(No Model.)

4 Sheets—Sheet 1.

S. DANIELS.

VAPOR STOVE.

No. 347,161. Patented Aug. 10, 1886.

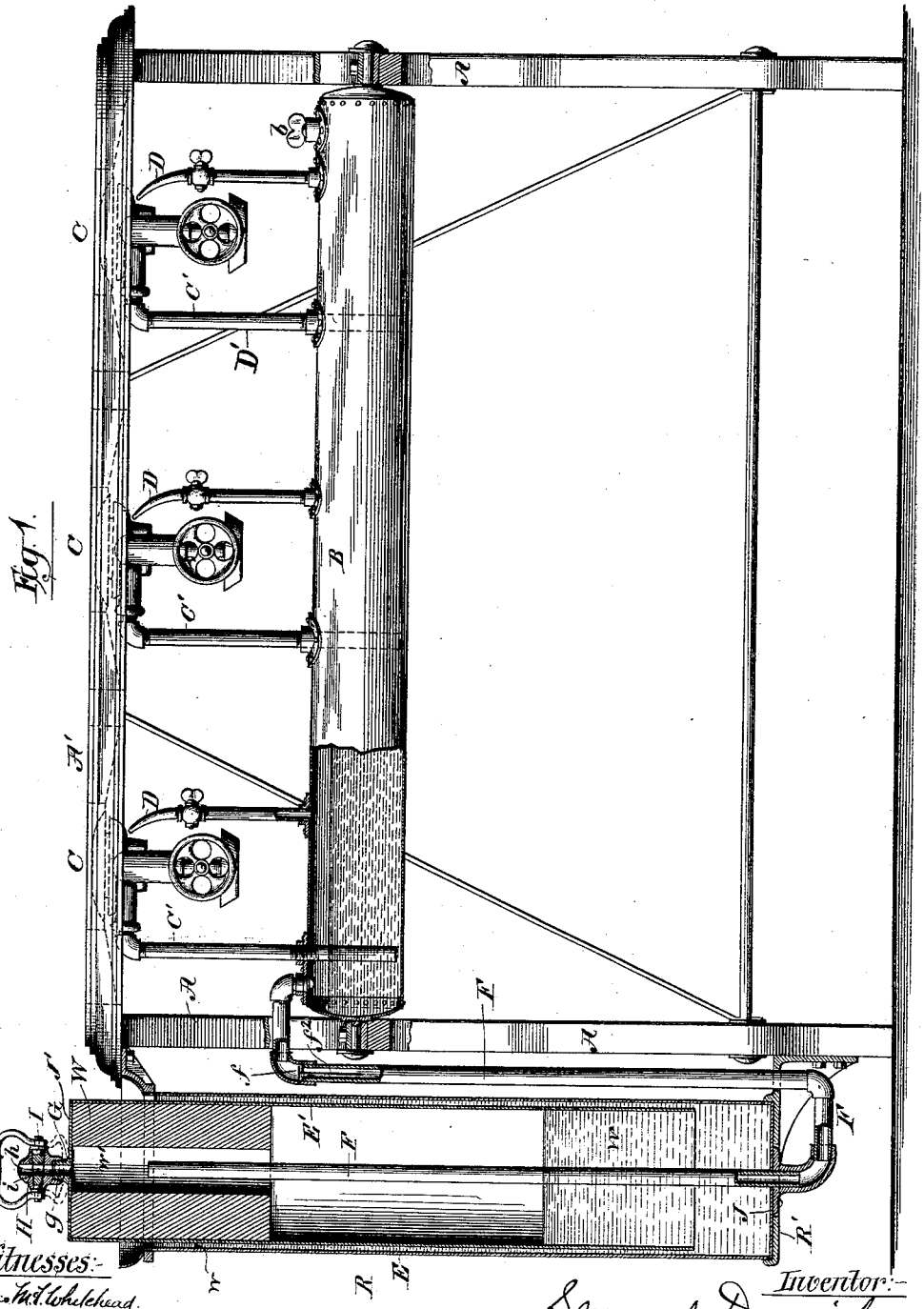

Fig. 1.

Witnesses:-
Louis M. Whitehead.
Jesse Cox Jr.

Inventor:-
Samuel Daniels
by:-
M. E. Dayton
Attorney:-

(No Model.)

4 Sheets—Sheet 2.

S. DANIELS.

VAPOR STOVE.

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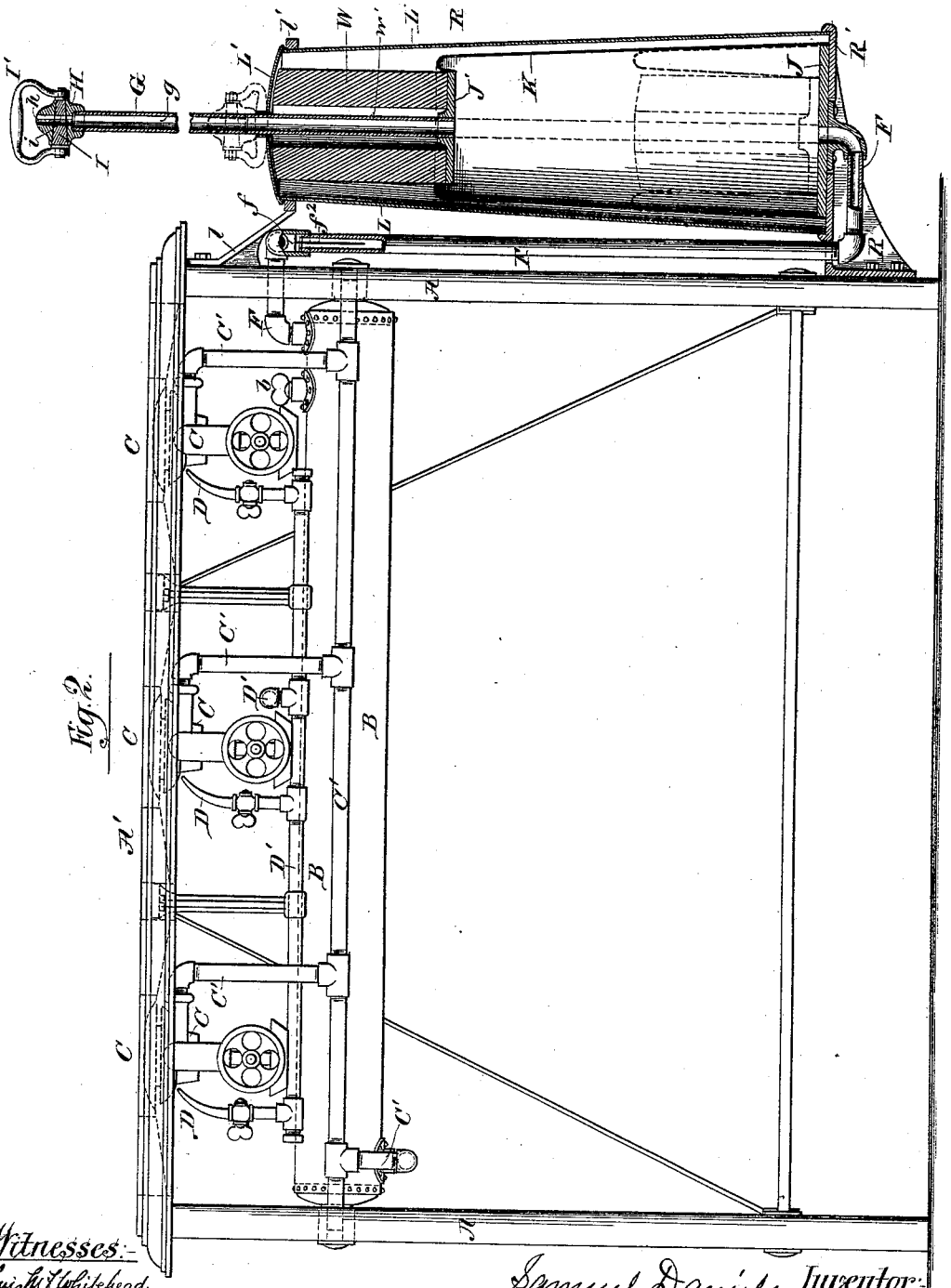

Fig. 2.

Witnesses:-
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Samuel Daniels Inventor:-
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Attorney:-

(No Model.)

4 Sheets—Sheet 3.

S. DANIELS.

VAPOR STOVE.

No. 347,161. Patented Aug. 10, 1886.

Fig. 3.

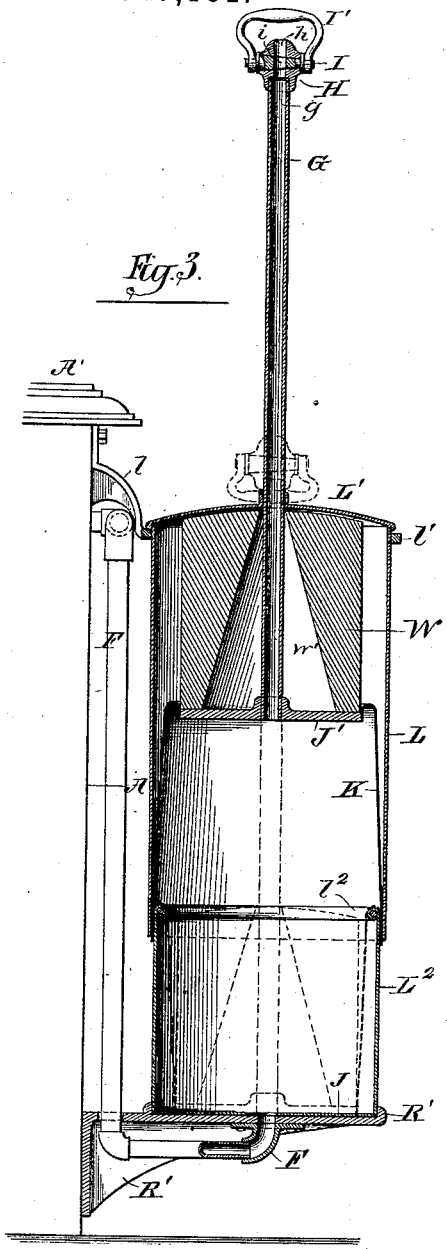
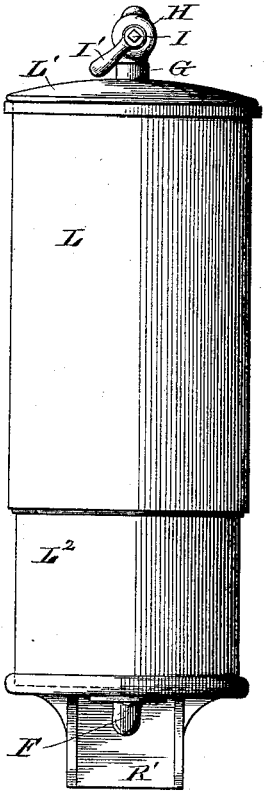


Fig. 4.



Witnesses:
Louis H. Whitehead.
Jesse Cox Jr.

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(No Model.) 4 Sheets—Sheet 4.

S. DANIELS.

VAPOR STOVE.

No. 347,161. Patented Aug. 10, 1886.

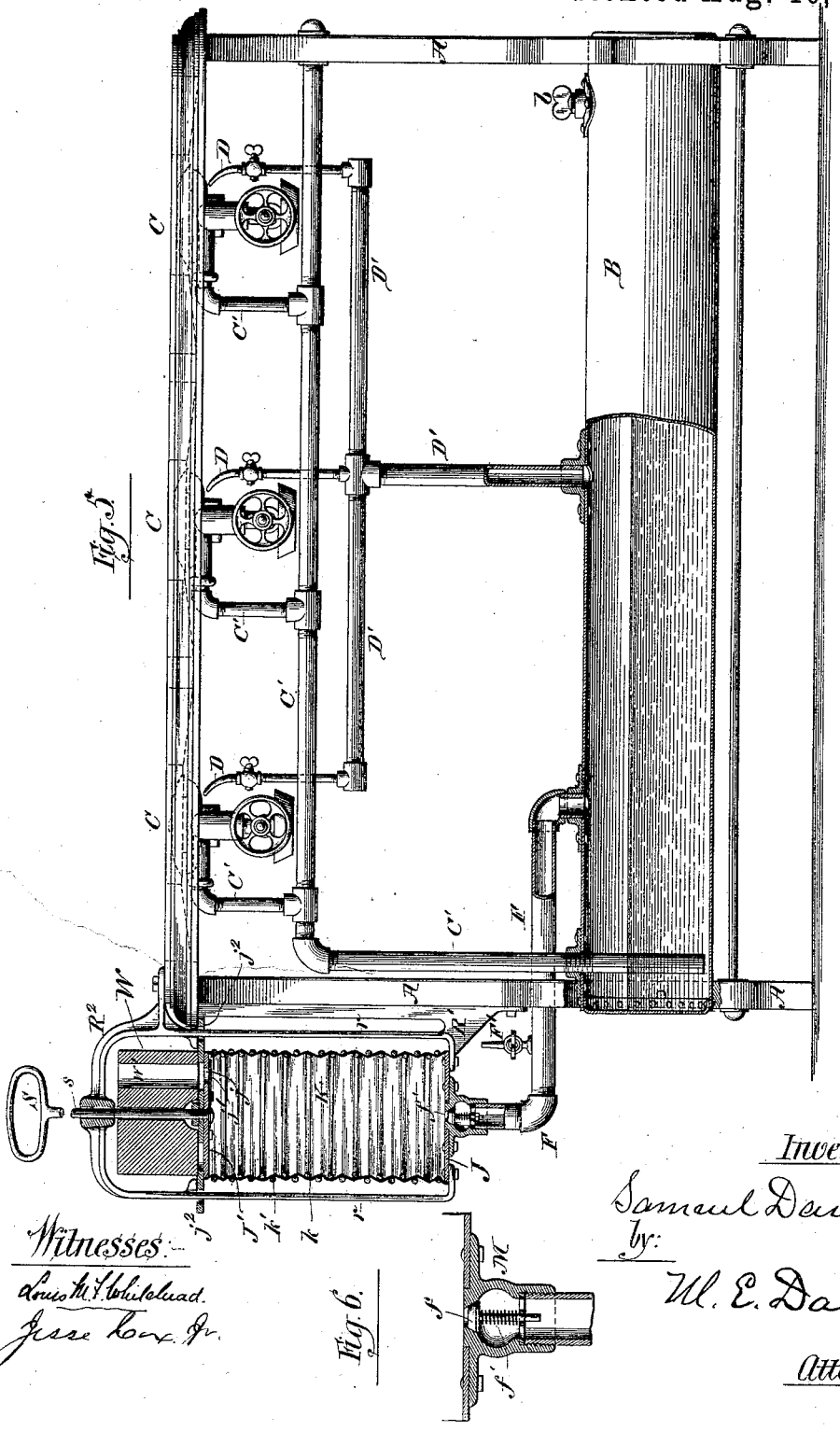

Fig. 5.

Fig. 6.

Witnesses:
Louis M. Whitehead.
Jesse Lowe Jr.

Inventor:
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by:
W. E. Dayton
Attorney.

UNITED STATES PATENT OFFICE.

SAMUEL DANIELS, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO MELVILLE E. DAYTON, OF SAME PLACE.

VAPOR-STOVE.

SPECIFICATION forming part of Letters Patent No. 347,161, dated August 10, 1886.

Application filed September 7, 1885. Serial No. 176,304. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL DANIELS, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Vapor-Stoves; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to means in vapor-stoves for forcing the liquid hydrocarbon to the vapor-generator or the vapor or carbureted air derived from such liquid to the burner.

More particularly, it relates to that class of vapor-stoves in which the hydrocarbon liquid or its vapors are thus forced to the generator or burner by air-pressure.

The primary object of the invention is to provide a means for giving the pressure, which, though it may be varied by the operator, will, when adjusted or determined, be practically uniform so long as it lasts.

To this and other ends that will further appear the invention consists in the matters hereinafter described and claimed.

In the drawings, Figure 1 is a front elevation of a three-burner domestic vapor-stove provided with one form of air-pressure device in accordance with my invention, certain parts being shown in vertical section. Fig. 2 is a front elevation of a similar vapor-stove provided with another form of air-pressure device in accordance with my invention, certain parts being shown in vertical section. Fig. 3 is a central vertical section of an air-pressure device essentially like that shown in Fig. 2, but different in certain details of construction. Fig. 4 is a side elevation of the construction shown in Fig. 3. Fig. 5 is a front elevation of a vapor-stove provided with a form of air-pressure device in accordance with my invention, differing in certain particulars of construction from those forms shown in the preceding figures of the drawings.

The same reference-letters are applied to corresponding parts in the various figures.

A A is one form of stove-frame having a top, A′, and B is one form of tank or reservoir for the hydrocarbon liquid.

At C C are vapor-burners of any approved description, said burners being in the present instance each impliedly of the same generating order.

D D are carbureted-air burners, or the terminals of pipes arranged adjacent to the burners C and communicating with the air-space of the hydrocarbon-liquid tank B by a pipe or pipes, D′, each of said burners D being to direct a stream of carbureted air against the adjacent burner C for the purpose of heating its generator. The hydrocarbon-liquid tank communicates with the burners by a pipe, (or pipes,) C′, which leads from the bottom or near the bottom of said tank, (as variously shown,) and said tank is provided with a filling-hole and air-tight stopper, *b*.

These are all familiar parts in stoves of this class; but the arrangement of the liquid-tank B is believed to be novel in Figs. 1 and 2. In Fig. 1 the tank B is directly beneath the burners, and near them in the usual position of the ordinary main supply-pipe, and is long enough to permit connection of the several vertical burner-pipes directly therewith. The tank B here takes the character of an enlarged supply-pipe. In Fig. 2 it has the same elongated shape and horizontal position, but is situated at the rear of the stove or behind the customary horizontal main supply-pipe, which is located directly below the burners. In both these figures the elevation of the tank has a certain significant relation to the pressure-giving devices, which will be hereinafter pointed out.

Coming to the adjunctive device for producing the air-pressure, which device forms the principal novel or newly-added element of the structure herein claimed as my invention, I first remark that it consists, essentially, of a contractible air-chamber in communication with the interior of the hydrocarbon-liquid tank, and a weight, or its equivalent, continuously operating to contract said chamber with a constant or practically constant force throughout its range of motion when the stove is in operation. This device is designated as a whole in all of the drawings by the letter R.

In Fig. 1 the contractible chamber R is constituted of an open-topped stationary cylinder,

E, and a smaller open-bottomed vertically-movable cylinder, E′, inserted in the cylinder E. A weight, W, is applied to the cylinder E′, and a suitable quantity of water, *w*, in the cylinder E furnishes an air-tight seal between the two loosely-telescoping vessels E and E′. A pipe, F, open at its ends and properly connected gives communication between the interior of the liquid-tank B and the air-space inclosed by the chamber R. An air-inlet is provided in the cylinder E′, (preferably at its top,) by which a new supply of air may be admitted to the chamber R when exhausted, and a handle or other suitable contrivance is also provided, by which to lift the cylinder E′ for the purpose of refilling it with air. In the present instance two forms of these minor devices are shown. In said Fig. 1, (and also in Figs. 2, 3, and 4,) a nipple or pipe, G, having a passage, *g*, is applied to the vertically-movable top of the chamber R, to the upper end of which pipe is attached a head, H, having a hole, *h*, through it in continuation of that in the pipe G. Fitted in this head and intersecting the hole *h* is a rotatable tapered plug, I, having also a hole, *i*, through it, which may be brought into or out of line with the hole *h*, all after the familiar manner of a plug-valved faucet. To the squared end or ends of this plug is fastened a handle, I′, arranged in the plane of the hole *i* in the plug, so that when the handle is raised into a vertical position in lifting the cylinder E′ (or other form of the top of the chamber R) the passage through the plug will be opened, and will freely admit the air. After being thus lifted to its limit of movement the handle I′ will be turned down into a substantially horizontal position against a suitable stop (as pipe G or the top of the cylinder E′) and released, in which position the hole through the plug I will be out of line with the air-passage *h*, and the latter will be closed. The chamber R will then at once contract by the compression of the air therein, and in the air-space of the tank B, to an extent due to the gravity of the weight W, after which it will further contract only as the liquid is expelled from the tank B in the operation of the stove, unless other vent is made for the escape of the air.

In Fig. 2 and other remaining figures of the drawings the contractible chamber R is contrived to avoid the use of water, *w*, employed in the construction shown in Fig. 1. To this end it consists in what may be generically termed a "bellows." Of this bellows, as shown in said Fig. 2, J is a preferably rigid circular bottom piece or disk, which is stationary, and J′ is a desirably smaller disk, which has a vertical movement. K is a flexible air-tight tube, fastened properly at its ends to the disks J and J′, and W is the weight resting on the top plate or disk, J′. F is the pipe connecting the interior of the bellows with the interior of the liquid-tank B. The weight, as shown, has a central hole, *w*′, for the accommodation of the pipe G, which, if single, is of course preferably centrally inserted in the disk or bellows-top J′. In the expulsion of the air from the bellows by the descent of the weight W, the flexible tube K folds downwardly within itself, as shown in dotted lines. To favor this form of fold, it is preferable that the upper end of the tube K be smaller than the lower end, and that the upper edge be attached to the disk J′ in the downwardly-turned position shown.

For the proper guidance of the weight W in its vertical movements various contrivances may obviously be employed; but for this purpose and for the protection of the tube K, I prefer to employ an outer case, L, of sheet metal or other material, firmly seated concentric with the bottom plate or disk, J, and having a cap, L′, with a hole in it to serve as a guide for the pipe G. This cap is also desirably placed at such a height as to serve further as a limit to the upward movement of the bellows-top by striking the weight W. The upper end of the shell L is shown as being steadied from the stove-frame by a brace, *l*, attached to a ring, *l*′, surrounding the shell. The bellows and shell are also shown as resting upon a bracket, R′, fastened to the stove-frame at a little distance from the floor.

In Figs. 3 and 4 a sheet-metal cylinder, L^2, takes the place of the lower half of the tube K of Fig. 2, which is obviously practicable, because this part is always upright. The upper edge of the cylinder L^2 is desirably rounded over inwardly, as seen at l^2, in order that the flexible part K may not be injured thereby in folding over it. In this construction the outer shell, L, may terminate at the top of the cylinder L^2, and the lower end of tube K may be confined between the parts L and L^2, with or without the aid of cement, and a reliably air-tight joint thereby made at this point.

In Fig. 5 another form of bellows, not requiring the use or aid of water, is shown, consisting of a collapsible tube, K, of rubber or other flexible and air-tight material, fastened at its ends to suitable disks or plates, J and J′, and connected through its bottom plate with the tank B, as in the preceding drawings. The flexible tube in this frame is shown as being laterally supported by inner and outer rings, K and K′, which preserve its form and insure its folding regularly upon itself, like the gussets of an accordion. For the inlet of air in this case the top is shown provided with a hole, *j*, over which is placed a flap-valve, *j*′, closing upwardly, and the weight is shown as having a hole, *w*′, through it coincident with the hole *j*. The top plate, J′, is provided with projections j^2, which serve as guides therefor in conjunction with the stationary rods *r r*, and also gives passage to the stem *s* of the handle S, by which the bellows is inflated.

It is evident that the air-inlet to the chamber R may be located elsewhere than in the top thereof, particularly in those forms of said chamber in which water is not employed.

The weight W is in all figures represented as a solid mass of metal; but it may consist

of a vessel filled or partly filled with sand. In any case it is variable in size or mass, though constant throughout its movement after being adjusted, and it acts continuously. The amount of weight required will vary somewhat, according to the elevation of the liquid-tank relative to the burners, because it has to overcome the head of said liquid due to its distance below the burners. In other words, the weight will need to be heavier to raise the liquid from a tank, B, located near the bottom of the stove, as shown in Fig. 5, than when the tank is placed higher, as shown in Figs. 1 and 2. Having reference to available dimensions of the structure R in a domestic vapor-stove, the total weight of all movable parts of said structure which exert a gravity force will be ordinarily about eight to fifteen pounds. In the telescoping construction of the chamber R, (shown in Fig. 1,) in which water is employed to afford the required seal, a sufficient weight, W, will raise the water *w* to such a height as to require a relatively long outer cylinder, E, and in this case to bring the top of the cylinder E′, when fully depressed, to the top of the outer cylinder, E; and to economize room I prefer to place the weight W within the top of the cylinder E′, and to provide a hole through *w′* (or a space about it) for the admission of the air in recharging. A hole through it of course equally accommodates the outlet-tube F. The said cylinder E′ may, as an equivalent of the construction shown, be made of cast-iron and heavy enough to dispense with a separate weight for ordinary purposes, though in this case when greater pressure is required additional weight will be placed thereon.

It is for some reasons desirable that in refilling the contractible chamber R the air shall not be drawn from or through the liquid-tank B. I therefore prefer to avoid this, and to prevent it a check-valve, *f*, is shown in the pipe F. In Figs. 5 and 6 this valve *f* is shown as located in a special casting, M, which forms the coupling for joining the pipe F to the bottom plate, J, of the bellows. It is of familiar and obvious construction and need not be minutely described. The spring *f′* is desirably only strong enough to uphold the valve, which, it may be added, need not be very tight for the mere purpose of retaining the pressure in the tank B during the brief time of recharging the bellows with air.

In Figs. 1 and 2 the valve *f* is placed in an ascending part of the pipe F, and consists only of a light metal or leather disk large enough to rest at its margin upon the end of the pipe F, but not large enough to fill the coupling in which it is housed. It is provided with a light wire stem, f^2, which depends in the pipe F and operates to keep the disk horizontal. The valve rises readily when the stove is in operation and the weight W is falling.

When it is desired to remove the pressure from the tank B in order that the stove may stand unused without possible escape of liquid, I prefer to light one of the burners D, if present, and thus allow the air to burn as it escapes. As it passes off here very rapidly, it will soon discharge both the tank and the chamber R, and the stove may be safely left after lighting such burner in the assurance that it will soon burn out and extinguish itself. If the carbureted-air burner D is not present, and a check-valve, *f*, is employed, a special discharge-cock, F′, Fig. 5, may be provided in position to be safely opened, whether the main burners are left alight or not. If the valve *f* is absent, and the externally-manageable valve and handle I I′ of Figs. 1, 2, 3, and 4 is used, this valve may be opened to discharge the air. Of course in any case the stopper *b* of the liquid-tank may be loosened or removed to the same end.

I do not pretend to have illustrated all forms of devices in which my invention may be embodied, but enough to show its practicability in several forms. As at present advised, I prefer the construction shown in Figs. 3 and 4.

It is obviously immaterial to my invention whether the bottom or the top of the contractible chamber is made movable. It is also apparent that while I have spoken of certain parts as forming the contractible air-chamber, and have designated them as a whole by the letter R, in fact said chamber includes not only said parts, but the liquid-tank B and the connecting-pipe F. It is further manifest that the tank and the adjunctive device R may be directly connected, so as to dispense with a special pipe, F; but the preferred arrangement of the several devices, as shown, makes the use of such a pipe desirable.

I do not wish to be restricted to the particular forms of construction shown, and I desire to be understood that such modifications of the devices described as shall attain one or more but less than all the results obtainable from my improvement as set forth shall not be regarded as departures from my invention.

I am aware that a reciprocating piston-pump has been employed in connection with a hydrocarbon-liquid tank located below the level of a burner or burners of a vapor-stove for the purpose of compressing air in the space above the liquid within the tank, so that the air thus compressed will by its expansion force the liquid upward to the burner. Such contrivance has not been found successful, a principal objection thereto lying in the fact that the pressure is not constant, but gradually diminishes with the consumption of the liquid. Starting therefore with a sufficient pressure to give the desired force and volume of vapor at the flame, the flame gradually lessens and becomes insufficient or ineffective. An improvement upon such devices has been proposed consisting in the introduction of an automatic valve between the air-space of the reservoir and an air-chamber communicating therewith for the supply of air under pressure to the space above the liquid in the reservoir, and with the purpose of maintaining a more uni-

form pressure in the reservoir; but this device is not entirely satisfactory, and, moreover, after the pressure in the air-supply chamber has settled to the resistance of the valve, air in the reservoir operates with diminishing force, as described of the other devices above mentioned not having this proposed improvement. The device here presented differs, essentially, from a pump and all analogous contrivances which rely upon the expansive force of compressed air, in that the pressure is constant or uniform and continuous throughout the entire descent of the weight, so that if the weight and pressure be properly adjusted to begin with it continues the same and the flame remains uniform. Distinguishing the devices with reference to these differences in operation, I designate my air-chamber as "continuously contractible," because one of its walls is continuously moving inward under the action of the weight, which is not true of a pump or of the walls of a liquid-tank within which the air compressed by the pump may be confined.

I reserve the right to make additional application for Letters Patent for any and all improvements herein shown or described and not herein claimed.

I claim as my invention—

1. The combination, with the generating vapor-burner of a hydrocarbon-vapor stove, and with the hydrocarbon-liquid-supply tank connected with and located below the level of the burner, of a contractible air-chamber communicating with the liquid-tank, and having a valved air-inlet, a weight applied to contract the said air-chamber, and a handle for raising the weight, and thus refilling the air-chamber through the valved air-inlet.

2. The combination, with a hydrocarbon-liquid tank of a vapor-stove and a vapor-burner located at a higher elevation than the tank, of a contractible air-chamber in communication with the liquid-tank and provided with a valve for admitting air, a weight applied to contract the air-chamber, and an automatic check-valve arranged in the air-passage leading to the liquid-tank, to prevent back movement of air from the tank, and thus maintain the pressure at the burner when the air-chamber is recharged.

3. The combination, with the burner of a vapor-stove and a liquid-tank located below the level of the burner, of a contractible air-chamber communicating with the liquid-tank and containing a weighted movable part, said air-chamber being provided with an inlet-valve independent of the pipe leading to the liquid-tank and a handle for lifting said movable part, which handle is connected with the inlet-valve, whereby said valve is opened in the act of lifting the movable part of the air-chamber.

4. The combination, with the frame of a hydrocarbon-vapor stove, of a burner or burners, a hydrocarbon-liquid tank located below the level of the burner or burners, and an air-pressure device consisting of a continuously-contractible air-chamber in communication with the liquid-tank, and a weight applied to a movable part of said tank, said burner, liquid-tank, and pressure device being all mounted on the stove-frame, and the whole forming a unitary portable structure.

5. The combination, with the frame of a vapor-stove, a burner or burners at the top of the stove, and a hydrocarbon-liquid tank secured to the frame below and near the burners, of an air-pressure device comprising a continuously-contractible air-chamber communicating with the liquid-tank and a weight applied to contract said chamber and impart a uniform pressure at the burner, substantially as described.

6. The combination, with the stove-frame, a vapor-burner at the top of the stove, and a hydrocarbon-liquid tank mounted on the frame below the level of the burner, of a contractible air-chamber communicating with the tank and provided with an inlet-valve, said air-chamber comprising a stationary bottom, a movable weighted top, a handle for lifting the top, and flexible side walls, substantially as described.

7. The combination, with the burner of a vapor-stove, and with a hydrocarbon-liquid tank located on the stove-frame below the burner, of a contractible air-chamber communicating with said tank, and consisting of a rigid tube, L^2, fixed to a bottom, J, a flexible tube, K, fixed to a top, J′, and to the rigid tube L^2, and a weight bearing on the top J′, the said top and flexible tube being constructed to fold within the tube L^2, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

SAMUEL DANIELS.

Witnesses:
M. E. DAYTON,
JESSE COX, Jr.