No. 848,586. PATENTED MAR. 26, 1907.

A. J. BLACKFORD.

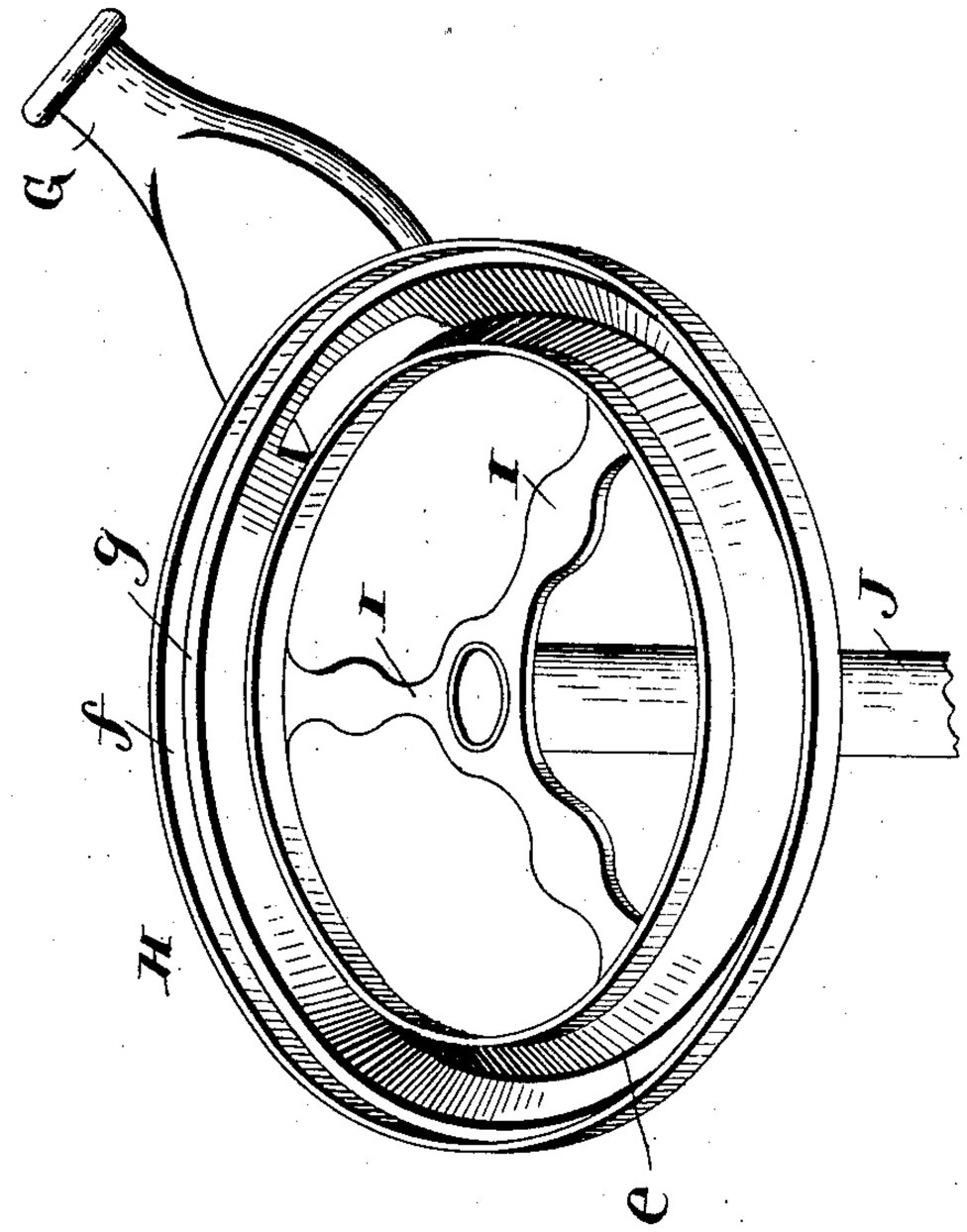
OIL BURNER.

APPLICATION FILED AUG. 23, 1897.

2 SHEETS—SHEET 1.

Fig. 8.

Fig. 2.



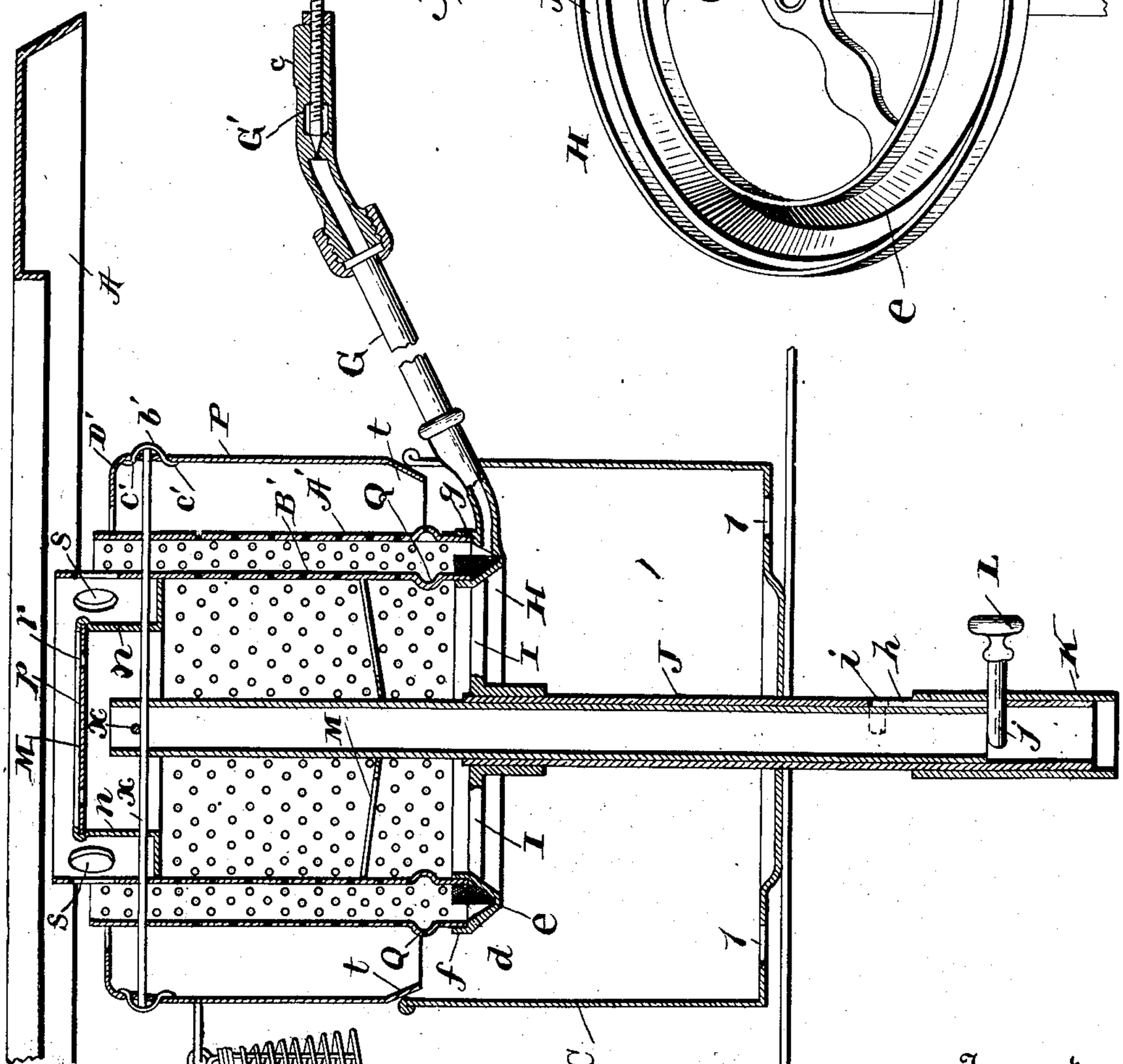


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 3.

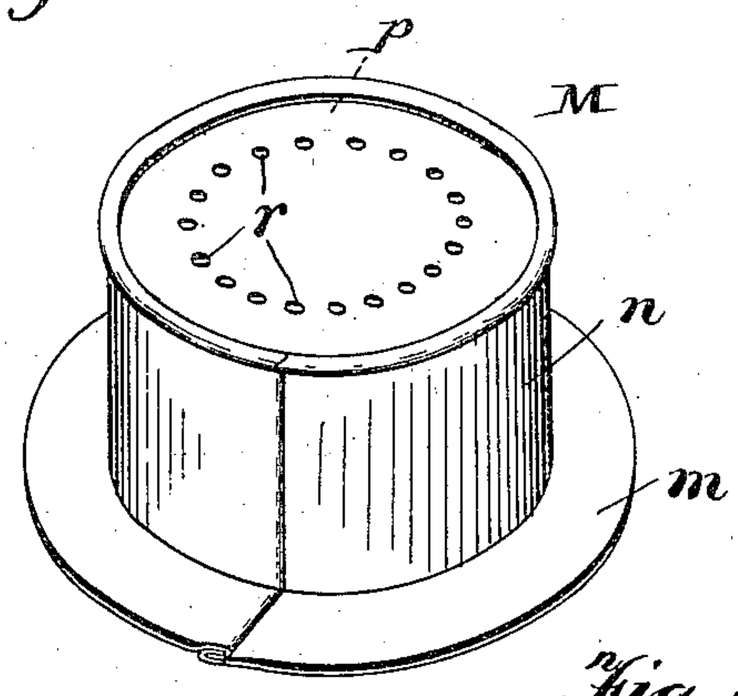


Fig. 4.

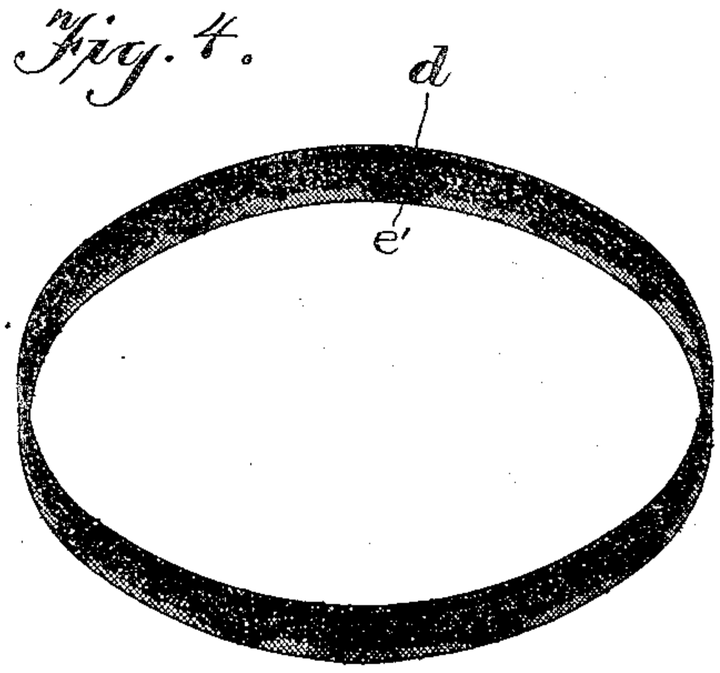


Fig. 5.

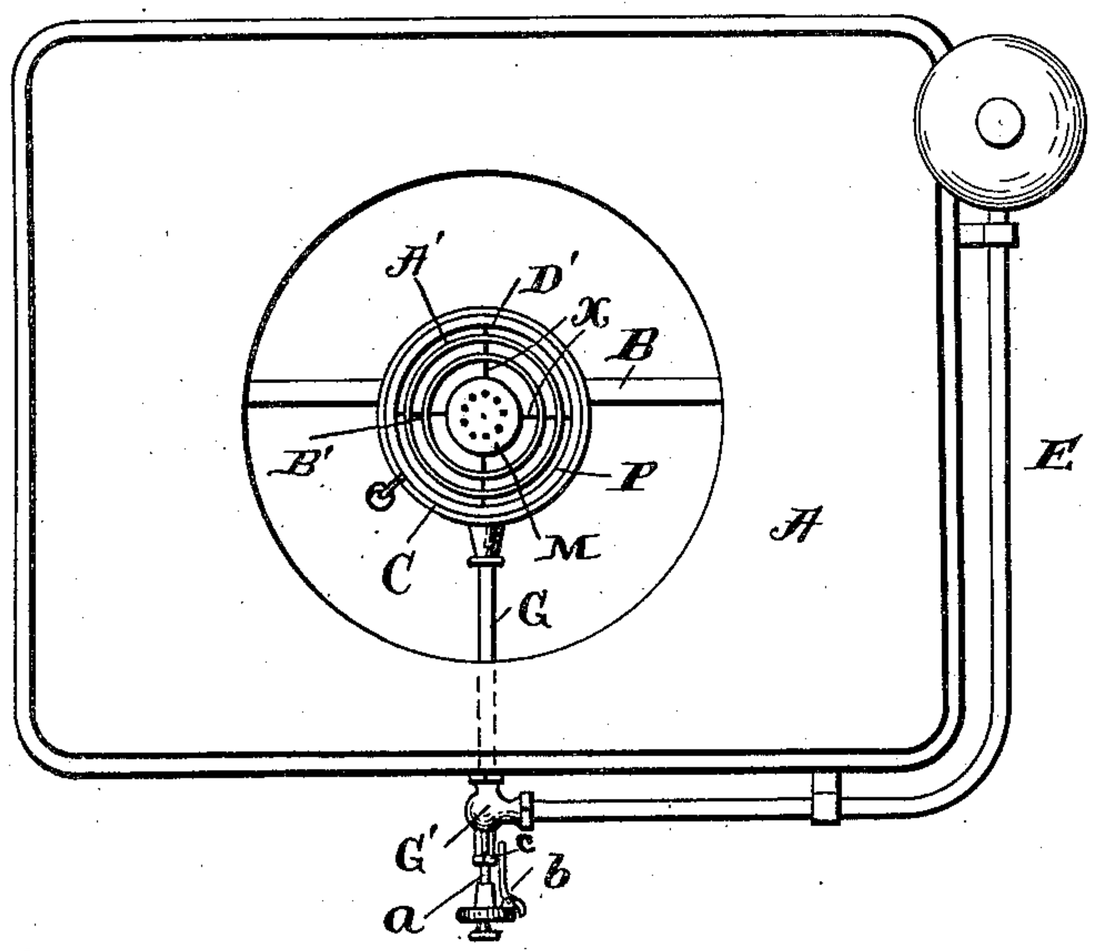
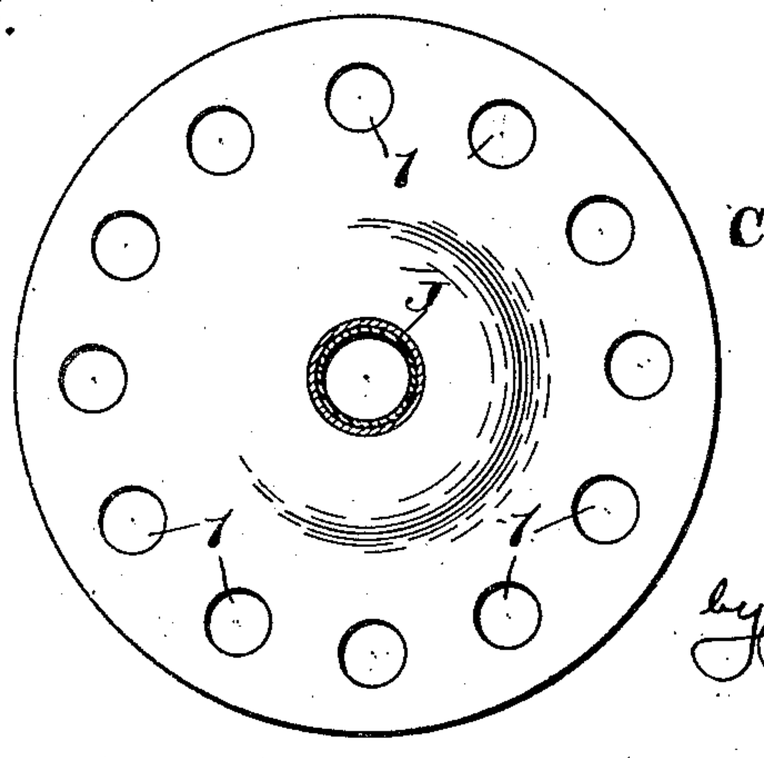


Fig. 7.

Fig. 6.



Witnesses
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UNITED STATES PATENT OFFICE.

ATWELL J. BLACKFORD, OF CLEVELAND, OHIO, ASSIGNOR TO AMERICAN STOVE COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION.

OIL-BURNER.

No. 848,586. Specification of Letters Patent. Patented March 26, 1907.

Application filed August 23, 1897. Serial No. 649,211.

To all whom it may concern:

Be it known that I, ATWELL J. BLACKFORD, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Oil-Burners; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to improvements in oil-burners, and pertains to that type which produce a blue flame, all of which will be fully described hereinafter and particularly referred to in the claims.

Heretofore blue-flame oil-burners have been produced in which the oil has been conveyed to the point of vaporization in various ways, one way being by capillary attraction, as in the common wick-burner. In this instance the oil has been vaporized either directly from the wick or partly from a wick and an adjacent cup or channel or channels into which the oil is conveyed by capillary action from the wick. The use of a wick is objectionable for several practical reasons well known to those skilled in the art, chiefly among which are the trimming of the wick and keeping it straight to produce an even flame at the top of the combustion-tubes used in such burners, the cost of production, the difficulty of holding the flame at a uniform height when the burner becomes hot, and the necessity of lifting and holding the combustion-tubes away from the wick-tube when not in use.

Another method effects the distribution of the vapors within a vapor holder or trough by the well-known superior density of gravity of hydrocarbon vapors as compared with air. In this instance the oil is vaporized at one point in the holder and distributed throughout the holder by the action of gravity or may be generated at a distant point and fed to and distributed throughout the vapor-holder by the action of gravity.

My invention differs radically from this last-named method in that I maintain a constant supply of oil throughout all parts of the oil-trough during the entire operation of the burner, as does the wick in the common wick-burner, and the vapors generated from the oil by contact with the heated trough pass upward directly from the point of vaporization and are oxygenated and distributed exactly as in the common blue-flame wick-burners.

The primary object of my present invention is to produce a burner having practically the same action in generating and distributing the vapors as the old and common blue-flame wick-burners, but so constructed as to overcome the disadvantages heretofore pointed out in that form of burner, for I find that the best results are obtained by that form of burner which keeps a constant and continual supply of oil throughout all parts of the bottom of the vaporization-chamber as does the wick.

The preferred form of trough here shown for carrying out the invention is V-shaped in cross-section, the apex of the V serving to provide a small oil-channel, and thus enable a small supply or feed to keep a constant supply of oil throughout all parts of the channel of the trough, the oil being vaporized by contact with the heated trough and passed upward between the combustion-tubes to be oxygenated and distributed exactly as in the wick-burner now in common use. While I here show a V-shape trough, this exact cross-sectional form of the trough is not necessary and may be varied so far as the generic invention herein claimed is concerned. Also the trough instead of being annular and adapted for the "Argand" type of burner here shown may be made straight for the "flat-wick" form of burner without departing from the spirit and scope of my invention.

For the purpose of lighting and starting the burner a thin vertical wick, preferably of wire-gauze, is placed in and rests directly upon the bottom of the apex of the V-shaped trough, and this serves to take up the oil by capillary action as it flows around the apex of the trough and enables it to be readily lighted with a match.

Heretofore an asbestos string has been placed on the bottom of a flat-bottomed trough; but this is difficult to get at to light and causes a vaporization of the oil on the flat surface at the sides thereof before the burner is sufficiently heated to properly take care of and consume it, which causes a bad odor, and also several wires have been used on an elevated shelf within the trough to facilitate the distributing of the oil by capil-

lary action and without absorbing any of it, as does the asbestos string; but this latter has been found to cause a bad odor, as air is permitted to circulate below it and make a smoky flame. In my burner neither of these constructions or methods is used. I place a thin web upon its edge within the oil-containing portion of the trough, such as a fine wire-gauze, and a thin vertical wick is thus provided, which takes up the oil vertically from the oil-supply groove the same as a wick, and it stands sufficiently high to be readily lighted. The wick retards, of course, to some extent the running of the oil in the apex of the V-shaped trough or the groove, as the case may be, by forming an obstruction thereto and also by taking up a part of the oil by a vertical capillary action. However, when the hydrocarbon oils are used, such as kerosene, an initial lighting device is necessary. When the burner is in operation, the wick also to some extent serves to facilitate the vaporization of the oil owing to the fact that it is seated in the oil-containing groove or apex and takes up a part of the oil contained therein by capillary action and holds it suspended in a vertical web. It will also be noted that the wick rests directly upon the bottom of the groove and no air is admitted beneath it to permit combustion in starting, and it is found that in this arrangement the oil exposed to the flame of the wick does not cause more vaporization than is properly oxygenated and consumed in the starting of the burner, and there is a space at each side of the wick for vaporization by the walls and a free upward passage of the generated vapor, both of which are essential to a properly-operating burner. I also find that where the oil is fed to the trough through an ordinary pipe, as heretofore, the flame is sometimes higher at the point of supply, and so much so as to make a very undesirable and unsatisfactory burner. I prevent this result by widening out the lower end of the supply-pipe to provide a large or wide delivery of the oil to the trough, which effects in practice an even distribution of the oil and an even flame.

In a burner of this character it is desirable to provide against any disturbance of the vapors generated, and this I provide for by means of an inclosing air-reservoir at the lower end of the burner, into which a limited quantity of air is admitted, and the burner fed therefrom, and an inclosing drum for the burner-section, which I find materially adds to the production of a steady and even flame and enables me to dispense with the usual multiplicity of diaphragms within the inner or central combustion-tube.

In my present construction I use only one check to the upward flow of the air within the central air-tube, and this is placed within the upper portion, but below the upper end thereof, and is so constructed as to provide a distinct central flame independent of the annular flame issuing from between the upper ends of the combustion-tubes. To aid in the best results, I use in conjunction with this diaphragm or check an air-tube which takes air from without the combustion-section and delivers fresh air below the top and adjacent or at the escape-openings in the diaphragm.

Referring now to the drawings, Figure 1 is a vertical central sectional view taken longitudinally throughout the supply-tube and valve, the burner being shown in position for operation. Fig. 2 is a detached perspective view of the oil-trough looking from the top thereof and the communicating end of the supply-tube. Fig. 3 is a detached perspective view of the thimble-shaped deflector or diaphragm within the inner tube. Fig. 4 is a detached perspective view of the wick. Fig. 5 is a top plan view of a one-burner stove embodying my invention. Fig. 6 is an inverted view of the cup-shaped inclosing shell. Fig. 7 is a cross-sectional view of the wick. Fig. 8 is a detached perspective view of one of the caps *b'*.

A is the frame of a stove to which my invention is shown applied and which may be of the form here shown or any other desired. This frame is provided with a cross piece or bar B, which assists in supporting the air well or shell C of the lower portion of the burner.

D is the reservoir, supported at any desired point in an elevated position, and has a pipe E communicating with the bottom thereof, and which also communicates with the upper end of the pipe G, that extends downward from the front of the frame and communicates with the oil-trough H.

At the intersection of the pipes E and G or at any other convenient point is an ordinary needle-valve G', by means of which the flow is either cut off entirely from the trough or turned on, as may be desired. However, to prevent the operator turning on too large a flow of oil the valve-stem *a* is provided with a pivoted spring-actuated finger *b*, adapted to engage a stop *c* on the valve-stem socket, and this is so set that the proper amount of oil will be fed when in engagement with the stop to produce the best results.

The trough here shown is V-shaped in cross-section to provide an oil-containing groove *e* by its apex, into which the oil flows, and is constantly kept supplied with oil while the burner is in operation. The cross-sectional shape of the trough, however, may be varied without departing from the spirit and scope of my generic invention, though a contracted or V shape is preferred. Placed loosely within this trough and resting upon the bottom of the said apex or groove is a strip of wire-gauze *d*, formed to correspond to the shape of the trough and standing upon its

edge. The function of this strip of gauze is to act as a wick for lighting the burner and to also assist in the vaporization of the oil after the burner is in full operation by taking up a part of the oil from the oil-containing portion of the trough. The outer wall of the trough is preferably provided with a shallow flange *f* and a lateral shoulder *g*, forming a seat for the outer combustion-tube of the combustion-chamber, to be fully described hereinafter.

Especial attention is called to the horizontal enlargement of the lower end of the supply-tube G where it communicates with the trough, whereby an even distribution of the oil fed in the trough is effected and a high burning of the flame at the end of the supply-tube prevented. This trough is provided with the arms or spiders I, connected to the upper end of the central vertical tube J, which passes down through and is preferably secured to the shell C, which supports it at its lower end. The tube is provided at its lower end with a vertical slot *h*, having at its upper end an offset *i*, and surrounding the lower end of the tube is a sleeve K, having a handle L and a pin *j* extending into the slot of the tube J. This construction is used to elevate the combustion-section from the vaporizing-section for the purpose of lighting the wick.

The shell C, which surrounds the trough, is made considerably larger and serves to provide an air-well into which air is admitted through the openings *l*, formed in the bottom of the shell, and is distributed or fed from this reservoir to the burner. This construction serves to prevent any disturbance of the vapors within the combustion-chamber and trough and materially aids in producing an even and steady flame at the top of the combustion-tubes.

The combustion-section consists of the two concentric perforated tubes A′ and B′, which are of the ordinary form, and the lower ends thereof are seated within the upper end of the oil-containing trough when the burner is in operation. The outer tube is provided with small perforations throughout its length, and the inner tube is provided with small perforations throughout a portion only of its length. A diaphragm M is situated within this inner tube at a point above these small perforations and consists of an annular horizontal portion *m* and a vertical central extension *n*, projecting upward therefrom and provided with a cap *p*, having a circular series of small perforations *r*. At the upper end of the inner tube are formed a series of air-passages *s*, here shown in the form of large circular openings, and the inner tube is preferably imperforate from the horizontal portion of the diaphragm *m* to the said passages *s*. These passages *s* are formed at a point opposite the top of the central portion *n*, so that the inner tube extends slightly above the said vertical central portion *n* of the diaphragm M, as shown, and the outer combustion-tube has its upper end below both the inner tube and the said central extension *n* of the diaphragm. It will be noted that this shape of diaphragm constitutes what may be termed a "thimble" or "hat-shaped" diaphragm, the particular function of which will now be stated.

The horizontal annular portion of the diaphragm being below the upper end of the inner tube forms a "well" and tends to cause a vacuum thereabove, so that some of the gases rising between the tubes is drawn inward over the central extension of the diaphragm, and air passing through the perforations *r* of the cap supports combustion, and a distinct and separate annular blue flame is produced, which is very effective in heating the center of the vessel thereabove. The air-passages are very effective in causing a tumbling and mixing of the gases and air at the upper end of the combustion-tubes as they are drawn inward and over by the tendency to vacuum caused by the well before mentioned. The central flame is produced on account of the passages *s* at the upper end of the inner tube being about opposite the upper end or top of the central extension *n* of the diaphragm M, though practically the same result will be effected in a less degree should the upper end of the inner tube be terminated at this point to permit a passage thereover of some of the gases. I prefer to form the perforations *r* near the edge of the cap, as shown, and in a circular series, so that air is fed more effectively to all parts of the gases passing over the top of the diaphragm and a circular central flame produced. The function of this diaphragm is to confine air below it within the inner tube, and thus force most of it through the inner tube into the combustion and mixing space between the two tubes, while a small portion passes through the cap to feed the flame thereabove and also to provide a well within the upper end of the inner tube. These openings in the cap can, however, be varied in size, number, and location without departing essentially from the spirit and scope of my invention, and to this feature *per se* I make no claim, it being very old in the art to provide a diaphragm with openings in the inner tube, whereby the upward flow of air is impeded and part permitted to pass therethrough to mix with the gases above, as shown in the Morrill patent, Number 44,548, October 4, 1864, the essential feature of this part of my invention being the shape of the diaphragm, as before set forth, whereby a well is produced between the inner tube and the extension of the diaphragm to cause a tendency to vacuum at the upper end of the inner tube.

I improve the character of the center flame produced by the openings in the cap of the diaphragm extension, by delivering air under it to said openings from a point out-

side of the combustion-chamber. This is accomplished by means of the tube J, before referred to, which passes through the combustion-section and has open ends. The lower end receives fresh air, and the open upper end delivers air just under the cap of the extension *n* and to the openings *r* made therein. This construction, as will be readily conceived, enables me to deliver fresh unvitiated air to the openings in the cap and to the gases passing over and adjacent to said openings, whereby an improved separate flame is produced.

Another feature of my present invention pertains to providing a drum P surrounding the outer combustion-tube and secured to the combustion-section to be raised thereby. This drum P has its lower end preferably tapered, as shown at *t*, to better coöperate with and pass within the upper end of the cup-shaped shell or reservoir C, surrounding the oil-trough, which keeps away the draft and prevents a disturbance of the gases as they rise between the combustion-tubes and also serves to direct and confine the air and to cause it to be forced through the outer combustion-tube into the mixing and combustion chamber between the two tubes. This action is greatly increased by providing the upper edge with an inwardly-extending portion D′ to furnish a restricted escape for the air. It also serves an additional function in causing an inward draft at the point of passage of the gases over or through the inner tube, thus tending to throw them inward. By the combined use of this drum and the reservoir or shell C inclosing the trough I am enabled to dispense with the multiplicity of diaphragms and retarding devices and obstructions situated within the inner tube of the burners now on the market and to produce a most satisfactory result with a single retarding element within and below the upper end of the inner tube. I also find that the action of the burner may be improved somewhat by providing the lower ends of the combustion-tubes, respectively, with inwardly and outwardly projecting bends or beads Q. These are situated, preferably, just above the oil-trough and serve to retard the upward passage of the vapors, and thus cause a better and more thorough mixture of the vapors and air for effecting a more perfect combustion, and especially when the burner is being started and before it has become thoroughly heated. They form "pockets," so to speak, into which the vapors spread and are held or retarded, so that there is a more thorough oxygenation thereof. However, this construction may be omitted without affecting the operation of the other features of my burner. It will also be readily conceived that this construction of the tubes will serve the same advantageous function in conjunction with any form of blue-flame burner using perforated tubes, and I do not, therefore, limit myself to its use solely in connection with the form of burner here shown.

The combustion-tubes, drum P, and tube J are secured together and in place by means of wires *x*, passing therethrough at right angles, as shown. The ends of these wires extend slightly through the drum P and are held against endwise displacement by means of the caps *b*′, which are somewhat similar to paper-fastenings, having arms *c*′, passing through the drum and turned around against it and forming pockets for the ends of the wires. The tube J is secured to the lower end of the inner combustion-tube B′ by means of the arms M′. This furnishes a very simple, cheap, and efficient means for holding the wires in place and also enables the combustion-section to be readily assembled and disassembled.

In operation the combustion-section is lifted by means of the handle at the lower end of the tube J and, if desired, supported in an elevated position by turning the handle laterally. The valve is then turned about two-thirds open and the oil permitted to flow a few seconds until the entire apex or groove is supplied and the wick started, when the wick is fired with a match, preferably all the way around, the same as the common wick-burners. The combustion-section is then dropped down. The valve may then be turned on full or the burner left a few minutes until heated and then turned on full, when a full and even flame at the upper ends of the combustion-tubes and an independent central blue flame will be the result.

In a burner of this construction there is no difficulty in maintaining a flame and holding it at a predetermined height and which will not be affected by the heating of the burner, as in a wick, and the flame is readily under control through the manipulation of the valve in regulating the supply of oil to the apex of the oil-trough. A trough with a small contracted oil-groove is admirably adapted to handle either a small flow of oil for a low flame or a larger flow for a full flame in that a small flow will cover all parts of the groove, and when a larger flow is fed there is an increased vaporizing-surface to take care of the increased flow.

I do not make any claim in this application broadly to a central lifting extension, nor broadly to a supporting means situated at the lower end thereof, nor broadly to a central air-tube which forms a lifting element, for these are claimed in my application pending concurrently herewith.

In Fig. 8 I show the wick in section and from which it will be seen that the wire-gauze from which the wick is formed is doubled and preferably incloses a very small quantity of asbestos fiber or other refractory material *e*′ in the form of a very thin vertical web. The

object of this is to facilitate the capillary action of the wick and also its lighting.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an oil-burner, the combination with an oil-holding trough, the lower part of the trough being adapted to contain a body or column of oil when in normal operation, and the upper part forming a vaporizing-chamber to vaporize the oil from its free surface and means located in the trough for igniting or starting the vaporizing of the oil, of perforated combustion-tubes forming an uninterrupted continuation of the vapor-chamber and adapted to cause the vapors arising from the surface of the oil to burn with a blue flame by admixture with the air.

2. In a burner, the combination with a trough and perforated tubes situated thereabove and forming a combustion-chamber, said trough having at its bottom a liquid-containing portion, and an upper vapor-receiving space, and a vertically-disposed lighting member seated in the liquid-containing portion and extending upward between the walls of the vapor-receiving portion to form a vapor-space at the side of the lighting member.

3. In an oil-burner, the combination with an oil-holding trough having a contracted lower part and an enlarged upper part, the lower part of the trough being adapted to contain a body or column of oil when in normal operation and the upper part forming a vaporization-chamber to vaporize the oil from its free surface and means located in the trough for igniting or starting the vaporizing of the oil, of perforated combustion-tubes forming an uninterrupted continuation of the vapor-chamber and adapted to cause the vapors arising from the surface of the oil to burn with a blue flame by admixture with the air.

4. In a burner the combination with a trough and perforated tubes situated thereabove and forming a combustion-chamber, said trough having at its bottom a liquid-containing portion, and an enlarged upper vapor-receiving space, and a vertically-disposed lighting member seated in the liquid-containing portion and extending upward between the walls of the enlarged vapor-receiving portion to form a vapor-space at the side of the lighting member.

5. In a burner the combination of a trough and perforated tubes situated thereabove and forming a combustion-chamber, a lighting member vertically disposed between the upwardly-disposed walls of the trough, said trough having a contracted lower portion in which the lighting member is seated, and a vapor-space above the contracted portion at the side of the vertically-disposed lighting member.

6. In a burner, the combination of a trough and perforated tubes situated thereabove and forming a combustion-chamber, said trough being contracted at its lower portion, and a vertically-disposed lighting member seated in said contracted portion and extending upward between the upwardly-disposed walls and constituting a vapor-space in the upper portion of the trough at the side of the said lighting member.

7. In a burner the combination of a trough and perforated tubes situated thereabove and forming a combustion-chamber, said trough being contracted at its lower portion and being provided with a wick seated in the contracted portion of the trough and extending upwardly between and distant from its upwardly-disposed walls.

8. An oil-burner comprising a trough having a contracted oil-groove, and an oil-supply pipe having an enlarged supply end communicating directly with the contracted oil-groove.

9. An oil-burner comprising a vaporizing-section, a depending guideway, an independently vertically movable combustion-section having a depending lifting extension engaging said guideway, and a vertically-movable lifting member carried by said guideway and adapted to engage the lifting extension.

10. An oil-burner, comprising a vaporizing-section, a depending guideway, an independently vertically movable combustion-section having a depending lifting extension engaging the guideway, a lifting member carried by the guideway and adapted to engage the lifting extension, the lifting member and guideway having laterally-engaging members for sustaining the lifting member and thereby the combustion-section in an elevated position.

11. An oil-burner comprising a vaporizing-trough, a vertically-movable combustion-section to permit access to the trough for lighting purposes, a cup-shaped shell inclosing the trough and extending below it and provided with a restricted air-opening, a drum inclosing the combustion-section and movable therewith, the upper end of the cup-shaped shell extending considerably above the said trough for the purpose of protecting the initial flame when lighting.

12. A combustion-section comprising concentric perforated combustion-tubes, a hat-shaped diaphragm situated within the inner tube with its lower end engaging the tube below its upper end, the extension of the diaphragm having a top provided with an air-passage to feed oxygen to the gases and flame above.

13. A combustion-section comprising concentric perforated combustion-tubes, a hat-shaped diaphragm situated within the inner tube with its lower end engaging the inner tube below its upper end, the top of the ex-

tension having air-openings and the upper end of the inner tube constructed to permit an inward passage of the vapors over said extension-openings for the purpose described.

14. A combustion-section comprising concentric perforated combustion-tubes, an air-deflector or diaphragm situated within the inner tube and provided with an upward extension, the lower end engaging the inner tube below its upper end, the top of the extension of the deflector having air-passages, and the inner tube having air-passages about opposite the top of the diaphragm to deliver the gases over the said openings in the top of the diaphragm.

15. A combustion-section comprising concentric perforated combustion-tubes, a diaphragm situated within the upper portion of the inner tube below its upper end and having air-passages, the inner tube constructed to deliver some of the gases over said passages, and an inclosing drum for the outer combustion-tube open to the atmosphere at its lower end and having an inwardly-extending flange at its upper end to deflect the gases inward for the purpose described.

16. A combustion-section comprising concentric combustion-tubes, a diaphragm having an upwardly-extending central portion and situated within the inner tube with its lower end engaging the tube below its upper end to form a "well," the central portion of the diaphragm extending upward to near the top of the inner tube and provided with a plurality of small openings, whereby the escaping gases are drawn inward and supplied with oxygen.

17. A combustion-section comprising concentric combustion-tubes, a diaphragm situated within, closing the upper end of and having communication with the inner tube, and provided with an air escape or escapes, and an air-pipe delivering air against the under side of the diaphragm.

18. A combustion-section comprising concentric combustion-tubes, a hat-shaped diaphragm situated within and spanning the upper end of the inner tube and having an air-passage, a pipe having its upper end within the inner tube and adapted to deliver air within the crown of the said diaphragm, and its opposite end receiving fresh air from without the combustion-section.

19. A combustion-section comprising concentric combustion-tubes, a hat-shaped diaphragm situated within the inner tube below its upper end and closing the same, the crown of the diaphragm having an air-passage, a centrally-disposed air-pipe having its upper end extending within the crown of the said diaphragm and its lower end receiving air from the lower portion of the burner.

20. A combustion-section comprising concentric perforated combustion-tubes, a hat-shaped diaphragm situated within the upper end of the inner tube and closing the same, the crown of the diaphragm having an air passage or passages, an air-pipe situated within the inner combustion-tube and delivering air within the crown of the diaphragm, the inner combustion-tube having openings at a point adjacent the top of the crown of the diaphragm, whereby air is delivered to the openings in the crown of the diaphragm and passes over the crown through the openings of the inner tube.

21. The combination of the combustion-tubes and inclosing drum provided with registering horizontal openings, of transverse rods passing through said openings in the tubes and drum and projecting beyond the latter, and sockets inclosing the projecting ends of the rod, said sockets having arms attaching them to the drum.

22. A burner comprising a V-shaped trough having its apex forming a contracted oil-groove, and a supply-pipe having its supply end enlarged horizontally and communicating directly with the apex thereof, substantially as described.

23. In a burner, the combination of a trough and perforated tubes situated thereabove and forming a combustion-chamber, said trough being V-shaped in cross-section, a contracted liquid-containing portion constituting the apex thereof, and a wick seated in the apex of said trough and extending upwardly between and distant from its upwardly-disposed walls.

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

ATWELL J. BLACKFORD.

Witnesses:
RAY M. RAFF,
THOS. M. SOURBECK.