

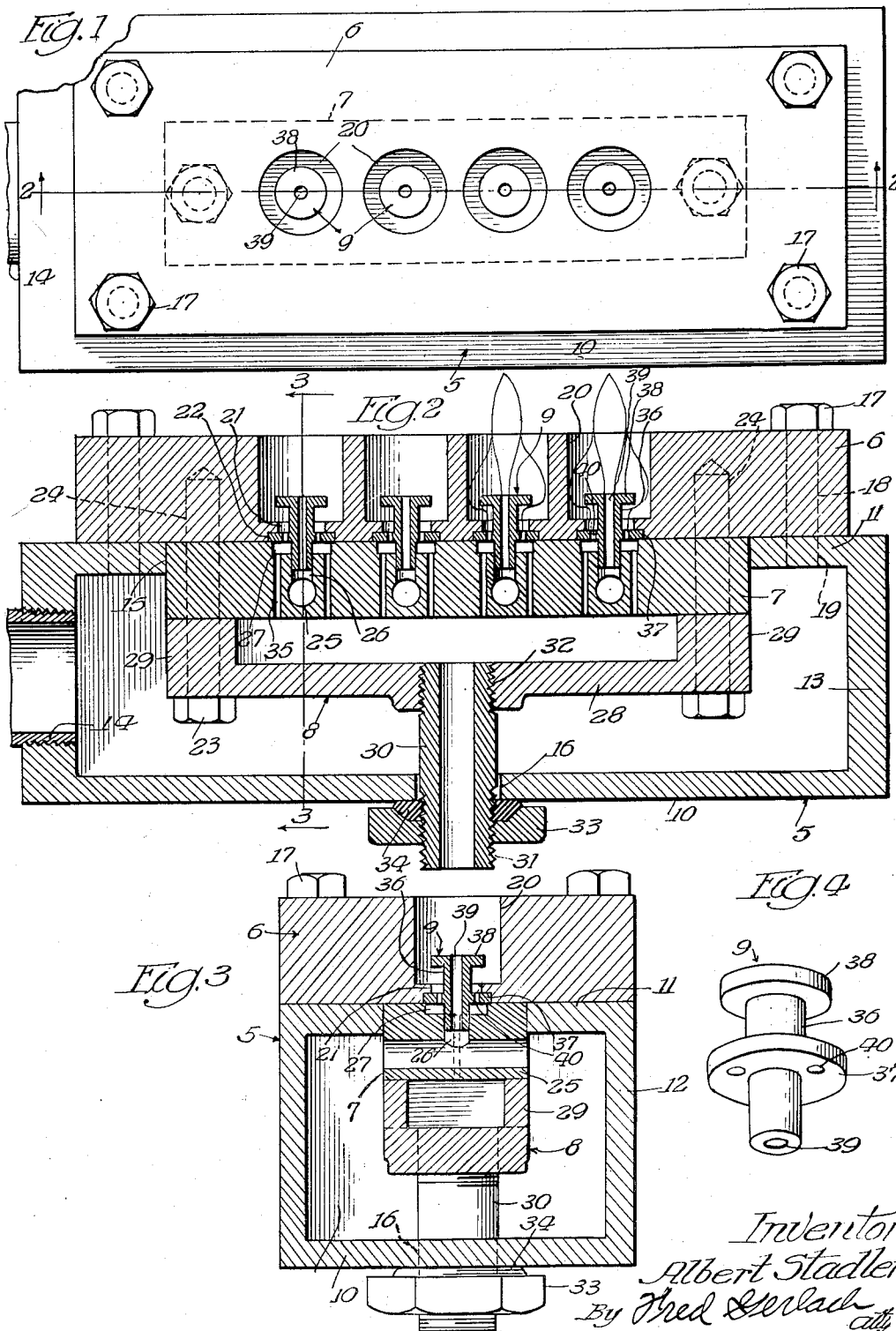
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A. STADLER

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FLAME RETAINING GASEOUS FUEL BURNER

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Inventor
 Albert Stadler
 By Fred S. Lach
 atty

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FLAME RETAINING GASEOUS FUEL BURNER

Albert Stadler, Rockford, Ill., assignor to Eclipse Fuel Engineering Co., Rockford, Ill., a corporation of Illinois

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The present invention relates generally to burners for gaseous fuel under pressure. More particularly the invention relates to that type of burner which is designed to effect burning of slow burning gaseous fuel in the form of a mixture of air and a gas of high calorific (B. t. u.) value, such, for example, as natural gas, propane or butane and as its principal components or parts comprises: (1) an elongated manifold which is adapted normally to extend horizontally and has associated with it means for connection to a source of gaseous fuel under pressure to be burned; (2) means on the upper portion of the manifold forming a longitudinal series of spaced apart open top wells, the upper portions of which constitute or form combustion chambers; (3) insert members which are disposed for the most part in the lower central portions of the wells, embody vertically extending shanks and outwardly extending disc-like flanges at the upper ends of the shanks, and have vertical open ended ducts extending centrally through the shanks and flanges and serving to deliver or introduce into the central portions of the combustion chambers from the interior of the manifold main streams of gaseous fuel; and (4) vertically extending ports which are arranged in annular series around the lower ends of the shanks of the insert members and serve to introduce into the space beneath the disc-like flanges at the upper ends of the shanks jets of gaseous pilot fuel to the end that such jets, after flowing outwards under the flanges and then upwards past the flanges into the outer portions of the combustion chambers, form, when ignited, ignition rings for maintaining ignited the main streams of gaseous fuel emanating from the longitudinal ducts in the insert members.

As evidenced by my copending application Serial No. 710,367, filed November 16, 1946, it has heretofore been proposed in connection with a burner of the aforementioned type to supply the pilot fuel to the ports from the interior of the manifold. In practice it has been found that when the ports are supplied with pilot fuel from the interior of the manifold and the gaseous fuel in the manifold is under high pressure the velocity of the pilot fuel entering the combustion chambers in the upper portions of the wells is greater than the rate of flame propagation of the fuel with the result that the ignition rings become extinguished and do not carry out or fulfill their function of maintaining ignited the main streams of fuel that emanate from the longitudinal ducts in the insert members. It has also been found in practice that when the ports receive the pilot

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fuel from the interior of the manifold and the pressure of the fuel in the manifold is materially reduced in connection with "turn-down" of the burner the pilot fuel entering the combustion chambers is deficient to the point where the ignition rings are likely to become extinguished and hence fail so far as their purpose or function is concerned.

One object of the invention is to provide a gaseous fuel burner of the type under consideration which is an improvement upon, and has certain inherent advantages over, previously designed burners of the same general character and is characterized by the fact that the pilot fuel that is delivered to the ports around the lower ends of the shanks of the insert members is from a source which is separate from, or independent of, the gaseous fuel under pressure in the manifold. By supplying the pilot fuel from a source that is separate from, or independent of, the fuel within the manifold the quality of the pilot fuel (type of gas or ratio of air to gas) and the pressure of the pilot fuel may be controlled or regulated to the end that the pilot fuel as it enters the combustion chambers is at all times stable regardless of variations in the pressure of the fuel within the manifold and hence will at all times during operation of the burner maintain the desired ignition rings around the main streams of fuel that emanate from the longitudinally extending ducts in the insert members.

Another object of the invention is to provide a gaseous fuel burner of the last mentioned character in which the means for supplying the pilot fuel to the ports from the source of gaseous fuel under pressure comprises parts within the manifold, and the means for forming the longitudinal series of spaced apart open top wells is in the form of a block which is bolted to the upper portion of the manifold and has the aforementioned parts bolted thereto to the end that the burner as a whole may be readily assembled and dismantled.

Another object of the invention is to provide a gaseous fuel burner of the type and character last mentioned in which one of the parts of the means for supplying the pilot fuel to the ports is in the form of a block which underlies and abuts directly against the well forming block, serves in conjunction with the last mentioned block to hold the insert members in place and embodies horizontally and transversely extending open ended ducts which serve to deliver gaseous fuel under pressure from the interior of the mani-

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fold to the vertically extending centrally disposed ducts in the insert members.

A further object of the invention is to provide a gaseous fuel burner of the type and character under consideration in which another of the parts of the means for supplying the pilot fuel to the ports from the separate or independent source is in the form of an elongated cup-shaped member which directly underlies and extends longitudinally of the block beneath the well forming block and has the interior thereof in communication with the ports by way of vertically extending ports in the superjacent block, i. e., the block which underlies the well forming block and has the horizontally extending open ended ducts for delivering fuel from the interior of the manifold to the longitudinally extending ducts in the insert members.

A still further object of the invention is to provide a gaseous fuel burner which is generally of new and improved construction and is characterized by high efficiency and the fact that it may be manufactured and produced at a comparatively 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 drawing which accompanies and forms 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 plan view of a gaseous fuel burner embodying the invention;

Figure 2 is a vertical longitudinal section taken on the line 2—2 of Figure 1 and illustrating in detail the construction, arrangement and design of the various parts of the burner;

Figure 3 is a vertical transverse section taken on the line 3—3 of Figure 2 and showing the cross sectional design of the block and cup-shaped member constituting parts of the means for supplying the pilot fuel from the separate or independent source to the ports; and

Figure 4 is a perspective of one of the insert members.

The burner which is shown in the drawing constitutes the preferred form or embodiment of the invention. It is primarily designed and adapted to effect burning of slow burning high B. t. u. gaseous fuel in the form of a mixture of air and gas of high calorific value, such, for example, as natural gas, propane or butane. As its principal components or parts the burner comprises a manifold 5, a block 6, a block 7, a cup shaped member 8 and a plurality of insert members 9.

The manifold 5 is elongated and in normal use of the burner extends horizontally. It is rectangular in cross section and comprises a bottom wall 10, a top wall 11, a pair of side walls 12 and a pair of end walls 13. These walls are suitably secured together and, if desired, are formed integrally with one another. The interior of the manifold is supplied with the gaseous fuel to be burned by way of a pipe 14, one end of which is connected to a suitable source of fuel under pressure and the other end of which extends through a hole in, and is connected by a screw thread connection to, a wall of the manifold other than the top wall 11. Preferably the pipe

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14 is connected to one of the end walls 13 as shown in Figures 1 and 2. The top wall 11 of the manifold is provided in its central portion with a rectangular longitudinally extending opening 15. The latter extends completely through the manifold top wall and is of less width and length than the latter. The bottom wall 10 of the manifold is spaced an appreciable distance beneath the top wall 11 and has in its central portion a circular hole 16. Preferably the manifold is in the form of a one-piece casting. When the burner is in operation the gaseous fuel to be burned flows into the interior of the manifold from the pipe 14.

The block 6 is horizontally elongated and rests on, and extends lengthwise of, the top wall 11 of the manifold 5. It is of greater width and length than the rectangular opening 15 and overlies and covers the latter. Bolts 17 serve releasably or removably to secure the block 6 in connected relation with the manifold top wall. As best shown in Figure 2 of the drawing, these bolts are four in number and extend downwards through vertical holes 18 in the corners of the blocks. The lower ends of the bolts fit within screw threaded sockets 19 in the corner portions of the manifold top wall 11. The central portion of the block 6 is shaped to form a longitudinal series of equidistantly spaced open top wells 20, the side walls of which are either cylindrical as shown in the drawing, or, if desired, may be upwardly flared. The upper portions of the wells constitute or form combustion chambers. As shown in Figure 3 the wells 20 overlie the rectangular opening 15 in the manifold top wall 11 and are of such depth that the bottoms thereof are spaced but a comparatively small distance above the bottom surface of the block 6. The wells are of uniform diameter and together with the insert members 9 form burner units. The diameter of the wells is less than the width of the opening 15. At the bottoms of the wells 20 are upper circular holes 21 and lower circular holes 22. The upper holes 21 are of materially less diameter than the wells. They are positioned in coaxial relation with the side walls of the wells and open onto and lead downwards from the bottom portions of the wells. As hereinafter described the pilot fuel enters the bottom portions of the wells via the upper holes 21. The lower circular holes 22 are of greater diameter than the upper holes 21 but are of less diameter than the side walls of the wells. They are arranged in concentric or coaxial relation with the upper holes, communicate with, and lead downwards from, the latter and extend through the bottom surface of the block 6.

The block 7 is horizontally elongated and underlies and fits against the central portion of the well forming block 6. It is the same in size as, and fits within, the rectangular opening 15 in the top wall 11 of the manifold and is secured removably or detachably to the block 6 by way of upwardly extending bolts 23. As shown in Figures 2 and 3, the height of the block 7 is materially greater than the thickness of the manifold top wall 11 and the top surface of the block 7 is flush with the top surface of said top wall. The shanks of the bolts 23 extend upwards through circular holes in the ends of the block 7 and fit within internally threaded sockets 24 in the ends of the block 6. As shown in Figures 1 and 2, the bolts 23 are disposed inwards of the bolts 17 which, as previously pointed out, serve removably to secure the block 6 to the

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manifold top wall 11. The block 7 is provided with a longitudinally extending series of equidistantly spaced, horizontal, transversely extending, open ended ducts 25. These ducts correspond in number to, and are located beneath, the wells 20. They are located beneath the bottom surface of the manifold top wall 11 and receive gaseous fuel from the interior of the manifold. Preferably the ducts 25 are circular in cross section. In addition to the ducts 25 the block 7 has vertically extending ducts 26. The latter correspond in number to, and lead or extend upwards from the central portions of, the ducts 25. When the burner is in operation the gaseous fuel under pressure within the interior of the manifold flows into the ducts 25 and then upwards through the ducts 26. The latter are disposed in concentric or coaxial relation with the holes 21 and 22 that are formed in the block 6 and are located beneath the well bottoms. The block 7 has in addition to the ducts 25 and 26 a longitudinal series of equidistantly spaced, cylindrical, comparatively shallow, open top cavities 27. The latter are formed in the upper portion of the block 7, correspond in number to, and are located beneath, the wells 20. As shown in Figures 2 and 3, the cavities 27 are in concentric relation with, and are of slightly less diameter than, the lower circular holes 22 in the block 6. The block 7 is, in effect, a fuel supply block.

The cup shaped member 8 is horizontally elongated and underlies the block 7. It is the same in length and width as the block 7 and consists of a bottom wall 28 and a continuous rectangular upstanding side wall 29. As shown in Figures 2 and 3, the top surface of the side wall 29 abuts against the marginal portion of the bottom surface of the block 7. The cup shaped member is clamped against the block 7 by way of the bolts 23, the shanks of which extend through circular holes in the end portions of the side wall 29 of the cup shaped member. Gaseous pilot fuel under pressure is supplied to the interior of the cup shaped member 8 from a separate or independent source by way of a vertically extending pipe 30. This pipe extends through the circular hole 16 in the bottom wall 10 of the manifold 5 and has an external screw thread 31 at its lower end. The upper end of the pipe 30 extends through a circular hole in the central portion of the bottom wall 28 of the cup shaped member 8 and is connected to said bottom wall by a screw thread connection 32. A nut 33 is mounted on the screw thread 31 on the lower end of the pipe 30 and serves to clamp a ring shaped gasket 34 against the hole defining portion of the manifold bottom wall 10 in order to prevent fuel in the manifold from leaking through the hole 16. The interior of the cup shaped member 8 communicates with the cavities 27 by way of vertically extending ports 35 in the block 7. Preferably there are two ports 35 for each cavity and the two ports are disposed on opposite sides of the adjacent horizontally extending duct 25. When the burner is in operation the gaseous pilot fuel under pressure from the separate or independent source flows into the interior of the cup shaped member 8 via the vertically extending pipe 30. From the interior of the cup shaped member the pilot fuel flows upwards through the vertically extending ports 35 into the cavities 27. The cup shaped member 8 is preferably in the form of a one-piece metallic casting and constitutes a part

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of the means for supplying pilot fuel into the wells 20.

The insert members 9 correspond in number to, and are associated, respectively, with, the wells 20. They are preferably formed of single pieces of steel and consist of vertically extending shanks 36, circular or disc-like flanges 37 on the central portions of the shanks, and circular or disc-like flanges 38 on the upper ends of the shanks. The flanges 37 and 38 are flat and extend horizontally. As shown in Figures 2 and 3, the upper portions of the insert members are disposed centrally within the lower portions of the wells 20. The flanges 37 are the same in size as, and fit within, the lower circular holes 22. The outer marginal portions of the flanges 37 rest on the portions of the block 7 that define the comparatively shallow cylindrical cavities 27. Such block serves to hold the flanges 37 in place in the holes 22. In view of the fact that the flanges 37 are the same in size as the holes 22 the insert members 9 are fixedly or rigidly held in place. The circular or disc-like flanges 38 are of slightly less diameter than the upper holes 21 and are spaced a comparatively small distance above the bottoms of the wells 20. The lower ends of the shanks 37 of the insert members extend downwards through the central portions of the cavities 27 and fit snugly within the upper ends of the vertically extending ducts 26. The insert members are provided with vertical open ended ducts 39. These ducts extend longitudinally and centrally through the shanks 36 and serve to deliver or introduce into the central portions of the combustion chambers upwardly flowing main streams of gaseous fuel from the main fuel source. In connection with operation of the burner the main fuel under pressure within the manifold 5 flows into the horizontally extending ducts 25 and then upwards through the vertically extending ducts 26. After flowing through the last mentioned ducts the main fuel flows upwards through the vertical ducts 39 in the central portions of the shanks of the insert members and enters the upper portions of the combustion chambers in the form of single high velocity streams. Preferably the ducts 39 are circular in cross section and are of uniform diameter from end to end. It is contemplated, however, that if comparatively long flames are desired the ducts 39 will be formed so that they are upwardly tapered. The main streams of fuel that emanate from the ducts 39 flow upwards through the central portions of the combustion chambers at a velocity which generally is in excess of the rate of flame propagation of the fuel, it being understood that the rate of flame propagation of the fuel depends upon the type of gas that is mixed with air and the proportion of gas to air. When the fuel is under comparatively high pressure as is contemplated in connection with normal operation of the burner the velocity of the fuel in transit through the vertical ducts 39 is in excess of the rate of flame propagation of the fuel. As soon as the main streams of fuel enter the combustion chambers where they are permitted to expand the velocity of the fuel is reduced to some extent.

In order to maintain ignited the main streams of fuel emanating from the vertical ducts 39 pilot fuel is introduced into the outer portions of the combustion chambers from the separate or independent source, i. e., the source to which the pipe 30 is connected, by means of vertical ports 40 in the flanges 37. These parts are lo-

cated directly outwards of the central portions of the shanks 36 of the insert members 9 and establish communication between the cavities 27 and the upper holes 24. In connection with operation of the burner the pilot fuel, after flowing into the cavities 27, flows upwards through the ports 40, then impinges against the lower surface of the flanges 38, then flows laterally outwards against the lower portion of the side walls of the wells 20, and then flows upwards into the outer portions of the combustion chambers through the annular spaces between the flanges 38 and the adjacent portions of the well side walls. During outward flow of the pilot fuel against the lower portions of the well side walls and upward flow of such fuel past the flanges 38 the pilot fuel expands to the point where its velocity is less than the rate of flame propagation of the pilot fuel. It is contemplated that the pilot fuel will burn as it enters the outer portions of the combustion chambers and produce ignition rings around the main fuel streams that emanate and flow upwards from the ducts 39 in the shanks of the insert members 9. Such ignition rings are entrained and mixed with the main streams of fuel and serve at all times to ignite the latter. The disc-like flanges 38 are imperforate except for the upper ends of the ducts 39 and hence all of the pilot fuel is deflected outwards against the lower portions of the well side walls. There are three ports 40 in each flange 37 and the total cross sectional area of the ports is less than the total cross sectional area of the ducts 39. By supplying the pilot fuel from a source that is separate from, or independent of, the main fuel within the manifold the quality of the pilot fuel, i. e., the type of gas or the ratio of air to gas, and the pressure of the pilot fuel may be so controlled or regulated that the pilot fuel as it enters the combustion chambers will at all times be stable regardless of variations in the pressure of the fuel within the manifold and hence will at all times, while the burner is in operation, maintain the desired ignition rings around the main streams of fuel that emanate from the vertical or longitudinally extending ducts 39 in the shanks of the insert members. In other words, by supplying the pilot fuel from a source that is separate from, or independent of, the main fuel source, i. e., the fuel within the manifold, there are always ignition rings within the combustion chambers during operation of the burner and such rings effect ignition of the main streams of fuel even though the pressure of the main fuel is extremely high and the main streams of fuel emanating from the ducts 39 have a velocity far in excess of that of the rate of flame propagation of the main fuel. With the present burner arrangement it is possible to obtain efficient burning of the main fuel even though such fuel is under extremely high pressure and of the slow burning high B. t. u. type of variety.

The operation of the burner is as follows:

The main gaseous fuel enters the manifold 5 by way of the pipe 14 and flows into the horizontally extending open ended ducts 25 in the block 7. After flowing through the ducts 25 the main fuel flows upwards first through the vertically extending ducts 26 and then through the vertical ducts 39. From the latter ducts the main fuel enters the central portions of the combustion chambers in streams of comparatively high velocity. The pilot fuel from the separate or independent source flows into the interior of

the cup shaped member 8 from the pipe 30 and then flows into the cavities 27 after passing upwards through the ports 35. After flowing into the cavities 27 the pilot fuel, as hereinbefore pointed out, flows upwards through the ports 40, then, after impinging against the flanges 38 on the upper ends of the shanks of the insert members, flows outwards against the lower portions of the side walls of the wells and then upwards past the flanges 38 into the outer portions of the combustion chambers. The pilot fuel burns within the combustion chambers and forms ignition rings which mix with, and serve to ignite, the main streams of fuel emanating from the ducts 39. Regardless of whether the main fuel is under high pressure in connection with normal operation of the burner or is under low pressure due to "turn-down" of the burner the ignition rings that are formed by the pilot fuel always maintain ignited the main streams of fuel. In the event that it is desired to dismantle the burner the nuts 33 and the bolts 17 are removed. This frees the blocks 6 and 7 and the cup shaped member 8 so that they may be withdrawn as a unit from the manifold by raising them relatively to the manifold. Should it be necessary or desirable to clean or replace the insert members 9 the bolts 23 are removed from their normal or operative position.

The herein described gaseous fuel burner is highly efficient so far as operation is concerned and this is directly attributable to the fact that the pilot fuel which serves to form ignition rings around the main streams of fuel is obtained from a source that is separate from, or independent of, the main fuel source. Due to the construction and arrangement of the various parts of the burner the burner may be assembled and dismantled with facility and is capable of being produced at a comparatively low cost.

Whereas the burner has been described as comprising a plurality of burner units it is to be understood that the invention contemplates a burner with a single burner unit or any number of burner units. It is also to be understood that the invention is not to be 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 I claim as new and desire to secure by Letters Patent is:

1. A gaseous fuel burner comprising a manifold provided with means for supplying it with main gaseous fuel under pressure and having associated therewith an independent source of gaseous pilot fuel under pressure, means on the upper portion of the manifold forming a series of spaced apart open top wells, insert members corresponding in number to, and associated, respectively, with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks and enlarged disc-like flanges connected to the upper ends of the shanks and spaced a small distance above the well bottoms and inwards of the well side walls, and having vertical open ended ducts extending centrally through the shanks and flanges, having their lower ends in communication with the interior of the manifold, and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering jets of pilot fuel from the independent source upwards into the spaces beneath said flanges,

embodying a closed hollow member disposed within the central portion of the manifold interior and beneath the well forming means and connected to receive pilot fuel from said source and annular series of vertically extending ports extending around the shanks and having the lower ends thereof in communication with the interior of said hollow member.

2. A gaseous fuel burner comprising a manifold provided with means for supplying it with main gaseous fuel under pressure and having associated therewith an independent source of gaseous pilot fuel under pressure, means on the upper portion of the manifold forming a series of spaced apart open top wells, insert members corresponding in number to, and associated, respectively, with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks and enlarged disc-like flanges connected to the upper ends of the shanks and spaced a small distance above the well bottoms and inwards of the well side walls, and having vertical open ended ducts extending centrally through the shanks and flanges, having their lower ends in communication with the interior of the manifold, and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering jets of pilot fuel from the independent source upwards into the space beneath said flanges, including a pipe having one end thereof adapted for connection to the source and its other end extending into the manifold, a closed hollow member disposed within the central portion of the manifold interior and beneath the well forming means and connected to the other end of the pipe so as to receive the pilot fuel therefrom, and annular series of vertical ports extending around the shanks of the insert members and having their lower ends in communication with the interior of the hollow member.

3. A gaseous fuel burner comprising a manifold provided with means for supplying it with gaseous fuel under pressure, having associated therewith an independent source of gaseous pilot fuel under pressure, and embodying an opening in its top wall, a block-like structure fitting within said opening and having the upper portion thereof disposed above the manifold top wall and provided with a series of spaced apart open top wells and the lower portion thereof disposed beneath said manifold top wall and provided with substantially horizontal open ended ducts in communication with the interior of the manifold and corresponding in number to, and disposed beneath, the wells, a plurality of insert members corresponding in number to, and associated respectively with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks and enlarged disc-like flanges connected to the upper ends of the shanks and spaced a small distance above the well bottoms and inwards of the well side walls, and having vertical open ended ducts extending centrally through the shanks and flanges, having their lower ends in communication with the first mentioned ducts, and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering jets of pilot fuel from the independent source upwards into the spaces beneath the flanges, including a cup shaped member disposed within the manifold, fitting against the bottom surface of the block structure and connected to said independent source, and vertical ports extending

around the shanks of the insert members and having the lower ends thereof in communication with the interior of the cup shaped member.

4. A gaseous fuel burner comprising a manifold provided with means for supplying it with gaseous fuel under pressure, having associated therewith an independent source of gaseous pilot fuel under pressure, and embodying an opening in its top wall, a block-like structure fitting within said opening and having its upper portion disposed above the manifold top wall and provided with a series of spaced apart open top wells and the lower portion thereof disposed beneath said manifold top wall and provided with substantially horizontal open ended ducts in communication with the interior of the manifold and corresponding in number to, and disposed beneath, the wells, and in addition vertical ducts leading upwards from the central portions of the horizontal ducts, a plurality of insert members corresponding in number to, and associated, respectively with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks with the lower ends thereof fitting within the upper ends of the vertical ducts and enlarged disc-like flanges connected to the upper ends of the shanks and spaced a small distance between the well bottoms and inwards of the well side walls, and having vertical open ended ducts extending centrally through the shanks and flanges and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering jets of pilot fuel from the independent source upwards into the spaces beneath the flanges, including a cup shaped member disposed within the manifold, fitting against the bottom surface of the block structure and connected to said independent source, and vertical ports extending around the shanks of the insert members and having the lower ends thereof in communication with the interior of the cup shaped member.

5. A gaseous fuel burner comprising a manifold provided with means for supplying it with gaseous fuel under pressure, having associated therewith an independent source of gaseous pilot fuel under pressure, and embodying an opening in its top wall, a block-like structure fitting removably within said opening and having the upper portion thereof disposed above the manifold top wall and provided with a series of spaced apart open top wells and the lower portion thereof disposed beneath said manifold top wall and provided with substantially horizontal open ended ducts in communication with the interior of the manifold and corresponding in number to, and disposed beneath, the wells, a plurality of insert members corresponding in number to, and associated respectively with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks and enlarged disc-like flanges connected to the upper ends of the shanks and spaced a small distance above the well bottoms and inwards of the well side walls, and having vertical open ended ducts extending centrally through the shanks and flanges, having their lower ends in communication with the first mentioned ducts, and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering jets of pilot fuel from the independent source upwards into the spaces beneath the flanges, including a vertically extending pipe having its lower end adapted for connection to said independent source and its upper end extending

into the manifold interior through a hole in the manifold bottom wall, a cup shaped member disposed within the manifold, fitting against the bottom surface of the block structure and having its interior connected to receive pilot fuel from said upper end of the pipe, and vertical ports extending around the shanks of the insert members and having the lower ends thereof in communication with said interior of the cup shaped member.

6. A gaseous fuel burner comprising a manifold provided with means for supplying it with gaseous fuel under pressure, having associated therewith an independent source of gaseous pilot fuel under pressure, and embodying an opening in its top wall, a block mounted on the top wall of the manifold, extending across said opening and having formed therein a series of spaced apart open top wells, a second block disposed within, and projecting beneath, the opening in the manifold top wall, fitting against and removably secured to the bottom surface of the first mentioned block and provided with horizontal open ended ducts in communication with the interior of the manifold and corresponding in number to, and disposed beneath, the wells, and in addition vertical ducts leading upwards from the central portions of the horizontal ducts and disposed in centered relation with the wells, a plurality of insert members corresponding in number to, and associated respectively with, the wells, disposed partly in the lower central portions of the wells, and embodying vertical shanks with the lower ends thereof fitting within the upper ends of the vertical ducts, and enlarged disc-like flanges connected to the upper ends of the shanks and spaced a small distance above the well bottoms and inwards of the well side walls, and having vertical open ended ducts extending centrally through the shanks and flanges and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering jets of pilot fuel from the independent source upwards into the spaces beneath the flanges, including a cup shaped member disposed within the manifold, fitting against the bottom surface of the second block and connected to said independent source, and vertical ports extending around the shanks of the insert members and having the lower ends thereof in communication with the interior of said cup shaped member.

7. A gaseous fuel burner comprising a manifold provided with means for supplying it with gaseous fuel under pressure, having associated therewith an independent source of gaseous pilot fuel under pressure, and embodying an opening in its top wall, a block mounted on the manifold top wall, extending across the opening and having formed therein a series of spaced apart open top wells and circular open bottom holes directly beneath the wells, a second block disposed within, and projecting beneath, the opening in the manifold top wall, fitting against the removably secured to the bottom surface of the first mentioned block and provided with horizontal open ended ducts in communication with the interior of the manifold and corresponding in number to, and disposed beneath, the wells, and in addition vertical ducts leading upwards from the central portions of the horizontal ducts and disposed in centered relation with the wells, a plurality of insert members corresponding in number to, and associated respectively with, the wells, disposed partly in the lower central portions of the wells,

embodying vertical shanks with the lower ends thereof fitting within the upper ends of the vertical ducts, enlarged disc-like upper flanges connected to the upper ends of the shanks and spaced a small distance above the well bottoms and inwards of the well side walls, and enlarged disc-like lower flanges connected to the central portions of the shanks and fitting within the aforementioned open bottom holes, and having vertical open ended ducts extending centrally through the shanks and flanges and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering jets of pilot fuel from the independent source upwards into the spaces beneath the upper flanges, including a cup-shaped member disposed within the manifold, fitting against the bottom surface of the second block and connected to receive the pilot fuel from said independent source, and vertical ports formed in the lower flanges directly outwards of the shanks and having the lower ends thereof in communication with the interior of the cup shaped member by way of vertical ports in said second block.

8. A gaseous fuel burner comprising a manifold provided with means for supplying it with main gaseous fuel under pressure and having associated therewith an independent source of gaseous pilot fuel under pressure, means on the upper portion of the manifold forming a series of spaced apart open top wells, insert members corresponding in number to, and associated respectively with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks, and having vertical open ended ducts extending centrally through the shanks, having their lower ends in communication with the interior of the manifold, and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, a closed hollow member disposed within the central portion of the manifold interior and beneath the well forming means and connected to receive pilot fuel from said source, and means forming vertically extending ports positioned outwards of the shanks, having the lower ends thereof in communication with the interior of said hollow member, and adapted to deliver streams of pilot fuel upwards into the outer upper portions of the wells.

9. A gaseous fuel burner comprising a manifold provided with means for supplying it with main gaseous fuel under pressure, having associated therewith an independent source of gaseous pilot fuel under pressure, and embodying an opening in its top wall, a structure fitting within said opening, having the upper portion thereof disposed above the manifold top wall and provided with means forming a series of spaced apart open top wells, and having its lower portion disposed beneath said manifold top wall and provided with substantially horizontal open ended ducts in communication with the interior of the manifold and corresponding in number to, and disposed beneath, the wells, a plurality of insert members corresponding in number to, and associated respectively with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks, and having vertical open ended ducts extending centrally through the shanks, having their lower ends in communication with the first mentioned ducts, and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and a cup shaped member disposed within the manifold, fitting against the bottom surface of the

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block structure and connected to said independent source, said structure having formed therein vertical ports extending around the shanks of the insert members, having the lower ends thereof in communication with the interior of the cup shaped member, and adapted to deliver streams of pilot fuel upwards into the upper portions of the wells.

10. A gaseous fuel burner comprising a manifold provided with means for supplying it with main gaseous fuel under pressure, having associated therewith an independent source of gaseous pilot fuel under pressure, and embodying an opening in its top wall, a structure fitting within said opening and having its upper portion disposed above the manifold top wall and provided with means forming a series of spaced apart open top wells, and having its lower portion disposed beneath said manifold top wall and provided with substantially horizontal open ended ducts in communication with the interior of the manifold and corresponding in number to, and disposed beneath, the wells, and in addition vertical ducts leading upwards from the central portions of the horizontal ducts, a plurality of insert members corresponding in number to, and associated respectively with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks with the lower ends thereof fitting within the upper ends of the vertical ducts, and having vertical open ended ducts extending centrally through the shanks and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering streams of pilot fuel from the independent source upwards into the outer central portions of the wells, including a pipe extending into the manifold and having its outer end adapted for connection to said independent source, a cup shaped member disposed within the manifold, fitting against the bottom surface of the structure and connected to the inner end of said pipe, and vertical ports formed in said structure, extending around the shanks of the insert members and having the lower ends thereof in communication with the interior of the cup shaped member.

11. A gaseous fuel burner comprising a manifold provided with means for supplying it with main gaseous fuel under pressure, having asso-

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ciated therewith an independent source of gaseous pilot fuel under pressure, and embodying an opening in its top wall, a block mounted on the top wall of the manifold, extending across said opening and having formed therein a series of spaced apart open top wells, a second block disposed within, and projecting beneath, the opening in the manifold top wall, fitting against and removably secured to the bottom surface of the first-mentioned block and provided with horizontal open ended ducts in communication with the interior of the manifold and corresponding in number to, and disposed beneath, the wells, and in addition vertical ducts leading upwards from the central portions of the horizontal ducts and disposed in centered relation with the wells, a plurality of insert members corresponding in number to, and associated respectively with, the wells, disposed partly in the lower central portions of the wells, embodying vertical shanks with the lower ends thereof fitting within the upper ends of the vertical ducts, and having vertical open ended ducts extending centrally through the shanks and adapted to deliver upwards into the upper central portions of the wells streams of main fuel, and means for delivering streams of pilot fuel from the independent source upwards into the outer central portions of the wells, including a cup shaped member disposed within the manifold, fitting against the bottom surface of the second block and connected to said independent source, and vertical ports extending around the shanks of the insert members and having the lower ends thereof in communication with the interior of said cup shaped member.

ALBERT STADLER.

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