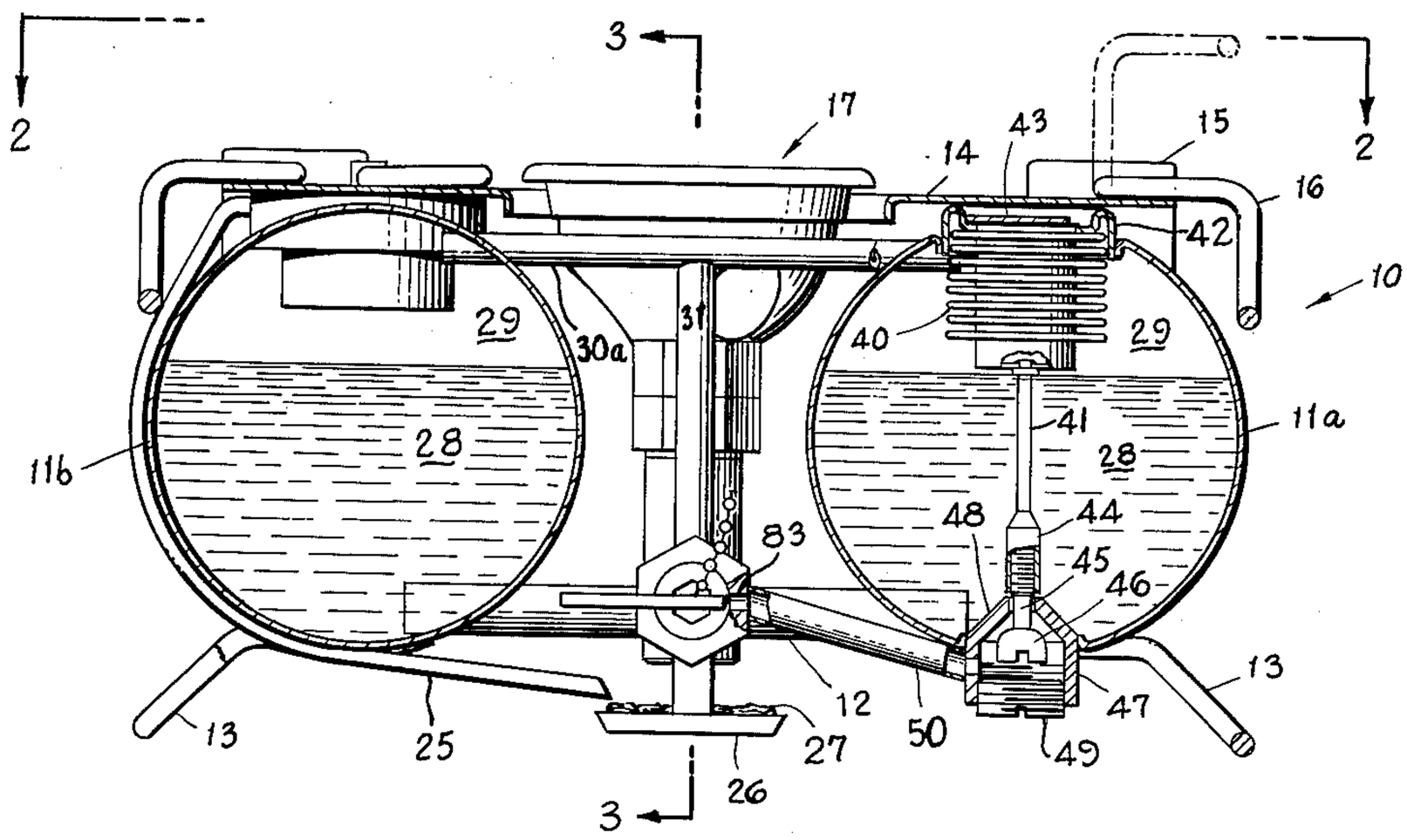
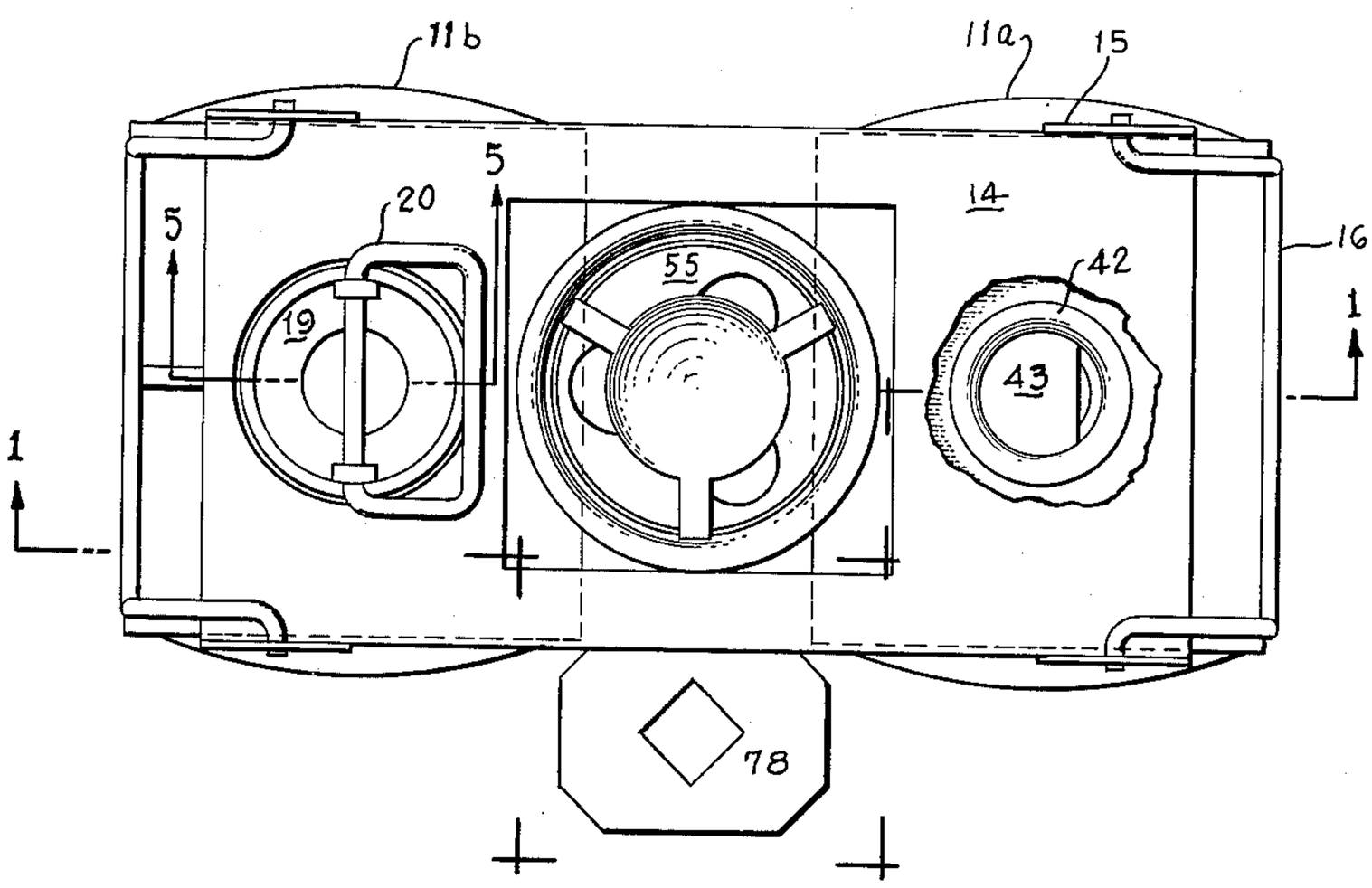
Aug. 27, 1963 I. N. VANT 3,101,770

SELF PRESSURIZING LIQUID FUEL BURNING APPARATUS

Filed June 22, 1959 2 Sheets-Sheet 1



Fig—1



Fig—2

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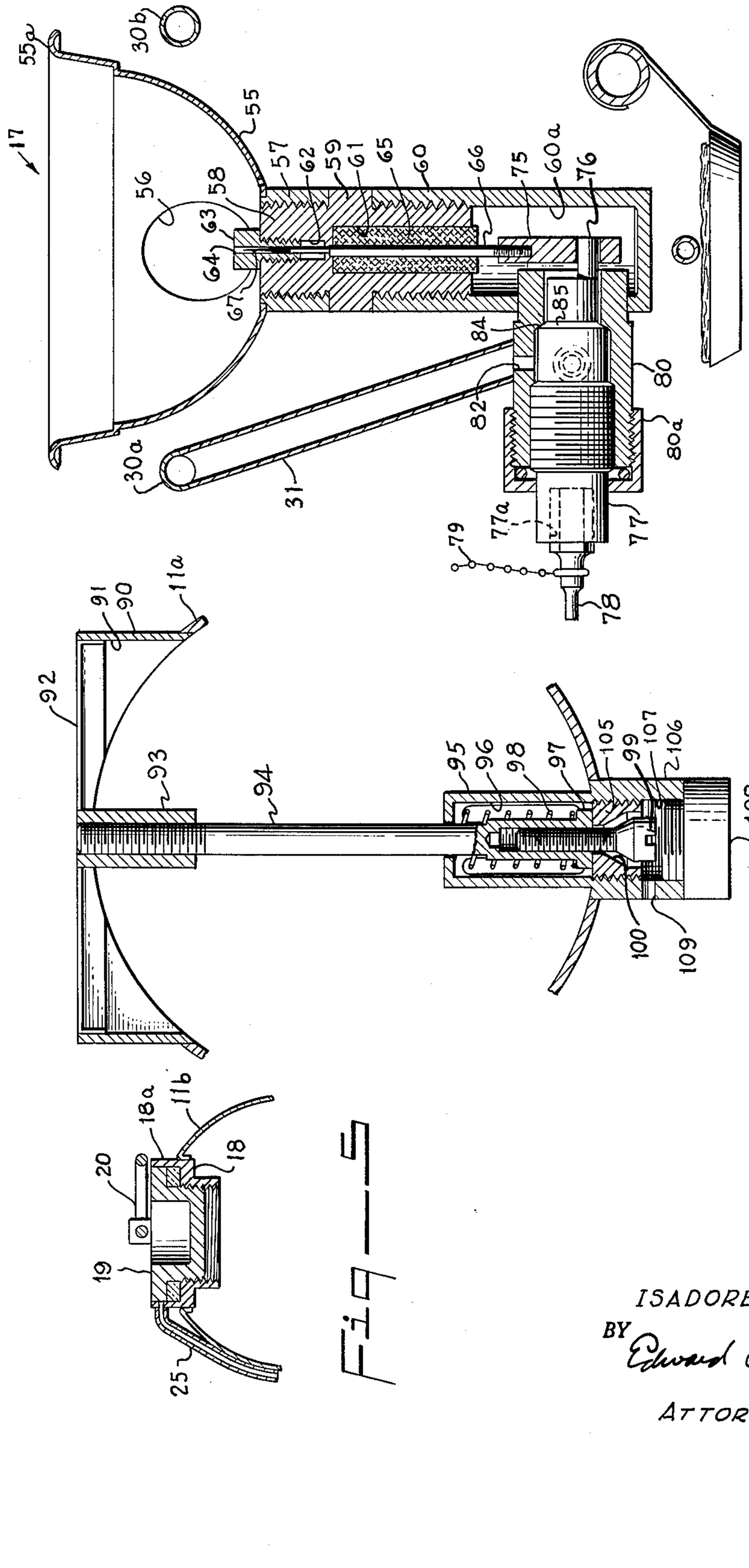

Fig—3

Fig—4

Fig—5

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SELF PRESSURIZING LIQUID FUEL BURNING APPARATUS

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16 Claims. (Cl. 158—32)

This invention relates to a gasoline stove. More particularly it relates to a small stove adapted for use out of doors, on camping trips, in the military service and the like; which is small, compact and light, therefore, easily carried about; which carries an adequate supply of fuel; and which is self-pressurizing and self-regulating.

This application is a continuation-in-part of my copending patent application Serial No. 806,648, filed April 15, 1959, now Patent No. 3,057,399, entitled "Self-Pressurizing Gasoline Stove."

It is an object of the present invention to provide an improved gasoline stove which is self-pressurizing and self-regulating.

It is a further object of the invention to provide a gasoline stove of self-pressurizing, self-regulating variety which is small and compact, efficient in use, etc.

The above and other objects of the invention will be apparent from the ensuing description and the appended claims.

Certain forms of my invention are shown by way of example in the accompanying drawings, in which:

FIGURE 1 is a view partly in vertical longitudinal section and partly in side elevation of the stove of my present invention. The view is shown with the end covers of the fuel tank removed to reveal certain interior elements more clearly.

FIGURE 2 is a top plan view of the stove of FIGURE 1, with a portion broken away to reveal certain concealed elements of construction.

FIGURE 3 is a section taken along the line 3—3 of FIGURE 1, but on a larger scale than that of FIGURE 1, showing in detail the construction of the burner assembly.

FIGURE 4 is a fragmentary vertical sectional view of a modified form of pressure regulating assembly.

FIGURE 5 is a fragmentary sectional view taken along the line 5—5 of FIGURE 2 but on a larger scale.

Referring now to the drawings and more particularly to FIGURES 1 and 2, the self-pressurizing, self-regulating gasoline stove there shown is generally designated by the reference numeral 10. It comprises a right-hand tank 11*a* and a left-hand tank 11*b*, using "right" and "left" as they appear in FIGURE 1. The two tanks 11*a* and 11*b* are joined together by means including tubes 12 which are welded, brazed or otherwise secured to the tanks 11*a* and 11*b*. The tubes 12 serve not only as mechanical connectors but also to provide liquid communication between the tanks. Legs 13 are also provided which are welded, brazed or otherwise suitably secured to the bottoms of the tanks 11*a* and 11*b*. A top plate or cover 14 is provided which is secured to brackets 15 which in turn are fixed to the tanks 11*a* and 11*b*. Hinged handles 16 are provided which, when elevated to the position shown in broken lines in FIGURE 1, serve as supports for vessels which are heated on the stove.

A burner assembly is shown which is generally designated by the reference numeral 17 and which will be described in detail hereinafter with particular reference to FIGURE 3.

Referring now to FIGURE 5 as well as FIGURES 1 and 2, the left-hand tank 11*b* is provided with a fitting 18 having an interior thread to receive a threaded plug

or closure 19 to which a hinged bail or handle 20 is attached. It will be seen that the fitting 18 has a rim 18*a* which projects above the level of the tank 11*b* so that a tube 25 can connect therewith for a purpose described hereinafter. The tube 25 is bent around the tank 11*b* as shown in FIGURE 1 and terminates just above and close to a cup 26 (see FIGURE 1) which contains a wick material 27 such as asbestos.

Referring again primarily to FIGURE 1 it will be seen that a volatile liquid fuel such as gasoline is contained in the tanks 11*a* and 11*b*, there being a vapor space 29 above the liquid in each of the tanks. The vapor spaces 29 of the tanks 11*a* and 11*b* are communicated with one another by tubes 30*a* and 30*b* shown in FIGURES 1 and 3. The tube 30*a* has a branch 31 which has an important pressurizing and regulating function described hereinafter.

Still referring primarily to FIGURE 1 a bellows member 40 is provided whose closed lower end is connected to a rod 41 and whose open upper end is secured by a sealing member 42 to the top of the tank 11*a*. A partial cover member is provided at 43. The enlarged lower end 44 of the rod 41 is tubular and is threaded inside to receive the threaded upper end of a valve stem 45 having a valve member 46 at its lower end. As will be seen the valve member 46 is formed with a slot to receive a screwdriver so that adjustment can be made. That is, by screwing the stem 45 farther into or out of the tubular end 44 of the stem 41, the valve 46 can be adjusted. The valve stem 45 passes slidably through an opening in a valve chamber 47 whose conical upper end 48 is intended to mate with and form a sealing engagement with the valve 46. The lower end of the chamber 47 is threaded to receive a screw 49 which can be removed for purposes of cleaning, inspection, disassembly and reassembly. If desired the screw 49 may be soldered to prevent its removal and tampering with the setting of valve 46. The chamber 47 also communicates with a liquid fuel transfer tube 50 having an important function described hereinafter.

Referring now principally to FIGURE 3, the burner assembly 17 comprises a burner cup 55 formed with openings 56 to admit primary air to mix with fuel vapor, and at its top it is formed with a lip 55*a*. A short length of tubing 57 is fixed to the bottom portion of the burner cup 55 and it is threaded internally to receive a threaded member 58 having a widened midportion 59. The lower threaded portion of the member 58 is in threaded engagement with a somewhat longer tubular member 60 which has a closed lower end as illustrated. The tubular member 60 forms a vapor generating chamber 60*a*. The member 58 is formed with an axial passage 61 which is of reduced diameter near the top at 62 and is threaded at its upper extremity to receive a threaded orifice member 63 formed with a small orifice 64. A porous filter 65 is provided which is lodged in the lower, wide portion of the axial passage 61. A rod 66 is provided which extends slidably through the filter 65 and terminates in a needle point 67 for a purpose described hereinafter. The lower end of the rod 66 is threaded to a link 75 which receives an eccentric projection 76 formed on a valve member 77. The connection between the eccentric member 76 and the link 75 is sufficiently loose and/or the latter is sufficiently flexible that, when the valve operating member 77 is rotated, the rod 66 will move up or down according to the direction of rotation of the member 77.

As will be seen, at its outer or left-hand end as viewed in FIGURE 3 the valve member 77 is formed with a squared socket 77*a* to receive a key 78 which is attached to the stove by means of a bead chain 79. The valve member 77 is threaded into a housing 80 to which a cap

80*a* is threaded to retain the various parts in place. The housing 80 is formed with an opening 82 connecting with the tube 31 and, as is best shown in FIGURE 1 it is also formed with an opening 83 connecting with the tube 50. As will be seen from an inspection of FIGURE 3, the housing 80 is formed with a valve seat 84 and the valve member 77 is formed with a mating shoulder 85. As will be seen, the forward or inner portion of the valve member 77 is of substantially smaller diameter than the housing 80. Therefore there is communiaction between the tubes 31 and 50 and the generating chamber 60*a* except when the valve member 77 is turned to seat the shoulder 85 against the seat 84.

In operation the tanks 11*a* and 11*b* are filled with gasoline, preferably not quite to the top. The plug 19 is removed and the tank 11*b* is tipped to the left as viewed in FIGURE 5 so that some of the fuel will flow into the tube 25, thence onto the wick material 27 in cup 26. The plug 19 is then inserted and tightened. The fuel in the wick is ignited, as with a match. The key 78 will have been rotated to turn the valve member 77 to its closed position. This same movement will also elevate the rod 66 so that its upper portion enters the orifice 64. During such movement, and during the subsequent retractive movement described hereinafter, the needle point 67 will clean the orifice, thereby maintaining it free from obstruction.

The heat from the burning fuel in the wick 27 will heat the liquid fuel in the vapor generator 60*a* and will raise the vapor pressure. After a short period of preheating and pressure generation in this manner, the key 78 will be turned to open the valve member 77 and to retract the rod 66 from the orifice 64. The issuing fuel vapor will mix with air in the burner cup 55 and the fuel vapor-air mixture may be ignited with a match unless it ignites automatically from the preheating flame.

From thence on the burner will be self-operating and self-pressurizing by reason of the fact that heat from the burner will heat the tanks 11*a* and 11*b* and the vapor generator 60*a*, thereby maintaining an adequate vapor pressure. Also, during normal operation vapor pressure will be communicated from the generator 60*a* through tubes 31 and 30*a* to the tanks 11*a* and 11*b*. Burning will, therefore, continue without the need to apply pressure by external means such as an air pump.

It may happen that the heat from the burner will overheat the metal parts of the apparatus and that the vapor pressure developed will tend to become excessive. Such, however, is counteracted and an automatic throttling action is effected by the bellows 40 and associated elements. It will be apparent that the pressure on the interior of the bellows 40 is atmospheric pressure while the pressure on the exterior of the bellows 40 (that is to say, within the tank 11*a*) will be the vapor pressure of the fuel. Should this vapor pressure tend to become excessive it will act against the opposing atmospheric pressure and will raise the rod 41 and with it the valve 46. The supply of liquid fuel to the generator 60*a* will, therefore, be diminished, and it will be completely cut off when the valve member 46 seats against the conical portion 48 of the valve chamber 47. When this occurs the only supply of fuel for operation of the burner will be through the tubes 30*a* and 31. This supply of fuel vapor will be consumed quickly, thereby reducing the vapor pressure very rapidly and avoiding excessive rise in vapor pressure. As the vapor pressure diminishes, the bellows 40 will reopen the valve 46, or will open it more widely.

It will, therefore, be apparent that an automatic, self-pressurizing, self-regulating operation results. When it is desired to shut the burner off it is merely necessary to turn the key 78 to its closed position.

Referring now to FIGURE 4 an alternative form of pressure regulating mechanism is there shown. The right-hand tank 11*a* is illustrated, to the top of which is fixed a shell 90 which forms a chamber 91 which is closed

over by a diaphragm 92. To the center of the diaphragm 92 is fixed a tubular member 93 within which is threaded the upper end of a rod 94. The rod 94 extends slidably into and through the upper end of a tubular member 95. The lower end of the rod 94 is formed with a shoulder 97 and a coil spring 98 is compressed between the upper end of the tubular member 95 and the shoulder 97, thereby tending to hold the rod 94 and associated elements in a relatively downward or lowered position. A vlave member 99 is threaded into the lower end of the rod 94 and is intended to mate with the conical seating portion 100 of a cooperative valve member 105. A housing 106 is provided which provides a liquid chamber 107, the lower end of which is closed by a plug 108. The chamber 106*a* has a lateral opening 109 which connects with a liquid transfer tube such as that shown at 50 in FIGURE 1.

In operation a stove equipped with the self-regulating mechanism illustrated in FIGURE 4 will operate similarly to that illustrated in FIGURE 1 and described hereinabove. It will be apparent that the atmosphere acts against the top surface of the diaphragm 92 and that vapor pressure in fuel tank 11*a* acts on the under surface. When the vapor pressure tends to become excessive the vapor pressure will act on the undersurface of the diaphragm 92, thereby moving the rod 94 upwardly and with it the valve member 99, bringing it closer to the valve seat 100 until actual seating occurs, in which case the supply of liquid fuel supply to the burner will be cut off completely.

It will, therefore, be apparent that a novel and very advantageous type of gasoline burner is provided. It is simple in its construction, it is very compace and convenient to carry about, and it is self-pressurizing and self-regulating.

I claim:

1. Apparatus of the character described comprising a burner for burning a mixture of fuel vapor and air, a fuel vapor generator for converting liquid fuel to fuel vapor, said generator being heated by said burner, a fuel tank for holding a supply of liquid fuel, means connecting said tank to said generator to supply liquid fuel to the generator, a valve for controlling such supply of liquid fuel, pressure responsive means located within said fuel tank acted on by the difference between fuel vapor pressure and atmospheric pressure, means connecting said pressure responsive means to said valve to control the latter and to move the valve to and from closed position as the fuel vapor pressure increases and decreases, and means connecting said pressure responsive means to said generator to apply fuel vapor pressure to the pressure responsive means.

2. The apparatus of claim 1 wherein the pressure responsive means is a bellows.

3. The apparatus of claim 1 wherein the pressure responsive means is a diaphragm.

4. Apparatus of the character described comprising a fuel tank having a lower portion for holding a supply of liquid fuel and having an upper portion for holding fuel vapor, pressure responsive means in said upper portion acted on by the differences between atmospheric pressure and the fuel vapor pressure, a liquid fuel outlet in the lower portion of the tank, a valve for controlling the outflow of liquid fuel through such outlet, means interconnecting said pressure responsive means and said valve to regulate the latter automatically to reduce the outflow of liquid fuel as the fuel vapor pressure increases, a burner for burning a mixture of fuel vapor and air, a vapor generator in heat exchange relation to said burner to convert liquid fuel to fuel vapor, means connecting said generator to said burner to supply fuel vapor thereto, means connecting said generator to said fuel outlet to supply the generator with liquid fuel, and means connecting said generator to the upper portion of said fuel tank

to transmit vapor pressure from the generator to the fuel tank.

5. The apparatus of claim 4 wherein said pressure responsive means is a bellows.

6. The apparatus of claim 4 wherein said pressure responsive means is a diaphragm.

7. Apparatus of the character described comprising a burner assembly including a burner and a vapor generator in heat exchange relation to said burner, said generator being also connected to said burner to supply fuel vapor thereto, a fuel tank, a liquid fuel outlet in the lower portion of said tank, means communicating said outlet with said vapor generator to supply liquid fuel thereto, a valve for regulating said outlet to control the rate of liquid fuel supply to the vapor generator, a bellows in communication on one side with the atmosphere and on the other side with vapor in the upper portion of said tank, means for communicating vapor pressure in said generator with the upper portion of said tank, and means connecting said bellows and said valve to operate the latter to diminish the supply of liquid fuel when the vapor pressure in the tank becomes excessive.

8. Apparatus of the character described comprising a burner assembly including a burner and a vapor generator in heat exchange relation to said burner, said generator being also connected to said burner to supply fuel vapor thereto, a fuel tank, a liquid fuel outlet in the lower portion of said tank, means communicating said outlet with said vapor generator to supply liquid fuel thereto, a valve for regulating said outlet to control the rate of liquid fuel supply to the vapor generator, a diaphragm in communication on one side with the atmosphere and on the other side with vapor in the upper portion of said tank, means for communicating vapor pressure in said generator with the upper portion of said tank, and means connecting said diaphragm and said valve to operate the latter to diminish the supply of liquid fuel when the vapor pressure in the tank becomes excessive.

9. A self-pressurizing, self-regulating gasoline stove comprising a fuel tank, a bottom outlet for said tank, a burner assembly having a top burner and a vapor generator therebelow for vaporizing liquid fuel by absorption of heat from the burner and supplying fuel vapor to the burner, means connecting said generator with said bottom outlet to supply liquid fuel thereto and means also connecting said generator to the top of said tank to apply the vapor pressure created in the generator to the top of the fuel tank, a pressure responsive member at the top of said tank acted on by the atmosphere on one side and by fuel vapor on the other side, a valve for opening, closing and regulating said bottom outlet and means interconnecting said pressure responsive member to said valve to control the same.

10. A self-pressurizing, self-regulating gasoline stove comprising a fuel tank, a bottom outlet for said tank, a burner assembly having a top burner and a vapor generator therebelow for vaporizing liquid fuel by absorption of heat from the burner and supplying fuel vapor to the burner, means connecting said generator with said bottom outlet to supply liquid fuel thereto and means also connecting said generator to the top of said tank to apply the vapor pressure created in the generator to the top of the fuel tank, a bellows at the top of said tank acted on by the atmosphere on one side and by fuel vapor on the other side, a valve for opening, closing and regulating said bottom outlet and means interconnecting said bellows to said valve to control the same.

11. A self-pressurizing, self-regulating gasoline stove comprising a fuel tank, a bottom outlet for said tank, a burner assembly having a top burner and a vapor generator therebelow for vaporizing liquid fuel by absorption of heat from the burner and supplying fuel vapor to the burner, means connecting said generator with said bottom outlet to supply liquid fuel thereto and means also connecting said generator to the top of said tank to apply

the vapor pressure created in the generator to the top of the fuel tank, a diaphragm at the top of said tank acted on by the atmosphere on one side and by fuel vapor on the other side, a valve for opening, closing and regulating said bottom outlet and means interconnecting said diaphragm to said valve to control the same.

12. A self-pressurizing, self-regulating gasoline stove comprising a fuel tank; a burner assembly comprising a burner for burning a mixture of fuel vapor and air, an orifice for injecting fuel vapor into the burner, a valve for opening and closing said orifice, a fuel vapor generator in heat exchange relation to the burner to heat liquid fuel and vaporize the same, and a preheater for burning a small quantity of fuel in close proximity to the generator while said valve is in closed position to generate a starting pressure; and pressure regulating and fuel supply means comprising means connecting the generator with said tank to supply liquid fuel to the generator, means connecting the generator to the upper portion of the tank to apply vapor pressure to such upper portion, a control valve for controlling the outflow of liquid fuel to the generator, a pressure-responsive member in the upper portion of the tank acted on by the difference between atmospheric pressure and the fuel vapor pressure in the tank, and means connecting the pressure responsive member and said control valve to diminish the supply of liquid fuel to the generator when the fuel vapor pressure becomes excessive.

13. Self-pressurizing liquid fuel burning apparatus comprising a plurality of substantially duplicate tanks for liquid fuel rigidly fixed in predetermined relatively closely spaced relation and intrecommunicating respectively adjacent the upper most and lowermost regions thereof to equalize the level of the liquid fuel in said tanks and the pressure of the vapor in the uppermost regions of said tanks above the level of the liquid fuel therein, a generator rigidly fixed in predetermined relation to said tanks and having an inlet, a burner supported in heat conducting relation to said generator and in heat radiating relation to both said generator and said tanks, means for establishing communication between the inlet side of said generator and both the uppermost vapor containing and the lowermost liquid fuel containing regions of said tanks including a valve adjacent the bottom of one of said tanks in the means communicating with the inlet side of said generator and pressure-responsive mechanism in the same tank automatically operating said valve in response to variations in the pressure in the vapor-collecting uppermost region of the said tank, when said pressure exceeds a predetermined value.

14. Self-pressurizing liquid fuel burning apparatus comprising a plurality of substantially duplicate tanks for liquid fuel rigidly fixed in predetermined relatively closely spaced relation and intercommunicating respectively adjacent the uppermost and lowermost regions thereof to equalize the level of the liquid fuel in said tanks and the pressure of the vapor in the uppermost regions of said tanks above the level of the liquid fuel therein, a generator rigidly fixed in predetermined relation to said tanks and having an inlet, a burner supported in heat conducting relation to said generator and in heat radiating relation to both said generator and said tanks, means for establishing communication between the inlet side of said generator and the liquid fuel containing lowermost region of said tanks, a valve in said communication means to cut off the flow of liquid fuel to said generator when the pressure in said tanks exceeds a predetermined value, pressure-responsive means operatively associated with a said tank and exposed to the pressure therein, said pressure-responsive means being operatively associated with said valve for operating said valve in response to pressure variations in said tank, and means for maintaining uninterrupted communication between said generator and the space in said tanks above the level of the liquid fuel therein when said burner is operating.

15. Self-pressurizing liquid fuel burning apparatus comprising a plurality of substantially duplicate tanks for liquid fuel, a generator for vaporizing liquid fuel, means for rigidly fixing said tanks and generator in predetermined spaced side-by-side relation including means for interconnecting the said elements to equalize the level of the liquid fuel in said tanks and the pressure of the vapor in the space in the uppermost regions thereof above the level of the liquid fuel therein and to connect said generator to both the liquid and vaporized fuel containing regions of said tanks, a burner supported in heat conducting relation with said generator and in heat radiating relation with both said generator and said tanks substantially equally spaced from the latter, and means for controlling the flow of fuel through the said interconnecting means between said tanks and said generator including a manually operable on-off valve for starting and stopping the operation of said burner, a valve in said interconnecting means responsive to the pressure in the said tanks for controlling the flow of liquid fuel to said generator when said manual valve is open, said last-named valve restricting the flow of fuel to said generator when the pressure in said tank exceeds a predetermined value, and pressure-responsive means exposed to the pressure in said tank and connected to said last-named valve for operating said last-named valve in response to pressure variations in said tanks.

16. Self-pressurizing liquid fuel burning apparatus comprising a plurality of substantially duplicate tanks for liquid fuel, a plurality of pipes rigidly fixed adjacent the opposite ends thereof to said tanks in open communication therewith fixedly to secure said tanks in predetermined spaced relation at substantially the same elevation

and to establish communication between the spaces in the lowermost liquid fuel containing regions and the uppermost vaporized fuel containing regions of said tanks above the level of the liquid fuel therein to equalize the level of the liquid fuel in said tanks and the pressure of the vapor in the spaces above the level of the liquid fuel, a generator for vaporizing liquid fuel, piping to connect said generator to the liquid fuel containing region and the uppermost vapor containing space in at least one of said tanks and rigidly to fix the generator upon an axis passing through the approximate midpoint of the space between said tanks a burner centrally supported by said generator above the space between said tanks but in sufficiently close proximity thereto radiantly to heat said tanks, said burner being directly connected to said generator to heat the same by conduction as well as radiation and means for controlling the operation of said apparatus including a manual on-off valve for starting and stopping the operation of said burner, a valve controlling flow of liquid fuel in said piping to said generator automatically responsive to variations in the pressure in said tanks so as to restrict the flow of fuel to said generator when said manual valve is open and pressure-responsive means exposed to pressure in a said tank and operatively associated with said last-named valve for operating said last-named valve.

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