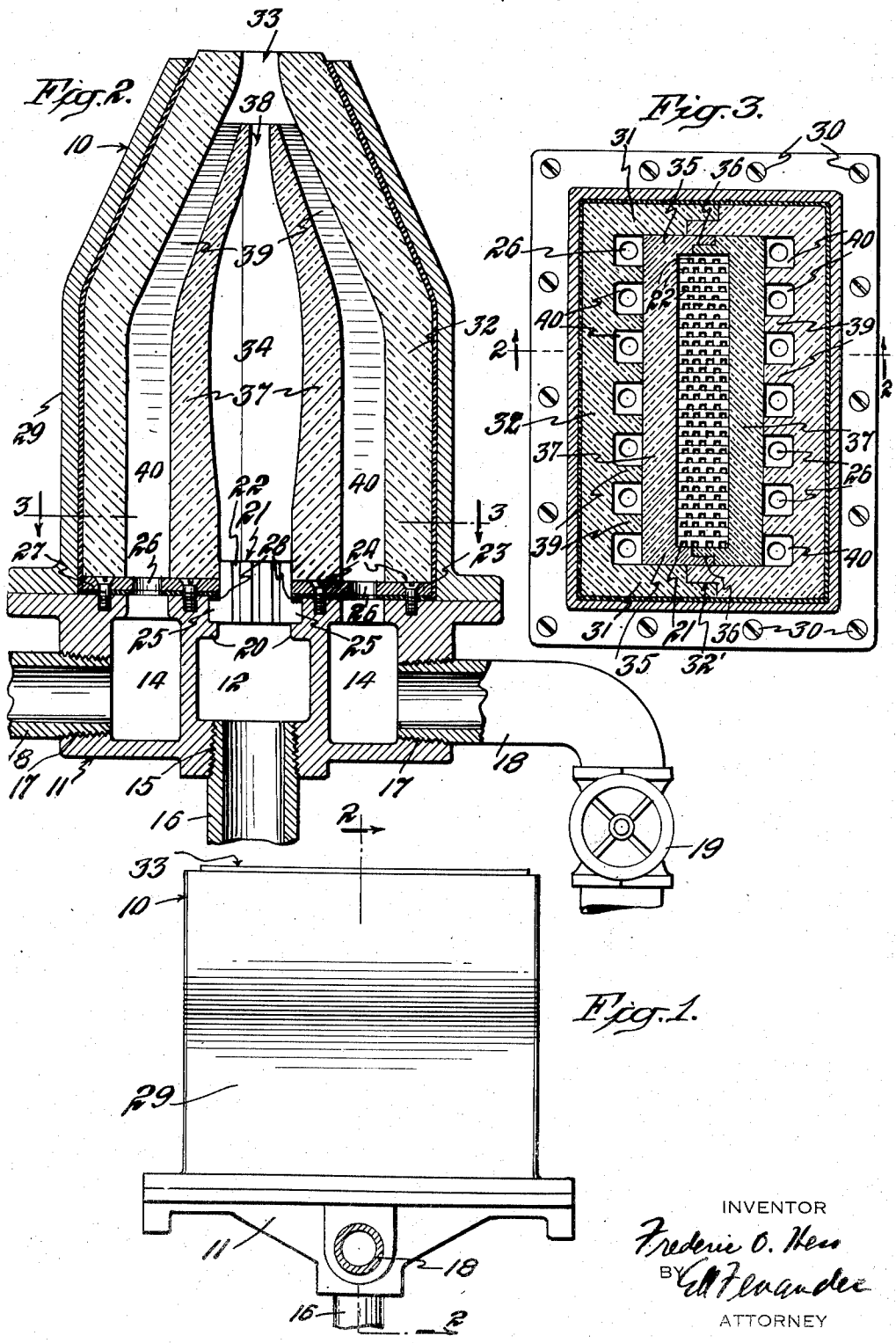
Jan. 29, 1952 F. O. HESS 2,583,736

GAS HEATER

Filed Feb. 23, 1946



INVENTOR

Frederic O. Hess

BY Ellis Alexander

ATTORNEY

Patented Jan. 29, 1952

2,583,736

UNITED STATES PATENT OFFICE

2,583,736

GAS HEATER

Frederic O. Hess, Philadelphia, Pa., assignor to Selas Corporation of America, Philadelphia, Pa., a corporation of Pennsylvania

Application February 23, 1946, Serial No. 649,675

4 Claims. (Cl. 263—19)

1

My invention relates to the art of producing a high velocity gas stream of heated products of combustion in which another medium is mixed therewith, and, although not to be limited thereto, is especially concerned with the production of such a high velocity gas stream whose temperature may be accurately controlled by mixing therewith regulated quantities of another gaseous medium at a temperature less than the temperature of the products of combustion.

In accordance with the invention, heated products of combustion are maintained in a first space at a pressure appreciably above that of atmospheric and discharged therefrom through a restricted outlet, and a medium at a temperature less than the temperature of the products of combustion is supplied to a second space which envelops at least the outlet end of the first space, such medium being discharged from the second space through a discharge port and commingling with the heated products of combustion in a high velocity gas stream.

A gaseous medium, such as air, nitrogen or carbon dioxide, for example, is supplied to the second space which mixes with the heated products of combustion discharged from the first space, and such mixture then discharged in the form of a high velocity gas stream from the discharge port of the second space. By controlling the supply of the gaseous medium to the second space and the rate at which the latter mixes with the heated products of combustion, the temperature of the heated gas stream produced at the discharge port of the second space can be nicely regulated through a wide temperature range from a low temperature to the temperature of the heated products of combustion.

The invention, together with the objects and advantages thereof, will be more fully understood upon reference to the following description and accompanying drawing forming a part of this specification, and of which Fig. 1 is a vertical plan view of a gas burner embodying the invention; Fig. 2 is a vertical sectional view, taken on line 2—2 of Fig. 3, to illustrate the burner more clearly; and Fig. 3 is a horizontal sectional view, taken on line 3—3 of Fig. 2, to illustrate details of the burner.

Referring to the drawing, the gas burner 10 embodying the invention includes a base member 11 shaped to form a plurality of inlet chambers 12 and 14. The centrally disposed inlet chamber 12 is provided with a threaded inlet 15 which receives a conduit 16 through which a

2

combustible gaseous mixture is delivered from a suitable source of supply.

The inlet chambers 14 at each side of the central inlet chamber 12 are provided with threaded inlets 17 which receive conduits 18 through which a gaseous medium is delivered, as will be explained more fully hereinafter. In one of the conduits 18 is provided a manually operable valve 19 for controlling the rate at which the gaseous medium is supplied to the burner 10. It is to be understood that a similar manually operable valve may be provided in the other conduit 18.

The base member 11 is formed with internal shoulders 20 at the upper part of the inlet chamber 12 to receive an apertured member or burner screen 21 formed with a plurality of openings or passages 22. As shown most clearly in Fig. 3, the burner screen 21 comprises a plurality of relatively thin plates stacked and closely held together. One face of each plate is formed with a plurality of slots of relatively small depth, and the plates are stacked together with a slotted face of each plate, except one end plate, contiguous to and contacting a smooth face of an adjacent plate. Although not to be limited thereto, the thin plates forming the burner screen 21 may be formed of suitable refractory material.

To the top surface of the base member 11 is secured a slotted clamping plate 23, as by screws 24, for example, which overlies flanges or lugs 25 formed at opposing sides of the burner screen 21. The clamping plate 23 is also formed with two rows of openings 26 each of which is directly above the top reduced portions of the inlet chambers 14. In order to obtain a gas-tight seal about the burner screen 21 and the openings 26, a gasket 27 formed of suitable material, such as asbestos, for example, is interposed between the plate 23 and the base member 11. The spaces 28 above the lugs 25 may be filled with a suitable high temperature fire-brick cement.

The large open end of a cup-shaped metal shell or casing 29 is removably secured at 30 to the base member 11. Within the outer shell 29 is provided an outer wall or lining of refractory material. The outer refractory lining is formed by a hollow rectangular shell comprising two complementary wall parts, U-shaped in horizontal section, and having parallel ends 31. The extreme vertical Z-shaped edges of opposing ends 31 at each end of the burner 10 are in abutting relation, as indicated at 32' in Fig. 3.

As best shown in Fig. 2, the outer surfaces of the sides 32 of the outer refractory lining conform to the shape of the metal shell 29. The

ends 31 of the outer refractory wall parts are straight throughout the heights of these walls while the connecting side walls 32 include straight wall portions extending upwardly from the clamping plate 23 to an intermediate part of the outer refractory lining, and inwardly sloping wall portions which terminate in a narrow rectangular-shaped slot or discharge port 33a extending or projecting through an opening at the top part of the metal shell 29.

A second inner refractory lining is disposed within the outer refractory lining just described and forms a combustion chamber 34. The inner refractory lining is also formed by a hollow rectangular shell comprising two complementary parts, U-shaped in horizontal section, and having parallel ends 35 over which snugly fit the ends 31 of the outer refractory wall parts. The extreme vertical Z-shaped edges of opposing ends 35 at each end of the burner 10 are in abutting relation, as indicated at 36 in Fig. 3.

The ends 35 of the inner refractory wall parts are straight throughout the heights of these walls while the connecting side walls 37 include straight wall portions extending upwardly from the plate 23 substantially the same distance as the straight wall portions of the outer refractory lining, and inwardly sloping wall portions terminating in a narrow rectangular-shaped slot or restricted outlet 38 closely adjacent to the discharge port 33a.

The bottom edges of the inner refractory lining overlie and fit snugly against the peripheral edges of the narrow portion of the apertured member or burner screen 21 extending through the slot in clamping plate 23 toward the outlet 38. The side walls 37 of the inner refractory lining are rigidly held in position against the upper part of the burner screen 21 by vertically extending ribs 39 formed at the inner surface of the side walls 32 of the outer refractory wall parts.

The ribs 39 extend vertically upward from the clamping plate 23 to a region adjacent to the outlet 38 formed by the inner refractory lining, and spaces 40 between adjacent spaced apart ribs 39 form vertically extending passages which communicate at their lower ends with the openings 26 in the clamping plate 23. When the cup-shaped shell 29 is secured to the base member 11 at 30, both the outer and inner refractory linings are rigidly held in position, the bottom parts of the ribs 39 bearing against the inner refractory lining to cause the latter to fit snugly against the upper narrow part of the burner screen 21 while the top sloping parts of the ribs exert a downward component of force against the upper part of the inner refractory lining so that the latter will be firmly held and seated against clamping plate 23.

When it is desired to employ the burner 10 to produce a high velocity gas stream of heated products of combustion, a combustible fuel mixture comprising a gaseous fuel and a combustion supporting gas is supplied through conduit 16 from a suitable source of supply. When the burner 10 is relatively cool and at the ambient temperature, the gaseous mixture supplied thereto passes through the inlet chamber 12, burner screen 21, and chamber 34 from which it is successively discharged through the outlet 38 and discharge port 33. The combustible gaseous mixture is initially supplied to the burner 10 at a relatively low pressure which may be equivalent to 5 or 6 inches of water column, for example, so that the gaseous mixture discharged from the chamber 34 can be

ignited to produce and maintain a flame at the discharge port 33.

When a flame is being maintained at the discharge port 33 the pressure of the gaseous mixture supplied to the burner 10 is then reduced sufficiently to cause the flame to backfire from the discharge port 33 onto the burner screen 21 in chamber 34. When this occurs a plurality of flames are produced and maintained at the upper ends of the openings 22.

When the flames are being maintained within chamber 34 at the top surface of the burner screen 21, the pressure of the gaseous mixture supplied to the burner 10 may be increased. After a short interval of time, the flames maintained at the top surface of the burner screen 21 effect such heating of the inner refractory lining that these surfaces are heated to a highly incandescent condition. Due to heating of the inner refractory lining to a high temperature, substantially complete combustion of the gaseous mixture is accomplished in chamber 34 before the mixture reaches the restricted outlet 38. From the outlet 38 is discharged a high velocity jet or stream of heated gases consisting substantially entirely of the heated products of combustion.

During normal operation the burner 10 is characterized by the absence of a bright and luminous flame. It is only when the burner 10 is first started that a flame is momentarily maintained at the elongated slot or discharge port 33, as previously explained. After the gaseous mixture has once been ignited, the delivery pressure of the gaseous mixture is reduced sufficiently to cause backfiring into the chamber 34, so that burning of the gaseous mixture will take place at the top surface of the burner screen 21.

In a burner of the type just described, the heated products of combustion are discharged from the combustion chamber 34 through the restricted outlet 38 thereof at an elevated temperature ranging from 2700° F. to 2900° F. and higher when a combustible gaseous mixture of air and ordinary gas, such as city gas, for example, is supplied at a pressure in the neighborhood of three pounds per square inch. Under such operating conditions, the pressure in the combustion chamber 34 may be equivalent to from 55 to 70 inches of water column and appreciably above that of atmospheric pressure.

The gas stream discharged from the combustion chamber 34 through its outlet 38 is at a temperature nearly equal to the temperature in the combustion chamber. In many instances it is desirable to produce such a high velocity gas stream which is at a temperature below that prevailing in the combustion chamber 34. In accordance with the present invention, this is accomplished in the burner 10 by providing the passages 40 at each side of the central chamber 34 which communicate with the inlet chambers 14 and to which a suitable medium may be supplied through the conduits 18.

In a burner of the character described, a suitable gaseous medium, such as air, nitrogen or carbon dioxide, for example, may be supplied through the conduits 18 to the inlet chambers 14 for flow through the passages 40. Such gaseous medium supplied to the passages 40 mixes with the heated products of combustion emerging through the restricted outlet 38, and such mixture then issues from the burner 10 at the discharge port 33 at a temperature depending upon the supply of the gaseous medium to the passages 40 and the rate at which the gaseous

mixture mixes with the heated products of combustion.

The gaseous medium may be positively fed under pressure through the conduits 18 for flow through the passages 40, or the heated products of combustion issuing at a high velocity from the restricted outlet 38 may be utilized to inspirate the gaseous medium through the passages 40. In either case the manually operable valves connected in the conduits 18, only one end of each is shown at 19, can be effectively employed to control the rate of flow of the gaseous medium through the passages 40, whereby the temperature of the heated gas stream produced at the discharge port 33 can be nicely regulated through a wide temperature range from a low temperature to the temperature of the heated products of combustion issuing from the combustion chamber 34.

When it is desired to produce a stream of heated gases at the discharge port 33 which is at the highest possible velocity, the gaseous medium under such conditions is preferably supplied under pressure through the conduits 18 to the passages 40. In certain instances it may be desirable to inspirate the gaseous medium into the passages 40, as just explained, and under such conditions the velocity of the heated products of combustion discharged through the restricted outlet 38 is reduced depending upon the extent to which the gaseous medium is entrained in the heated products of combustion.

It will now be understood that the passages 40 form a plurality of spaces at each side of the combustion chamber 34 which are separated therefrom by a partition formed by the inner refractory lining. The outer refractory lining, which provides the spaces at each side of the combustion chamber 34, is formed and shaped to provide a slotted region enveloping the restricted outlet 38. Hence, the outer refractory lining having the elongated slot or discharge port 33 forms a hood enveloping at least the outlet end of the combustion space 34 to provide a path of flow in which a medium at a temperature less than the temperature of the products of combustion is supplied, such medium being discharged through the port 33*a* and commingling with the heated products of combustion in a high velocity gas stream. The wall parts forming the inner and outer linings of the burner 10 may be formed of a suitable high temperature refractory material, such as mullite, for example.

Although a single embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that various changes and modifications may be made in practicing the invention. Thus, the relative positions of the restricted outlet 38 and discharge port 33 with respect to each other may vary depending upon the character of the heated gas stream desired to be produced by the burner 10 and the manner and extent to which the medium, which is at a lower temperature than the heated products of combustion, comingles with the latter in the resulting gas stream produced. I therefore aim in the following claims to cover all changes and modifications which fall within the true spirit and scope of the invention.

What is claimed is:

1. A burner comprising structure including a partitioned hollow body which provides a plurality of individual spaces alongside of each other separated by partitions, one of said spaces being centrally disposed between two other

spaces, said central space having an inlet at one end and restricted outlet at its opposite end, said structure providing said other spaces being formed and shaped so that the latter merge at the outlet end of said central space to form a region enveloping said outlet which is provided with a discharge port substantially in alignment with said outlet, said inlet for said central space having a number of small passages for subdividing into a plurality of gas streams a combustible gaseous mixture adapted to be supplied thereto under pressure, said central space having its outlet and inner wall surface formed of high temperature refractory material so that combustion of the gas streams may be effected within said space and cause heating of the inner wall surface thereof to incandescence and produce a region of intense heat in which substantially complete combustion is accomplished while products of combustion are discharged from said central space through said outlet at a temperature nearly equal to the temperature in said space, and said other spaces having inlets for a gaseous medium adapted to be supplied thereto at a temperature less than the temperature of the products of combustion, whereby such gaseous medium is discharged from said other spaces through said discharge port and merges with the heated products of combustion to form a gas stream.

2. In a gas burner the combination of structure forming a combustion chamber having a restricted outlet and an inlet, a screen provided with a plurality of small passages across said inlet, means through which a combustible mixture is forced through said screen to burn in said chamber, the products of combustion issuing at high velocity through said outlet, structure forming additional chambers on opposite sides of said combustion chamber, said additional chambers extending beyond said combustion chamber and having a common restricted discharge port axially aligned with said outlet, and means through which a fluid can be forced into said additional chambers to be mixed with the products of combustion between said outlet and said discharge port.

3. A gas burner including structure forming a combustion chamber having a restricted outlet, additional structure forming an additional chamber substantially surrounding said combustion chamber and having a restricted discharge opening axially aligned with said outlet and beyond the same, a base member having compartments therein upon which said structure is mounted, a compartment communicating with each of said chambers, a screen located between said combustion chamber and the compartment communicating therewith, means to supply a combustible mixture to the last-mentioned compartment to be burned in said combustion chamber and issue through said restricted outlet as hot products of combustion, and means to supply a gas to the remaining compartments to pass through said additional chamber and mix with the products of combustion as they pass beyond said outlet and through said discharge opening.

4. A gas burner including a base member having a plurality of compartments therein, a screen formed with a plurality of passages therein over one of said compartments, a plurality of ceramic parts cooperating to form a combustion chamber having a restricted outlet fastened to said member over said screen whereby said screen forms the inlet to said chamber, additional ceramic

parts surrounding said first-mentioned ports and forming a pair of chambers on opposite sides of said combustion chamber and extending beyond the same, said additional parts extending to form a common discharge opening for said additional chambers aligned with said outlet, means to attach said additional parts to said member with said pair of chambers each over a compartment in said member, means through which a combustible mixture may be forced past said screen into said combustion chamber to be burned therein, and means through which a gas may be forced through said member and into said additional chambers.

FREDERIC O. HESS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,311,235	Kemp et al.	July 29, 1919
1,863,391	Bluemel	June 19, 1932
1,991,750	Keeling	Feb. 19, 1935
2,044,715	Bluemel	June 16, 1936
2,107,365	Bray	Feb. 8, 1938
2,147,925	Schwalbe	Feb. 21, 1939
2,174,962	Blayney	Oct. 3, 1939
2,225,775	Garrett	Dec. 24, 1940