mixing of gas and air and increasing burner efficiency; the gas discharge orifices are in the form of individual jet members designed to cause the gas to flow therefrom at a maximum velocity, which also cooperates in obtaining efficient mixing of the air and the gas; the gas burner is of such character as to allow an auxiliary burner, such as an oil burner, to be used, which may be positioned conveniently out of the way when the gas burner is being employed; and in which the construction is of relatively simple and economical design.

In general, the burner of my invention comprises a hollow ring having an interior annular passage and which on one face thereof has a large number of annularly disposed orifices from which the gas may flow. Such ring is adapted for positioning in an opening of a furnace, and is made of less diameter than that of the opening, thereby providing an annular space between the outer edge of the ring and the wall of such opening. Thus, air can enter the furnace through the furnace opening on both the inner and the outer sides of the ring of gas discharge orifices, resulting in efficient intermixing of the gas and the air. The burner opening is preferably in the form of a Venturi passage, and the gas-emitting orifices are preferably positioned at the narrow portion or throat of such venturi. This causes the gas emitted from the orifices to induct more air than would otherwise be the case, thereby resulting in more efficient intermixing and better combustion. Preferably, the orifices are in the form of individual jet members of such design as to cause the gas to issue therefrom at a maximum

velocity, thus further enhancing the inductive effect and making for more thorough mixing.

In some cases, it may be desirable to have auxiliary burner equipment for employment in place of the gas burner. For this reason, the construction of my gas burner is preferably of such character as to enable an auxiliary burner, such as an oil burner, to be used when so desired. The auxiliary burner can be readily moved out of the way when the gas burner is employed.

Reference is now made to the drawings for more detailed description of the invention, in which:

Fig. 1 is a vertical sectional view of a preferred form of burner construction of my invention, having mounted thereon an auxiliary oil burner which is shown in end elevation out of the way;

Fig. 2 is a view similar to Fig. 1, on a reduced scale, showing the oil burner in side elevation, and in operative position;

Fig. 3 is a fragmentary front elevational view of the gas ring looking in the direction of arrow 3 in Fig. 1;

Fig. 4 is a longitudinal sectional view through one of the gas jets;

Fig. 5 is a fragmentary longitudinal section through the gas ring, at the pilot light location thereof, which does not appear in the sections illustrated by Figs. 1 and 2; and

Fig. 6 is a vertical sectional view similar to the section in Fig. 1, but of a modified construction.

With reference to Figs. 1 and 2, the burner of my invention is shown in conjunction with furnace 1 having front wall 2, the inner face of which is lined with suitable refractory material 3. To the front wall 2 is secured an outwardly projecting ring 4 which provides a support for suitable refractory material 5 arranged to provide my specially designed furnace opening passage 6, the construction of which will be more fully described hereinafter; any transverse section through such furnace opening 6 being circular. Gas burner supporting means is provided, comprising supporting plate 7 secured to the furnace by means including bolts 8, and which is closed off at the bottom except for adjustable butterfly valve 9 which provides a damper for controlling flow of air; the upper end of plate 7 being shut off by hood member 11.

The gas ring 12 of my invention is generally trapezoidally shaped in cross section, and is provided with an interior annular passage 13 which communicates at comparatively narrow front face 14 thereof with a plurality of gas-

emitting orifices 16 in the form of specially designed jets, the construction of which will be described more fully hereinafter. As can be observed from Fig. 3, such orifices are closely spaced; and they form a ring with the axis of furnace opening 6 as its center. At its rear face 17, ring 12 is secured to a generally conically shaped ring member 18 having a longitudinally extending passage 19 which communicates through port 21 in such rear face 17, with annular passage 13. An annular flange 22 is formed at the rear of ring member 18, and provides means for attachment of the burner to supporting plate 7 by screws 23; a suitable spacer ring 24 of predetermined thickness being interposed between flange 22 and plate 7 to provide for proper location of gas-emitting discharge orifices 16 within furnace opening 6. A coupling 26 is secured to flange 22 and communicates with passage 19; and a gas inlet pipe 27 is connected to the coupling. Thus, gas from the customary gas mains can flow through coupling 26, passage 19, annular ring passage 13, and out of orifices 16. Any suitable valve (not shown) may be provided for pipe 27 to control the flow of gas.

Gas ring 12 is of less diameter than furnace opening 6, thus providing an annular space 28 between the outer peripheral edge 29 of the burner and the wall of furnace opening 6. Air can, hence, flow past damper valve 9, and then in a ring about the outer side of orifices 16. Also, air can flow in a solid stream through the inside of the gas ring and past the opposite or inner side of orifices 16. Thus, the gas discharge orifices 16 are positioned between two streams of incoming air, which is an important feature of my invention because it enables the gas to be substantially completely enveloped by the air which causes ready intermixing of the gas and the air, to make for efficient and economical combustion.

The control of the volume of air flowing on the outer side of orifices 16 may be readily accomplished by adjustment of damper 9. Means is also provided for controlling the flow of air inside of the gas ring past the inner side of orifices 16, comprising plate 31 having a plurality of apertures 32 and which is fixedly secured by screws 33 to ring member 18. A shaft 34 is fixedly attached at the center of plate 31 and has mounted thereon for slidable axial adjustment, plate 36 having annular flange 37 and hub 38, and which can be held in adjusted fixed position on shaft 34 by set screw 39. Air can thus enter between flange 37 and plate 31, and can flow through apertures 32 into the inside of the gas ring. The spacing between plate 36 and plate 31 as determined by the axial position of plate 36, determines the volume of air that can flow through the inside of the gas ring.

An auxiliary burner is preferably associated with the gas ring burner of my invention for use in place of the gas burner when so desired. Any suitable type of auxiliary burner may be employed, but I prefer to employ an oil burner manufactured by my assignee, which is of the horizontal, rotary, atomizing cup type. Such burner 41, which includes the usual fan casing 42 and rotatable atomizing cup 43, is preferably supported for pivotal swinging in a horizontal plane on brackets 44 secured to the burner supporting structure. When the oil burner is not to be used, it can be swung out of the way, as

indicated in Fig. 1. Should it be desired to employ the oil burner in place of the gas burner, plates 31 and 36 of the gas ring burner construction, can be readily removed, and the oil burner swung in position, as is illustrated in Fig. 2. Under some circumstances, when the gas burner is employed, it may be desirable to force feed air through the inside of the gas ring. For this purpose, the oil burner may be positioned as shown in Fig. 2; and without igniting the fuel oil, the fan in fan casing 42 may be merely operated to create a pressure draft of air. Force feeding of air, although not necessary, may be also employed for the outside stream of air by forcing air past damper 9 by means of any suitable fan. The oil burner, instead of being attached to the gas burner, may be mounted on an independent standard which may be moved to position the burner in the gas ring when so desired.

Means is provided for enabling ready ignition of the gas burner. As indicated in Fig. 5, I employ an ignition burner or pilot light, comprising a tube 51, the inner end of which communicates with aperture 52 in ring 12. The outer end of the tube 51 communicates with a small pilot jet 53 in turn communicating with gas pipe 54. About jet 53 is a spring pressed apertured air admission plate 56 which is thrust against apertured plate 57 fixed to the outer end of tube 51, and which can be turned to control the volume of air for the pilot light. To ignite the pilot light, I provide an aperture 58 in plate 36, in alignment with one of apertures 32 to allow insertion of a lighted torch or the like into the interior of the ring. Such aperture 58 may be also employed as a peek or sight opening to allow one to inspect or observe burner operation. Normally, aperture 58 is covered by a detachably mounted cover plate 59 which can be readily removed when so desired. The gas issuing from jet 53, as is customary with pilot lights, is lighted all the time; so that by opening of a valve (not shown) for gas inlet pipe 27, the gas issuing from all of orifices 16 may be readily ignited.

The previously described gas ring arrangement, wherein the gas-emitting orifices 16 are closely spaced in an annular ring within the furnace opening 6 and wherein air for combustion is admitted on both sides of such orifices, will provide markedly improved results compared to those of prior commercial gas ring burners with which I am familiar, and may be employed alone. However, I have found that more thorough mixing of the air and the gas, and consequently greater efficiency, can be obtained by forming the furnace opening 6 as a Venturi passage with the orifices 16 located in a plane substantially at the narrow portion or throat 61 of such passage. The particular design of such Venturi passage for any burner installation may be readily calculated according to well known gas formulae. In the commercial installations wherein my burner is now being employed, in environments where the gas is emitted under the customary gas pressures, I have found that the frustro-conical surface 62 which forms the outwardly tapered wider or rear part of such Venturi passage, should for best results be at an angle of between forty to fifty degrees (40 to 50°) to the axis of the passage. The frustro-conical surface 63 which forms the outwardly tapered front or narrower part of such Venturi passage, as is customary in Venturi design, should taper more gradually, an angle of from ten to twenty degrees (10 to 20°) to the

axis of the Venturi passage being desirable for best results; and the length of such outwardly tapered front part 63 of the Venturi passage should for best results be at least about four (4) times that of the outwardly tapered rear part 62. In the drawings, the length of the outwardly tapered front part appears less because to shorten the views its entire length is not shown. The diameter of the ring may vary according to the capacity of the furnace; the larger the ring the more gas discharge orifices 16, and hence the greater will be the capacity. However, the gas discharge orifices are preferably of the same character irrespective of ring diameter. Therefore, inasmuch as the inductive effect is a function of the individual orifices, the width of annular space 28 may be the same irrespective of the diameter of the ring, and that of the Venturi passage. For best results under the commercial operations above referred to, I find that the width of space 28 should be about one and one-half ($1\frac{1}{2}$) to two (2), and preferably one and three quarters ($1\frac{3}{4}$) inches.

As previously stated, the plane in which the discharge ends of orifices 16 lie, should be located substantially at the narrow portion of throat 61 of the Venturi passage to provide for maximum inductive effect on the air, and thereby enhance mixing. Preferably, the axes 64 of such orifices should all be inclined outwardly and substantially parallel to the outwardly tapered front surface 63 of the Venturi passage, so that the gas may issue therefrom in streams substantially parallel to surface 63 for further enhancement of the inductive effect. In addition to providing for maximum inductive effect, it is desirable to position the discharge ends of orifices 16 substantially in line with the narrow portion of Venturi throat 61 because I have found that if such orifices are moved forwardly of the desired location, this increases the flame length and provides excessive heat at the rear of the furnace. If the jets are moved rearwardly, this shortens the flame length and gives excessive heat at the front of the furnace.

The front of gas ring 12 is naturally subjected to the deteriorating action of burning gas. Therefore, to protect the ring 12, I preferably taper the front part 66 of the inner edge of the ring inwardly from comparatively narrow front face 14; and I cover such part 66 with suitable refractory material 67. Hence, there is very little unprotected metal of the ring which is subjected to the burning gas. Orifices 16 are preferably formed as detachably mounted individual jet members (Fig. 4) which are made of suitable heat-resistant metal press fitted in the narrow front face 14 of the ring. Such jets will thus be better able to withstand the corrosive action of burning gas; and should they become damaged, they may be readily replaced.

To obtain maximum velocity of the gas issuing from jet orifices 16 and thereby further increase the inductive effect, and consequently enhance further mixing of the gas and the air, I preferably design the jet members so as to form so-called "true orifices." The particular design of such jet members may be readily calculated from gas formulae well known to those skilled in the art. Fig. 4 illustrates the construction which I have found satisfactory for commercial installations wherein my burner is now employed and wherein the gas is supplied from gas mains at the usual pressures and velocities. The jet comprises an elongated rela-

tively wide passage 71 which communicates with a narrower discharge passage or aperture 72. Preferably, the junction between aperture 72 and passage 71 should be a conically tapered surface 73 having an included angle of between seventy and one hundred and ten degrees (70° and 110°), and preferably ninety degrees (90°). Passage 71 may be of any suitable length but the diameter thereof should not be much below seven thirty-seconds ($\frac{7}{32}$) of an inch; while the ratio of the length of aperture 72 to the diameter thereof should be from about one and one-half to one ($1.5/1$) to two to one ($2/1$).

From the preceding description, it is seen that the gas burner construction of my invention provides for maximum intermixing of air and gas; an important feature contributing to this result being the introduction of air at both sides of the gas-emitting orifices 16. The Venturi passage in the furnace opening enhances mixing, because it enables induction of greater quantities of air, and this is also facilitated by virtue of the "true orifice" design of the jets 16 which I preferably employ. Although for best results, I prefer to employ the combination of these three features, suitable results may be obtained merely by introducing the air at both sides of the gas orifices. An arrangement of this type, which is one of my earlier constructions, is disclosed in Fig. 6. Such construction is somewhat the same as that previously described, except for certain differences, which to shorten the description will be primarily referred to. The furnace opening 81 is not in the form of a Venturi passage but is merely generally cylindrical in shape; being lined with suitable refractory material. Gas ring 82 is positioned within such opening 81 and has an annular interior passage 83 into which the gas is fed in the manner previously related. Passage 83 communicates with the orifices 84 formed directly in the front face of ring 82, and from which gas is emitted. Air can flow in an annular path 85 at the outer side of orifices 84 through adjustable shutter or damper 86; and the inside stream of air can be controlled by adjustable plate 87 in the manner previously related.

I claim:

1. A gas ring burner construction for a furnace having a wall provided with an opening comprising a gas ring having a plurality of annularly disposed gas discharge orifices positioned within such opening, said ring being of less diameter than the diameter of said opening to provide an annular space for flow of air at the outer side of said orifices, means for controlling the flow of air to such annular space, said ring allowing flow of air therethrough past the inner side of said orifices, and means independent of said first mentioned control means for controlling the latter flow of air.

2. In a burner construction, a furnace wall provided with an opening, a gas ring having a plurality of annularly disposed gas discharge orifices positioned within such opening and which is of less diameter than the diameter of such opening to provide an annular space for flow of air at the outer side of said orifices, said opening being in the form of a Venturi passage having a throat portion and a front surface tapering outwardly from said throat portion, and said orifices being in a plane substantially at said throat portion and having their axes substantially parallel to said tapering surface, means for controlling the flow of air through

said annular space, said ring allowing flow of air therethrough past the inner side of said orifices, and means independent of said first mentioned control means for controlling the latter flow of air.

3. A gas burner construction for a furnace having a wall provided with an opening, comprising a ring having an annular interior passage, a comparatively narrow front face, a wall tapering inwardly from said face, a plurality of annularly disposed gas discharge orifices in the form of individual jet members secured to said comparatively narrow front face, and refractory material over said inwardly tapering wall; said ring being of less diameter than the diameter of said furnace opening and being adapted for positioning within said opening to provide an annular space between the wall of said opening and said ring, and said jet members being positioned with their axes inclined outwardly.

4. In a burner construction, a furnace wall provided with an opening, a gas ring having a plurality of annularly disposed gas discharge orifices positioned within such opening, said ring allowing flow of air therethrough past the inner side of said orifices and being of less diameter than the diameter of said opening to provide for flow of air past the outer side of said orifices; means for controlling the flow of air past said inner side of said orifices; and means for con-

trolling the flow of air past said outer side of said orifices; said opening being in the form of a Venturi passage to enhance air induction and said orifices being in a plane substantially at the throat of said Venturi passage.

5. In a burner construction, a furnace wall provided with an opening, a gas ring having a plurality of annularly disposed gas discharge orifices positioned within such opening and which is of less diameter than the diameter of such opening to provide an annular space for flow of air at the outer side of said orifices, said opening being in the form of a Venturi passage having a throat portion from which extend a rear outwardly tapering surface and a front outwardly tapering surface, and said orifices being in the form of individual jet members secured to said ring and having their discharge ends in a plane substantially at such throat portion, the axes of said jet members being inclined outwardly and substantially parallel to said front outwardly tapering surface of said Venturi passage, means for controlling the flow of air through said annular space past the outer side of said orifices, said ring allowing flow of air therethrough past the inner side of said orifices, and means independent of said first mentioned control means for controlling the flow of air past the inner side of said orifices.

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