

Feb. 13, 1945.

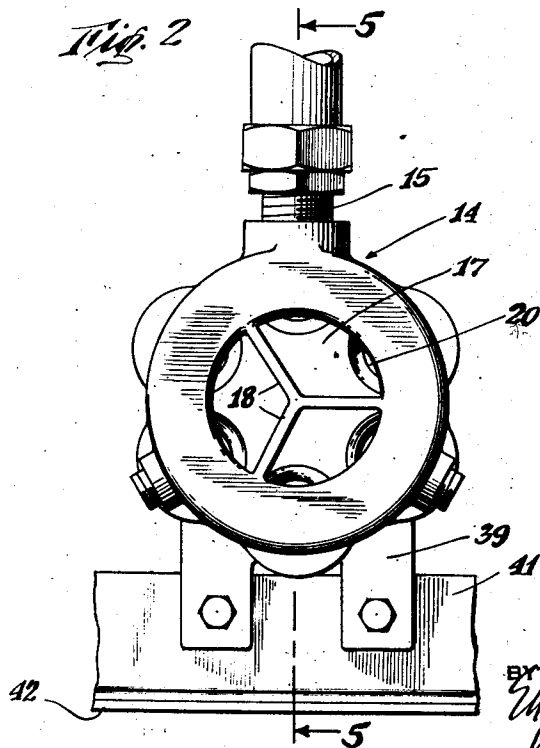
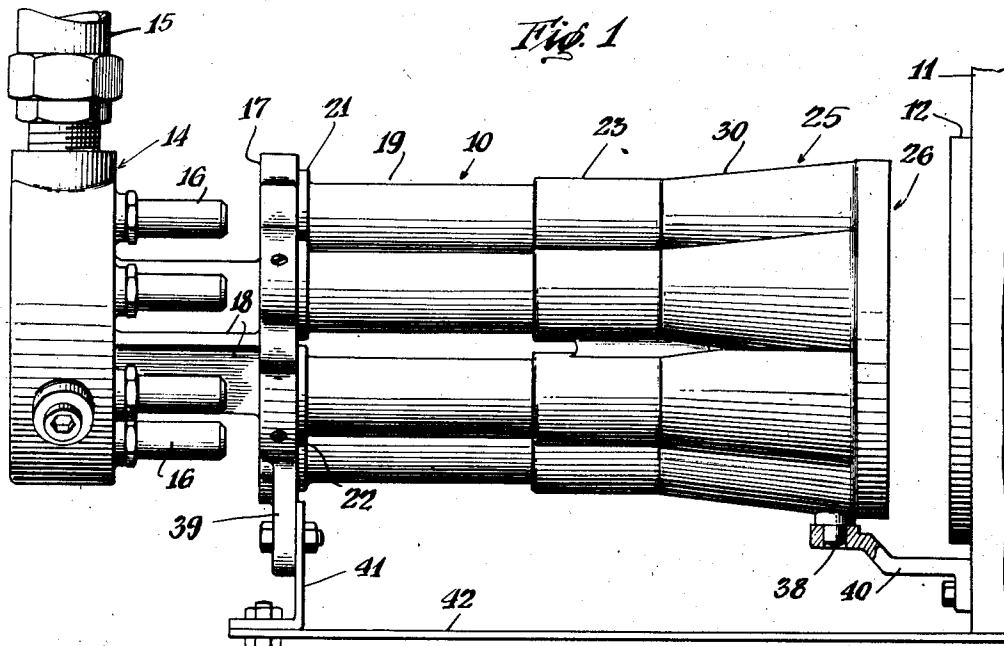
S. JAROS

2,369,235

GAS BURNER

Filed May 10, 1941

2 Sheets-Sheet 1



INVENTOR
Stanley Jaros
BY *W. H. Under*
ATTORNEY

Feb. 13, 1945.

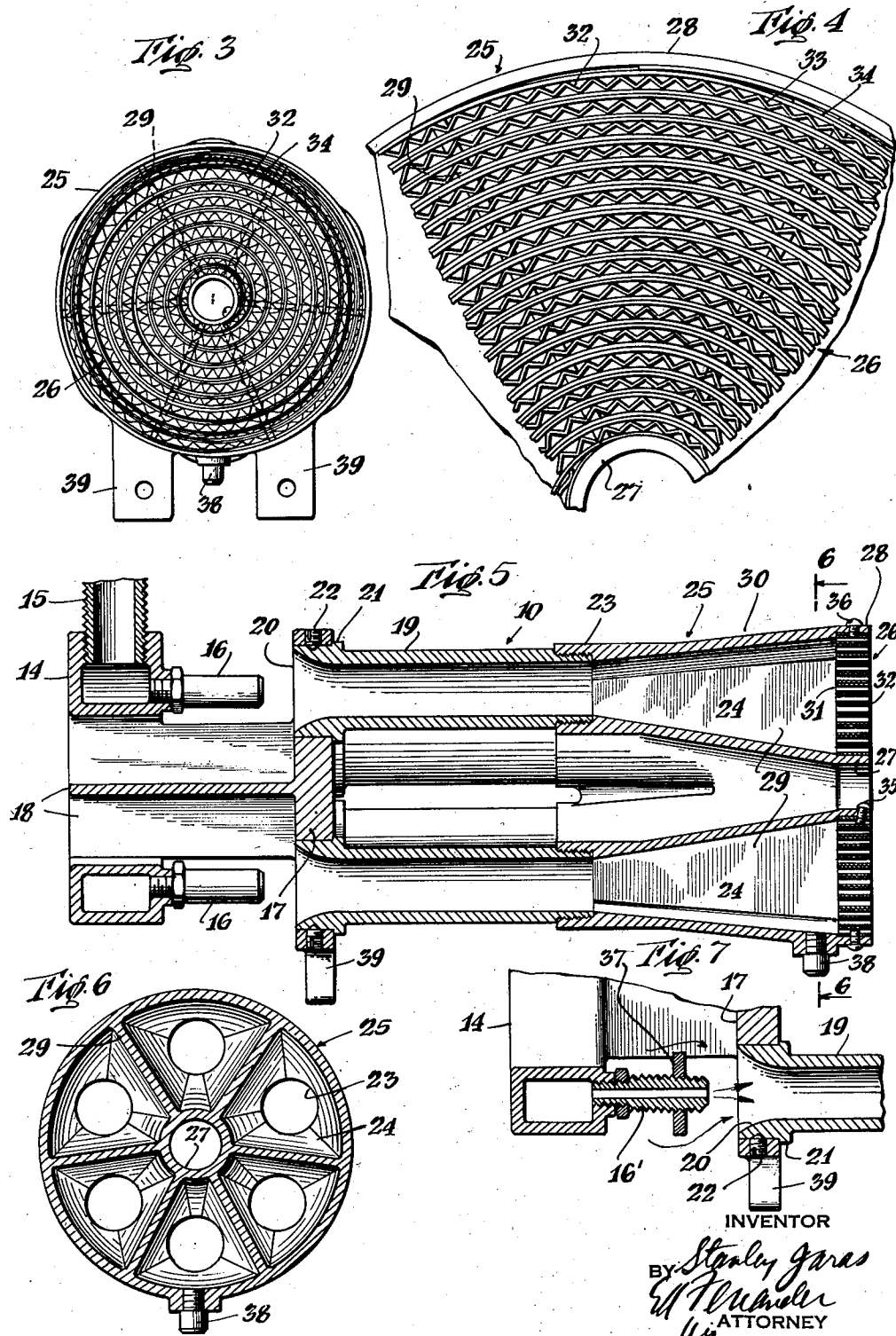
S. JAROS

2,369,235

GAS BURNER

Filed May 10, 1941

2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,369,235

GAS BURNER

Stanley Jaros, Evansville, Ind., assignor to Servel, Inc., New York, N. Y., a corporation of Delaware

Application May 10, 1941, Serial No. 392,844

7 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 minimum amount of space.

Another object of the invention is to provide an improved burner of relatively high capacity which is noiseless under all operating conditions including not only normal burner operation but 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 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 substantially all of the air required to effect complete combustion of the gas is supplied as primary air in a plurality of gas streams which merge in a single region at which the burner flame is produced and maintained.

A still further object of the invention is to provide an improved gas burner having a cellular grid structure comprising alternate layers of flat and corrugated metal stripping.

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 objects and advantages thereof, will be better understood by reference to the following description taken in connection with the accompanying drawings of which Fig. 1 is a side view of a burner embodying my invention; Fig. 2 is an end view of the burner shown in Fig. 1 illustrating the burner from the manifold end to which gas is supplied from a source of supply; Fig. 3 is an end view of the burner shown in Fig. 1 illustrating the burner from the front end at which region the burner flame is produced and maintained; Fig. 4 is an enlarged fragmentary view of the grid disposed at the front end of the burner; Fig. 5 is a vertical sectional view, taken on line 5—5 of Fig. 2, to illustrate parts of the burner more clearly; Fig. 6 is a vertical sectional view, taken on line 6—6 of Fig. 5, illustrating the manner in which the several gas streams merge to form a single region at which the burner flame is produced; and Fig. 7 is a fragmentary sectional view of a burner similar to that shown in Figs. 1 to 6 inclusive illustrating a modification of the invention.

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. To the manifold 14 are threadedly secured a plurality of nozzles 16 to provide several gas streams, as will be described presently. The manifold 14 is formed integrally with and spaced from a base plate 17 by webs 18, as shown most clearly in Figs. 1, 2 and 5.

The base plate 17 is formed with spaced openings which are in alignment with the nozzles 16 and receive the ends of burner tubes 19. Each of the burner tubes 19 is referred to as a venturi having its inner wall forming a passage flaring out gradually at the end adjacent the nozzles 16, as indicated at 20 in Fig. 5. The burner tubes 19 are formed with shoulders 21 which abut the base plate 17, and are secured in position by set screws 22 at the periphery of the base plate. With this construction the flared ends 20 of the burner tubes 19 can be accurately spaced from the tips of nozzles 16.

The burner tubes 19 are threadedly secured to tubular portions 23 constituting the inlets of a plurality of passages 24 formed in a header 25. The header 25 serves to merge and bring together the several gas streams entering the inlets 23. At the inlets 23 the passages 24 are circular in cross section, as shown in Fig. 6. From the inlets 23 toward the single annular outlet 26 formed by the spaced inner and outer wall portions 27 and 28, respectively, the passages 24 change in shape and, at the region adjacent the outlet 26, the passages form sectors of a circle having radial dividing walls 29, as shown in Fig. 6. The passages 24 are formed by similar-shaped legs 30 which merge together and form a short truncated hollow cone, as best shown in Fig. 1. The radial walls 29 dividing the passages 24 terminate at the region of the short cylindrical wall portions 27 and 28, as indicated at 31 in Fig. 5.

The spaced and coaxial wall portions 27 and 28 at the outlet 26 provide an annular space which receives a grid 32, as shown in Figs. 3 and 5. The grid 32 comprises a corrugated metal band or strip 33 which is as wide as the length of the straight wall portions 27 and 28. The metal strip 33 is of spiral shape with each turn or layer spaced from the next outer turn by a double-walled flat metal band 34. The inner ends of the corrugated or zig-zag shaped strip 33 and band 34 are secured at 35 to the inner cylindrical wall 27, and the outer ends thereof are secured at 36

to the outer cylindrical wall 28. The metal band 34 is employed with the corrugated metal strip 33 to provide a cellular grid structure and is preferably double-walled to facilitate the fabrication of the grid 32. In fabricating the grid, the inner sheet of the double-walled band 34 can creep and move on the outer sheet to provide a tight and compact cellular grid structure.

Although I do not wish to be limited thereto, the burner 10 is especially suitable for use with gases like natural gas, for example, which contains methane and ethane and are relatively slow burning compared to manufactured gas. When relatively slow burning gases are used, it is possible to employ a cellular grid structure at the region at which the burner flame is produced and maintained. In a burner of relatively high capacity provided with a cellular grid structure, the area of the grid may become so great that the gas discharged from the center portions thereof will be blanketed from the surrounding atmosphere by an envelope of gas. In order to insure adequate mixing of air with the gas, it becomes necessary to supply the required amount of air for combustion as primary air, so that complete combustion of the gas will be effected.

When all of the air required to complete combustion is supplied to a burner as primary air, the air is mixed with the gas in a burner tube or venturi to provide a combustible gas mixture before the gas is discharged from the burner. In a burner of relatively high capacity, such as, for example, a burner having a rating of 60,000 B. t. u. per hour, supplying all of the primary air at a single zone in a venturi or burner tube results in burner operation which is extremely objectionable because a continuous noise is produced during normal operation and an even louder noise is produced at times when the burner flame is extinguished. Further, it has been found that a single burner of the type just mentioned is readily subject to flash-backs.

When a number of smaller burners are grouped together to obtain a rating equivalent to a single burner of relatively high capacity, there is not only the objectionable requirement of providing duplication of a great number of parts but the amount of space taken up by the burners is relatively large. Even when a plurality of small burners are disposed as close together as possible there is loss of valuable space which in many applications may prevent the use of such burners as a practical consideration.

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 all of the primary air is mixed with the gas at one zone in a single gas stream, the burner 10 employs a plurality of nozzles 16 from the tips of which the gas is discharged into a plurality of burner tubes or venturis 19. The gas discharged into the several burner tubes 19 draws atmospheric air into the flared ends 20 of the tubes by injection action to provide a combustible gas mixture in each of the tubes. The nozzles 16 and burner tubes 19 are so proportioned and located with respect to each other that all of the air required to complete combustion of the gas discharged into each tube 19 can be supplied by the primary air drawn into the tube. By providing primary air at a plurality of zones in several gas streams, the same advantages are obtained that result with the use of a number of small burners in that quiet burner

operation is assured not only during normal operation but also at times when the burner flame is extinguished.

The combustible gas mixture formed in each tube 19 flows into the passages 24 with the gas mixture in each of the last-mentioned passages constituting a separate and distinct gas stream until the very moment it passes through a sector of the grid 32. Stated another way, the burner flame produced and maintained at the region of grid 32 is in reality a composite burning of a plurality of gas streams which are distinctly separate and individual from each other. However, the separate gas streams are so interrelated and correlated that the merging of the streams is effected in a circular area of minimum size with the burner flame being produced substantially at the instant that merging of the gas streams takes place. Not only do the several gas streams merge in a plane transverse to the outlet 26, but the entire grid area serves as an outlet which comprises a major portion of the overall area of the outlet end of the burner structure. Referring to Fig. 6 for example, it will be noted that the top sector constitutes a passage 24 for a single gas stream. With the grid 32 overlying and abutting against the outer ends of the radial dividing walls 29 at 31, as seen in Fig. 5, it will be apparent that the portion of the burner flame formed at the sector of the grid overlying the top passage 24 is produced by the gas mixture issuing from this top passage. In this way, by providing several smaller gas streams with which air is intimately mixed, and then merging the several gas streams in the manner just described to produce a high capacity burner flame in an area of minimum size, the advantages of a single large burner are captured without the usual disadvantages heretofore encountered.

By dividing the gas entering manifold 14 into a plurality of nozzles 16 and discharging the gas from the nozzles into a plurality of tubes 19, the likelihood of flashback occurring is completely avoided. When natural gas is used and the gas issuing from the tip of one of the nozzles 16 is ignited, the flame produced at the nozzle tip is immediately extinguished because of the high velocity at which air is drawn into the tube 19. Since the occurrence of flashbacks is substantially eliminated, it is not necessary to provide air shutters for the nozzles 16 and as much primary air as possible is allowed to be drawn into the tubes 19 to insure an adequate supply of air for complete combustion of the gas. If desired, however, air shutters like the shutter 37 in Fig. 7 may be employed. In the modification illustrated in Fig. 7, the nozzle 16' is externally threaded to receive the air shutter 37, so that the shutter can be adjusted axially of the nozzle to vary the quantity of air allowed to be drawn into the tube 19.

When the supply of gas to burner 10 is shut off, the gas remaining in the gas passages moves forward so that the passages are cleared of gas without the occurrence of any extinguishing noise. This clearing of gas from the burner passages is another advantage that is realized in a high capacity burner of the type described by providing several gas streams into each of which air is drawn at a relatively high velocity.

The burner 10 is adapted to be disposed in a horizontal position and, to insure proper positioning of the burner, the header 25 is provided with a locating pin 38 and the base plate 17 is

formed with spaced downwardly extending tabs 39. Referring to Fig. 1, the locating pin 38 is adapted to fit in an opening in a bracket 40 which is fixed to the front of the heat receiving part 11 and centrally located with respect to flue 12. The tabs 39 are arranged to be secured to an angle member 41 which in turn is fixed to a suitable support 42.

In a burner of relatively high capacity, additional problems are encountered that are not present in small gas burners. In a burner like that described and having a rating of 60,000 B. t. u. per hour when using natural gas, blue cones approximately $\frac{1}{8}$ inch long are produced at the outer surface of the grid 32 with combustion being completed within a distance of approximately 24 inches. 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, the gases of the flame become cooled due to contacting the cooler flue wall and tend to fall below the temperature at which the reaction is normally effected in the burner flame. At any time when the reaction between the gas and air is not complete, carbon monoxide rather than carbon dioxide may be formed.

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 at the outlet 26 of the burner. Referring to Fig. 6, it will be noted that six gas passages 24 are provided which cooperate with the same number of burner tubes 19 and nozzles 16. The gas in manifold 14 is substantially equally divided by the nozzles 16 with approximately the same quantity of gas being discharged into each tube 19. Hence substantially the same quantity of gas and air is discharged from the three bottom passages and the three top passages. However, the three bottom passages 24 take up less than 180° of the circumference of outlet 26, so that the gas discharged from these bottom passages is directed lower into flue 12 than would be the case if the passages 24 at the outlet were of equal size. By forming the passages 24 so that gas is discharged from the three top passages for more than half the area of the grid 32, and from the three bottom passages for less than half the grid area, contacting of the flue wall by the burner flame is avoided.

In view of the foregoing, it will now be understood that an improved burner of relatively high capacity has been provided which occupies a minimum amount of space and is foolproof in operation. By supplying primary air to effect complete combustion in a plurality of gas streams which merge and come together in a single region at which the burner flame is produced and maintained, numerous advantages are obtained to insure quiet operation of the burner.

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 extin-

guished, so that no objectionable noise of extinction is encountered. This advantage is captured and retained in a large burner like that described above by employing a plurality of Venturi tubes of such size and shape 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 a single large venturi without the attendant objections of such a single large venturi.

In addition, control over the manner in which the burner flame is projected horizontally from the burner outlet is also effected. The provision of the cellular grid structure 32 is especially valuable in that a grid of this type formed from the corrugated double-walled metal strip 33 and metal band 34 and spirally wound together is relatively inexpensive compared to grid structures of this character heretofore provided for gas burners.

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 with a substantially horizontal flue, a horizontal type gas burner comprising structure including a cluster of hollow arms providing passages having outlets and substantially identical inlets, means to introduce air and gas into the inlets of said passages, the air and gas adapted to flow through said passages forming gas streams adapted to be discharged from the outlets at which region the burner flame is produced and maintained, said inlets converging inwardly so that primary air adapted to mix with gas in said passages may be drawn into said inlets solely by injection action at a rate adequate to supply substantially all of the air required to effect complete combustion of the gases, so that the burner flame may be projected directly into the substantially horizontal flue, said outlets being grouped closely adjacent to each other and together forming a discharge orifice for the burner, and said outlets consisting of an upper and a lower group of like number and so distributed at the discharge orifice that said lower group of outlets forms a smaller area of said orifice than said upper group, whereby a major portion of the air and gas mixture issues from the lower half of the orifice and is directed into the bottom half of the flue.

2. In combination with a substantially horizontal flue, a horizontal type gas burner comprising structure including a cluster of hollow arms providing passages having outlets and substantially identical inlets, means to introduce air and gas into the inlets of said passages, the air and gas adapted to flow through the said passages forming gas streams adapted to be discharged from the outlets at which region the burner flame is produced and maintained, said inlets converging inwardly so that primary air adapted to mix with gas in said passages may be drawn into said inlets solely by injection action at a rate adequate to supply substantially all of the air required to effect complete combustion of the gases, so that the burner flame may be projected directly into the flue, the outlets of said hollow arms being divided into several massed groups compactly arranged together to form a discharge orifice for the burner, and

said outlets consisting of a lower and an upper group of like number and being of such sizes and so distributed at the discharge orifice that said lower group of outlets forms a smaller area of said orifice than said upper group, whereby a major portion of the air and gas mixture issues from the lower portion of the orifice and is directed into the bottom half of the flue.

3. In combination with a substantially horizontal flue, a horizontal type gas burner comprising structure including a cluster of hollow arms providing passages having outlets and substantially identical inlets, means to introduce air and gas into the inlets of said passages, the air and gas adapted to flow through the said passages forming gas streams adapted to be discharged from the outlets into a common discharge orifice of substantially the same cross-sectional area as the combined cross-sectional area of said outlets at which region a burner flame is produced and maintained, said inlets converging inwardly so that primary air adapted to mix with gas in said passages may be drawn into said inlets solely by injection action at a rate adequate to supply substantially all of the air required to effect complete combustion of the gases, so that the burner flame may be projected directly into the flue, said outlets comprising an upper and a lower group of like number and being so located and distributed at the discharge orifice that the lower group of outlets forms a smaller area of said orifice than the upper group, whereby a major portion of the air and gas mixture is discharged from the bottom half of said orifice and is directed to the bottom part of the flue to offset the rising tendency of the gases and prevent the burner flame contacting the ceiling of the flue.

4. A gas burner comprising structure providing passage means having an inlet and an outlet, means to introduce a mixture of air and gas into the inlet, the air and gas being adapted to flow through said passage means and adapted to be discharged at the outlet at which region the burner flame is produced and maintained, and a cellular grid at the outlet comprising alternate layers of spirally wound flat and zigzag-shaped metal stripping, said flat stripping being double-walled and comprising contacting sheets whereby the inner sheet can creep and move on the outer sheet during fabrication of the grid.

5. A gas burner including a plurality of tubes providing passages having outlets and inlets, a manifold into which a combustible gas is adapted to be introduced, a plurality of nozzles secured to said manifold and extending toward said inlets, a hollow truncated cone partitioned to provide a plurality of sector-shaped outlets, a plurality of passages and a plurality of hollow legs extending from the smaller end thereof, said hollow legs communicating with the outlets of

said tubes, the larger end of said cone providing a single annular-shaped outlet merging directly into said sector-shaped outlets, said cone being so shaped and partitioned and the passages therein being so formed that the air and gas mixture adapted to flow therethrough is discharged from the outlet in substantially parallel relation and merge immediately in the vicinity of the outlet, said inlets converging inwardly so that primary air adapted to mix with the gas in said passages may be drawn into the inlets solely by injection action at a rate adequate to supply substantially all of the air required to effect complete combustion of the gases, a cellular grid at the outlet comprising alternate layers of spirally wound flat and zigzag-shaped metal stripping, and means for securing said cellular grid at the larger end of said truncated cone to provide an uncovered grid through all parts of which the air and gas mixture issuing from said passages can freely flow and at all regions of which the air and gas mixture can freely burn.

6. A gas burner comprising an annular gas manifold, a plurality of gas jets connected to and projecting from one side of said manifold, a plurality of tubular members each in axial alignment with one of said gas jets having inlets and outlets, said inlets converging inwardly and the remainder of said tubular members being of cylindrical shape, a plurality of hollow tapering members each having an inlet and an outlet, each of said inlets being connected to the outlet of a corresponding tubular member and the outlets merging in a common annular-shaped discharge orifice, said hollow tapering members being circular in cross-section at their inlet ends, sector-shaped at their outlet ends and of gradual or easy transition from the inlet to the outlet.

7. A gas burner of the horizontal type comprising a gas manifold, a plurality of gas nozzles opening into and projecting from one side of said manifold, a cluster of burner tubes, one in axial alignment with each of said gas nozzles and having inlets and outlets, said inlets converging inwardly, the remainder of said tubes being of cylindrical shape, a plurality of hollow members connected to and extending from the outlet ends of said burner tubes, each of said hollow members having an inlet of the same size and shape as the outlets of said burner tubes and outlets which merge into a common annular discharge orifice, the total area of said outlets being substantially the same as the area of said discharge orifice, a cellular grid located in said common discharge orifice, and the passages formed by each of said hollow members being of gradual increasing cross-sectional area from the inlets thereof up to immediately adjacent the cellular grid located in said common discharge orifice.

STANLEY JAROS.