No. 628,659. Patented July 11, 1899.

C. M. GRAY.

HYDROCARBON BURNER.

(Application filed July 30, 1898.)

(No Model.) 2 Sheets—Sheet 1.

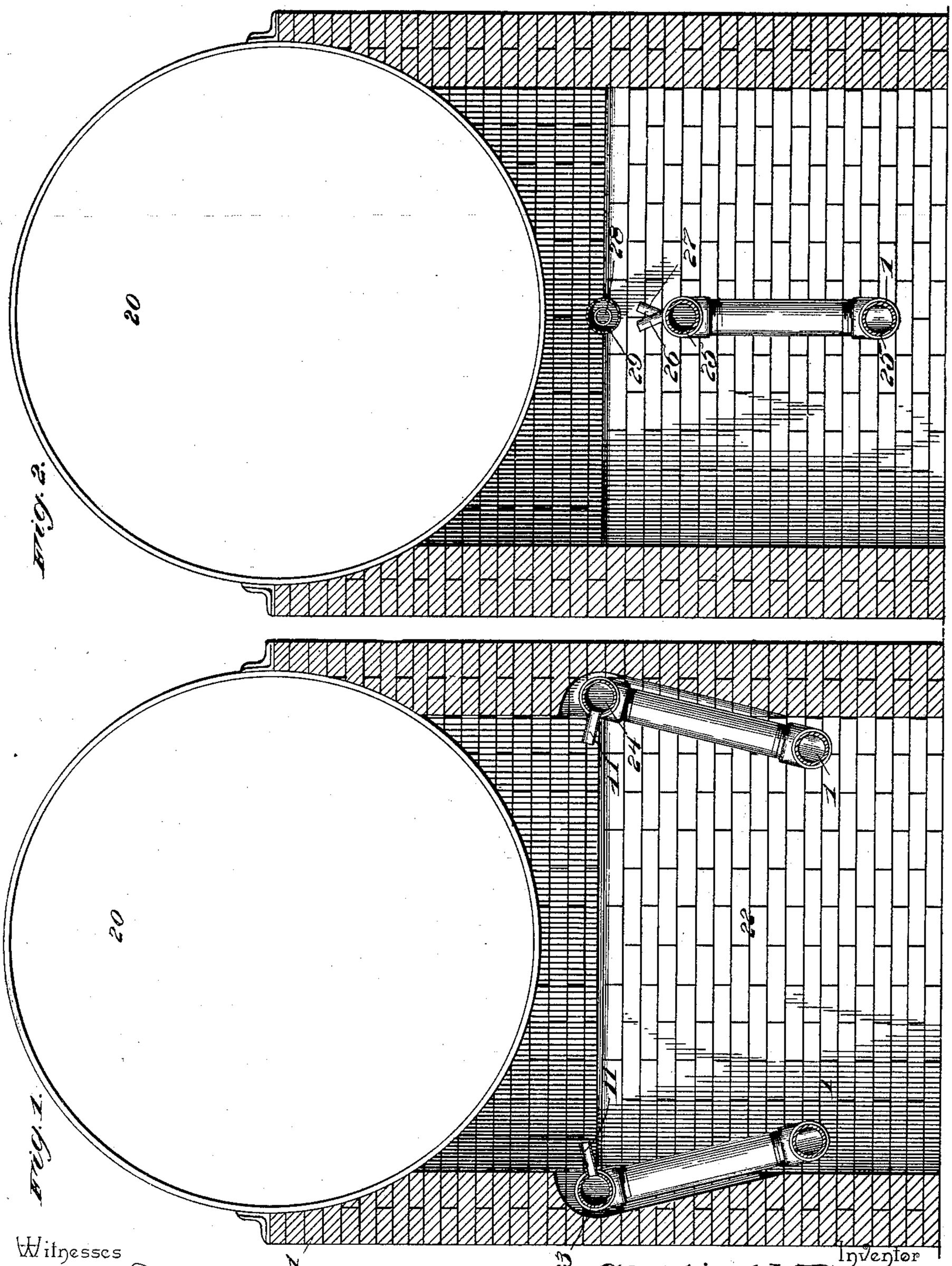

Fig. 2.

Fig. 1.

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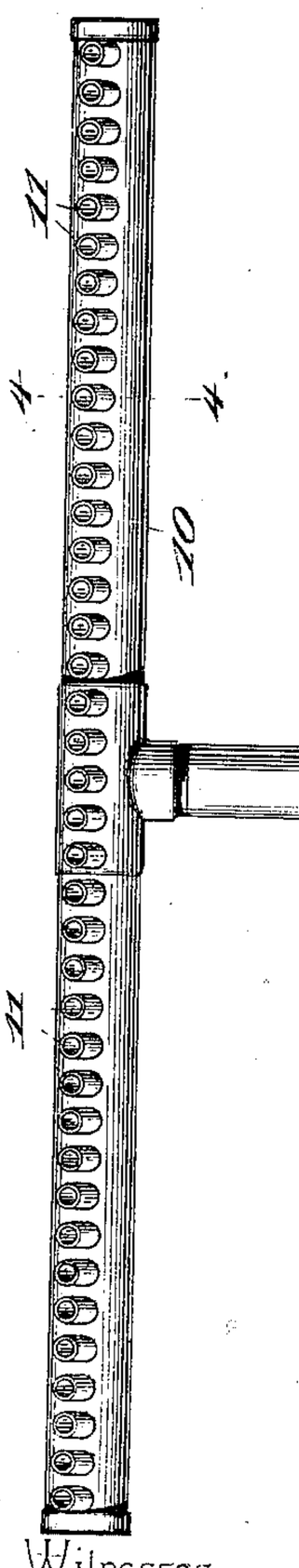

Fig. 4.

Fig. 3.

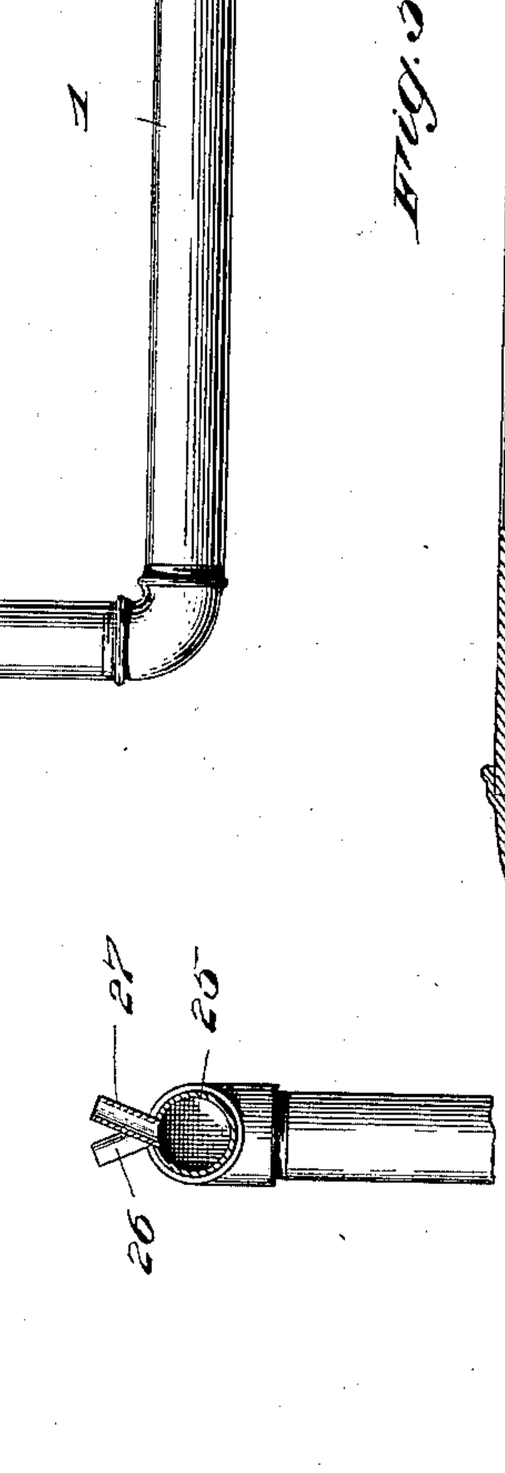

Fig. 1.

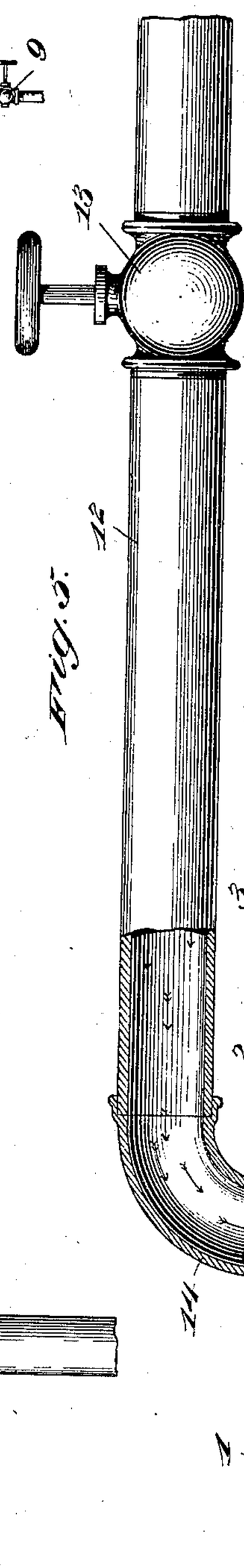

Fig. 5.

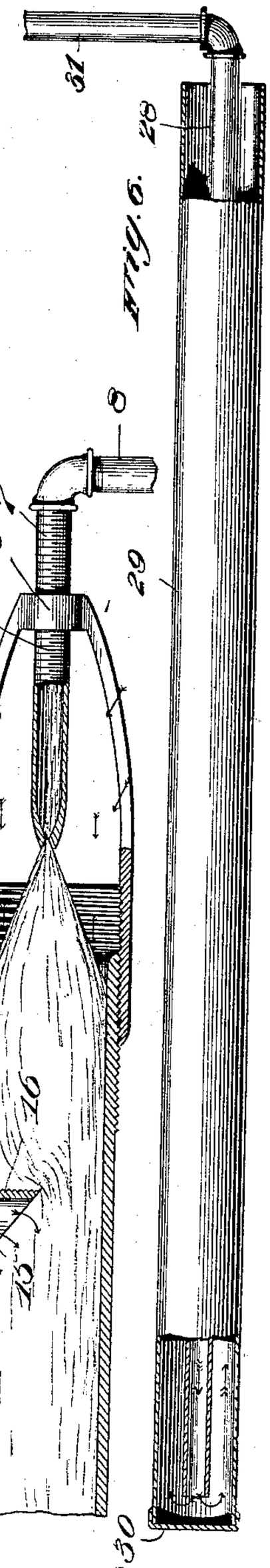

Fig. 6.

Fig. 2.

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UNITED STATES PATENT OFFICE.

CASSIUS M. GRAY, OF TITUSVILLE, PENNSYLVANIA.

HYDROCARBON-BURNER.

SPECIFICATION forming part of Letters Patent No. 628,659, dated July 11, 1899.

Application filed July 30, 1898. Serial No. 687,336. (No model.)

To all whom it may concern:

Be it known that I, CASSIUS M. GRAY, a citizen of the United States, residing at Titusville, in the county of Crawford and State of Pennsylvania, have invented a new and useful Hydrocarbon-Burner, of which the following is a specification.

My invention relates to hydrocarbon-burners for steam-boiler furnaces; and the prime object of the invention is to simplify the construction of the mixing appliance by which a current of steam and air may be commingled intimately with a low-pressure gas for the production of a gaseous fuel which will attain perfect combustion and generate a high degree of heat beneath a steam-boiler.

Another object of the present invention is to combine the several elements of the mixer, to the end that a low-pressure gas, not exceeding a pressure of from four to six ounces to the inch, may be mixed intimately with a high-pressure current of steam and air, and such admixture is attained without the high-pressure steam and air flowing into the low-pressure gas-supply and checking and retarding the flow of the low-pressure gas-current.

A further object of the invention is to provide an improved burner with means which will distribute the flame, so as to direct the latter against the under side of the boiler to good advantage, and also serve to create frictional resistance to the passage of the gas sufficient to check the flow of said gas and insure thorough admixture of the currents of steam, gas, and air before the fuel emerges from the distributing-nipples.

My improvements are susceptible of use in connection with high or low pressure steam-boilers. In using the burner with high-pressure boilers having a steam-pressure of one hundred pounds or over I employ two distributing-pipes adapted to have their sources of steam-supply connected directly with the boiler, so as to be supplied with high-pressure steam directly therefrom; but in adapting the burner to a low-pressure boiler having a steam-pressure at or about forty pounds to the inch I employ in connection with the burner a superheater by which a relatively dry current of steam may be supplied to the mixer.

To attain the objects of my invention I have devised the novel construction shown by the accompanying drawings and which will be specifically pointed out in the claims.

To enable others to understand the invention, it is illustrated in the accompanying draawings, forming a part of this specification, and in which—

Figure 1 is a sectional elevation of a high-pressure steam-boiler, showing my improved hydrocarbon-furnace adapted thereto. Fig. 2 is a sectional elevation of a low-pressure steam-boiler, illustrating the hydrocarbon-furnace installed with the superheater in the combustion-chamber. Fig. 3 is an elevation of the burner detached from the boiler-furnace. Fig. 4 is a detail cross-section through one style of the distributing-pipe shown in Fig. 1. Fig. 5 is an enlarged detail sectional view of the mixing-tube, the steam-jet, and the gas-pipe, showing the peculiar form of the gas-inlet nozzle constituting one of the improvements which I have made. Fig. 6 is a detail sectional view of the superheater. Fig. 7 is a cross-section through the style of injector-burner represented by Fig. 2.

Like numerals of reference denote like and corresponding parts in each of the several figures of the drawings.

1 designates the mixing-pipe of the burner, which has a vertical branch adapted for connection with a distributer-pipe which is equipped with nipples arranged to direct the flame against the under side of a steam-boiler. At its receiving end this mixing-pipe is externally threaded, as at 2, and an adjustable sleeve is internally threaded for the purpose of screwing the same to the threaded end 2 of the mixing-pipe. The adjustable sleeve 3 is constructed or provided with a yoke 4 in the form of an open frame adapted to admit air freely to the sleeve 3 and the end of the mixing-pipe. This yoke is provided at its outer extremity with an internally-threaded collar 5, which is arranged in line with the axis of the mixing-pipe 1, and said yoke is adapted to sustain the steam-jet pipe 6, which is externally threaded, as at 7, for the proper application of the collar 5 of the yoke 4 to the jet-pipe. This collar of the yoke supports the steam-jet in axial relation to the sleeve 3 and the mixing-pipe 1, so that the jet of

steam may be injected centrally into the mixing-pipe, but the jet-pipe does not extend into the sleeve 3, which is supported on the threaded end of the mixing-pipe. The extremity of the steam-jet pipe 6 terminates externally to the sleeve 3, and the steam under pressure is injected centrally through the sleeve into the mixing-pipe, so as to create a suction in the mixing-pipe sufficient to draw in the necessary volume of air to support combustion, the currents of steam and air being commingled somewhat before the admission of the gas-current to the mixing-tube. The sleeve 3 and its yoke 4 may be adjusted on the mixing-pipe and the steam-jet pipe by rotating said sleeve and yoke on their threaded connections with the two pipes for the purpose of varying the interval or space between the tapered extremity of the jet-pipe 6 and the open end of the sleeve 3, and this adjustment is advantageous because provision is made for regulating the volume of air which may be drawn by suction into the mixing-pipe along with the current of steam. Steam is supplied to the jet-pipe 6 from a boiler or other suitable source of supply by a steam-supply pipe 8, having a suitable cock or valve 9 to regulate the quantity of steam which may be supplied through the jet-pipe.

The vertical branch of the mixing-pipe 1 is attached by a suitable coupling to a distribution-pipe 10, which is arranged in a horizontal position within the combustion-chamber of a furnace and extends longitudinally beneath the boiler. This distribution-pipe is provided with a series of nipples 11, which are arranged in diagonal or inclined positions, so as to stand radially to the axis of the pipe and direct the flame against the under side of the boiler. I employ a comparatively large number of these radial nipples, which are of small diameter and extend a proper distance beyond the surface of the pipe 10, and these nipples serve not only to distribute the flame and apply it at intervals to the surface of the boiler, but they also offer considerable frictional resistance to the outflow of the gaseous fuel, and thereby check in a measure the escape of the fuel and exert a back pressure for the purpose of retaining the fuel in the mixing-pipe, to the end that the currents of steam, air, and gas will be intimately commingled and thoroughly combined to produce a highly-inflammable gaseous fuel.

It is now the common practice to employ a gas-current of low pressure not exceeding four to six ounces pressure, and while my apparatus is especially useful in connection with gas-currents of low pressure it may also be used to good advantage with high-pressure gas-currents. The gas in my apparatus is not admitted to the mixing-tube at the same point as the steam and air; but I have arranged and combined the gas-feeding devices to admit a current of gas into the mixing-tube at a point in front of the adjustable sleeve 3 and to insure a free inward flow to the gas-current without hindrance or check from the high-pressure current of commingled air and steam. The gas is conveyed by means of a pipe 12, having a cock or valve 13, to the gas-inlet nozzle 14, which is attached to the mixing-pipe 1 at a point about six inches, more or less, in front of the sleeve 3 and the steam-jet pipe 8. This gas-nozzle is of peculiar construction, and it is provided with a beveled end 15, which presents an imperforate convex face 16 to the current of air and steam. This convex face of the gas-nozzle forms a deflector or shield against which the high-pressure current of steam and air may impinge, so that the current of gas will flow freely into the mixing-pipe 1 in rear of the deflector formed by said face 16. The convexed contour of this imperforate deflector-face 16 gives a whirling motion to the high-pressure current of steam and air and causes such current to traverse around the gas-nozzle 14 and convey the current of gas with such high-pressure current, thereby insuring thorough admixture of the steam, air, and gas as the fuel traverses the mixing-pipe toward the distribution-pipe. I attach especial importance to the peculiar construction of the gas-nozzle arranged to present its convexed deflecting-face toward the opening or port by which the steam and air are admitted to said mixing-pipe, because such construction of the nozzle 14 provides for the free ingress of the gas-current, particularly if a low-pressure gas-current is utilized without permitting the high-pressure current to pass into the gas-pipe or retarding the inflowing gas-current from the gas-supply pipe.

In Fig. 1 of the drawings I have illustrated the improved hydrocarbon-burner applied in operative relation to a high-pressure steam-boiler, in which 20 indicates the boiler proper, 21 the boiler-setting, and 22 the combustion-chamber, all of said parts being ordinary in the art. In adapting the improved burner to a high-pressure boiler I employ a set of the distributing-pipes, which are disposed on opposite sides of the vertical center of the combustion-chamber 22, and these pipes are indicated at 23 24. The distribution-pipes are supplied with currents of gaseous fuel by mixing-pipes and the appliances heretofore described and said pipes 23 24 have their nipples 11 inclined in reverse directions with the nipples of each series at an angle to forty-five degrees to its pipe, whereby the jets of flame from the two series of nipples on the pipes 23 24 are directed against the central portion of the boiler on the under surface thereof. In using the burners with the combustion-chamber of a high-pressure steam-boiler it is not necessary to employ superheaters for the circulation of steam prior to conducting the steam to the jet pipes or nozzles 6, and hence the steam-pipes 8 may be connected directly with the jet-pipes or nozzles 6. If desired, however, superheaters such as indicated in

Figs. 2 and 6 may be employed for the reception of the steam prior to its admission through the nozzles or jet pipes 6.

In Fig. 2 of the drawings I have illustrated the improved burner in connection with a low-pressure boiler in which the boiler-setting and combustion-chamber are substantially similar to the construction shown by Fig. 1. In this type of boiler a single distributing-pipe is arranged centrally beneath the boiler, as indicated at 25 in Fig. 2, and said distributing-pipe has two series of nipples 26 27, (shown by Figs. 2 and 7,) which are inclined in opposite directions from the upper face of the pipe, so as to direct the gaseous fuel against the under surface of the boiler and insure uniform distribution of the heat on both sides of said boiler. In boilers having a steam-pressure of forty pounds or thereabout I find it desirable to employ a superheater for the purpose of raising the temperature of the steam and placing it in a comparatively dry condition for admixture to the best advantage with the currents of air and gas, and in Figs. 2 and 6 of the drawings one type or construction of the superheater which I may employ is illustrated. This superheater consists of an inner tube 28, which is arranged centrally within an outer tube 29, having one end thereof closed by a suitable head 30, and to the inner tube 28 is coupled the inlet-pipe 31, which is operatively connected with the steam-space of the boiler. The tube or pipe 8 for conveying the superheated dry current of steam to the nozzle or jet-pipe 6 is attached to the outer tube 29 at the end opposite to the head 30. The superheater is arranged within the combustion-chamber of the furnace above the distributing-pipe, as shown by Fig. 2, so that it is exposed to the heat within said chamber, and the current of steam from the boiler is caused to traverse the full length of the inner tube 28 before it is discharged into the outer tube and it flows in a reverse direction through the outer tube 29 prior to finding its exit from the superheater through the pipe 8, which leads to the nozzle or jet-pipe.

Changes may be made in the form of some of the parts, while their essential features are retained and the spirit of the invention embodied. Hence I do not desire to be limited to the precise form of all the parts as shown, reserving the right to vary therefrom.

Having thus described the invention, what I claim is—

1. The combination with a mixing-pipe, and a steam-jet nozzle, of a gas-inlet nozzle having a beveled mouth in front of an imperforate deflector-surface which is situated in the path of a jet injected by said steam-nozzle, whereby the deflector-surface of the gas-nozzle imparts a whirling action to the high-pressure current supplied by the steam-nozzle, and gas under low pressure is free to flow through the beveled mouth of the gas-nozzle, substantially as described.

2. The combination with a mixing pipe or tube and a steam-jet pipe or nozzle, of a gas-pipe and a gas-nozzle communicating with the gas-pipe, attached to the mixing-pipe at a point in rear of the jet-pipe or nozzle and provided with a beveled end and with a convex imperforate deflector-surface which is presented to the inflowing current of air and steam, whereby the current of air and steam may impinge against said deflector-surface and a low-pressure gas-current may flow from the nozzle without impediment from the high-pressure current of air and steam, substantially as described.

3. The combination with a mixing-pipe, and a low-pressure gas-pipe, of the gas-inlet nozzle provided with a convex deflector-surface and with a beveled mouth at one side of said deflector-surface, and said nozzle projecting into the mixing-pipe at a short distance from the open end thereof to present its deflector-surface toward said open end of the mixing-pipe, a steam-jet nozzle, and means for supporting said steam-jet nozzle in axial alinement with the mixing-pipe and in a position to discharge its jet against the convex face of the gas-nozzle, substantially as described, for the purpose set forth.

4. In a hydrocarbon-furnace, the combination with a chamber, of a distributing-pipe arranged centrally in said chamber and having two series of oppositely-inclined discharge-nipples, a mixing-tube connected centrally to said distributing-pipe and having a gas-inlet nozzle which is attached thereto at a point in front of its open receiving end, a superheater situated in the vertical plane of the distributing-pipe and between the diverging lines of the fuel ejected by the oppositely-inclined nipples of said pipe, and a steam-jet pipe or nozzle connected to the superheater and arranged to discharge superheated steam into the open end of the mixing-tube and in rear of the gas-inlet nozzle thereto, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

CASSIUS M. GRAY.

Witnesses:
W. T. Cox,
P. Burns.