(No Model.) 2 Sheets—Sheet 1.

J. H. BULLARD.

BURNER AND BURNER TANK FOR HYDROCARBON FUEL.

No. 407,639. Patented July 23, 1889.

Fig 3

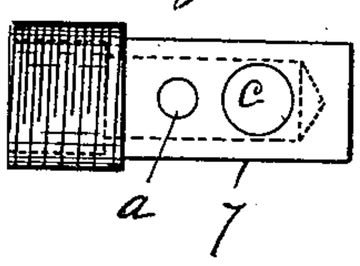
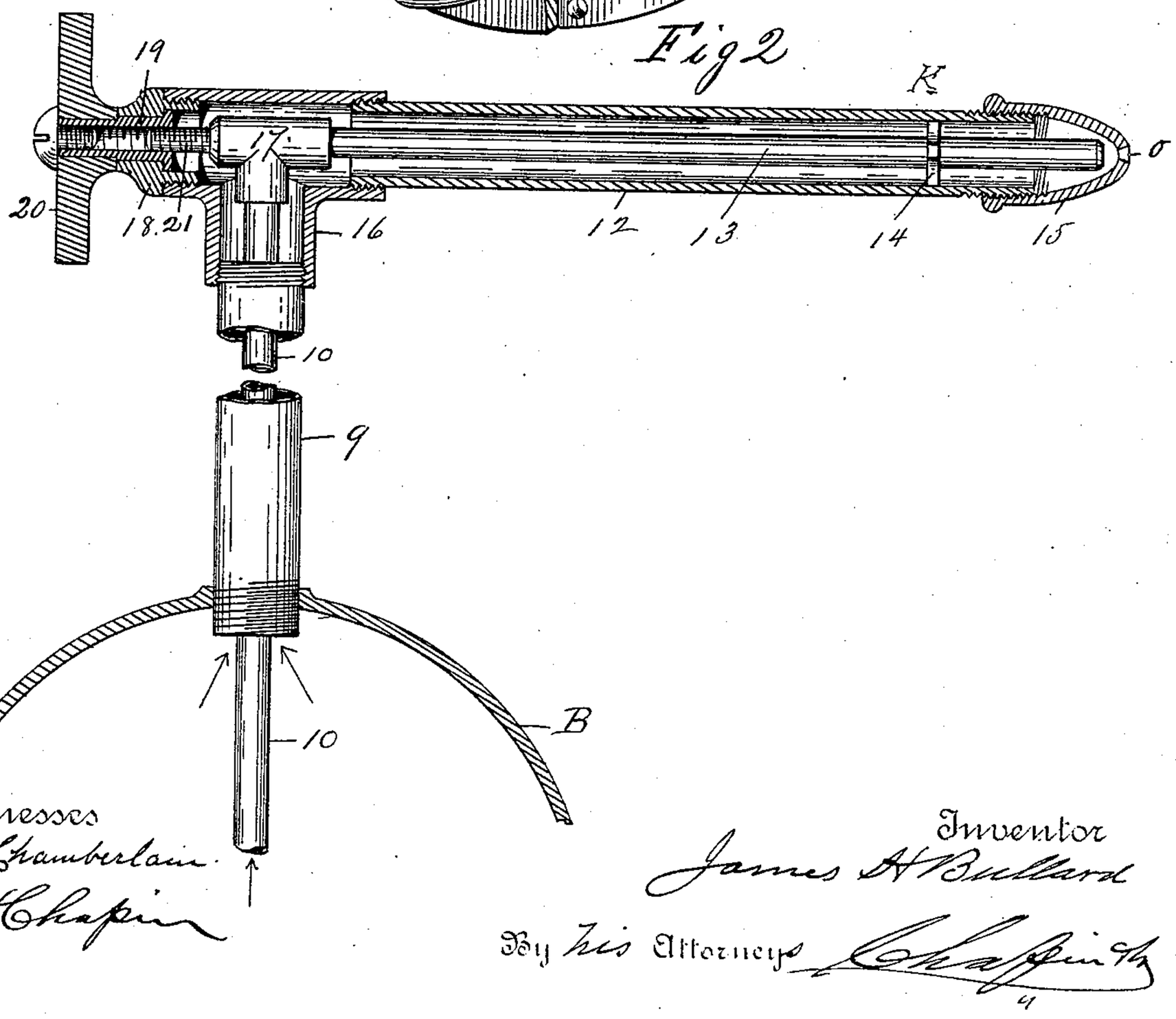


Fig 1

Fig 2



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(No Model.) 2 Sheets—Sheet 2.

J. H. BULLARD.

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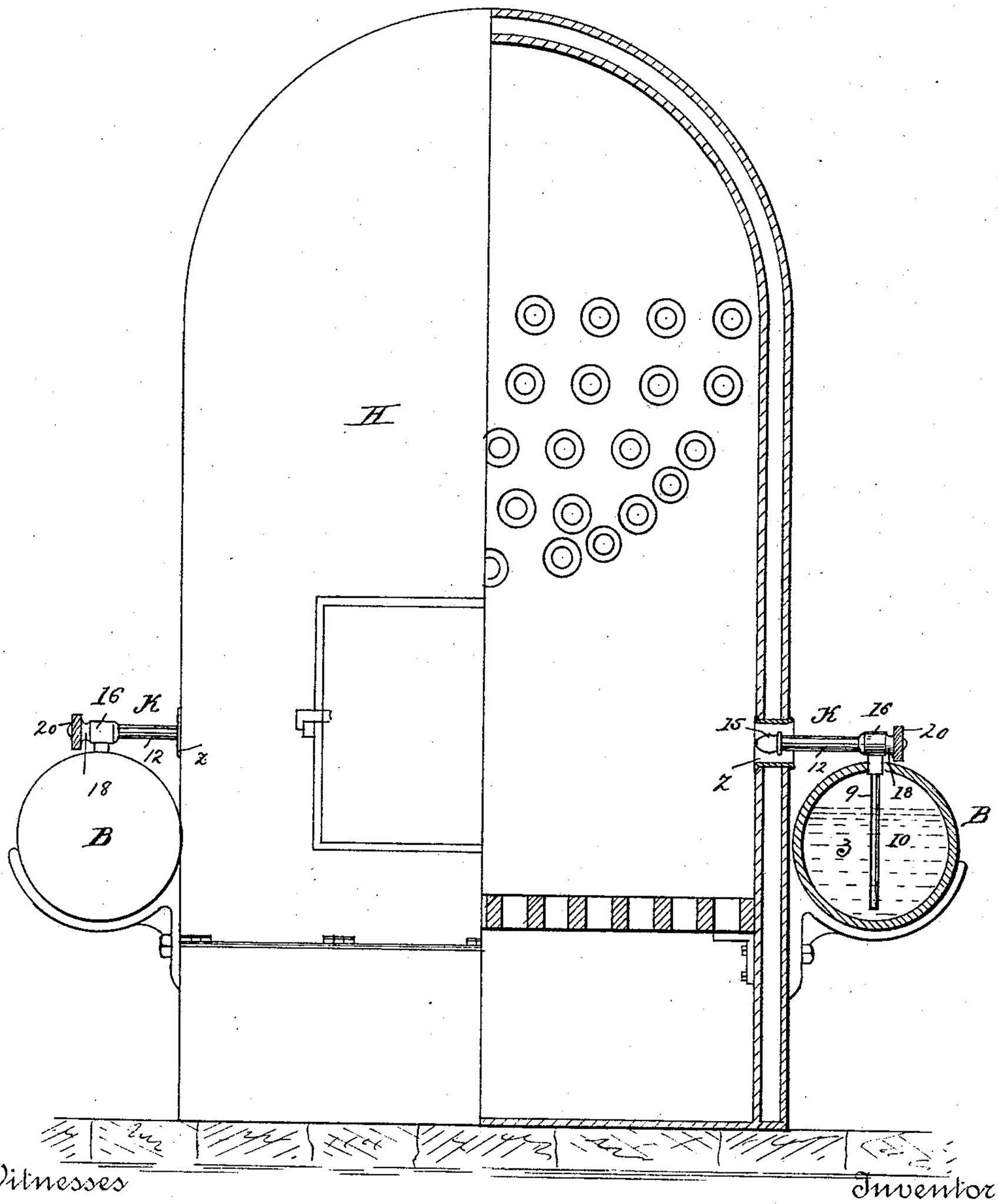
Fig. 4



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UNITED STATES PATENT OFFICE.

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BURNER AND BURNER-TANK FOR HYDROCARBON FUEL.

SPECIFICATION forming part of Letters Patent No. 407,639, dated July 23, 1889.

Application filed December 1, 1887. Serial No. 256,588. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. BULLARD, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Burners and Burner-Tanks for Hydrocarbon Fuels, of which the following is a specification.

This invention relates to the consumption of hydrocarbons for fuel purposes, and pertains to improvements in burners therefor, and means for the retention of a hydrocarbon and air under pressure in communication with said burners, whereby said hydrocarbon and air are injected together into a furnace; and the invention consists in the peculiar construction and arrangement of said devices, all as hereinafter fully described, and pointed out in the claims.

In the drawings forming part of this specification, Figure 1 is a perspective view of one end of a burner-tank for hydrocarbon fuels, having applied thereto my improvements for governing the supply of hydrocarbon to burners connected thereto, said figure showing a part of the side of the tank removed and a portion of the head thereof broken away. Fig. 2 is a side elevation, partly in section, of a hydrocarbon-burner constructed according to my invention, and a transverse section of a portion of the hydrocarbon fuel-tank of Fig. 1, said burner in this figure being shown connected to said tank in operative relation thereto. Fig. 3 is a side elevation of an oil-valve, through which the hydrocarbon is admitted to the burner-tank. Fig. 4 is a front elevation, partly in section, of the front end of a steam-boiler, showing the furnace of the latter and the above-mentioned burner-tanks (one of the latter being shown in section) and burners attached to said boiler.

In the drawings, B indicates a tank of cylindrical form, having a suitable head 2, secured on each end thereof, whereby it is adapted to receive and hold a certain quantity of petroleum or other hydrocarbon fuel. (Indicated in Fig. 1 by 3.) A pipe 6 serves to conduct said hydrocarbon from a suitable reservoir or pump to the tank B, and one end thereof is connected to a boss on the head 2 of the tank near the lower side of the latter, as shown in Fig. 1. The hydrocarbon conveyed to said tank B by the pipe 6 is admitted to the tank through the valve 7, Fig. 3, said valve having one end of cylindrical form and screw-threaded, and having a chamber therein formed by boring longitudinally from its screw-threaded end toward the opposite end thereof, as indicated by dotted lines in Fig. 3. The valve 7 has a transverse circular perforation *a*, through which a pin passes, which serves as a pivot-connection for a valve and ball lever, as below described, and said valve has also a larger circular transverse perforation *c*, communicating with said internal chamber, through which oil escapes from the latter into tank B. The said valve 7 is screwed into the same hole in the head 2 of the tank as that with which the supply-pipe 6 is connected, as shown, the screw-threaded end of the valve being thus brought into communication with the end of said supply-pipe, as shown, and its opposite end being allowed to project beyond the inner face of said head into the tank, as shown in dotted lines in Fig. 1.

A ball-float 4 of ordinary construction is fixed on the end of a lever 8, (indicated within the hydrocarbon in tank B by dotted lines,) and the opposite end of said lever is bifurcated, as shown, and is adapted to receive between its arms the perforated end of said valve 7, and is pivoted thereto by a pin passing through its arms and the perforation *a* of the valve, as shown in Fig. 1. The said arms of the lever 8, on opposite sides of the valve 7, cover the perforation *c* in the valve when there is an ample supply of hydrocarbon in the tank B, or when it rises about to the level indicated in Fig. 1, thereby preventing any further escape thereof from the pipe 6 through the said valve; but when the hydrocarbon within the tank is drawn or forced therefrom through the burner or burners, as below described, sufficiently to permit the ball 4 to swing downward, the arms of the lever 8 uncover, more or less, the perforation *c* in the valve 7, thereby admitting a further supply of hydrocarbon from the pipe 6, whereby the supply thereof in tank B is maintained so near a uniform level that a substantially uniform volume thereof is discharged through

the burner or burners connected with the tank under the action of a uniform air-pressure, as below described.

The above-described valve 7 and the valve and ball lever 8 constitute valve devices for the admission of hydrocarbon to the tank B, which are capable of operating substantially without friction, and therefore they constitute particularly efficient devices in connection with the ball 4 for automatically maintaining the requisite supply of hydrocarbon within the burner-tank.

The above-described burner-tank and hydrocarbon-supply-governing devices, together with the burner shown in Fig. 2, constitute essential elements of apparatus for burning hydrocarbons wherein air-pressure is employed for forcing the hydrocarbon through the burners, together with an adequate supply of atmospheric air whereby the hydrocarbon is atomized or reduced to a state of vapor, and so commingled with the said air-supply as to produce perfect combustion. To this end a pipe 5 is connected with the tank B, and communicates with that portion of the interior thereof above the level of the hydrocarbon 3, said pipe 5 serving to convey air under suitable pressure from any suitable well-known air-compressing mechanism, whereby a certain degree of air-pressure is maintained within that portion of the burner-tank not occupied by the hydrocarbon.

The hydrocarbon-burner K, illustrated in Fig. 2, consists of a vertical pipe 9, having one end screwed into the upper side of the burner-tank B, as shown in Fig. 4, and its opposite end screwed to one arm of a T-connection 16. A horizontal pipe 12 is screwed to another arm of said T-connection, and the said pipe 9 and pipe 12 constitute an air-conduit conveying air under pressure from the burner-tank to the end of said pipe 12, where the air is delivered through a perforation in the end of the nozzle 15, which is screwed on the end of said horizontal pipe, as shown. Within the said air-pipes 9 and 12 are placed the hydrocarbon conducting-pipes 10 and 13, united at their junction within the T-connection 16 by the T-connection 17. The said pipes 10 and 13 are of considerably smaller diameter than the said air-pipes of the burner 9 and 12, and therefore the air from the tank B passes freely through the latter-named pipes around the said hydrocarbon-conducting pipes 10 and 13. As shown in Fig. 2, the end of the pipe 13 projects slightly beyond the end of the inclosing-pipe 12 into the nozzle 15 and terminates opposite the said perforation in the end of the latter. To support the end of said pipe 13 in a central position within the pipe 12, a wheel 14 is fixed on the pipe 13, having a periphery of sprocket-wheel form or of star-shape, the points of which bear on the interior of the tube 12 and permit the pipe 13 to have a free longitudinal movement within pipe 12. The lower end of the internal tube 10 is shown broken off in Fig. 2, but in practice it extends nearly to the bottom of the burner-tank B, so as to be in constant communication with the hydrocarbon therein.

A hub 18 is screwed into one arm of the T-connection 16, and a sleeve 19 is fitted within said hub and is adapted to rotate freely therein, said sleeve being internally screw-threaded and receives within it the screw-threaded end of a stud 21, which is fixed in the said T-connection 17 in a line with the horizontal tube 13, which is connected thereto. A hand-wheel 20 is secured to the outer end of said sleeve 19 by a screw entering the latter, as shown.

In burners to be used in the consumption of hydrocarbon fuels under the conditions above set forth, it is of the first importance that they possess capabilities of such adjustment of air and fuel delivering parts as provides for the required proportions of air and hydrocarbons, whereby perfect combustion is produced, and to this end the said burner is constructed as above described, and its operation in connection with the burner-tank B supplied with hydrocarbon, as stated, and air-pressure within said tank is as follows:

The position of the end of the tube 13 within the nozzle 15, relative to the internal surface of said nozzle, determines the amount of air which can pass from within the pipe 12 between the end of said tube 13 and the adjoining inner wall of the nozzle 15 through the aperture *o* in the end of said nozzle, and said position of the end of the tube 13 also determines, by the varying air-pressure, as below described, the quantity of hydrocarbon which may be discharged under the action of said air-pressure within said nozzle, and therefore the said tube 13 is made adjustable horizontally within the pipe 12, whereby the end of the tube 13 is brought to varying distances from the said aperture *o* in the end of the nozzle 15, said horizontal adjustment being accomplished by turning the hand-wheel 20 and said sleeve 19, whereby the T-connection 17 is caused to move toward or from said hand-wheel, the tube 13 having a corresponding movement. The internal dimensions of the T-connection 16 and the pipe 9 are such as to permit the internal tube 10 and the T-connection 17 to freely move to the requisite extent when said hand-wheel is turned as aforesaid. The air-tube 9, as aforesaid, connects with the air-space of the burner-tank, and the air from the latter enters said tube, as indicated by the arrows in Fig. 2, the arrow at the lower end of the tube 10 in said figure indicating the direction of movement of the hydrocarbon within that tube simultaneously with the movement of the air into the tube 9.

Fig. 4 illustrates the application of said burners and burner-tanks to the furnace of a steam-boiler H; but the manner of applying them to other furnaces—such as those for forging purposes, brass annealing and melting furnaces, and others of similar character—is substantially the same.

Hydrocarbon-burners as heretofore made, embodying in their construction an outer air-pipe inclosing a smaller tube through which the hydrocarbon passes, are provided with a nozzle similar to that shown in Fig. 2, screwed onto the end of the air-pipe and covering the end of the inner pipe, substantially as shown in Fig. 2. In said construction the only means of adjusting the nozzle to the end of the said inner pipe for the purpose above described is to screw it on the end of the said outer pipe to move it toward or from the end of the inner tube. Said manner of adjustment is inconvenient and not practicable while the burner is in operative position in the side of a hydrocarbon burning boiler or furnace fitted with said burners, as shown in Fig. 4, for in practice the tank B is located at the side of a boiler, and the nozzle end of the burner extends nearly through a tube Z, set in the side of the fire-box, and hence the nozzle is not accessible for adjustment while the burner is in operation, and the burner must be disconnected and removed for that purpose. On the other hand, the within-described burner provides means for adjusting the supply of hydrocarbon through the tube 13 while the burner is in operation by turning the hand-wheel 20, the operator meanwhile watching the flame and so graduating the hydrocarbon supply as to produce a perfect combustion thereof, and consequently a clear, white, and smokeless flame. Furthermore, the said adjustable feature of the tube 13 longitudinally in the pipe 12 provides for drawing the end of said tube so far away from the end of the nozzle that the escape of hydrocarbon is entirely prevented by admitting a current of air into the nozzle in advance of the end of the tube 13 of so great a volume that it cannot all escape at the aperture *o*, and it "sets back," so to speak, with such force against the end of said tube as to prevent the escape of the hydrocarbon. This characteristic of the within-described burner enables the operator to extinguish the flame of any one of several burners which are attached to a boiler or furnace, and thereby to regulate the fire as may be desired.

What I claim as my invention is—

1. A hydrocarbon-burner consisting of an air and oil reservoir, an oil-pipe communicating therewith, a nozzle connected to one end of said pipe, an air-pipe communicating with the air-space in the reservoir and with the nozzle, said oil and air pipes being adjustable in the nozzle with reference to each other, and a pipe by which compressed air may be conveyed to the reservoir, whereby the air-pressure in the reservoir serves to force the oil as well as an air-jet to the nozzle, and whereby by the adjustment of the nozzle the relative force of the air and oil jets may be regulated, substantially as described.

2. A hydrocarbon-burner consisting of an air-pipe in two sections, as described, united by a T-connection 16, having a hub screwed thereto, said pipe having a nozzle thereon in which is a discharge-aperture, a hydrocarbon-conducting tube within said air-pipe, consisting likewise of two sections united by a T-connection 17, having a screw-stud thereon, one end of said tube terminating within said nozzle, a sleeve 19, having a screw-connection with said stud, and a hand-wheel connected with said sleeve, combined and operating substantially as set forth.

3. The combination of a reservoir, an oil-pipe leading thereto, and a float-valve controlling said pipe, an air-supply pipe leading to said reservoir, an oil-escape and an air-escape pipe leading from the reservoir to a nozzle, and a screw-thread for adjusting one of these pipes with reference to the nozzle, whereby the air-pressure is made to control the flow of air and of oil from the reservoir, and the nozzle is made to control the final mixing of the same, substantially as described.

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Witnesses:
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