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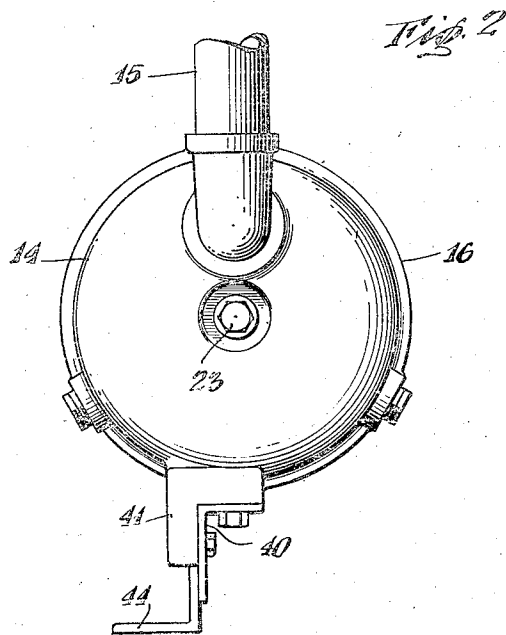
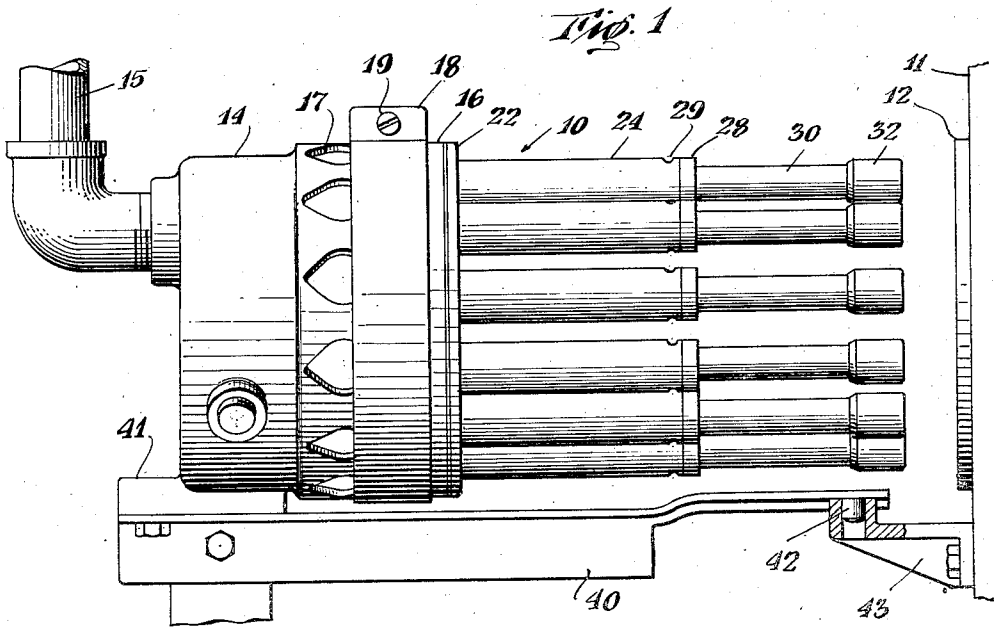
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2,369,236

GAS BURNER

Filed May 10, 1941

2 Sheets-Sheet 1



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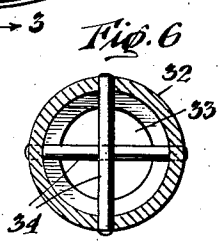
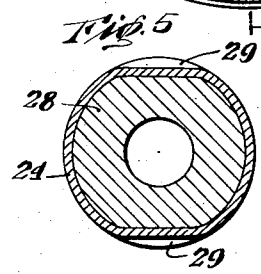
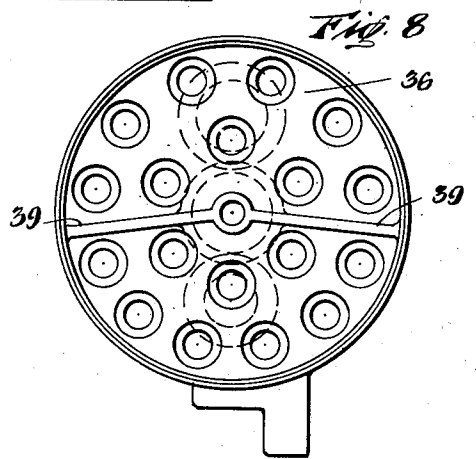
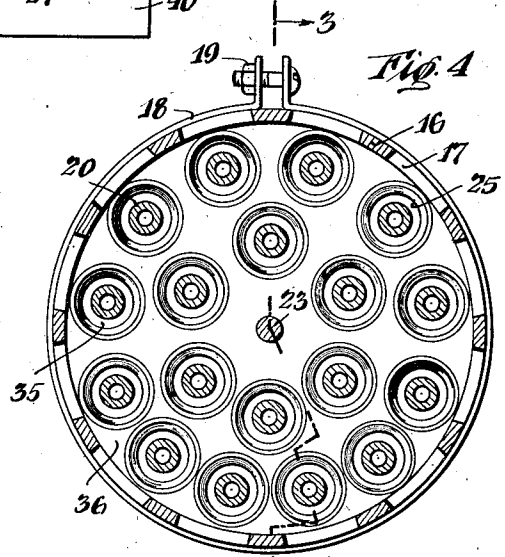
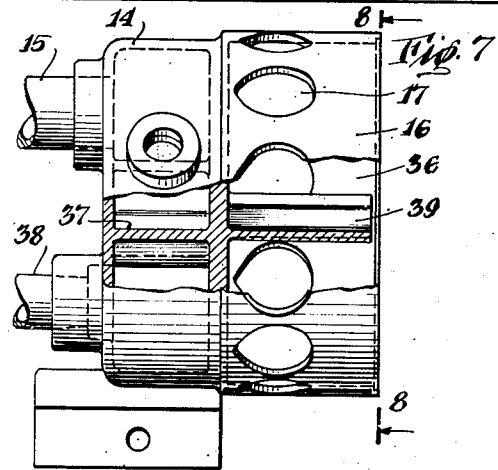
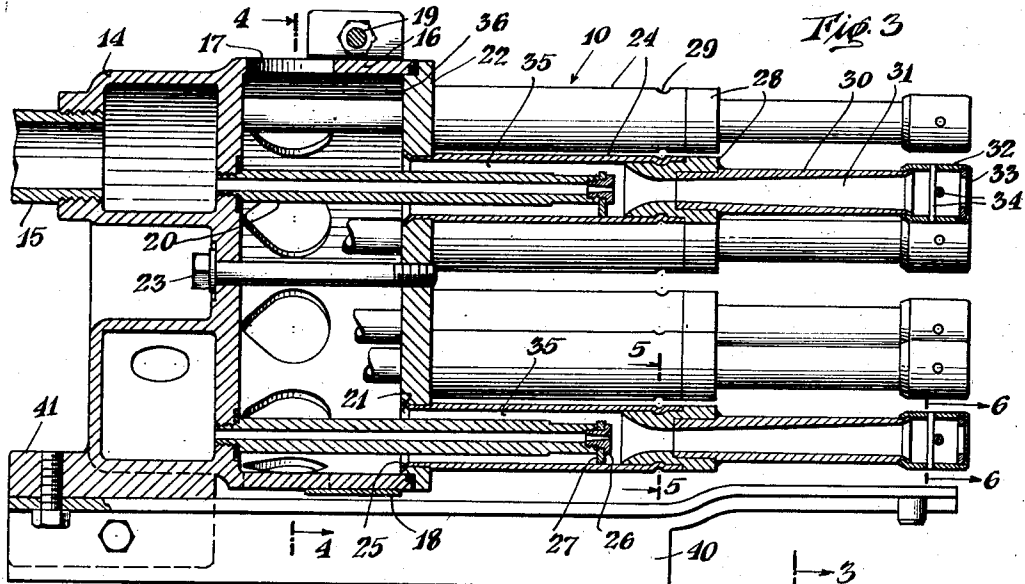
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2 Sheets-Sheet 2



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2,369,236

GAS BURNER

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Application May 10, 1941, Serial No. 392,845

6 Claims. (Cl. 158—104)

My invention relates to gas burners.

It is an object of my invention to provide an improved gas burner of relatively high capacity which occupies a small amount of space.

Another object of the invention is to provide an improved burner of relatively high capacity which is noiseless during normal burner operation and also at times when the burner flame is extinguished.

A further object of the invention is to provide an improved horizontal type burner in which the burner flame is of such shape that contacting of the horizontal flue wall by the burner flame is avoided.

A still further object of the invention is to provide an improved horizontal type burner of relatively high capacity in which all of the air required to effect complete combustion is supplied to a plurality of gas streams and the regions at which air is intimately mixed with the gas streams are effectively shielded so that flash-backs are avoided.

A still further object of the invention is to flow primary air to several zones for mixing with gas streams in such a manner that the air is utilized as a cooling agent for the gas before the gas mixes with the air.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the claims. The invention, both as to organization and method, together with the above and other objects and advantages thereof, will be better understood by reference to the following description taken in connection with the accompanying drawings, and in which:

Fig. 1 is a side view of a burner embodying my invention;

Fig. 2 is a vertical end view of the burner shown in Fig. 1 illustrating the burner from the manifold end to which gas is delivered from a source of supply;

Fig. 3 is a longitudinal sectional view, taken on line 3—3 of Fig. 4, to illustrate parts of the burner more clearly;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3;

Figs. 5 and 6 are fragmentary sectional views taken on lines 5—5 and 6—6, respectively, of Fig. 3;

Fig. 7 is a fragmentary vertical view, partly broken away and in section, of a burner similar to that shown in Figs. 1 to 3 illustrating a modification of the invention; and

Fig. 8 is an end view taken on line 8—8 of Fig. 7.

Referring to Fig. 1, the improved horizontal type burner 10 embodying my invention is disposed in a substantially horizontal position in front of a heat receiving part 11 provided with a horizontal flue 12 into which the burner flame is adapted to project. The burner 10 includes an annular manifold 14 having a threaded opening to which is connected a conduit 15 of a gas supply line. The manifold 14 forms part of a body member having a cylindrical wall 16 forming an open-ended cup. The wall 16 is formed with openings or ports 17 which can be partly covered, when desired, by a shutter comprising a metal clamp 18 disposed about the wall and having the ends thereof secured together at 19. The openings 17 are provided in wall 16 to supply primary air to the burner 10, as will be described presently.

To the manifold 14 are threadedly secured a plurality of nozzles 20 which pass or extend through openings 21 in a cover plate 22 which is drawn tightly against the open end of wall 16 by a screw 23. The nozzles 20 are coaxial with and project into burner tubes or sleeves 24 which are secured at their inner ends at 25 about the openings 21 in cover plate 22. The tubes or sleeves 24 are imperforate and are disposed about the nozzles 20 for a major portion of their lengths. The outer ends of nozzles 20 are provided with tips 26 which are threadedly secured in position and utilized to hold suitable spacers 27 to keep the nozzle tips in properly spaced relation with respect to the burner tubes 24.

The outer ends of the burner tubes or sleeves 24 are secured to Venturi tubes 28, as shown more clearly in Fig. 3. This is accomplished by forming the Venturi tubes 28 with depressed or flattened portions and indenting the burner tubes or sleeves 24 at such depressed portions, as indicated at 29 in Figs. 3 and 5. The outer ends of the Venturi tubes 28 are secured, as by welding, for example, to outer tube portions 30 each having a diverging passage 31. To the outer ends of the tube portions 30 are secured caps 32 provided with discharge orifices 33. Within the caps 32 are secured intersecting wires or spiders 34 provided for a purpose which will be described presently.

During operation of the burner 10, gas is delivered through conduit 15 to manifold 14 from which the gas is divided into a plurality of streams for flow through the nozzles 20. The gas issues from the tips 26 of nozzles 20 into the Venturi tubes 28, and in so doing air is drawn into the venturis by injection action from the

passages 35 surrounding the nozzles. The air flows into the passages 35 from chamber 36 through the openings 21 in cover plate 22, the air being admitted into the chamber 36 through the openings 17 in cylindrical wall 16. The gas mixture formed in the Venturi tubes 28 flows through the diverging passages 31 into the caps 32 from which the gas is discharged through the orifices 33.

Although I do not wish to be limited thereto, the burner 10 is especially suitable for use with gases like manufactured gas, for example, which are relatively fast burning compared to natural gas which contains methane and ethane. In order to insure adequate mixing of air with gas, a part of the air is supplied as primary air and another part is supplied as secondary air. In a relatively large burner in which the primary air is supplied at a single zone in a Venturi or burner tube, the ratio of primary air to gas is relatively high. By employing a plurality of compactly arranged burner tubes or sleeves 24 having associated outer portions 30, the space between the burner tubes or sleeves is advantageously utilized to allow for ample flow of secondary air which mixes with the gas discharged from the orifices 33. With this arrangement less primary air is required than in a burner of comparable capacity having a single venturi, so that the ratio of primary air to gas is decreased which in turn reduces the occurrence of flashbacks.

The burner 10 described above provides a high capacity burner which is extremely quiet in operation with ratings upwards from 60,000 B. t. u. per hour. In order to eliminate the noise occurring when the primary air is mixed with the gas at one zone in a single gas stream, the burner 10 employs a plurality of nozzles 20 to provide a plurality of gas streams. Small gas burners have less volume per B. t. u. of rating than large burners. For this reason small burners clear themselves of combustible gases very quickly when the burner is extinguished, so that no objectionable noise of extinction is encountered. This advantage is captured and retained in a large burner like that described herein by employing a plurality of Venturi tubes of such size that each venturi will clear itself of combustible gases very quickly when the burner flame is extinguished. At the same time the burner described provides a high capacity comparable to that produced by burner having a single large venturi without the attendant objections of such a burner with a single large venturi. By providing primary air at a plurality of zones in several gas streams, the same advantages are obtained that result with use of a relatively small burner, in that quiet burner operation is assured not only during normal operation but also at times when the burner flame is extinguished.

The burner tubes or sleeves 24 and outer tube portions 30 associated therewith are compactly arranged together in cylindrical fashion to provide a burner of relatively high capacity which occupies a relatively small amount of space. The burner flames produced at the discharge orifices 33 merge together to provide a single flame which is projected horizontally from the burner 10.

The burner tubes or sleeves 24, cover plate 22, and cylindrical wall 16 of the body member form a shield to protect the tips 26 of the nozzles 20 and associated Venturi tubes 28 from any flame in the vicinity of the burner. Even when a flame is produced in the vicinity of one of the openings or ports 17 in wall member 16, the flame will go

out before reaching a Venturi tube 28. Thus, flashbacks are effectively prevented by the shielding arrangement provided which forms a more or less circuitous path of flow for air through the openings 17, chamber 36, and passages 35 to the inlets of the Venturi tubes 28.

By providing a plurality of gas streams and intimately mixing combustion supporting gas with each gas stream, a burner of relatively high capacity has been provided in which the distance of travel of the gas mixture is relatively short. Referring to Fig. 3, the distance of travel of the gas mixture is from the inlet to the Venturi tubes 28 to the discharge orifices 33.

The shielding provided by cylindrical wall 16, cover plate 22, and burner tubes or sleeves 24, which has just been described, possesses another desirable advantage in that air flowing through chamber 36 and the passages 35 exerts a cooling influence on the gas flowing through the nozzles 20. By preventing heating of gas so that there will be no gas expansion in nozzles 20, the likelihood of any change in burner rating due to heating of gases is avoided.

The burner 10 is of rigid construction so that the nozzles 20, burner tubes or sleeves 24, and associated outer portions 30 will be in proper alignment with respect to each other. For this reason, the spacers 27 are provided at the nozzle tips 26 to insure the gas streams issuing into the centers of the passages of the Venturi tubes 28. When the outer tube portions 30 and caps 32 are not in proper alignment with respect to the burner tubes or sleeves 24 and nozzles 20, there is quite often a tendency for dead air spaces to be formed at the outer corners of the caps 32 just inside the orifices 33. Such dead air spaces may be termed pockets containing stagnant air which remain unaffected by the gas flowing through the caps 32 at a relatively high velocity. When the stagnant air mixes with the proper proportion of gas to produce a combustible mixture, ignition of the gas mixture is effected to produce a flashback. In order to prevent the occurrence of flashbacks, the caps 32 are provided with the spiders 34 which act as air stirrers to prevent the formation of dead or stagnant air spaces, in the event that the parts of the burner are not in proper alignment due to jarring or other injury to which the burner may be subjected.

The burner 10 is readily adapted for use as a two-step burner with half of the burner tubes available in the initial or first stage of operation, and with all of the burner tubes available in the final or second stage of operation. Such a modification is shown in Figs. 7 and 8 in which the manifold 14 is provided with a partition or dividing wall 37 and an additional threaded opening to which is connected a conduit 38 of the gas supply line. The top conduit 15 delivers gas to the top half of the manifold 15 and the bottom conduit 38 delivers gas to the bottom half of the manifold. In the initial or first stage of the burner operation, gas is only delivered either to the top or to the bottom half of the manifold, so that gas will only be supplied to the top or bottom group of nozzles 20. In the final or second stage of the burner operation, gas is supplied through both of the conduits 15 and 38 to both parts of the manifold, so that gas will be supplied to all of the nozzles 20.

In order that the required amount of primary air will be supplied to the gas issuing from the tips 26 of the top or bottom group of nozzles 20 in the first or initial stage of the burner opera-

tion, a partition 39 is also provided in chamber 36, as shown in Figs. 7 and 8. The partition 39 may be formed integrally with manifold 14 and cylindrical wall 16 and provided with an opening at its center region through which can pass the screw 23 for drawing the cover plate 22 tightly into position against the ends of the wall 16 and partition 39.

The quantity of primary air admitted into chamber 36 through the openings 17 can be varied by adjusting the position of the shutter 18. It will be noted that the openings 17 are of tear-drop shape rather than circular. When it is deemed desirable to move the shutter 18 toward the extreme left with the major part of the openings or ports covered, the remaining uncovered portions at the narrow regions of the openings will not appear as narrow elongated slots or slits, as would be the case if the ports were circular in shape, but instead will be more circular or round in appearance, and this has been found to be quite advantageous in that any tendency for the openings 17 to be clogged by foreign matter in the air is reduced considerably.

The burner 10 is adapted to be disposed in a horizontal position and, to insure proper positioning of the burner, an L-shaped member 40, which extends lengthwise of the burner, is secured to a tab 41 formed integrally with and at the bottom part thereof of the manifold 14. The member 40 is cut away at its forward part, as shown most clearly in Fig. 1, and at its forward end is provided with a locating pin 42. The locating pin 42 is adapted to fit in an opening in a bracket 43 which is fixed to the front of the heat receiving part 11 and centrally located with respect to the flue 12. The L-shaped member 40 is arranged to be secured to a suitable support indicated at 44.

In a burner like that described and having a rating in the neighborhood of 60,000 B. t. u. per hour when using manufactured gas, combustion of the gases is completed in a distance of approximately 24 inches from the discharge orifices 33 of the burner. When the burner flame is projected horizontally into the flue 12, an ample supply of excess air is also drawn in a horizontal direction to form a blanket about the inner surface of the flue wall. The forming of a horizontal air blanket in flue 12 is quite essential in order to prevent the flame from actually contacting the flue wall. As the combustion gases pass through the flue, there is a tendency for the hot gases to rise and displace the air in the upper part of the air blanket. When the burner flame strikes the inner surface of a flue in a conventional gas burner, the gases of the flame become cooled due to contacting the flue wall and tend to fall below the temperature at which the reaction is normally effected in the burner flame. However, with my improved burner the formation of carbon dioxide rather than carbon monoxide is always insured.

In order to make certain that striking of the flue walls by the burner flame is avoided under all operating conditions encountered, the burner 10 is constructed so that the rising tendency of the flame is offset by bringing the bottom gas streams closer together than the top gas streams. Referring to Fig. 4, it will be noted that the individual burner tubes are arranged more or less three to a group with the burner comprising six groups of tubes. Substantially the same quantity of gas and air is discharged from each group of burner tubes. However, the three bottom groups of burner tubes are located and positioned closer

together than the three top groups of burner tubes. By providing a more compact arrangement of the bottom burner tubes in the manner just described, the burner flame is directed lower into the flue 12 than would be the case if the individual burner tubes were all equally spaced. Stated another way, the burner caps 32 occupy more or less a cylindrical space with the three bottom groups of caps 32 occupying less than half of the space, and with the three top groups occupying more than half of the space. With this arrangement, the rising tendency of the combustion gases, while passing through the horizontal distance in which combustion is completed, is adequately offset so that contacting of the flue wall by the burner flame is avoided.

While several embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that various modifications and changes may be made without departing from the spirit and scope of the invention, as pointed out in the following claims.

What is claimed is:

1. In combination, a horizontal flue, a horizontal type gas burner comprising two cylindrical chambers located in axial alignment with each other and with said flue, a connection for admitting gas to one of said chambers, the other of said chambers having an adjustable entry for air, a cylindrical cluster of horizontal sleeves secured to and projecting from said casing and each having one end opening into said air chamber, a Venturi type burner tube secured to and projecting from the other end of each of said sleeves, a corresponding cylindrical cluster of horizontal gas injector tubes each having one end secured to said casing and opening into said gas chamber, each of said gas injector tubes projecting through said air chamber and into a corresponding one of said sleeves to a point adjacent the inlet end of a corresponding burner tube, the outlet ends of said burner tubes terminating in a plane transverse to the longitudinal axis of said tubes and adjacent the inlet end of said horizontal flue, and the tubes of said cylindrical cluster of burner tubes being divided into an upper and a lower group of equal number and being so located and disposed with respect to each other that the outlets of the lower portion of said cluster are closer together than the outlets of the upper portion of said cluster whereby the major portion of the combustion gases discharged from said outlets is directed toward the lower portion of said horizontal flue.

2. A gas burner of the horizontal type comprising a plurality of substantially horizontal burner tubes each providing passages having inlets arranged to receive primary air and a combustible gas, and outlets at which region a horizontally projected burner flame is produced and maintained, said burner tubes being arranged in a substantially cylindrical cluster and being divided into six groups each containing three burner tubes with the outlets of all of said burner tubes being grouped substantially adjacent each other whereby secondary air may circulate therebetween and the resulting flame is substantially a single flame, and said burner tubes being so located and arranged with respect to each other that the three bottom groups of outlets are spaced closer together than the three top groups.

3. A gas burner comprising a casing forming a gas chamber and an air chamber located in axial alignment, a connection for admitting gas to one of said chambers, the other of said chambers hav-

ing an adjustable entry for atmospheric air, a cluster of sleeves secured to and projecting from said casing and each having one end opening into said air chamber, a Venturi type burner tube secured to and projecting from the other end of each of said sleeves, and a corresponding cluster of gas injector tubes each having one end secured to said casing and opening into said gas chamber, each of said gas injector tubes projecting through said air chamber and into a corresponding one of said sleeves to a point adjacent the inlet end of a corresponding burner tube.

4. A gas burner including a plurality of substantially parallel nozzles, means to introduce gas to said nozzles, structure including a removable plate and a plurality of hollow sleeves providing a chamber enveloping said nozzles and into which may pass atmospheric air serving as a source of primary air, a cluster of Venturi tubes arranged alongside of each other, said tubes providing passages having inlets into which gas is discharged from said nozzles and outlets at which the burner flame is produced and maintained, said sleeves having the outer ends thereof joined to the inner ends of said tubes, said removable plate forming a wall of said chamber and having a plurality of openings through which said nozzles extend and at which regions the inner ends of said sleeves are secured, said sleeves having imperforate portions disposed about said nozzles and spaced therefrom to provide annular spaces each having an inlet for air at the region of said plate and from which primary air passes from the other end into the inlets of said tubes, said outlets terminating in a plane transverse to the longitudinal axes of said tubes and being spaced to permit the flow of secondary air therebetween but still sufficiently close together so that the individual flames produced and maintained at said outlets merge together to provide a single large flame, the primary air mixing with gas at the inlets of said tubes being drawn solely by injection action through the annular spaces formed by said sleeves, and atmospheric air in the vicinity of and about said tubes constituting the sole source of supply of secondary air mixing with the gas and air mixture issuing from said outlets.

5. A gas burner including a plurality of substantially parallel nozzles, means to introduce gas to said nozzles, a cluster of Venturi tubes arranged alongside of each other, said tubes providing passages having inlets into which gas is discharged from said nozzles and outlets at which the burner flame is produced and maintained, imperforate hollow sleeves disposed about the outer parts of said nozzles and spaced therefrom to provide annular spaces, the outer ends of said sleeves being joined to the inlet ends of said tubes, a casing disposed about and enveloping the inner parts of said nozzles, said casing forming a chamber having an opening or openings for the passage of atmospheric air and communicating with the inner ends of the annular spaces formed by said sleeves, the atmospheric air passing through the opening or openings into said chamber serving as a source of primary air, said outlets terminating in a plane transverse to the longitudinal axes of said tubes and being spaced to permit the flow of secondary air therebetween but still sufficiently close together so that the individual flames produced and maintained at said outlets merge together to provide a single large flame, the primary air mixing with gas at the inlets of said tubes being drawn solely by injection action through the annular spaces from said chamber, and atmospheric air in the vicinity of and about said tubes constituting the sole source of supply of secondary air mixing with the gas and air mixture issuing from said outlets, and movable means associated with said casing for varying the size of the opening or openings and hence the quantity of primary air flowing into said chamber.

6. A gas burner as set forth in claim 3 in which said gas chamber includes a manifold, a partition in said manifold providing separate spaces from each of which gas is supplied to a group of said injector tubes, and a partition dividing said air chamber into separate spaces from each of which primary air is supplied to a group of said sleeves.

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