No. 864,116. PATENTED AUG. 20, 1907.

A. AKESON.

VAPOR STOVE.

APPLICATION FILED OCT. 24, 1906.

2 SHEETS—SHEET 1.

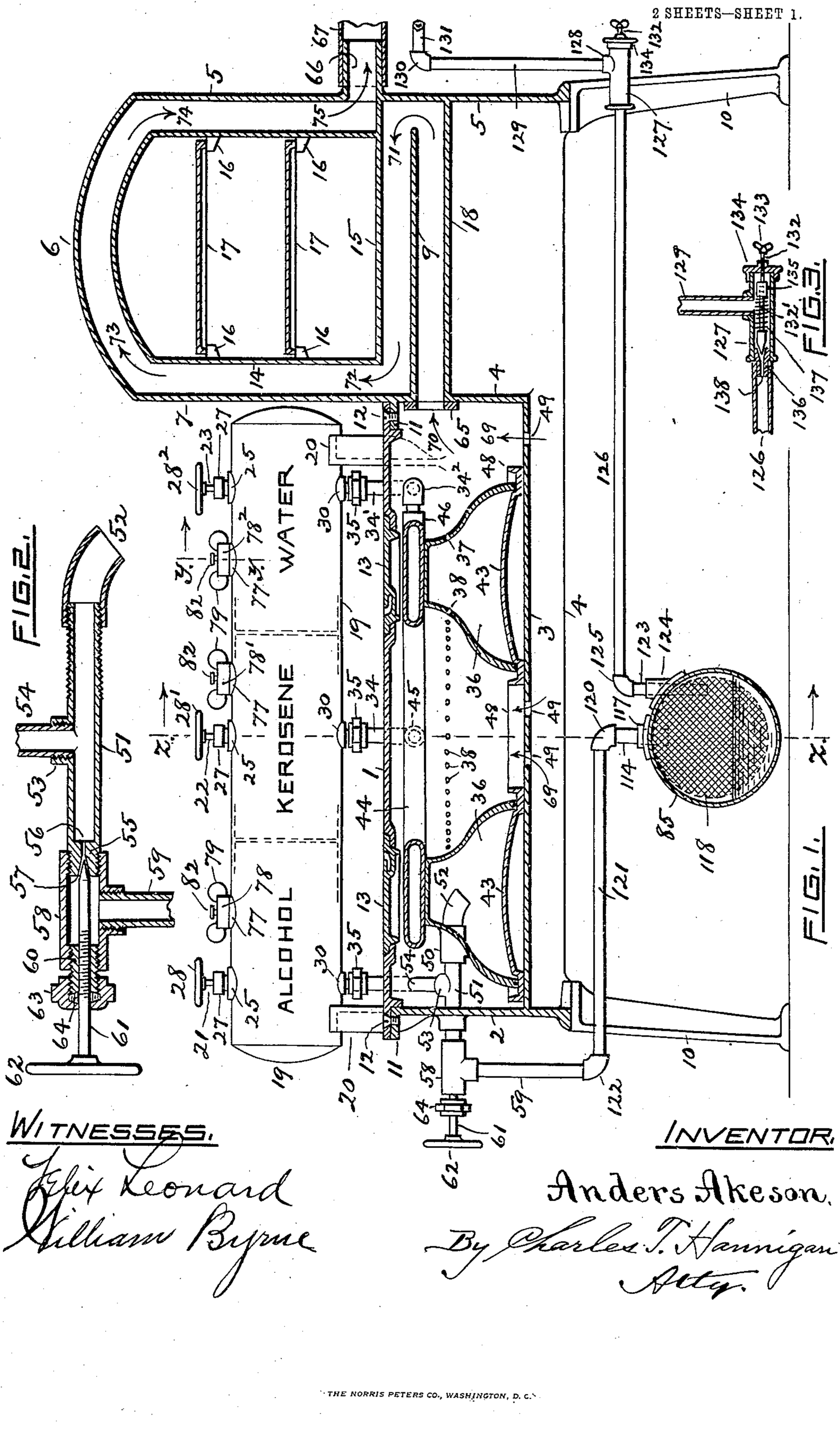

FIG. 1.

FIG. 3.

FIG. 2.

WITNESSES.

Felix Leonard

William Byrne

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By Charles T. Hannigan

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2 SHEETS—SHEET 2.

FIG. 6.

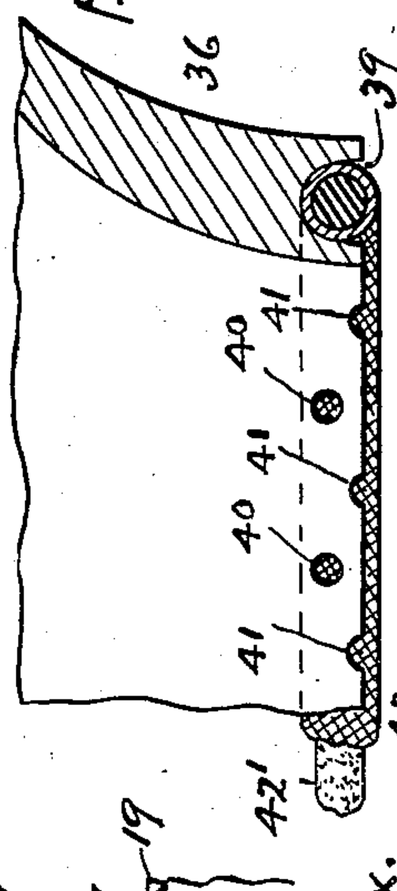

FIG. 7.

FIG. 8.

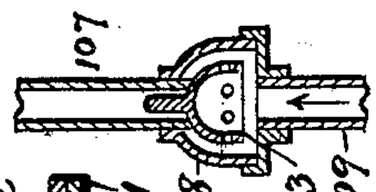

FIG. 9.

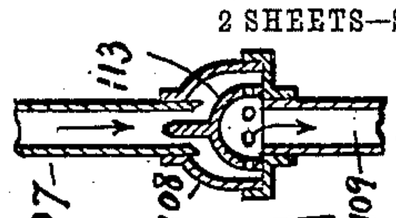

FIG. 5.

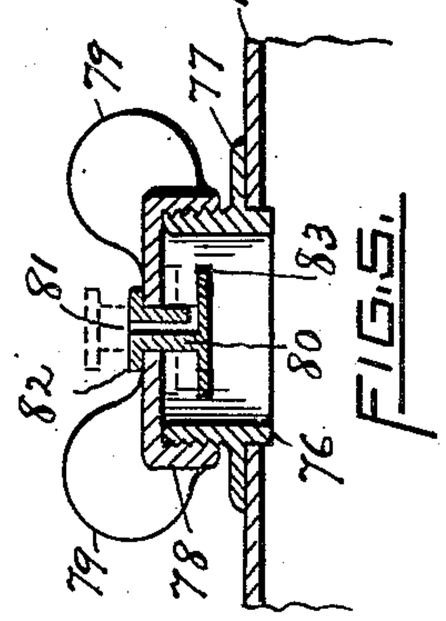

FIG. 4.

WITNESSES.

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UNITED STATES PATENT OFFICE.

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VAPOR-STOVE.

No. 864,116. Specification of Letters Patent. Patented Aug. 20, 1907.

Application filed October 24, 1906. Serial No. 340,418.

To all whom it may concern:

Be it known that I, ANDERS AKESON, a citizen of the United States, residing at the city of Worcester, county of Worcester, State of Massachusetts, have invented certain new and useful Improvements in Vapor-Stoves, of which the following is a specification.

My invention relates to vapor stoves for the burning of a hydrocarbon fluid, and consists of the novel and useful construction and combination of the several parts, as hereinafter described and specifically set forth in the claims.

It is the purpose of my invention to provide a vapor stove, which will burn the vapors of alcohol, kerosene and water for the production of a blue flame of intense heat, which can be utilized for cooking, baking and other uses.

In the accompanying drawings, Figure 1 is a view partly in front elevation and partly in central longitudinal vertical section of my improved vapor stove, as seen on line *x*.—*x*. of Fig. 4. Fig. 2 is a central longitudinal section of the needle valve and also of the supply pipe, which conveys fuel to the burner chamber under steam pressure. Fig. 3 is a central longitudinal section of the exhaust pipe and the needle valve therein. Fig. 4 is a view of my improved vapor stove as seen in vertical section on line *z*.—*z*. of Fig. 1. Fig. 5 is a diametrical section of one of the vent plugs used in my invention, as seen in section on line *y*.—*y*. of Fig. 1. Fig. 6 is a detail perspective view of a portion of the base of the burner chamber provided with an asbestos wick. Fig. 7 is a perspective view of said wick. Figs. 8 and 9 are diametrical longitudinal sectional views of the discharge pipe from the superheating chamber with the valve in said pipe, in Fig. 8 the valve being shown as open and in Fig. 9 as closed.

Like reference numerals indicate like parts.

In the drawings, the body of the stove is formed of the plates 1, 2, 3, 4, 5, 6, 7, 8 and 9 and is supported at the corners upon standards or legs 10. The vertical plates are provided with flanges 11, and the top plate 1 is secured thereto by screws 12. In the top plate are circular stove-holes, closed by stove-covers 13, as usual. An oven 14 has its bottom plate 15 secured at one side as a bracket to the side plate 5, as seen in Fig. 1. The oven has ledges 16, upon which shelves 17 rest. A horizontal partition or plate 18 extends from the plates 4 and 5. The plate 9 serves as a deflector.

A tank 19, preferably elliptical in cross section is supported by brackets 20, which extend from the back of the stove to the rear. This tank 19 is slightly above the top of the stove, and is divided by inner partitions into three substantially equal compartments, one to contain alcohol; another, kerosene; and the third, water, as represented in Fig. 1.

There are three valves 21, 22 and 23, extending vertically through said compartments respectively, the valve 21 extending through the alcohol compartment, the valve 22 through the kerosene compartment, and the valve 23 through the water compartment. In Fig. 4 one of these valves is shown in detail, and the others are of the same construction as that one. A tube 24 has an interior screw thread and is provided with a flange 25. The tube 24 extends through an opening in the top of the tank. A tube or sleeve 26 having exterior and interior screw threads fits in the screw-threaded bore of the tube 24, and is also provided with a central circumferential flange, which fits upon the top of the flange 25 of the tube 24. A screw-cap 27 fits upon the upper end of the sleeve or tube 26 and has a circular opening in the top. The needle-valve 22 extends through the opening of the screw-cap 27 and has a screw-thread by which it is engaged movably in the threaded bore of the sleeve or tube 26. Within the screw-cap 27 and above the top of the sleeve or tube 26, is a space for a packing to surround the stem of the valve 22, and at the upper end of this stem is a hand-wheel 28. At the bottom of each of said compartments is a round opening through which a tube 29 passes, which has a screw-threaded bore, and also a flange 30, which is secured upon the tank 19. A sleeve or tube 31 has an exterior screw-thread, which fits the bore of the tube 29. It has a small tubular bore 32, which at its upper end is enlarged to form a conical valve-seat 33. The lower end of the valve stem 22 is conically tapered to fit upon the valve-seat 33. The lower end of the sleeve or tube 31 is somewhat enlarged in diameter and which portion is screw-threaded to receive a screw-cap 35. A bent pipe 34 has a small annular flange by which said pipe is held in place by the screw-cap 35. The pipe 34 leads from the kerosene-tank to a superheating-chamber 44. A similar pipe 34′ leads from the water-tank through an elbow 34^2 into the tubular boss 46 of the superheating-chamber 44. The pipe 54 from the alcohol-tank does not lead, however, to the superheating-chamber 44, but to the burner-chamber 36, as hereinafter described.

The burner-chamber 36 is a hollow ring, shaped in cross section as illustrated in Figs. 1 and 4. It has a flat closed top and its sides are in the form of an inverted ogee. Through the outer side are the perforations 37 and through the inner side are the perforations 38, which perforations constitute the burners.

As seen in Fig. 6, the lower edge of the sides of the burner-chamber 36 has a groove or channel 39, substantially semicircular crosswise, though somewhat exceeding 180° in extent. These sides also have the round openings 40 near the lower edge thereof and the half-round notches 41 on the very edge.

In the groove or channel 39 a wick 42 is laid, composed of an internal portion or core 42′ of asbestos, covered by a tubular wire gauze. This wick 42, 42′ rests upon a circular ring-shaped trough or tray 43, the central portion of which is concavo-convex, as shown.

The superheating-chamber 44 is a ring-shaped receptacle, having a flat top, a flat bottom, and half-round sides. It rests upon the closed top of the burner-chamber 36, and has the bosses 45, 46 and 47, each provided with a screw-threaded bore.

The bottom and sides of the superheating-chamber 44 project considerably over the top of the burner-chamber 36, both on the outside and inside of the ring, as shown in Figs. 1 and 4.

The ring-shaped tray 43 has the annular flanges 48, 48. The base-plate 3, of the stove-casing, is provided with openings 49, 49 for the inlet of atmospheric air.

The burner-chamber 36 has a tubular boss 50, through which a feed pipe 51 passes, shown in Fig. 1, and also in detail on an enlarged scale in Fig. 2. The pipe 51 has one end screw-threaded exteriorly to receive a curved discharge-pipe 52, which projects into the burner-chamber 36, as shown in Fig. 1. The pipe 51 also has a centrally located coupling tube or tee 53, provided with an interior screw-thread to receive the lower end of a pipe 54. The upper end of the pipe 54 is provided with the screw-cap 35, valve-seat 33 and tube 29, the flange 30 of the latter being secured to the tank 19. A valve-seat 55 is provided at the outer end of the pipe 51 (see Fig. 2), having the small bore 56 and the conical enlargement thereof 57, and this portion of the pipe 51 is screw-threaded exteriorly to receive a tee pipe 58, which connects respectively with the pipe 59 and a nut-block 60, the latter having both outer and inner screw-threads.

A screw-threaded valve-stem 61 passes through the threaded bore of the nut-block 60 and has a conical needle point at its inner end, adapted to contact with the conical valve-seat 57. The valve-stem 61 is turned by means of the hand-wheel 62. A screw-cap 63 surrounds the valve-stem 61 and engages with the nut-block 60 and is adapted to compress a packing 64.

A slide damper 65 is mounted upon proper supports and is adapted to open or close, at the will of the operator, the air passages between the partition 18 and the deflector-plate 9.

The oven casing formed by the plates 5, 6, 7 and 15, has an outlet-pipe 66, which opens into a funnel 67 of a chimney flue, or into the external atmosphere.

The air enters from the external atmosphere through the openings 49 in the bottom plate 3 and passes in the directions indicated by the arrows 69, 70, 71, 72, 73, 74 and 75.

At the top of the three compartments of the tank 19 is a filling tube 76, having an exterior screw-thread and an annular flange 77, the latter of which is secured upon the upper surface of the tank 19. A screw-cap 78 has finger pieces 79, by which it can be turned upon the threaded portion of the tube 76. The screw-cap 78 has a central opening, through which a vent plug 80 passes loosely. This plug has the vent or L-shaped bore 81, shown in Fig. 5, and is provided with an upper annular flange 82 and a lower annular flange 83. This vent plug 80 normally is in the position shown in solid lines in Fig. 5, but is capable of movement into the position indicated by dotted lines in said figure.

A long tubular gas-holder 85 extends beneath the stove and is provided with end pieces or heads 86, 87. The head 86 has a screw-threaded tubular boss 88 through which the pipe 89 passes. At the end of the pipe 89 is a faucet 90. A tee piece 91 connects the pipe 89 and faucet 90 and supports a pipe 92. At the top of the pipe 92 is a funnel 93 and a valve 94.

A pipe 95 enters the gas-holder 85 through the top thereof and is connected by an elbow 96 to the pipe 97, which is connected by an elbow 98 to the pipe 99, which is connected by the elbow 100 to the pipe 101, which is connected by the elbow 102 to the pipe 103, which extends into the tank 19 at the top thereof. In the pipe 99 is a shut-off valve 104.

To the tubular boss 47 of the superheating-chamber 44 is connected a pipe 105, by which an elbow 106 is connected with a pipe 107. At the bottom of the pipe 107 is a globe-shaped valve-body 108, which receives at its upper end the pipe 107 and at its lower end a pipe 109, the latter passing into the gas-holder 85, through a screw-threaded tubular boss 110.

A fibrous capillary strainer 111, made of any suitable material, surrounds the lower end of the pipe 110, within the gas-holder 85, being held and secured in position by the nut 112 on the end of the pipe 110, as illustrated in Fig. 4.

In the globular valve-body 108 is a valve 113, like an open-mouthed bell, having a stem at its upper end, which projects up into the pipe 107. This valve, when closed, rests with the straight bottom edge in contact with the valve-seat, as shown in Fig. 9, on an enlarged scale, and when open, its convex upper surface rises in contact with the annular beveled surface of the bottom of the pipe 107, as shown in the same scale in Fig. 8. The bell portion of the valve 113 is provided with openings, as shown in Figs. 8 and 9.

A pipe 114 extends downward into the gas-holder 85, passing through and supported by a screw-threaded sleeve 115, which has an annular flange 116. The sleeve 115 passes through and is supported by a screw-threaded tubular boss 117. Between the flange 117 of the sleeve 115 and the inner surface of the gas-holder 85 is secured and supported a wire gauze bag or receptacle 118, made preferably of brass wire and filled with iron filings 119, or other suitable material.

The gas-holder 85 is filled to about one-third full of water to the level of the pipe 89, and the lower portion of the capillary strainer 111 and the lower portion of the wire gauze bag or receptacle 118, with its contents are submerged in the water as shown in Figs. 1 and 4.

The pipe 114 is connected by an elbow 120 to the pipe 121, which is connected by an elbow 122 to the pipe 59.

An exhaust-pipe 123 is supported by the flanged tubular boss 124 and extends into the gas-holder 85. It is connected by the elbow 125 to the pipe 126, which opens into the valve casing 127. From the valve casing 127, through a tubular boss thereof, extends the pipe 129, which is connected by the elbow 130 to the pipe 131, which extends into a chimney flue or into the external atmosphere.

A needle-valve for the exhaust pipes 126, 129, is

shown in detail in Fig. 3. It consists of a screw 132, rotatable by a thumb piece 133. A screw-cap 134 covers one end of the casing 127 and has a central screw-threaded opening to receive the threaded portion of the screw 132. The inner end of the screw 132 abuts a cap-piece 135. A stem 132′ has one end portion movable in the cap-piece 135 and its opposite end portion enlarged to form a shoulder, and this enlarged portion of said stem terminates in a conical point.

At the inner end of the valve casing 127 is a plug 136, having a small longitudinal bore 138, the inner end of which is enlarged to form a conical valve-seat, with which the conical point of the stem 132′ is adapted to contact. A coil spring 137 is interposed between the shoulder of the stem 132′ and the cap-piece 135, and said spring tends to keep the point of said stem upon the seat of the plug 136.

All the fittings and needle valves are preferably made of bronze or composition in order to prevent corrosion.

Having thus specified and described the parts of my improved vapor stove, I will now explain the operation of the same. The needle valve 21 is operated by the hand-wheel 28 and closed. The needle-valve 61 is operated by the hand-wheel 62 and closed. The screw-cap 78 is removed. Alcohol is poured into the alcohol compartment of the tank 19, and the screw-cap 78 replaced. The needle valve 22 is operated by the hand-wheel 28′ and closed. The screw-cap 78′ is removed. Kerosene is poured into the kerosene compartment of the tank 19 and the screw-cap 78′ replaced. The needle valve 23 is operated by the hand-wheel 28^2 and is closed. The screw-cap 78^2 is removed. Water is poured into the water compartment of the tank 19 and the screw-cap 78^2 is replaced. The valve 94 is opened. Water is poured into the funnel 93 and passes through the pipes 92, 89, into the gas-holder 85 till the gas-holder is preferably one-third full. The valve 94 is then closed. The valve 21 is then operated by the hand-wheel 28 and opened. Alcohol then flows from the alcohol compartment of the tank 19 down through the pipe 54 by gravity and thence through the pipes 51, 52 into the burner-chamber 36 (Fig. 1). The needle valve 21 is so regulated by hand as to allow the alcohol to be fed to the burner-chamber 36 in small quantity, preferably drop by drop. The alcohol drips from the end of the pipe 52 upon the convex bottom 43 of the burner-chamber 36 and is thereby directed to the bottom edge of the walls of said chamber, where it is absorbed by the asbestos wick 42′, the latter being kept in proper shape by the wire gauze covering 42 in the annular groove or channel 39. When a sufficient quantity of alcohol has been so collected and absorbed by the asbestos wick 42′, a lighted match is applied to the orifices 40, 41, and the alcohol vapor is thus ignited, causing a flame upon both the exterior and interior surfaces of the curved walls of the burner-chamber, and this flame is maintained by the alcohol fed into said chamber 36 from the pipe 52, the valve 21 being adjusted so as to supply the requisite quantity of alcohol for the purpose. As the superheating-chamber 44 overhangs the burner-chamber 36, all around the ring and on both the outer and inner sides thereof, the chamber 44 is soon intensely heated. Then the valve 22 is opened by the hand-wheel 28′ and the valve 23 is opened by the hand-wheel 28^2, and thus kerosene is fed, drop by drop, from the kerosene compartment of the tank 19 to the superheating-chamber 44, and water is fed, drop by drop, from the water compartment of the tank 19 to the superheating-chamber 44. In the superheating-chamber 44 the kerosene and water, thus supplied thereto, are instantly converted into a highly inflammable vapor. The water is decomposed and the hydrogen thereof unites with the carbon of the kerosene vapor, and a very combustible hydrocarbon, vapor or gas is thus produced. This compound gas or vapor, by the heat expansion thereof, passes through the pipes 105, 107, through the openings in the valve 113, thence through the pipe 109 into the midst of the capillary strainer 111, which, being moistened by the water in the gas-holder 85, by reason of the capillary attraction of the fibrous material of which the strainer is made, purifies the mingled vapor, thus discharged from the superheating-chamber 44. The gas is partially cooled and condensed in the gas-holder 85. Thence, when the needle valve 61 is operated by the hand-wheel 62, the gas or vapor flows up under the pressure of the steam in the gas-holder, first, through the strainer 118 and its filling 119, where it is further filtered, cleaned and purified, and then through the pipes 114, 121, 59, through the port of the needle valve 61, through the pipes 51, 52, into the burner-chamber 36, and, passing therefrom through the burners or orifices 37, 38 on both sides of said chamber, is there ignited, giving an intense blue hydrocarbon flame, the combustion being supported by the air, which rushes in from the external atmosphere through the inlets 49, 49, as indicated by the arrows there. Thus the stove chamber is heated and cooking is done in vessels, which are placed on the stove covers 13, or set in the stove holes, when said covers are removed. The heat also passes as indicated by the arrows 70, 71, 72, 73, 74 and 75, through the openings in the slide damper 65, under and around the oven 14, through the pipe 66 and funnel 67 into the chimney flue or external atmosphere, thus adapting the stove for baking purposes. When the pressure is sufficient to eject the gas or vapor from the pipe 52 into the burner-chamber 36, the alcohol may be shut off from the delivery pipes 51, 52, by closing the valve 21. To produce a greater heat, the valve 104 in the pipe 99 is opened. The gas and steam then rushes up the pipes 95, 97, 99, 101, 103, into the alcohol compartment of the tank 19 and causes a greater discharge of the alcohol therefrom through the pipe 54 into the burner-chamber 36. By closing the valve 104 again, the normal discharge of alcohol by the force of gravity only is resumed. In case of such increase of pressure in the alcohol compartment, the vent plug 80 is automatically closed by moving from the position shown by solid lines in Fig. 5, to the position shown in said figure by dotted lines. At other times the vent plug 80 is in its lower position, admitting the outer air into the alcohol compartment of the tank 19 so as to allow the alcohol to flow under atmospheric pressure down through the pipe to the burner-chamber 36. By similar means a

steam pressure may be used to increase the discharge of the contents of either or both of the other compartments of the tank 19. The gas-holder 85 is provided with the exhaust-pipe 123, 126, 129, 131, for the exhaust or discharge of excessive steam in the gas-holder 85. The exhaust-valve (Fig. 3) is set adjustably by the thumb-screw 132, thereby regulating the tension of the spiral spring 137. When the pressure in the gas-holder 85 is sufficient to overcome the pressure of the spring 137, the conical point that forms the valve of the stem 132′ is forced out of the conical seat of the plug 136 and the gas and steam escape from the gas-holder 85, until the predetermined pressure is reached in the gas-holder 85, whereupon the spring 137 closes the valve of the stem 132′ to the valve-seat in the plug 136 again. This constitutes an automatic safety device, and also prevents a steam pressure beyond the desired degree, for which the adjustment is set. The steam and gas, thus ejected from the gas-holder, pass into the chimney flue or into the external atmosphere. The valve 113 in the valve casing 108 acts automatically. In Fig. 9 the arrows indicate the flow of the hydrocarbon vapor down the pipe 107, through the orifices of the valve 113, and down the pipe 109 to the gas-holder 85. If, however, the pressure in the gas-holder 85 is greater than the pressure in the superheating-chamber 44, the valve 113 is raised thereby to the position illustrated in Fig. 8.

By this device the oil vapor, which is rich in carbon, is mingled with the hydrogen of the water, when the water is decomposed in the superheating-chamber, and means are provided for varying at will the amount of either the alcohol, kerosene or water, or of either two of them, in supplying the liquid fuel to the stove.

The superheated vapors are cooled and condensed and also filtered and purified in the gas-holder, so that when the hydrocarbon vapor is discharged into the burner-chamber and ignited, it burns, without leaving any carbon deposits.

The faucet 90 should be opened occasionally as a test and to allow the volume of water which may be caused by the condensation of the steam in the gas-holder to pass through said faucet.

The valve 61 regulates the quantity of hydrocarbon vapor supplied to the burner-chamber 36. The alcohol can be either entirely shut off, when the valve 61 is open, or it may be partially shut off, or allowed to flow without diminution, as may be desired. If the alcohol continues to flow as a whole or in part, while the hydrocarbon vapor is supplied to the burners, the heat is thereby intensified.

I claim as a novel and useful invention and desire to secure by Letters-Patent:

1. In a vapor stove, the combination of an alcohol tank; a kerosene tank; a water tank; a burner-chamber; a superheating-chamber; a feeding device from the alcohol tank to the burner-chamber; a feeding device from the kerosene tank to the superheating-chamber, and a feeding device from the water tank to the superheating-chamber.

2. In a vapor stove, the combination of an alcohol tank; an oil tank; a water tank; a burner-chamber; a feeding device from the alcohol tank to the burner-chamber; a feeding device from the oil tank to the superheating-chamber; a feeding device from the water tank to the superheating-chamber, and adjustable means in each of said feeding devices adapted to regulate the flow of liquid therethrough.

3. In a vapor stove, the combination of a tank adapted to contain a liquid fuel; a vaporizing chamber; a feed pipe from the tank to the chamber; a gas-holder; a pipe connecting said chamber and gas-holder; a pipe connecting the gas-holder and the tank and entering the top of said tank, and a valve in both said pipes.

4. In a vapor stove, the combination of a superheating-chamber; means of supplying a liquid fuel thereto; a gas-holder; a pipe leading from the chamber to the gas-holder, and a valve in said pipe.

5. In a vapor stove, the combination of a superheating-chamber; means of supplying a liquid fuel thereto; a gas-holder adapted to hold water in the lower part thereof; a pipe leading from the chamber to the gas-holder; a capillary strainer surrounding the discharging end of said pipe and partially submerged in the water, and a valve in the pipe.

6. In a vapor stove, the combination of a burner-chamber having burner jets; a superheating-chamber upon the burner-chamber; means of supplying a liquid fuel to the superheating-chamber; means of supplying a liquid fuel to the burner-chamber; a gas-holder adapted to contain water in its lower part; a pipe from the superheating-chamber to the gas-holder; a capillary strainer on the bottom of said pipe and partially submerged in the water, and a valve in the pipe.

7. In a vapor stove, the combination of a superheating-chamber; means of supplying a liquid fuel thereto; a gas-holder; a pipe leading from the chamber to the gas-holder, and an automatic valve in said pipe.

8. In a vapor stove, the combination of a superheating-chamber; a discharge-pipe therefrom; a gas-holder; an inlet-pipe therefor; a valve casing connecting said two pipes, and a valve having an open-bottomed bell-shaped body provided with orifices in its sides and also having a vertical stem projecting into the first named pipe.

9. In a vapor stove, the combination of a superheating-chamber; means of supplying a liquid fuel to said chamber; a gas-holder; a pipe leading from the chamber to the gas-holder; a wire gauze strainer in the gas-holder; a filtering material in the strainer; a burner-chamber; a pipe leading from the gas-holder within the strainer into the burner-chamber, and a valve in the last named pipe.

10. In a vapor stove, the combination of a superheating-chamber; means of supplying a liquid fuel to the chamber; a gas-holder adapted to contain water in its lower part; a pipe leading from the chamber to the gas-holder; a wire gauze strainer in the gas-holder partially submerged in the water; a filtering material in the strainer; a burner-chamber; a pipe leading from the gas-holder within the strainer and leading into the burner-chamber, and a valve in the last named pipe.

11. In a vapor stove, the combination of a burner-chamber; a superheating-chamber; means of supplying a liquid fuel to the superheating-chamber; a gas-holder adapted to contain water in its lower part; a pipe from the superheating-chamber to the gas-holder; a capillary strainer in the gas-holder partially submerged in the water and connected with said pipe at the bottom thereof; a wire gauze strainer in the gas-holder partially submerged in the water; filtering material in the wire gauze strainer; a pipe from the gas-holder within the wire gauze strainer and leading into the burner-chamber, and a valve in the last named pipe.

12. In a vapor stove, the combination of a gas-holder adapted to contain water in its lower part; a pipe leading from the gas-holder; a faucet on said pipe; a filling-pipe opening into the first named pipe, and means of supplying a superheated hydrocarbon vapor to said gas-holder.

13. In a vapor stove, the combination of a burner-chamber; means of heating the latter from the former; a gas-holder; a pipe from the superheating-chamber to the gas-holder; means of supplying a liquid fuel to the superheating-chamber; an alcohol tank; a pipe from the alcohol tank to the burner-chamber; a valve in the last named pipe; a pipe leading from the gas-holder to the alcohol

delivery pipe; a needle-valve connecting the last two pipes, and means of adjusting said valves.

14. In a vapor stove, the combination of a vaporizing chamber; a gas-holder; a pipe connecting the chamber and gas-holder; an exhaust-pipe from the gas-holder, and an automatic valve in the exhaust-pipe.

15. In a vapor stove, the combination of a vaporizing chamber; a gas-holder; an exhaust-pipe from the gas-holder; an automatic valve in the exhaust-pipe, and means of adjusting and regulating said valve to operate at a predetermined pressure.

16. In a vapor stove, the combination of a gas-holder adapted to contain gas and steam under pressure, an exhaust pipe therefrom and an adjustable automatic valve in the exhaust-pipe consisting of the following parts,—a cylindrical valve-case; a plug having a longitudinal bore the inner end of which is enlarged to form a conical valve-seat; a stem having a shoulder from which said stem is made tapering to fit upon the seat of said plug; a cap-piece on the inner end of said stem; a screw-cap on said valve-case provided with a central opening; a thumb-screw engaging the threaded opening of said screw-cap to abut said cap-piece, and a spiral spring interposed between the shoulder of said stem and said cap-piece.

In testimony whereof I affix my signature in presence of two witnesses.

ANDERS AKESON.

Witnesses:
FELIX LEONARD,
WILLIAM BYRNE.