Dec. 5, 1950 K. A. SCHARBAU ET AL 2,533,143

MULTIPLE COMBUSTION CELL GASEOUS FUEL BURNER

Filed Oct. 20, 1945 2 Sheets-Sheet 1

FIG. 1

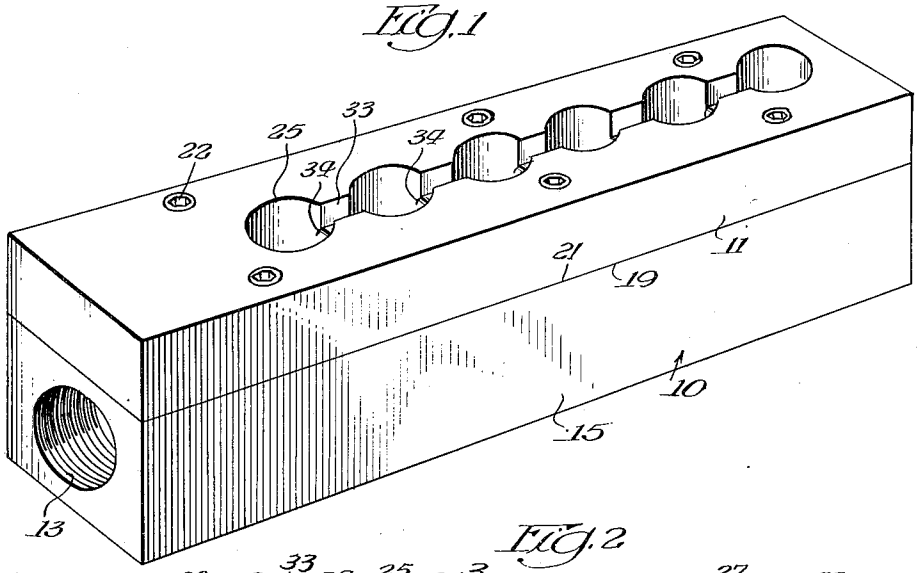

FIG. 2

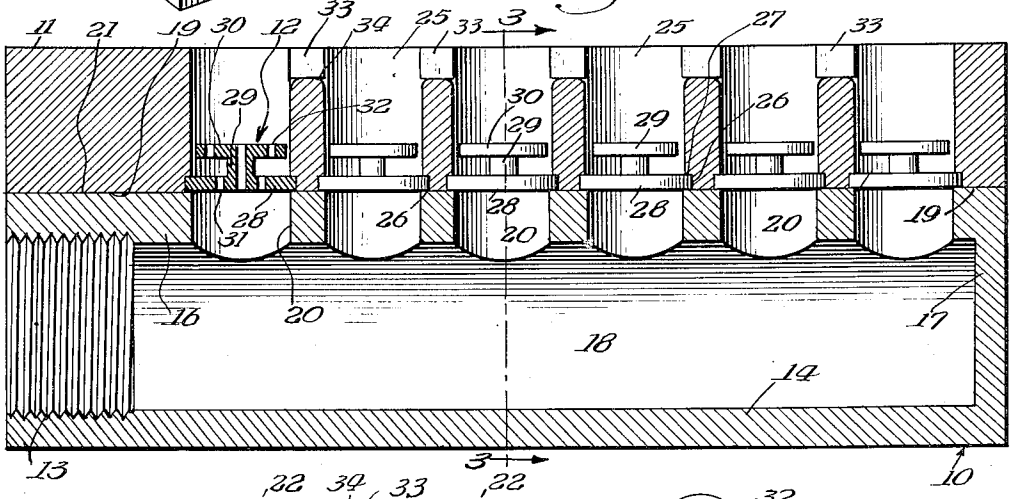

FIG. 3

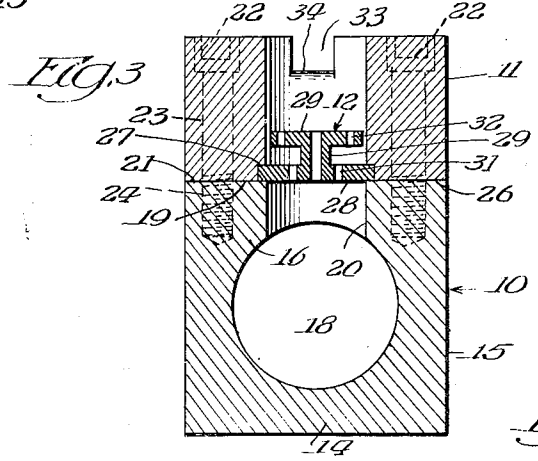

FIG. 4

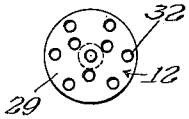

FIG. 5

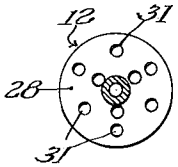

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FIG. 6

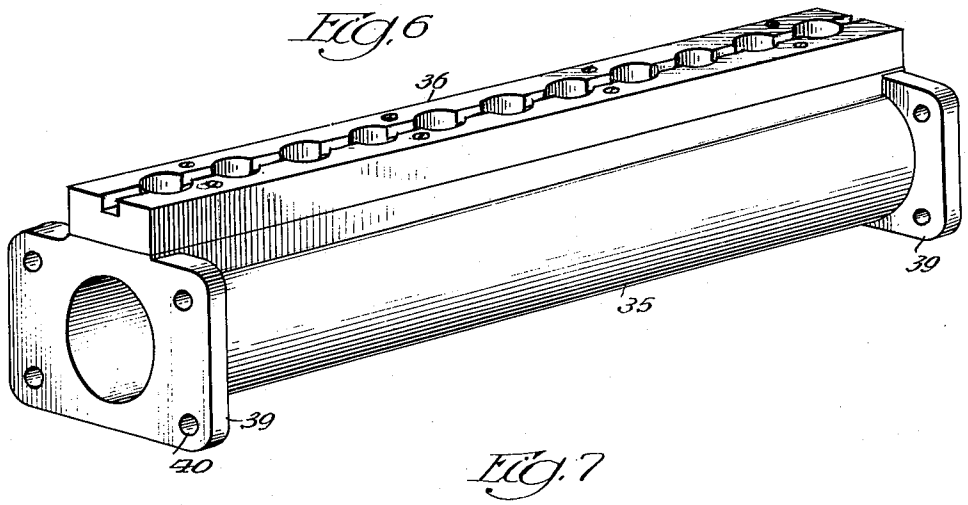


FIG. 7

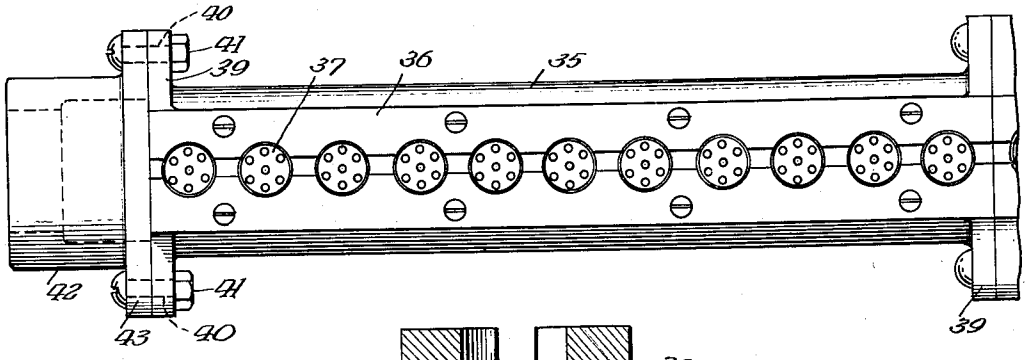
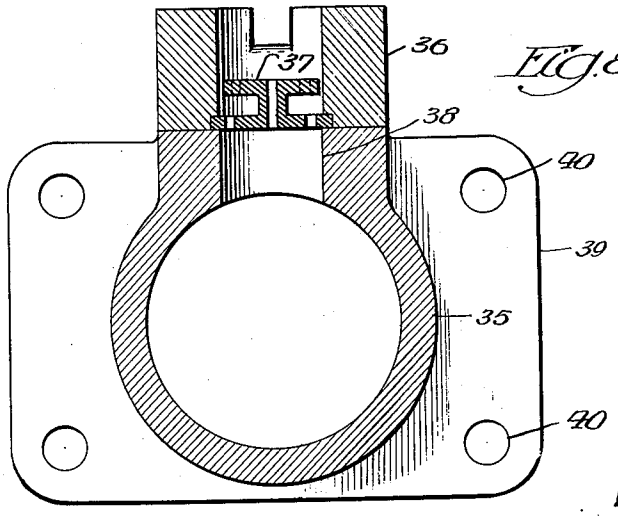


FIG. 8



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2,533,143

MULTIPLE COMBUSTION CELL GASEOUS FUEL BURNER

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Application October 20, 1945, Serial No. 623,500

3 Claims. (Cl. 158—104)

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The present invention relates generally to gaseous fuel burners. More particularly the invention relates to that type of burner which is designed to burn a combustible fuel mixture of air and a high calorific gas, such as propane, butane or natural gas and as its principal components comprises: (1) a horizontally elongated manifold to which the combustible fuel mixture to be burned is supplied under pressure; (2) means on the top portion of the manifold forming a longitudinal series of vertically extending, spaced apart, cylindrical combustion chambers with the lower ends thereof in registry or alignment with ports in the top portion of the manifold; and (3) circular or disc-like crosswalls which extend transversely across the lower ends of the combustion chambers, have vertically extending holes therein for permitting up-flow of the fuel mixture into the combustion chambers, and have associated therewith centrally disposed, upstanding shanks which terminate adjacent the central portions of the combustion chambers and embody at their upper ends disc-like hole equipped flanges for baffling or deflecting laterally the jets of fuel emanating from the holes in the crosswalls so as to reduce the velocity thereof prior to passage of the fuel mixture into the upper portions of the combustion chambers where burning of the mixture occurs.

As evidenced by United States Patent No. 1,909,496, granted on May 16, 1933 to Garnett W. McKee, it has heretofore been proposed in connection with a burner of the type under consideration to form the cylindrical combustion chambers by way of separately formed tubular walls, the lower ends of which extend into the ports in the top portion of the manifold and are attached to the manifold by screw thread connections. In practice it has been found that a gaseous fuel burner of the last mentioned character is subject to the objection that because of the fact that the combustion chambers are formed by separate or individual tubular walls the chambers are spaced apart to such a great extent that when the burner is lighted by directing a pilot or other flame into one of the combustion chambers the flame resulting from combustion of the fuel mixture in the one chamber does not ignite the fuel mixture in the other combustion chambers with the result that there is an escape of unburned fuel into the surrounding atmosphere with the attendant possibility that such fuel will ignite with explosive violence. Another objection to a gaseous fuel burner like that disclosed in the aforementioned

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McKee patent is that if the separate or individual tubular walls which form or define the combustion chambers and are attached to the top portion of the manifold by screw thread connections are not all screwed into the manifold to the same extent the combustion chambers are disposed at different levels and hence there is no uniformity of the flames resulting from combustion of the fuel mixture in the combustion chambers.

One object of the instant invention is to provide a gaseous fuel burner of the type and character under consideration which is an improvement upon, and eliminates the defects of, previously designed burners of like character and is characterized by the fact that the combustion chambers on top of the manifold instead of being formed by means of separate tubular wells, are formed in a one-piece body which fits flatly against the top surface of the manifold and is clamped in place by bolts. By forming the combustion chambers in a one-piece body such chambers may be disposed in such closely spaced apart relation that in connection with lighting of the burner in the conventional manner the flame resulting from combustion of the fuel mixture in the combustion chamber into which the flame of the pilot light is directed positively and substantially instantaneously ignites the fuel mixture in the adjacent combustion chambers. In addition the combustion chambers are all disposed at precisely equal distances from the manifold and hence there is uniformity of elevation of the flames resulting from combustion of the fuel mixture in the combustion chambers.

Another object of the invention is to provide a gaseous fuel burner of the type and character last mentioned in which the one-piece body with the longitudinal series of vertically extending, spaced apart cylindrical combustion chambers therein has formed therein at the lower ends of the combustion chambers annular grooves, and the marginal portions of the circular or disc-like hole equipped crosswalls are seated in the annular grooves and are clamped against the portions of the manifold that define the upper ends of the manifold ports.

Another object of the invention is to provide a burner of the type and character under consideration in which the portions of the one-piece body that are between the upper ends of the combustion chambers have notches therein which cross connect or establish communication between the upper ends of the combustion cham-

bers and serve materially to facilitate lighting of the burner.

A further object of the invention is to provide a gaseous fuel burner which is generally of new and improved construction and is characterized by the fact that it is extremely efficient in operation and may be produced and serviced at a low cost.

Other objects of the invention and the various advantages and characteristics of the present gaseous fuel burner will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a perspective of a gaseous fuel burner embodying one form of the invention;

Figure 2 is an enlarged vertical longitudinal section showing in detail the construction and design of the one-piece body in which the longitudinal series of spaced apart combustion chambers are formed, and illustrating the manner in which the hole equipped crosswalls are secured in place adjacent the lower ends of the combustion chambers;

Figure 3 is a vertical transverse section taken on the line 3—3 of Figure 2 and illustrating in detail the cross sectional design of the body and manifold of the burner;

Figure 4 is a plan view of one of the disc-like hole equipped flanges which are connected to the upper ends of the upstanding shanks on the crosswalls and serve so to baffle and deflect the jets of gaseous fuel emanating from the holes in the crosswalls as to reduce the velocity thereof prior to passage of the fuel mixture into the upper portions of the combustion chambers;

Figure 5 is a plan view of one of the hole equipped crosswalls at the lower ends of the combustion chambers;

Figure 6 is a perspective of a gaseous fuel burner which embodies another form of the invention and is so designed and constructed that it may be serially connected to one or more like burners;

Figure 7 is a plan view showing the burner of Figure 6 in connected relation with a like burner; and

Figure 8 is a vertical transverse section of the burner of Figure 6.

The burner which is shown in Figures 1 to 5, inclusive, of the drawings constitutes one form or embodiment of the invention. It is designed to burn a combustible fuel mixture of air and any high calorific gas and comprises as its principal components or parts a manifold 10, a body 11, and a group or set of burner tips 12. It is contemplated that the burner will be disposed in the fire box of a heating apparatus, such, for example, as a furnace or boiler.

The manifold 10 is horizontally elongated and has at one end thereof an internally threaded circular hole 13 into which fits the outlet end of a pipe (not shown) for supplying the fuel mixture into the manifold under pressure. As shown in the drawings the manifold 10 comprises a bottom wall 14, a pair of side walls 15, a top wall 16, and an end wall 17 which together define an elongated chamber 18 for the fuel mixture. Preferably the manifold is formed of cast metal.

The top wall 16 of the manifold has a flat upper surface 19 and embodies a longitudinal series of spaced apart, circular outlet ports 20. The latter communicate with the chamber 18 and permit the fuel mixture to flow upwards from the chamber. The end wall 17 serves as a closure for the other end of the manifold, i. e., the end that is opposite the internally threaded hole 13 for the outlet or discharge end of the pipe for supplying the fuel mixture into the chamber 18.

The body 11 rests on the top of the manifold 10 and is horizontally elongated. It is shaped conformably to the manifold and has a flat bottom surface 21 which rests flatly on the flat upper surface 19 of the top wall 16 of the manifold. Preferably the body 11 is formed of cast metal. Bolts 22 serve releasably to secure the body in connected relation with the manifold. As shown in Figure 1, these bolts are arranged so that the heads thereof are at the top. The shanks of the bolts extend downwards through cylindrical holes 23 in the body into internally threaded holes 24 in the top wall 16 of the manifold 10. The body 11 of the burner embodies a longitudinal series of vertically extending spaced apart cylindrical combustion chambers 25 and these correspond in diameter and number to the outlet ports 20 and are in registry with the latter, as shown in Figures 2 and 3. In connection with use or operation of the burner the fuel mixture which is delivered under pressure into the chamber 18 flows upwards into the combustion chambers 25 via the outlet ports 20. Combustion of the fuel mixture occurs in the upper portions of the combustion chambers. The portions of the body 11 that define the lower ends or extremities of the combustion chambers 25 have annular grooves 26 formed therein. These grooves are of greater diameter than, and are concentrically positioned with respect to, the combustion chambers. They open onto the flat bottom surface of the body 11 and have the upper ends thereof defined by flat annular shoulders 27. The combustion chambers are equidistantly spaced apart comparatively small distances in order to assure a positive and substantially instantaneous lighting of the fuel mixture in the combustion chambers in connection with lighting of the burner as hereinafter described. The upper surface of the body 11 is flat and is in true parallel relation with the flat bottom surface 21.

The tips 12 of the burner correspond in number to, and are associated respectively with, the combustion chambers. They serve to baffle or diffuse, and also to reduce the velocity of, the fuel mixture in connection with up-flow thereof into the combustion chambers. As shown in Figures 2 and 3 of the drawings, the tips are in the form of one-piece units. They are preferably formed of machined steel or other suitable material and consist of circular or dic-like crosswalls 28, centrally disposed upstanding shanks 29, and disc-like flanges 30 on the upper ends of the shanks. The crosswalls 28 of the tips 12 extend horizontally across the lower ends of the combustion chambers 25 and have a plurality of spaced apart, vertically extending holes 31 for permitting the fuel mixture to flow upwards into the lower ends of the combustion chambers in stream or jet form. The margins of the crosswalls fit snugly within the annular grooves 26 adjacent the lower ends of the combustion chambers. They are the same in height as the grooves and are clamped against the subjacent portions of the flat upper surface 19 of the manifold by

the annular downwardly facing shoulders 27, as shown in Figures 2 and 3. The vertically extending holes 31 are all disposed inwards of the clamped margins of the crosswalls 28 of the tips 12. The shanks 29 of the tips are formed integrally with, and project upwards from, the central portions of the tip crosswalls 28. They are preferably cylindrical and are of such length that the upper ends thereof terminate adjacent the central portions of the combustion chambers. The disc-like flanges 30 of the tips 12 are formed integrally with the upper ends of the shanks. They are of slightly less diameter than the cylindrical combustion chambers 25, and are disposed in concentric relation with the latter. Vertically extending holes 32 are formed in the disc-like flanges 30 and these holes are vertically or laterally offset with respect to the holes 31 in the crosswalls 28 and have a total cross sectional area either equal to, or greater than, the cross sectional area of the holes 31. In connection with operation of the burner the streams or jets of the fuel mixture emanating from the holes 31 in the crosswalls 28 strike against the bottom faces of the flanges 30 and are deflected outwards. A portion of the fuel mixture flows upwards through the holes 32 in the flanges 30 and the balance flows upwards through the annular spaces between the flanges and the opposite portions of the combustion chambers and enters the upper portions of the combustion chambers in the form of annular streams. The flanges 30, due to the baffling or deflecting action thereof, so reduce the velocity of the fuel mixture that the latter burns within the upper portions of the combustion chambers.

The burner is lighted or ignited by directing a pilot light or other flame into the upper end of one of the end combustion chambers while the gaseous fuel mixture to be burned is being supplied into the chamber 18 in the manifold 10. As soon as the fuel mixture in the one combustion chamber ignites the flame resulting from combustion ignites the fuel mixture in the combustion chamber which is next to the one combustion chamber, and the flame resulting from combustion ignites the fuel mixture in the next combustion chamber, and so on. In order materially to facilitate lighting of the burner the portions of the body 11 that are between the upper ends of the combustion chambers have notches 33 formed therein. These notches cross connect or establish direct communication between the upper ends of the combustion chambers. The portions of the body that define the end corners of the bottoms of the notches 33 are rounded as at 34 in order that the portions of the flames that are directed past the notches are caused to be laterally deflected into the notches in order materially to facilitate lighting of the burner, it being well known that a fluid when directed against a curved surface will follow such surface.

The burner of Figures 1 to 5, inclusive, is highly efficient in operation and may be manufactured at a low and reasonable cost. By having the combustion chambers 25 formed in a one-piece body instead of by separate tubular walls the chambers may be disposed in such closely spaced apart relation that in connection with lighting of the burner in a standard or conventional manner the flame resulting from combustion of the fuel mixture in the end combustion chamber into which the flame of the pilot light is directed positively and substantially instantaneously ignites the fuel mixture in the adjacent combustion chambers. Another advantage in having the combustion chambers in a one-piece body is that they are all disposed at precisely equal distances from the manifold and hence there is uniformity of elevation of the flames resulting from combustion of the fuel mixture in the combustion chambers. In the event that it is necessary to replace the tips 12 it is only necessary to remove the bolts 22 in order to free the one-piece body 11 from the manifold 10. As soon as the body is released or removed from the manifold the tips may be removed merely by forcing them downwards out of the lower portions of the combustion chambers.

The burner which is shown in Figures 6 to 8, inclusive, is like the gaseous fuel burner of Figures 1 to 5, inclusive, except that it is designed and adapted to be connected in series with like burners. It comprises a tubular open ended manifold 35, a one-piece body 36 and tips 37. The manifold 35 has a longitudinal series of outlet ports 38 in its top wall and embodies at its ends integral laterally extending flanges 39. Such flanges have horizontally extending holes 40 for attaching bolts 41. In Figure 7 of the drawings the burner is shown or illustrated as having one end of its manifold attached or connected to a nipple 42. The latter is adapted to receive the fuel mixture to be burned from a supply pipe (not shown) and has at its discharge or outlet end a pair of laterally extending flanges 43 which are in abutment with, and are bolted to, the laterally extending flanges 39 on the one end of the manifold. The other end of the manifold 35 is shown as being in connected relation with one end of the manifold of a like burner. The laterally extending flanges 39 and the attaching bolts 41 permit the manifold 35 to be connected in series form with one or more like burners. The body 36 and the tips 37 of the burner of Figures 6 to 8, inclusive, are respectively the same as the body 11 and the tips 12 of Figures 1 to 5, inclusive. The burner of Figures 6 to 8, inclusive, functions in the same manner as the burner of Figures 1 to 5, inclusive, and is characterized by the fact that the manifold thereof, due to the flanges at the ends, may be connected in series form with the manifolds of like burners.

The invention is not to be understood as restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what we claim as new and desire to secure by Letters Patent is:

1. A burner comprising a manifold embodying a closed bottom portion, provided with means for supplying it with a mixture of air and gas under pressure and having in the top portion thereof a plurality of spaced apart circular outlet ports for the mixture, a one-piece body connected to and overlying the top portion of the manifold, having formed therein a plurality of spaced apart vertically extending cylindrical combustion chambers corresponding in number and diameter to, and in registry with, the outlet ports, and embodying in its bottom annular grooves extending around the lower ends of the combustion chambers, and a plurality of disc-like crosswalls extending across said lower ends of the combustion chambers, having the margins thereof fitting snugly in the annular grooves and resting on the top portion of the manifold, and provided with

holes for causing the mixture to enter said combustion chambers in stream form.

2. A burner comprising a horizontally elongated tube-like manifold embodying a closed bottom portion, provided at one end thereof with means for supplying it with a mixture of air and gas under pressure and having a flat top wall with a longitudinal series of equidistantly spaced circular outlet ports for the mixture, a horizontally elongated body with a flat bottom surface, extending longitudinally of, and resting on, the top wall of the manifold, having formed therein a longitudinal series of equidistantly spaced vertically extending cylindrical combustion chambers corresponding in number and diameter to, and in registry with, said outlet ports, and embodying in its flat bottom surface annular grooves extending around the lower ends of the combustion chambers, and a plurality of horizontal disc-like crosswalls extending across said lower ends of the combustion chambers, having the margins thereof fitting snugly within the grooves and resting on the top wall of the manifold, and provided with vertical holes for causing the mixture to enter the combustion chambers from the outlet ports in stream form.

3. A burner comprising a one-piece horizontally elongated manifold provided with means for supplying it with a gaseous fuel mixture under pressure and having in the top portion thereof a plurality of closely spaced vertically extending individual outlet ports for the mixture, a one-piece horizontally elongated body resting on, and

connected to, the top portion of the manifold so that it extends longitudinally of said manifold and overlies said outlet ports, embodying a longitudinal series of closely spaced vertically extending open top combustion chambers corresponding in number to, and in registry with, said outlet ports, and having in the top portions thereof between the upper ends of the combustion chambers single longitudinally extending notches for cross connecting and establishing direct communication between said upper ends of the combustion chambers, and a plurality of horizontal crosswalls extending across said lower portions of the combustion chambers and provided with vertical holes for causing the mixture to enter said combustion chambers in stream form.

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ALBERT STADLER.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,074,626	Kemp et al.	Oct. 7, 1913
1,909,496	McKee	May 16, 1933
1,942,397	Cuyler	Jan. 9. 1934
2,134,972	Haney	Nov. 1, 1938
2,195,170	Henson	Mar. 26, 1940
2,302,751	Howe	Nov. 24, 1942
2,367,119	Hess	Jan. 9, 1945