June 10, 1958 C. BRAMMING 2,838,292

FUEL FEEDING APPARATUS FOR PRESSURE BURNERS

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FIG. 1

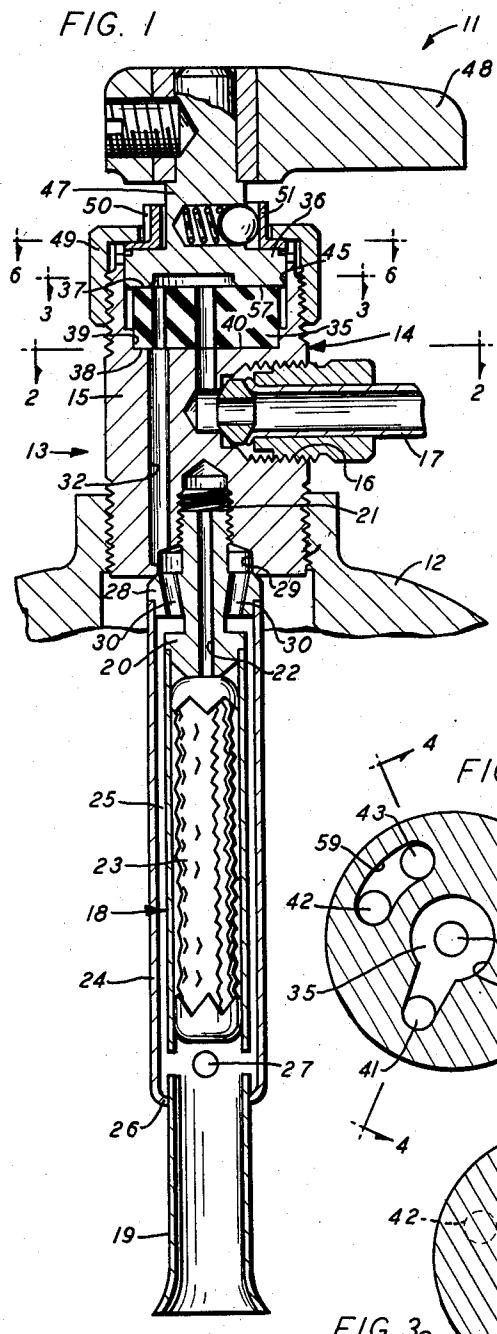
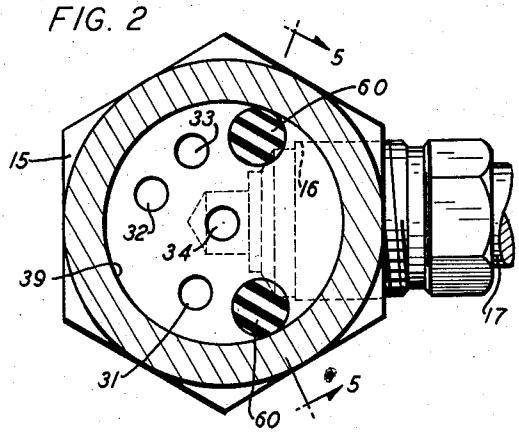


FIG. 2



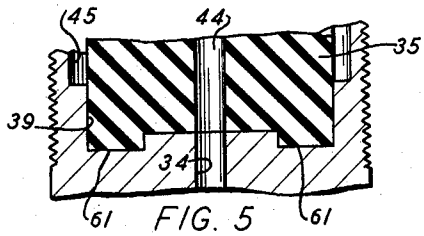


FIG. 5

FIG. 3a

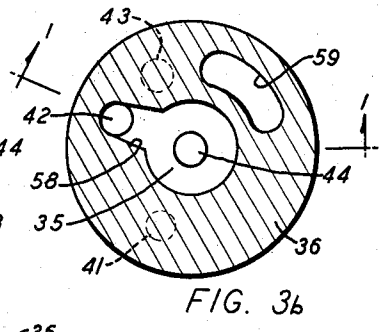


FIG. 3b

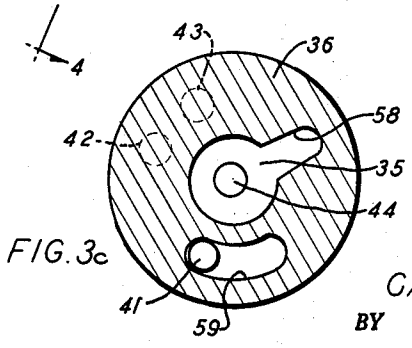


FIG. 3c

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FUEL FEEDING APPARATUS FOR PRESSURE BURNERS

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FIG. 4

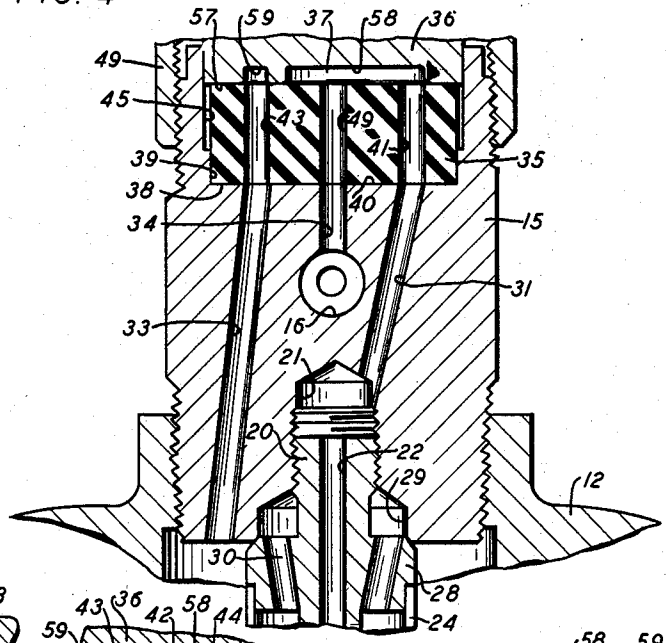
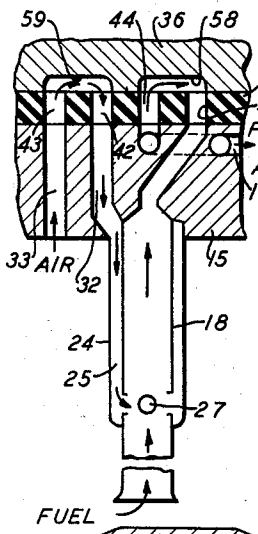


FIG. 7



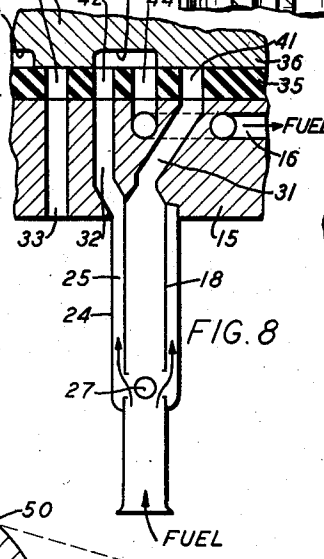


FIG. 8

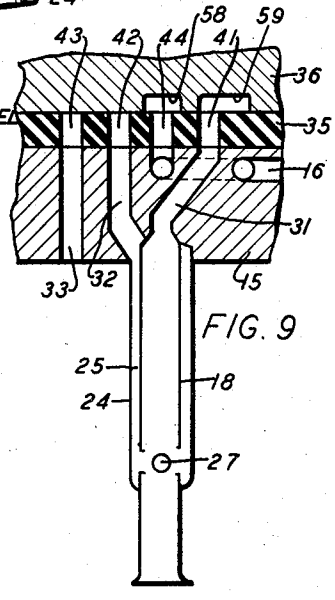


FIG. 9

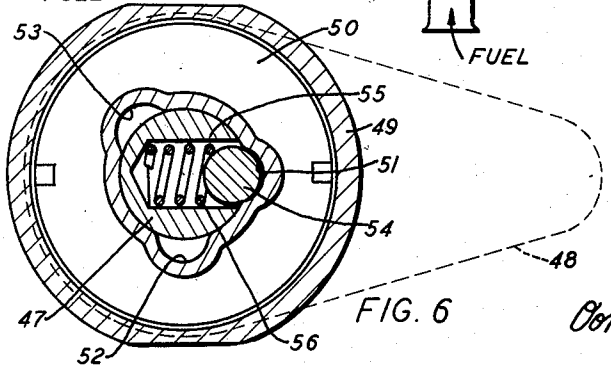


FIG. 6

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FUEL FEEDING APPARATUS FOR PRESSURE BURNERS

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Application November 30, 1954, Serial No. 472,059

13 Claims. (Cl. 261—19)

This invention relates to new and improved fuel feeding apparatus for pressure burners of the type adapted to use liquid hydrocarbon fuel such as gasoline or kerosene, for example.

One principal object of the invention is to provide a new and improved arrangement whereby the pressure burner may be started with a mixture of air and fuel and then may be operated with liquid fuel fed from the fuel tank.

A further object is to provide a fuel feeding arrangement of the foregoing character which is highly effective and dependable, yet is much simpler and less expensive than prior arrangements.

It is another object of the invention to provide a novel and improved control valve for use in pressure burners or the like.

Further objects and advantages of the invention will appear from the following description, taken with the accompanying drawings, in which:

Figure 1 is an elevational sectional view of fuel feeding apparatus constituting an illustrative embodiment of the invention, the view being taken generally along a line 1—1 in Fig. 3*b*;

Fig. 2 is an enlarged cross-sectional view taken generally along a line 2—2 in Fig. 1;

Figs. 3*a*, 3*b*, and 3*c* are somewhat diagrammatic fragmentary cross-sectional views taken generally along a line 3—3 in Fig. 1, the views showing the apparatus in starting, running, and shutoff positions, respectively;

Fig. 4 is an enlarged fragmentary elevational sectional view taken generally along a line 4—4 in Fig. 3*a*;

Fig. 5 is a fragmentary enlarged elevational view taken generally along a line 5—5 in Fig. 2;

Fig. 6 is an enlarged cross-sectional view taken generally along a line 6—6 in Fig. 1;

Figs. 7, 8, and 9 are diagrammatic elevational sectional views illustrating the operation of the exemplary apparatus in starting, running, and shutoff positions, respectively.

If the drawings are considered in greater detail, it will be seen that they illustrate, in fragmentary fashion, a pressure burner 11 having a fuel tank 12 adapted to hold gasoline, or other liquid hydrocarbon fuel, under pressure. The pressure may be provided, in the conventional manner, by means of a pump (not shown) adapted to supply compressed air to the upper end portion of the tank, above the body of liquid fuel. It will be understood that the burner 11 includes a suitable generator tube or other structure (not shown) adapted to heat and thereby vaporize liquid hydrocarbon fuel, together with a burner head (not shown) for burning the fuel vapor received from the generator.

In order to feed fuel from the tank 12 to the vapor generator, the burner 11 is provided with fuel feeding apparatus 13, including a fuel control valve 14 provided with a valve body 15. An outlet port 16 is formed in one side of the valve body 15 to receive an outlet fuel pipe or other conduit 17, which runs to the vapor generator (not shown).

Fuel is withdrawn from the tank 12 by means of a mixture tube 18 which is connected at its upper end to the valve body 15 and is arranged with an open-mouthed lower end portion 19 extending downwardly into the tank 12 for immersion in the body of liquid fuel. More specifically, the mixture tube 18 is connected to the valve body 15 by means of a hollow stem 20 having its lower end received in the upper end of the mixture tube. The upper end of the stem 20 is threaded into a bore 21 formed in the lower end of the valve body 15. An axial bore or passage 22 extends through the stem 20.

The mixture tube 18 is arranged to provide a mixture of air and atomized fuel for starting the burner, before the vapor generator has reached its operating temperature. To this end, the upper end portion of the mixture tube 18 is filled with loosely packed wick material 23 adapted to soak up liquid fuel from the tank 12. When air is directed upwardly through the wicking 23 in the upper portion of the tube 18, the air entrains and atomizes fuel so that a mixture of fuel and air will flow outwardly into the bore 21 in the valve body 15.

To afford communication between the valve body 15 and the lower end portion 19 of the mixture tube 18, the fuel feeding apparatus 13 includes a tube or conduit 24 which in this instance is in the form of a sleeve coaxially disposed around the mixture tube. The sleeve 24 is spaced outwardly from the mixture tube 18 to define an annular passage 25 between the sleeve and the tube. At its lower end, the sleeve 24 is closed by an inturned flange 26 soldered, welded, or otherwise secured to the mixture tube 18. Communication is afforded between the lower ends of the sleeve 24 and the mixture tube 18 by means of one or more ports 27 extending through the wall of the tube 18 adjacent the lower end of the sleeve 24. To connect the sleeve 24 to the valve body 15, and enlarged disk-like portion 28 is formed on the stem 20 and is received within the upper end of the sleeve 24. The enlarged portion 28 is seated in a counterbore 29 formed in the valve body 15 below the bore 21. One or more passages 30 extend through the enlarged portion 28 to connect the upper end of the sleeve 24 to the bore 29.

As shown in Figs. 1 and 4, generally longitudinal passages 31 and 32 are formed in the valve body 15 with their lower ends communicating with the bores 21 and 29, respectively. Thus, the passages 31 and 32 are in communication with the upper ends of the mixture tube 18 and the sleeve 24. In addition, the valve body 15 is formed with a generally longitudinal air passage 33 (Fig. 4) having its lower end opening into the upper end portion of the tank 12. An outlet passage 34 extends upwardly from the outlet port 16.

Provision is made for selectively controlling the communication between the various passages 31–34. To this end, the valve 14 is provided with a pair of relatively movable valve members 35 and 36, the latter of which is rotatable relative to the former, in this instance. It will be seen that the valve member 35 is in the form of a soft resilient rubber-like circular disk having flat upper and lower surfaces 37 and 38. A bore 39 is formed in the upper end of the valve body 15 to receive the resilient disk 35. Preferably, the resilient disk 35 is made of synthetic rubber or the like. A flat end surface 40 is formed in the bore 39 to abut against the lower end surface 38 of the resilient disk 35. The passages 31, 32, 33, and 34 in the valve body 15 communicate with the lower ends of respective vertical ports 41, 42, 43, and 44 (Fig. 3*a*) extending through the rubber-like disk 35.

As shown, the movable valve member 36 is disk-shaped in form and is rotatable in an enlarged counterbore 45 formed in the valve body above the bore 39,

A stem 46, extending upwardly from the valve member 36, is fitted with a manually rotatable handle or lever 48. The valve member 36 is retained in the bore 45 by means of a flanged collar 49 threaded over the upper end of the valve body 15. A flanged detent ring 50 is retained between the collar 49 and the valve member 36. It will be seen that the collar 49 holds the valve member 36 downwardly against the rubber-like member 35, with the result that compressive forces are exerted against the opposite end surfaces 37 and 38 of the rubber-like disk 35. Accordingly, the disk 35, in addition to functioning as a valve member, forms seals with the movable valve member 36 and the valve body 15.

To define starting, running, and shutoff positions of the movable valve member 36, the detent ring 50 is provided with angularly spaced detent recesses 51, 52, and 53. A movable detent member 54 is provided in the form of a ball disposed in a generally diametrical recess 55 formed in the stem 47. A spring 56 is disposed between the ball 54 and the closed end of the recess 55 to bias the ball outwardly.

It will be seen that the rotatable valve member 36 is formed with a flat lower surface 57 which engages the top surface 37 of the rubber-like disk 35. In order to control communication among the various ports 41–44, recesses 58 and 59 (Fig. 3*a*) are provided in the lower surface 57 on the movable valve member 36. In the illustrated construction, the recess 58 is radially disposed and hence is adapted to communicate continuously with the outlet port 44, which is axially disposed in the rubber-like disk 35. It will be seen that the ports 41, 42, and 43 are angularly spaced from each other and are spaced outwardly from the axial outlet port 44. Accordingly, the radial recess 58 is movable into registration with the ports 41 and 42. Such registration occurs in the starting and running positions of the valve member 36, respectively, as indicated in Figs. 3*a* and 3*b*. In the shutoff position, illustrated in Fig. 3*c*, the radial recess 58 is out of communication with all of the ports 41–43, with the result that the outlet port 44 is shut off from any communication with the tank 12.

As shown, the second recess 59 is arcuate and is disposed with its center of curvature coinciding with the axis of the rotatable valve member 36. In the starting position (Fig. 3*a*), the recess 59 bridges the ports 42 and 43 and hence provides communication between the upper end of the tank 12 and the upper end of the sleeve 24. Accordingly, air flows from the tank 12 into the sleeve 24 and thence through the ports 27 into the mixture tube 18. The air passes upwardly through the wicking 23 in the upper end of the mixture tube, with the result that a mixture of fuel and air passes through the port 41 and the radial recess 58 into the outlet port 44, and thence to the outlet pipe 17 leading to the vapor generator.

In the running position of the valve, as indicated in Fig. 3*b*, the recess 59 is out of communication with all of the ports 41–43. In the shutoff position, as shown in Fig. 3*c*, the recess 59 communicates only with the port 41, but this has no effect since there is no communication between any pair of the ports 41–44.

To prevent rotation of the rubber-like disk 35 when the valve member 36 is operated, one or more projections 60 are formed on the lower side of the disk 35 and are received in corresponding recesses 61 (Fig. 5) which are provided in the valve body 15. Two such projections 60 are utilized in the illustrated construction.

While the operation of the exemplary fuel feeding apparatus 13 will be clear from the foregoing description, it may be helpful to offer a brief résumé. When the pressure burner is to be lighted, the pressure pump (not shown) is operated to build up air pressure in the upper portion of the tank 12 above the body of liquid fuel. Then the handle 48 is rotated to move the valve member 36 to the starting position, as shown in Figs. 3*a*, 4, and 7. With the valve in this position, air passes upwardly from the tank through the air passage 33 into the port 43 and thence through the arcuate recess 59 into the port 42. The air then passes downwardly through the passage 32 into the upper end of the sleeve 24. After being conveyed downwardly through the annular passage 25 between the sleeve 24 and the mixture tube 18, the air enters the tube 18 through the ports 27 and passes upwardly through the wick material 23. Accordingly, fuel is mixed with the air and the mixture passes upwardly through the passages 22 and 31 to the port 41, and thence through the radial recess 58 and the port 44 into the outlet passage 34 and the outlet pipe 17. Accordingly, the mixture of fuel and air is carried to the burner so as to facilitate ignition of the burner.

Once the vapor generator of the burner has been heated to its normal operating temperature, it is desirable to supply liquid fuel to the burner, rather than a mixture of fuel and air. Accordingly, the handle 48 is rotated to move the valve member 36 to the running position, as shown in Figs. 1, 3*b*, and 8. In this position of the valve, liquid fuel passes upwardly through the lower end portion 19 of the mixture tube 18 and through the ports 27 into the sleeve 24. The upward movement of the liquid fuel is impelled by the air pressure in the tank. After passing through the annular passage 25 between the sleeve 24 and the mixture tube 18, the liquid fuel rises through the passages 30 and 32 and then is conveyed through the port 42 and the radial recess 58 into the outlet port 44 and the outlet pipe 17.

When it is desired to extinguish the burner, the handle 48 is rotated to move the valve member 36 into the shutoff position as shown in Figs. 3*c* and 9. In this position, one of the ports 41–44 is in communication with any other port. Accordingly, all communication between the tank 12 and the outlet pipe 17 is cut off, with the result that the burner is positively extinguished.

It will now be understood that the sleeve 24 serves the dual function of an air conduit during the starting phase and a liquid fuel conduit during the running phase of the burner. In this way the construction of the fuel feeding apparatus is greatly simplified.

Because of the resilience of the rubber-like disk 35, pressure is maintained between the faces 37 and 38 of the disk in the engaging components, consisting of the valve member 36 and the surface 40 of the valve body. Accordingly, the rubber-like disk 35 serves as both a valving member and a sealing member.

Because of the provision of the detent elements 53 and 54, the starting, running, and shutoff positions of the handle 48 and valve member 36 are definitely and positively defined. Accordingly, the valve 14 is positive and dependable in operation. It will be apparent that the fuel feeding arrangement is low in cost, yet effective in operation.

Various modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention as exemplified in the foregoing description and defined in the following claims.

I claim:

1. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank adapted to hold fuel and air under pressure, a mixture tube extending downwardly into said tank and having means in the upper portion thereof for mixing fuel and air, a sleeve around said tube and having a closed lower end, said tube having a port formed therethrough and communicating with the lower end of said sleeve, a fuel control valve having a soft resilient rubber-like valve member with an outlet port therein, a first, second, and third valve ports in said resilient valve member and communicating with said tube, said sleeve and said tank, respectively, a movable valve member engaging said resilient member and having recess means therein, said valve member being movable

to a first position with said recess means connecting said outlet port to said first port while interconnecting said second and third ports, to a second position with said recess means connecting said outlet port to said second port, and to a third position with said movable member cutting off said outlet port.

2. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a mixture tube having an open lower end extending into said tank for immersion in the fuel, said tube having means in the upper portion thereof for mixing fuel with air moving upwardly therethrough, a second tube extending into said tank and having a closed lower end, means establishing communication between the lower ends of said tubes, three-position valve means having an outlet conduit, said valve means having an air conduit connected to the upper end portion of said tank, said valve means including an operating member movable to a starting position for connecting said air conduit to the upper end of said second tube while connecting the upper end of said mixture tube to said outlet conduit to deliver a mixture of air and fuel thereto, said operating member being movable to a running position for connecting said second tube to said outlet conduit to supply liquid fuel thereto, said operating member being movable to a shutoff position for cutting off all communication to said outlet conduit.

3. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a mixture tube having an open lower end extending into said tank for immersion in the fuel, said tube having means in the upper portion thereof for mixing fuel with air moving upwardly therethrough, a second tube extending into said tank and having a closed lower end, means establishing communication between the lower ends of said tubes, valve means having an outlet conduit, said valve means having an air conduit connected to the upper end portion of said tank, said valve means including operating means movable to a starting position for connecting said air conduit to the upper end of said second tube while connecting the upper end of said mixture tube to said outlet conduit to deliver a mixture of air and fuel thereto, said operating means being movable to a running position for connecting said second tube to said outlet conduit to supply liquid fuel thereto, said operating means being movable to a shutoff position for cutting off all communication to said outlet conduit.

4. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a mixture tube having an open lower end extending into said tank immersion in the fuel, said tube having means in the upper portion thereof for mixing fuel with air moving upwardly therethrough, a second tube coaxially disposed around said mixture tube and extending into said tank, said second tube having a closed lower end, a port in said mixture tube establishing communication between the lower ends of said tubes, three-position valve means having an outlet conduit, said valve means having an air conduit connected to the upper end portion of said tank, said valve means including an operating member movable to a starting position for connecting said air conduit to the upper end of said second tube while connecting the upper end of said mixture tube to said outlet conduit to deliver a mixture of air and fuel thereto, said operating member being movable to a running position for connecting said second tube to said outlet conduit to supply liquid fuel thereto, said operating member being movable to a shutoff position for cutting off all communication to said outlet conduit.

5. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a mixture tube having an open lower end extending into said tank for immersion in the fuel,

said tube having means in the upper portion thereof for mixing fuel with air moving upwardly therethrough, a second tube extending into said tank in coaxial relation to said mixture tube and having a closed lower end, means establishing communication between the lower ends of said tubes, valve means having an outlet conduit, said valve means having an air conduit connected to the upper end portion of said tank, said valve means including operating means movable to a starting position for connecting said air conduit to the upper end of said second tube while connecting the upper end of said mixture tube to said outlet conduit to deliver a mixture of air and fuel thereto, said operating means being movable to a running position for connecting said second tube to said outlet conduit to supply liquid fuel thereto, said operating means being movable to a shutoff position for cutting off all communication to said outlet conduit.

6. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a mixture tube having an open lower end extending into said tank for immersion in the fuel, said tube having means in the upper portion thereof for mixing fuel with air moving upwardly therethrough, a second tube extending into said tank and having a closed lower end, means establishing communication between the lower ends of said tubes, means defining an outlet conduit, means defining an air conduit connected to the upper end portion of said tank, first valve means operable to starting and running settings for selectively connecting said outlet conduit to the upper end of said mixture tube in said starting setting and to the upper end of said second tube in said running setting, second valve means for selectively connecting said air conduit to the upper end of said second tube with said first valve means in said starting setting, and third valve means for shutting off said outlet conduit.

7. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a mixture tube having an open lower end extending into said tank for immersion in the fuel, said tube having means in the upper portion thereof for mixing fuel with air moving upwardly therethrough, a second tube extending into said tank and having a closed lower end, means establishing communication between the lower ends of said tubes, means defining an outlet conduit, first valve means for selectively connecting said outlet conduit to the upper end of said mixture tube, second valve means for selectively connecting the upper end of said second tube to the upper end of said tank, and third valve means for selectively connecting said outlet conduit to the upper end of said second tube.

8. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a mixture tube having an open lower end extending into said tank for immersion in the fuel, said tube having means in the upper portion thereof for mixing fuel with air moving upwardly therethrough, a second tube coaxially disposed around said mixture tube and extending into said tank, said second tube having a closed lower end, means establishing communication between the lower ends of said tubes, means defining an outlet conduit, means defining an air conduit connected to the upper end portion of said tank, first valve means operable to starting and running settings for selectively connecting said outlet conduit to the upper end of said mixture tube in said starting setting and to the upper end of said second tube in said running setting, second valve means for selectively connecting said air conduit to the upper end of said second tube with said first valve means in said starting setting, and third valve means for shutting off said outlet conduit.

9. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a mixture tube having an open lower end extending into said tank for immersion in the fuel,

said tube having means in the upper portion thereof for mixing fuel with air moving upwardly therethrough, a second tube coaxial with said mixture tube and extending into said tank, said second tube having a closed lower end, means establishing communication between the lower ends of said tubes, means defining an outlet conduit, means defining an air conduit connected to the upper end portion of said tank, first valve means operable to starting and running settings for selectively connecting said outlet conduit to the upper end of said mixture tube in said starting setting and to the upper end of said second tube in said running setting, second valve means for selectively connecting said air conduit to the upper end of said second tube with said first valve means in said starting setting, and third valve means for shutting off said outlet conduit.

10. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a fuel control valve having a valve body mounted on said tank, a tube for mixing fuel and air, said tube having its upper end connected to said valve body and having an open lower end extending downwardly into said tank for immersion in the fuel, a sleeve disposed around said tube, said sleeve having the upper end thereof connected to said valve body and having a closed lower end, said tube having a port therethrough establishing communication between the lower ends of said tube and said sleeve, said valve body having an outlet passage therein, a valve member movable in said valve body between starting, running, and shutoff positions, first, second, and third passages in said valve body extending between said valve member and said tube, said sleeve, and said tank, respectively, said valve member including first means operative in said starting position to connect said outlet passage to said first passage and thereby to convey a mixture of fuel and air therebetween, said valve member having second means operative in said starting position to interconnect said second and third passages and thereby convey air from said tank to said sleeve, one of said first and second means being operative in said running position to connect said second passage to said outlet passage and thereby convey liquid fuel from the upper end of said sleeve to said outlet passage, said movable valve member cutting off said outlet passage in said shutoff position.

11. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank for holding fuel and air under pressure, a fuel control valve having a valve body mounted on said tank, a mixture tube having its upper end connected to said valve body and having an open lower end extending downwardly into said tank for immersion in the fuel, said tube having means in its upper end for forming a mixture of fuel and air in response to the upward passage of air through said tube, a sleeve disposed around said tube, said sleeve having the upper end thereof connected to said valve body and having the lower end of said sleeve connected to said tube in sealing relation thereto, said tube having a port therethrough establishing communication between the lower ends of said tube and said sleeve, said valve body having an outlet passage therein, a valve member movable in said valve body between starting, running, and shutoff positions, first, second, and third passages in said valve body extending between said valve member and the upper end of said tube, the upper end of said sleeve, and said tank, respectively, said valve member including first means operative in said starting position to connect said outlet passage to said first passage and thereby to convey a mixture of fuel and air therebetween, said valve member having second means operative in said starting position to interconnect said second and third passages and thereby convey air from said tank to the upper end of said sleeve, one of said first and second means being operative in said running position to connect said second passage to said outlet passage and thereby convey liquid fuel from the upper end of said sleeve to said outlet passage, said movable valve member being effective in said shutoff position to cut off said outlet passage.

12. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank adapted to hold fuel and air under pressure, a mixture tube having an open lower end extending downwardly into said tank for immersion in the fuel, said tube having means in the upper portion thereof for mixing fuel and air, a sleeve around said tube and defining an annular passage therebetween, means closing the lower end of said sleeve, said tube having a port formed therethrough and opening into the lower end of said sleeve, a fuel control valve having a valve body mounted on said tank, said tube and said sleeve having their upper ends mounted on the lower end of said valve body, said valve body having an opening therein, a soft resilient rubber-like valve member seated in said opening and having an outlet port and first, second, and third valve ports extending therethrough, passages in said valve body connecting said first, second, and third ports to the upper end of said mixture tube, the upper end of said sleeve, and the upper end of said tank, respectively, a movable valve element having a surface in slidable sealing engagement with said resilient member, said movable element having a plurality of recesses formed in said lower surface, said movable element being movable to a first position with one of said recesses connecting said first port to said outlet port and thereby conveying a mixture of fuel and air to said outlet passage and with the other of said recesses connecting said second and third ports and thereby conveying air from said tank to the upper end of said sleeve, said movable element being movable to a second position with one of said recesses connecting said second port to said outlet port and thereby conveying liquid fuel from said sleeve to said outlet port, said movable element being movable to a third position with said element shutting off said ports.

13. In a pressure burner for liquid hydrocarbon fuel, the combination comprising a tank adapted to hold fuel and air under pressure, a mixture tube having an open lower end extending downwardly into said tank for immersion in the fuel, said tube having wicking loosely packed therein, a sleeve around said tube to define an annular passage therebetween, said sleeve having an inturned flange at its lower end connected to said tube in sealing relation thereto for closing the lower end of said annular passage, said tube having a port formed therethrough adjacent the lower end of said sleeve to connect the lower end of said annular passage with the interior of said tube, a fuel control valve having a valve body mounted on said tank adjacent the upper end thereof, said tube and said sleeve having their upper ends mounted on the lower end of said valve body, said valve body having an upwardly opening valve bore therein, a soft resilient rubber-like disk-shaped valve member seated in said bore and having an axial outlet port extending therethrough, said member having a flat upper face, first, second, and third valve ports extending through said resilient valve member in spaced parallel relation to said axial port, said valve body having a fuel outlet passage therein communicating with the lower end of said axial port, said valve body having a first passage therein communicating with the lower end of said first port and extending to the upper end of said mixture tube, said valve body having a second passage therein communicating with the lower end of said second port and extending to the upper end of said sleeve, said valve body having a third passage therein communicating with the lower end of said third port and extending into communication with the upper end of said tank, a rotatable disk-shaped valve element having a lower surface in slidable sealing engagement with the upper face of said resilient member, said rotatable element having a radial

recess and an arcuate recess formed in said lower surface, a member on said valve body retaining said rotatable element against said resilient member in compressive relation thereto, a handle for manually rotating said rotatable element, detent means defining first, second, and third angular positions of said rotatable element, said radial recess in said first position being adapted to connect said first port to said axial port and thereby deliver a mixture of fuel and air to said outlet passage, said arcuate recess in said first position being adapted to interconnect said second and third ports and thereby convey air from said tank to the upper end of said sleeve, said radial recess in said second position being adapted to connect said second port to said axial port and thereby deliver liquid fuel from the upper end of said sleeve to said outlet passage, said arcuate recess in said second and third positions being out of communication with said second and third ports, said axial recess in said third position being out of communication with said first, second, and third ports and thereby shutting off said outlet passage.

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