Jan. 6, 1942. C. B. HOLM 2,268,591

GASIFYING BURNER

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Fig. 2

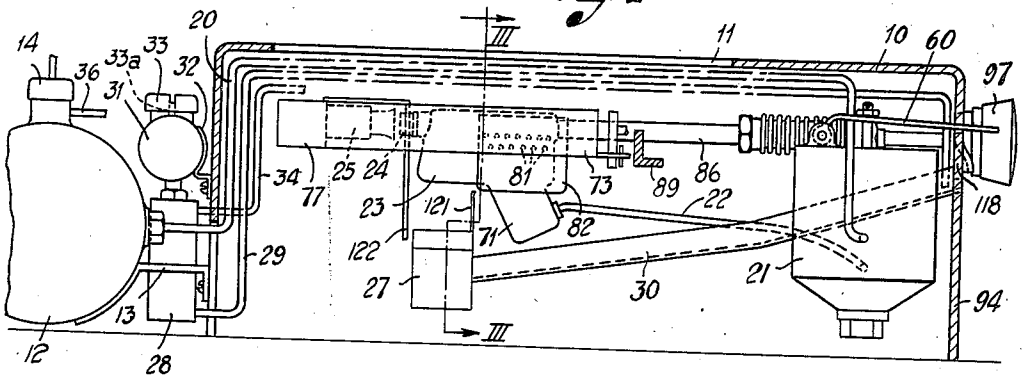
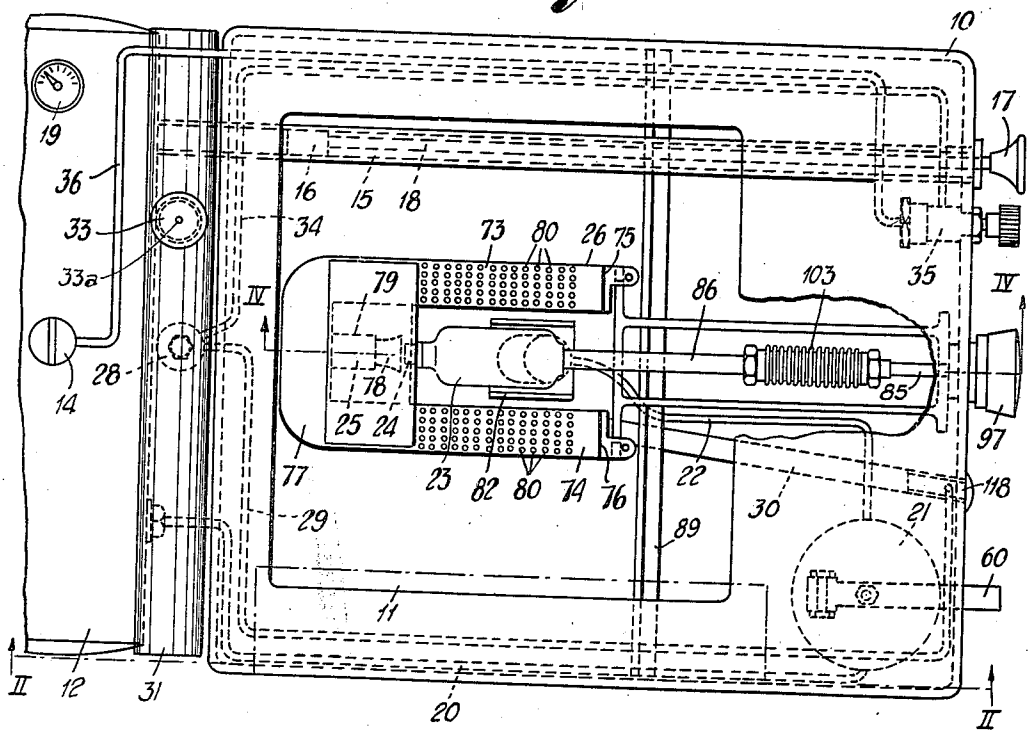


Fig. 1



C. B. Holm
Inventor

By: Glascock Downing & Seebold
Attys.

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Fig. 3

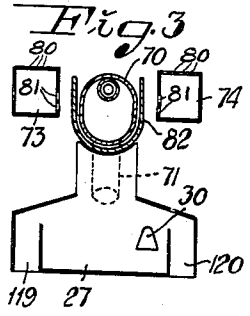
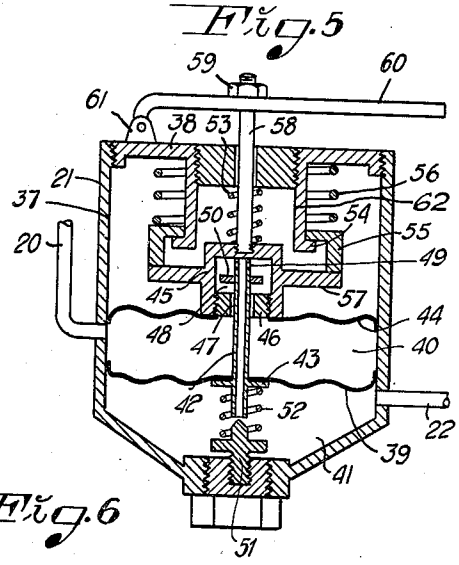


Fig. 5



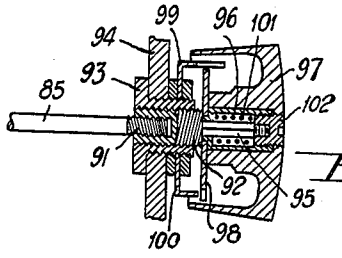


Fig. 6

Fig. 4

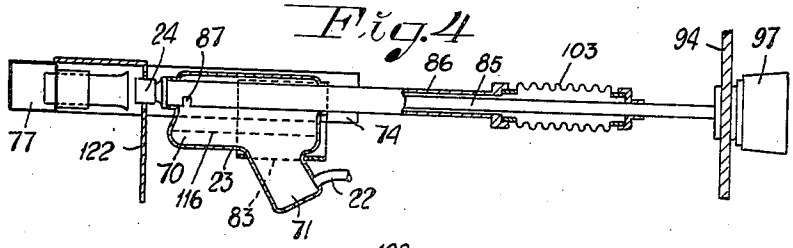
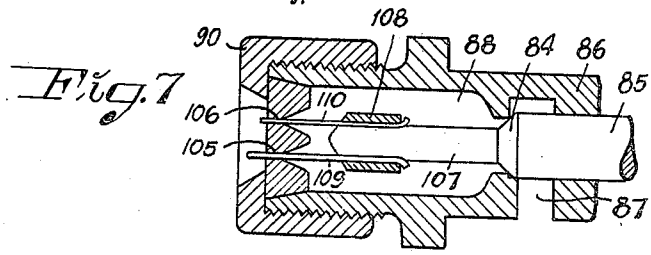


Fig. 7



C. B. Holm
Inventor

By: Glascock Downing & Seebold
Attys.

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UNITED STATES PATENT OFFICE

2,268,591

GASIFYING BURNER

Carl Bernhard Holm, Roslags-Nasby, Sweden

Application January 29, 1938, Serial No. 187,767
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7 Claims. (Cl. 158—42.1)

The present invention relates to gasifying burners and in particular to gasifying burners for small furnaces or ovens, such as portable ovens, in which liquid fuel is used as a combustible.

It is one of the objects of my invention to provide automatically operating means for opening and closing the valve device which controls the supply of liquid fuel to the vaporizer.

Another object of my invention is so to construct the vaporizer and so to arrange it relatively to the burner chamber that under all conditions the proper quantity of heat for the gasification of the fuel will be transmitted from the burner chamber to the vaporizer.

A further object of my invention is to provide a measuring device for delivering the exact quantity of starting fuel for heating and gasifying the cold fuel.

A still further object of my invention is to provide means for effectively cleansing the fuel nozzle of the burner.

I attain these and further objects and advantages by mechanism illustrated in the accompanying drawings, in which—

Fig. 1 is a plan view of an apparatus constructed in accordance with my invention, part of the cover being broken away;

Fig. 2 is a vertical section on the broken line II—II of Fig. 1;

Fig. 3 is a vertical section on the broken line III—III of Fig. 2;

Fig. 4 is a vertical section on the line IV—IV of Fig. 1;

Fig. 5 is a vertical central section on an enlarged scale through the control valve;

Fig. 6 shows to a larger scale a section of a detail of the fuel valve operating device; and

Fig. 7 shows to a larger scale a section of the fuel nozzle device.

Referring first to Figs. 1 and 2, reference numeral 10 designates the casing of a portable oven or heating apparatus having an opening 11 on its upper side. 12 is a reservoir for liquid fuel, such as petroleum, said reservoir being supported by the rear wall of the casing by means of a bracket 13. Through an opening normally closed by a cover 14 the reservoir can be filled with petroleum. A pump 15 the piston 16 of which can be reciprocated from the outside of the casing by means of a handle 17 secured to the piston rod 18 is provided for producing a super-atmospheric air pressure in the petroleum reservoir, said pressure being indicated by a pressure gauge 19. A conduit 20 connects the reservoir 12 with a control valve 21, the construction and mode of operation of which will be described later on with reference to Fig. 5. By means of a conduit 22 the control valve 21 is connected to the lower portion of a vaporizer 23. Fuel gasified in said vaporizer is discharged through a controllable nozzle device 24 opposite which there is arranged a mixing chamber 25 forming part of a burner chamber generally denoted at 26.

For the purpose of starting the vaporizer I provide a starting burner cup 27 arranged to receive starting fuel, such as alcohol, from a measuring device 28 which per se forms no part of the present invention through conduits 29 and 30. The measuring device communicates with an alcohol reservoir 31 which is secured to the rear wall of the casing 10 by means of a bracket 32. Through an opening normally closed by a cover 33 having an air inlet passage 33a the reservoir 31 can be filled with alcohol. By means of a conduit 34, a shut-off valve 35 and a conduit 36 the measuring device 28 can be brought into communication with the air space of the fuel reservoir 12.

Having now described the general arrangement of different parts of my improved gasifying burner, I will now proceed with a more detailed description of several parts and their mode of operation.

Referring to Fig. 5, the control valve 21 inserted between the conduits 20 and 22 is enclosed in a valve box 37 which has secured thereto a cover 38. In the lower portion of the valve box there is provided a resilient diaphragm 39 which divides the valve box into two chambers 40 and 41. The diaphragm has an opening through which extends a tube 42 rigidly connected to the diaphragm as at 43. A second resilient diaphragm 44 has secured thereto a flanged body 45 to which is screwed a member 46 having an opening 47 through which the tube 42 extends into a space 48 and normally abuts with its upper end against the upper wall of the said space. 49 denotes small radial apertures provided in the upper portion of the tube 42, and 50 indicates a ring fixed on the tube portion located within the space 48.

Adjustably secured to the lower portion of the valve box 37 is a flanged member 51 which forms a valve disk arranged to cooperate with the lower end of the tube 42. A helical spring 52 inserted between the diaphragm 39 and the member 51 tends to force the diaphragm and thus also the tube 42 in an upward direction. A helical spring 53 inserted between the cover of the valve box and the body 45 tends to move the said body and the tube 42 in a downward direction. The cover of the valve box has an inwardly extending sleeve portion 62 having a flange 54 against which rests a ring member 55 under the influence of a strong helical spring 56 inserted between the cover of the valve box and the ring member. In the position shown in the drawings the ring member 55 also abuts against the flanged portion 57 of the body 45. A rod 58 threaded into the

upper portion of the body 45 carries a nut 59 such that it can be lifted by means of a hand-lever 60 pivoted to the cover of the valve box as at 61. As will be seen from the drawings, the conduit 20 is connected to the valve chamber 40, whereas the conduit 22 communicates with the chamber 41.

As will be seen from Fig. 4, the vaporizer 23 is formed by a receptacle having an upper enlarged portion 70 and a lower portion 71 of smaller cross-sectional area, which is connected with the fuel supply pipe 22 and which is located at a place remote from the fuel nozzle device 24.

The burner chamber 26 consists of a substantially U-shaped structure having two hollow shank portions 73 and 74 which are closed at the front ends by means of end plates 75 and 76, respectively. The shank portions at their rear ends communicate with each other through a hollow cross piece 77 forming a mixing chamber together with an inlet portion 78 which is located opposite the fuel nozzle device and is adjustably mounted in a pipe 79. The shank portions are of rectangular cross section and have a number of apertures 80 for the flame in their upper walls. In their inner side walls the shank portions are further provided with a number of apertures 81 which serve to supply heat to a plate 82 consisting of heat-conveying material and arranged in spaced relation between the shank portions of the burner chamber and the upper portion of the vaporizer and connected to the lower portion of the vaporizer at a level 83.

The fuel valve for controlling the amount of gasified fuel flowing through the nozzle device is indicated at 84 in Fig. 7. The stem 85 of the fuel valve is enclosed, at a portion of its length, by a pipe 86 which has an opening 87 for the admission of gasified fuel into the nozzle chamber 88. The pipe 86 is carried by an angle 89 secured to the casing 10 and by a member 90 forming a part of the fuel nozzle device. The outer end of the valve stem 85 is connected by means of a right-handed thread portion 91 to a screw 92 having left-handed threads. The screw 92 is threaded into a nut 93 secured to the front wall 94 of the casing 10. The screw 92 has an elongation 95 in the form of a rectangularly shaped pin which engages a sleeve 96 secured to a turning button 97. Between the front wall 94 and a projection 98 secured to the sleeve 96 there are arranged abutments 99 and 100 to limit the turning movement of the button 97 within a range from the practically suitable minimum flame to the maximum flame. In order to extinguish the flame of the burner, the projection 98 is moved out of the path of the abutment 99 by drawing out the button 97 against the action of a helical spring 101 inserted between the sleeve 96 and a plug 102 secured to the button and the pin 95. Upon turning the button 97 the threaded portion 91 of the stem 85 will be displaced in axial direction in the screw 92, but it will be prevented from turning movements due to the fact that the threaded portions 91 and 92 are provided with right- and left-handed threads, respectively.

In order to prevent leakage of gasified fuel from the vaporizer, I provide a bellows member 103 secured on the one hand to the tube 86 and on the other hand to the stem 85 and thus allowing displacement of the stem in the longitudinal direction and yet forming a gas-tight connection between the valve stem and the interior of the vaporizer.

The nozzle device is provided with two openings 105 and 106 of which in the embodiment shown the first-named 105 has a larger diameter than the other one. The valve stem 85 has an elongation 107 carrying a head 108 which has secured thereto two cylindrical needles 109 and 110, of which the one 109 has substantially the same diameter as the larger opening 105, while the needle 110 has substantially the same diameter as the smaller opening 106.

When the valve stem 85 is retracted, the smaller opening 106 is first made free, while the larger opening is still closed. Upon continued retraction of the valve stem, the larger opening 105 is also made free. Since the needles 109 and 110 have substantially the same diameters as the respective nozzle openings, an effective cleansing from coked fuel is obtained, which is not the case in arrangements where the cleansing needle is conical and serves to regulate the size of the flame.

The apparatus described operates in the following manner.

At the starting of the burner the vaporizer is filled with petroleum to the level indicated at 116 in Fig. 4, and the petroleum reservoir 12 is under a pressure of for instance 15 lb. per sq. in. above atmospheric pressure, said pressure being set up by means of the pump 15. To start the burner, the valve 35 is opened, so that compressed air from the petroleum reservoir will pass through a conduit 36, the valve 35 and the conduit 34 into the measuring device 28 and will thereby force a certain quantity of alcohol through the conduits 29 and 30 into the starting burner cup 27.

At its flow from the conduit 29 to the conduit 30 the starting fuel can be lit through an opening 118 provided in the front wall of the casing 10. The combustion of the starting fuel takes place in the starting burner cup 27, combustion air being supplied to the cup through passages 119 and 120. Thereupon the fuel valve is opened by turning the button 97. By the heat transferred from the flame of the starting fuel to the upper portion of the vaporizer the fuel contained therein is caused to boil and escapes in a gasified state through one or both of the nozzle openings, is mixed with air in the mixing chamber 25, and is ignited by the heat produced by the starting burner. The burner chamber gives off heat partly through the apertures 80 on the upper side of the shank portions 73 and 74 and partly through the apertures 81 in the inner side walls of the shank portions. By the heat transferred from the apertures 81 to the heat-conveying plate 82 and the vaporizer the fuel in the gas producer is kept boiling, and the pressure prevailing in the same will be increased and, as a consequence thereof, the fuel level will be depressed to the level indicated by the dotted line 83. At the same time, the pressure also rises in the conduit 22 and thereby moves the diaphragm 39 and the tube 42 upwards to the position shown in Fig. 5. The valve formed by the lower mouth of the tube 42 and the valve disk 51 will thus be opened, and fuel will be forced from the reservoir 12 through the conduit 20, the valve chamber 40, the opening 47, the space 48, the small apertures 49, the tube 42, the chamber 41 and the conduit 22 into the lower portion 71 of the vaporizer. The quantity of fuel supplied to the gas producer corresponds substantially to the quantity gasified in the vaporizer so that the fuel contained in the lower portion of the vaporizer will be approximately maintained at the level indicated at 83.

The gasification of fuel in the vaporizer must be effected so rapidly by the flame of the starting burner, that the pressure in the vaporizer rises to such an extent that the diaphragm 39 can be lifted against the action of the pressure prevailing in the petroleum reservoir and the conduit 20 and the valve chamber 40. The vaporizer must consequently be shaped in such a manner, that the heat developed by the starting burner can be easily taken up by the fuel. To this end, the upper portion 70 of the vaporizer, which at the starting of the burner contains fuel, has a comparatively large horizontal cross section so that the fuel contained in the said portion forms a comparatively thin layer having great dimensions in the horizontal direction.

For a reason to be explained later on the lower portion of the vaporizer should not be heated to a high degree. To this end a screen 121 is arranged between the starting burner cup and the lower portion of the vaporizer so as to prevent as far as possible transmission of heat from the starting burner flame to the said portion. Another screen 122 prevents the starting burner flame from contacting the fuel nozzle device 24.

If for some reason or other, for instance, when using the burner at the first time or if the burner was out of operation for a long period, no or too little petroleum is contained in the vaporizer, the control valve can be opened manually by means of the level 60 which extends a short distance out of the casing 10. By lifting the lever 60 the body 45 is moved upwards against the resistance of the spring 56 and thereby the ring 50 is also moved upwards by the body 45 so that the tube 42 will be removed from the valve disk 51 and petroleum can flow from the reservoir 12 into the vaporizer. The spring 56 offers a comparatively great resistance to the actuation of the lever 60, in order to render difficult the lifting of the lever and thus to prevent manual opening of the valve by mistake.

Under normal working conditions heat is supplied to the vaporizer from the apertures 81 of the burner chamber by means of the heat-conveying plate 82 which is in direct contact with the lower portion of the vaporizer at the normal fuel level 83 so that the greatest portion of the heat is transmitted to the place where the boiling of the fuel takes place. A certain portion of the heat is transmitted to the upper portion of the vaporizer by radiation from the plate 82. In order to prevent oscillations of the fuel level during the operation of the burner, the lower portion of the vaporizer should not be too narrow.

By providing two diaphragms 39 and 44 in the control valve the position of the tube 42 relative to the valve disk 51 will not be materially influenced by variations in the pressure prevailing in the petroleum reservoir 12. If this pressure should be decreased to a small extent, both diaphragms will tend to move towards each other. The upward movement of the diaphragm 39 is, however, compensated for by the downward movement of the tube 42, said downward movement being effected on account of the contact between the upper end of the tube and the upper wall of the space 48.

Should, however, the pressure in the petroleum reservoir be decreased below a certain minimum value, the body 45 on account of the pressure reduction in the chamber 40 and under the influence of the spring 53 will bring the tube 42 into contact with the valve disk 51 and thereby shut off the supply of petroleum to the vaporizer.

When the burner is to be put out of action the fuel valve 84 is closed by turning the button 97. The flame is extinguished, and the heat supply from the burner chamber to the vaporizer ceases. Assuming that the pressure prevailing in the petroleum reservoir and the vaporizer is 15 lb. per sq. in. above the atmospheric pressure, and that the temperature of the vaporizer is about 50° F. higher than the temperature of the saturated fuel vapour at the above-named pressure, then at the extinction of the burner flame the pressure in the vaporizer will rapidly rise by a few pounds per square inch, but will soon be decreased to the first-named value. However, since the vaporizer at the same time is cooled, the pressure will be maintained substantially constant until the temperature of the vaporizer has been decreased to or substantially to the temperature of the saturated vapour at a pressure of 15 lb. per sq. in. above atmospheric pressure. Thereupon, the pressure begins to fall and fuel will flow from the fuel reservoir into the vaporizer. The temperature of the vaporizer will be lowered by the fuel supplied, and the pressure will thus continue to fall in spite of the reduction in volume caused by the fuel flowing to the vaporizer.

When the pressure in the vaporizer has been reduced to a certain value, for instance 12 lb. per sq. in., the diaphragm 39 of the control valve 21 will be moved downwards so as to shut off the connection between the interior of the tube 42 and the valve chamber 41. The supply of petroleum to the vaporizer is then entirely interrupted. The quantity of petroleum supplied to the vaporizer during the period from the reduction of the pressure in the vaporizer to the closing of the control valve is such that the fuel in the vaporizer will be raised to the level indicated by 116, which is suitable for starting the burner anew by means of the starting fuel.

The slower the petroleum flows to the vaporizer during the above-named period the longer is the time allowed for the cooling of the vaporizer, which cooling is effected by radiation and conveying of heat and, to a lower degree, by the cold petroleum supplied to the vaporizer. In order to render possible a reduction of the pressure during the comparatively long period for cooling the vaporizer, I provide a restricted flow of the petroleum by means of the small apertures 49 through which the petroleum must flow on its way from the petroleum reservoir to the vaporizer. Were it not for this restricted flow, the pressure in the vaporizer could not be decreased to the value required for closing the control valve.

It is thus of importance for the reliable operation of the controlling device, that the flow to the vaporizer of petroleum is throttled and that the upper portion of the vaporizer is so large as compared with the supplied quantity of petroleum that the vaporizer is cooled so rapidly during the supply of petroleum, that the pressure will be reduced in spite of the reduction of the gas space of the vaporizer during such supply. Besides, the vaporizer should be so formed that at a new starting of the burner the flame of the starting fuel readily can heat and gasify the fuel in the vaporizer. This is effected by giving the vaporizer the shape shown in the drawings so that the fuel at the closing of the control valve is raised to the level indicated at 116 in a portion of the vaporizer which can be directly heated by the flame of the starting fuel. Further, to shorten the period between the extinction of the

burner flame and the closing of the control valve, the mass of the vaporizer should be small as compared with the cross-sectional area of its upper portion so as to render possible a great radiation and convection of heat from the vaporizer to the surrounding atmosphere. It is therefore suitable to construct the vaporizer with walls as thin as is possible with regard to the required strength of the walls.

As will appear from the foregoing description, the opening as well as the closing of the control valve device 21 is solely effected in response to variations in the pressure prevailing in the vaporizer and fuel reservoir. Further the arrangement is such that at the moment when the control valve is closed the fuel in the vaporizer attains a level suitable for starting the burner anew. Such an operation is not attainable with means for closing the control valve mechanically, for instance simultaneously with the closing of the fuel valve, since in this instance the fuel in the vaporizer would not rise to the desired level.

What I claim is:

1. A gasifying burner comprising a vaporizer, a burner chamber arranged to receive gasified fuel from said vaporizer and to receive combustion air, a fuel reservoir, a conduit for connecting said vaporizer to said fuel reservoir, a control valve in said conduit, and means responsive to a certain rate of reduction of pressure in said vaporizer for closing said control valve.

2. A gasifying burner comprising a vaporizer, a burner chamber arranged to receive gasified fuel from said vaporizer and to receive combustion air, a fuel reservoir, a conduit for connecting said vaporizer to said fuel reservoir, a control valve in said conduit, and means responsive to variations in the pressure prevailing in said vaporizer for opening said control valve upon increase of said pressure above a predetermined value and responsive to a certain rate of air pressure in said vaporizer for closing said control valve.

3. A gasifying burner comprising a vaporizer, a burner chamber arranged to receive gasified fuel from said vaporizer and to receive combustion air, a fuel reservoir, a control valve including a valve box, a resilient diaphragm dividing said valve box into a first and a second chamber, a valve secured to said valve box in said second chamber, a tubular member connected to said diaphragm and forming a valve seat for said valve and extending into both of said chambers, said tubular member having apertures for restricted flow of liquid fuel from said first chamber into said tubular member, resilient means tending to force said diaphragm toward said first chamber, a conduit for connecting said first chamber with said fuel reservoir, and a conduit for connecting said second chamber with said vaporizer whereby at a predetermined rate of reduction of pressure in the vaporizer the control valve will be closed.

4. A gasifying burner comprising a vaporizer, a burner chamber arranged to receive gasified fuel from said vaporizer and to receive combustion air, a fuel reservoir, a control valve including a valve box, a first resilient diaphragm dividing said valve box into a first and a second chamber, a valve secured to said valve box in said second chamber, a tubular member connected to said diaphragm and forming a valve seat for said valve and extending into both of said chambers, said tubular member having apertures for restricted flow of liquid fuel from said first chamber into said tubular member, resilient means tending to force said diaphragm toward said first chamber, a second resilient diaphragm disposed in said first chamber, resilient means tending to force said second diaphragm toward said first diaphragm, a conduit for connecting said first chamber with said fuel reservoir, and a conduit for connecting said second chamber with said vaporizer whereby at a predetermined rate of reduction of pressure in the vaporizer the control valve will be closed.

5. A gasifying burner comprising a vaporizer, a burner chamber arranged to receive gasified fuel from said vaporizer and to receive combustion air, a fuel reservoir, a control valve including a valve box, a first resilient diaphragm dividing said valve box into a first and a second chamber, a valve secured to said valve box in said second chamber, a tubular member connected to said diaphragm and forming a valve seat for said valve and extending into both of said chambers, said tubular member having apertures for restricted flow of liquid fuel from said first chamber into said tubular member, resilient means tending to force said diaphragm toward said first chamber, a second resilient diaphragm disposed in said first chamber, resilient means tending to force said second diaphragm toward said first diaphragm, a manually operable device for moving said tubular member from said valve, a conduit for connecting said first chamber with said fuel reservoir, and a conduit for connecting said second chamber with said vaporizer whereby at a predetermined rate of reduction of pressure in the vaporizer the control valve will be closed.

6. A gasifying burner comprising a vaporizer, a burner chamber arranged to receive gasified fuel from said vaporizer and to receive combustion air, a fuel reservoir, a control valve including a valve box, a first resilient diaphragm dividing said valve box into a first and a second chamber, a valve secured to said valve box in said second chamber, a tubular member connected to said diaphragm and forming a valve seat for said valve and extending into both of said chambers, said tubular member having apertures for restricted flow of liquid fuel from said first chamber into said tubular member, resilient means tending to force said diaphragm toward said first chamber, a second resilient diaphragm disposed in said first chamber, resilient means tending to force said second diaphragm toward said first diaphragm, a manually operable device for moving said tubular member from said valve, resilient means arranged to render difficult the operation of said device, a conduit for connecting said first chamber with said fuel reservoir, and a conduit for connecting said second chamber with said vaporizer whereby at a predetermined rate of reduction of pressure in the vaporizer the control valve will be closed.

7. In a gasifying burner including a vaporizer, a fuel reservoir, and a conduit for connecting said vaporizer to said fuel reservoir, a control valve in said conduit, said control valve including a valve box, a resilient diaphragm dividing said box into two compartments, a valve body and seat structure in one of said compartments, and means independent of said valve body and seat structure to provide for restricted flow of fuel between said compartments.

CARL BERNHARD HOLM.