No. 631,012. Patented Aug. 15, 1899.

J. E. HEWES & D. S. WILLIAMS.

PETROLEUM INCANDESCENT LAMP.

(Application filed June 16, 1897.)

(No Model.)

FIG. 1.

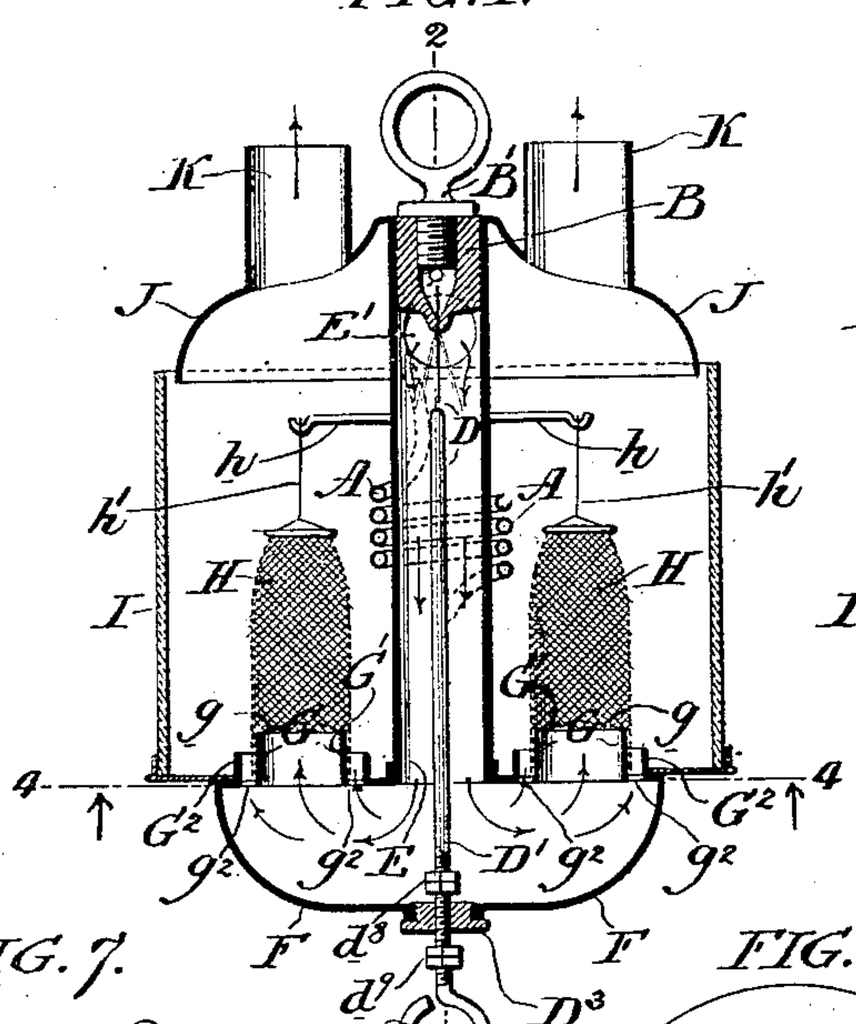


FIG. 2.

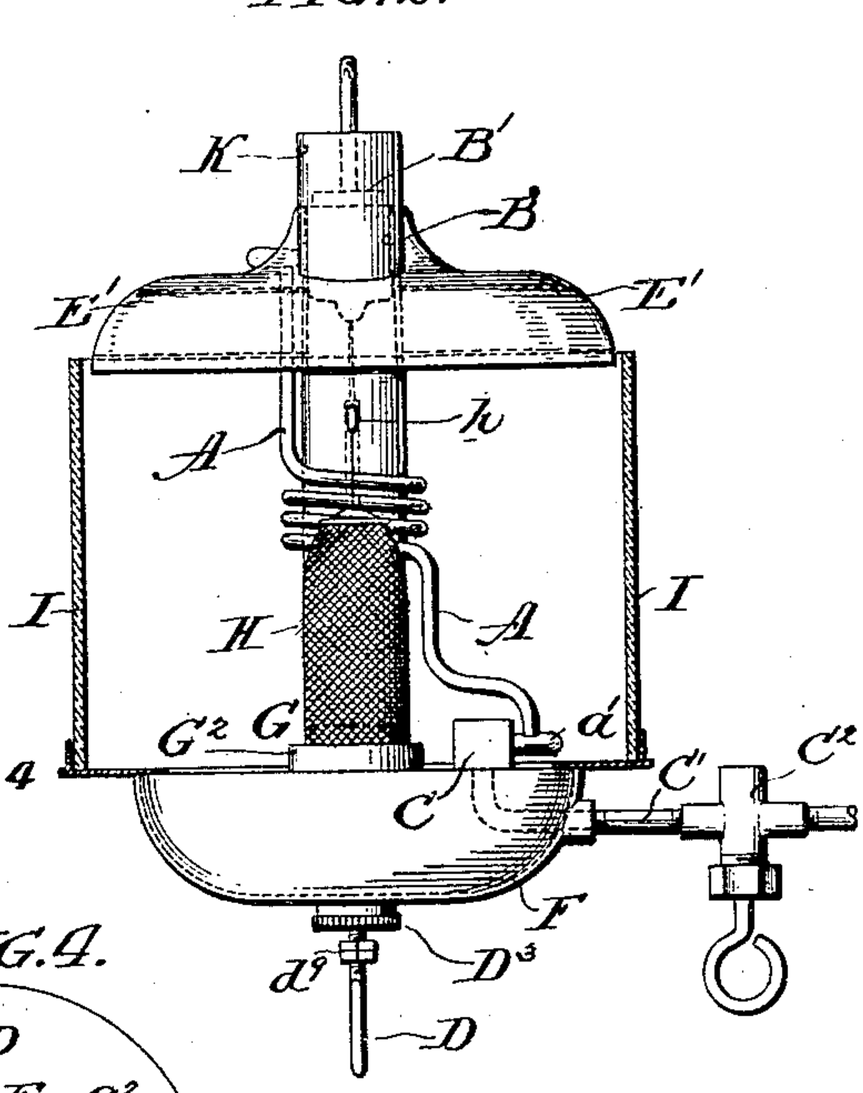


FIG. 7.

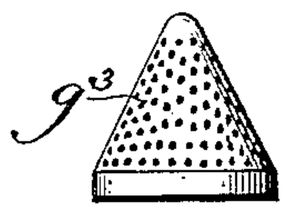


FIG. 4.

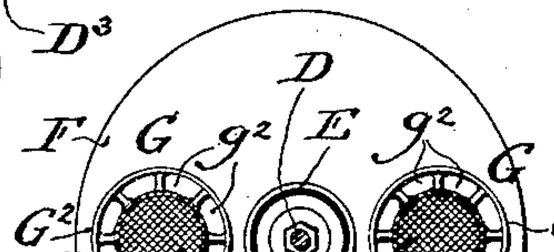


FIG. 3.

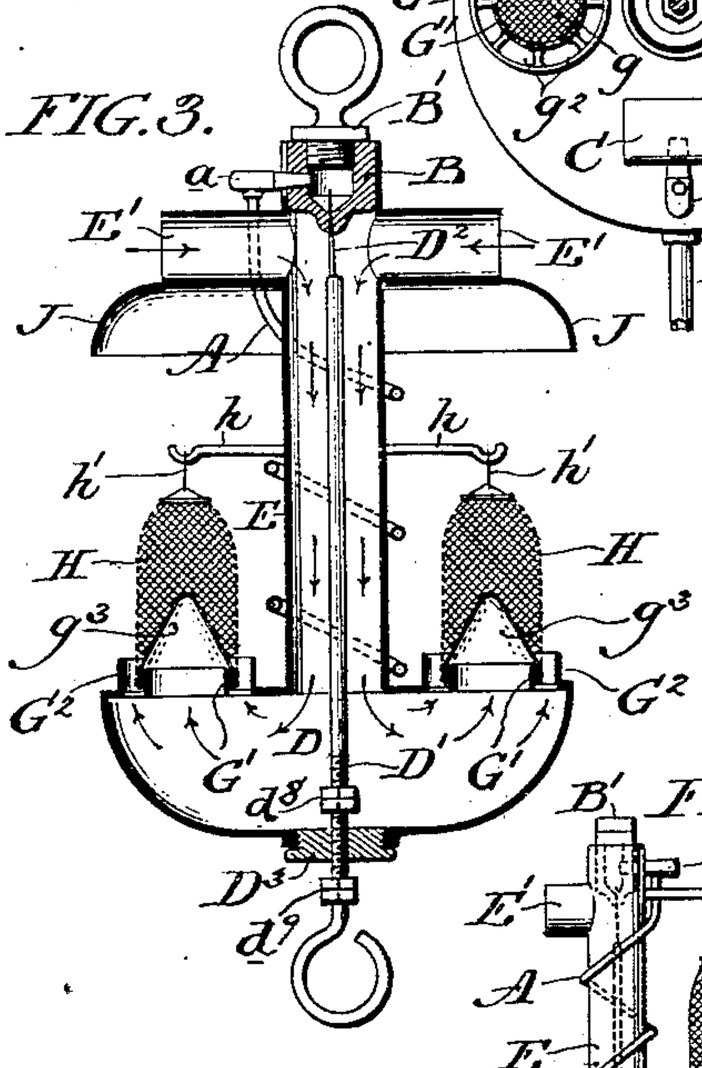


FIG. 5.

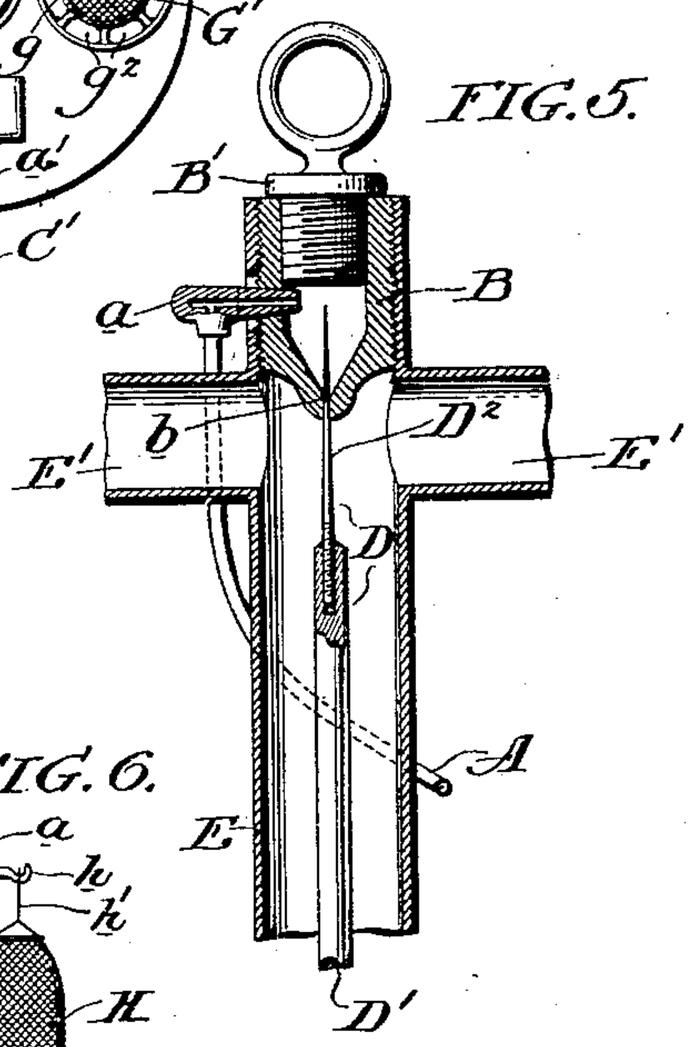
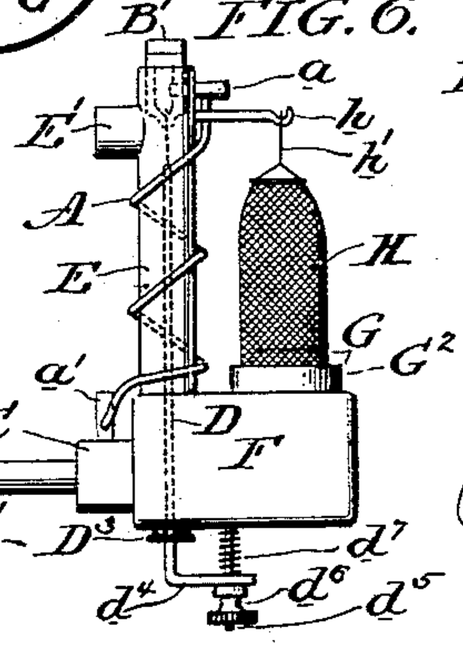


FIG. 6.



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UNITED STATES PATENT OFFICE.

JAMES E. HEWES AND DAVID S. WILLIAMS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO SAID WILLIAMS AND JOSEPH A. VINCENT, OF SAME PLACE.

PETROLEUM INCANDESCENT LAMP.

SPECIFICATION forming part of Letters Patent No. 631,012, dated August 15, 1899.

Application filed June 16, 1897. Serial No. 640,956. (No model.)

To all whom it may concern:

Be it known that we, JAMES E. HEWES and DAVID S. WILLIAMS, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improvement in Petroleum Incandescent Lamps; and we do 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 appertains to make and use the same.

Our invention relates to petroleum incandescent lamps, and has for its object to so construct the lamp that it will be specially adapted to the burning of high-test petroleum-oil.

The problem of successfully utilizing high-test petroleum-oil as an illuminant has been an extremely difficult one owing to the fact that an intense degree of heat is required to vaporize it, and that the vapor, unlike naphtha or gasolene, does not become fixed, but will liquefy as soon as it passes without the zone of intense heat, and hence must be consumed while in a highly-heated condition. Hydrocarbon oil of this character is also so heavy that to produce the necessary Bunsen effect, permitting the employment of an incandescent mantle, the oil must be first so thoroughly vaporized that the vapor must be dry and superheated as distinguished from comparatively heavy vapor tending to liquefy upon passing beyond the zone of intense heat of the incandescent mantle. After vaporization the quantity of air that must be mixed with a given volume of vapor must be relatively large owing to the great richness of the oil in carbon, and the vapor before being fed to the burners and while being mixed with air must be allowed the greatest feasible room for expansion. It is also essential to maintain the mixed oil and vapor within the effective heat zone of the mantle in its passage to the burner—that is, the mixed oil and vapor must not be conveyed to the burner by a path so remote from the burner that its temperature will drop to a point that will cause partial condensation of the vapor, resulting in deposits of carbon, clogging of the lamp, and a less hot flame due to insufficient heating of the cold air that is caused to combine with the vapor. The construction which forms the subject-matter of our invention is designed to meet these requirements and displays the following characteristics: The vaporizing-tube or vaporizer is located at a point above the burners and preferably at or near the top of the incandescent mantle and in such close proximity to the mantle that it will receive the direct as distinguished from merely the radiant heat therefrom and will be within the zone of most intense heat—that is, the vaporizing-tube is placed in such position that it will be in direct contact with the highly-heated air and products of combustion rising from the burner—and therefore within the most effective heating zone of the burner instead of being heated merely by its proximity to the burner. The main body of the vaporizer extends in a general lateral direction as distinguished from a vertical direction, so that a sufficiently-long section of the vaporizer will be subject to the intense heat necessary to effect thorough vaporization. The intensely-heated vapor is then fed into a tube or chamber of relatively large diameter, so as to permit the necessary free expansion of the vapor. At the vapor-inlet end of this expansion-tube we provide openings for air, and this combined mixing and expansion tube communicates at its opposite end with the burner. The mixing and expansion tube is located within the effective heat zone of the mantle, and in the various constructions we have illustrated the common characteristic is presented of a mixing and expansion tube which is placed so close to the burners that the distance between them is less than the diameter of either and the vaporizer is so disposed as to permit this arrangement. Thus we secure both thorough vaporization and the maintenance of the oil in a vaporized condition until it is consumed. This arrangement is quite important with the use of high-test hydrocarbon oil to insure the operativeness of the lamp with all degrees of external temperature. Any volatile oil—such, for example, as gasolene—will vaporize at such a relatively low temperature that it may be conveyed a considerable distance beyond the ef-

fective heat zone of the burner without danger of liquefaction; but we have found that to prevent any condensation of high-test petroleum-oil the expansion-tube should be placed in the relation specified. The preferred absolute minimum distance between the burner and the expansion-tube will of course vary with the size of the lamp; but in all cases to secure the best results the relation between the burner and expansion-tube should be such that the distance between them will be less than the diameter of one or both. With a two-burner lamp the problem of maintaining the mixed oil and vapor within the effective heat zone is solved by placing the expansion or mixing tube directly between the burners, whereby the oil after once being vaporized is subjected in its passage to the burners to direct heat on both sides of the conducting-tube, so as to entirely escape the cooling influences of the surrounding atmosphere. The vaporizing-coil is preferably so arranged as to be readily detachable from the lamp when filled with a deposit of carbon due to the intense heat to which the oil, being of a high test, is subjected. The valve for regulating the passage of vapor from the vaporizer to the expansion-tube extends through the expansion-tube and is operated from the low-pressure side, thus avoiding the use of a gland or stuffing-box and consequent inevitable leakage and unpleasant odor.

The problem of efficiently heating the combined mixture of petroleum-vapor and air sufficiently without heating it excessively has been one of the most difficult of the problems that have been met with in the attempt to utilize high-test petroleum-oil for illuminating purposes. An insufficient heating of the mixture results in the partial condensation of the vapor, with the resultant evils heretofore alluded to. An excessive heating of the mixture, on the other hand, results in a complete chemical combination of the oxygen with the oil-vapor, forming carbon monoxid, (CO,) which burns with a dull blue flame, or carbon dioxid, (CO_2,) which will result in a back firing of the flame. It has been attempted to secure effective heating of the mixture by providing a separate mixing and expansion chamber above the burner or above an auxiliary flame not intended for illumination and conveying heated air thereto and then conveying said heated mixture to the burner by a separate tube. The disadvantages of this expedient are serious—first, because not nearly as much air when heated will combine with the vapor as when the air is cold, and the larger the volume of air that combines with the vapor within limits the more intense the heat, and, secondly, because the mixture having a relatively long and circuitous route to travel to reach the burners its rate of flow will be seriously diminished. In our construction, by virtue of organizing the lamp so that there will be but two parts in which the burning fluid is prepared—namely, the laterally-extending vaporizer above the mantle and an upright combined mixing and expansion tube of relatively large diameter connected directly with the vaporizer above and with the burner beneath—we are enabled to introduce a sufficient volume of air and maintain the flow of the mixture to the burners at the necessary rate of speed, besides simplifying the entire organization and doing away with the unnecessary, cumbersome, and positively disadvantageous and useless separate chamber between the vaporizer and the upright mixing and expansion tube, a chimney being provided in the hood for the products of combustion to prevent the same heating the air-inlet tube. To overcome the tendency to liquefaction which would otherwise arise from the admission of relatively cold air to the mixing and expansion chamber, we arrange the latter, as before described, in such close proximity to the mantle or mantles that the mixture will be brought to and maintained at a temperature that will be as high as possible consistent with the maintenance of a mechanical mixture as distinguished from a chemical combination. We effect this, as before stated, to secure the best results, by arranging the expansion-tube and burner so close together that the distance between them will be somewhat less than the diameter of one or both. It is obvious, however, that our invention is not confined to this particular arrangement except wherein it is specifically claimed.

The invention consists also of various details of construction, all of which will be fully treated hereinafter.

Referring to the accompanying drawings, forming part of this specification, Figure 1 illustrates a front elevation, partly in section, of a lamp embodying our improvements. Fig. 2 represents a side elevation, partly in section, on the line 2 2 of Fig. 1. Fig. 3 is a sectional front elevation similar to Fig. 1, slightly modified in construction and embodying our improved form of flame-spreader. Fig. 4 illustrates a sectional view on the line 4 4 of Fig. 1, looking in the direction of the arrow. Fig. 5 shows an enlarged sectional view of the expansion-tube and regulating-valve contained therein. Fig. 6 illustrates a single form of burner, showing the manner of connecting the vaporizing-coil to the supply-pipe and to the screw-plug mounted in the upper end of the vaporizing-tube. Fig. 7 represents the conical burner-cap.

Referring to the reference-letters of the drawings, A indicates the vaporizing-coil, which is preferably formed of small steel tubing having an internal diameter of about one sixty-fourth of an inch or less. The coil has brazed upon each end tapered steel plugs a and a', one of which is fitted to the plug B by driving it into a hole contained therein of the same taper as the plug. The other of said plugs is connected to a block C, to which is connected the oil-supply pipe C'.

The oil which we prefer to use is common burning petroleum-oil of about 150° fire test, although oil of a lower test may be safely used by decreasing the number of coils, or, in other words, decreasing the length of the vaporizing-coil.

The oil is fed to the burner from any suitable receptacle at a pressure of about sixty pounds to the square inch, a needle-valve C^2 in the pipe C′ serving to entirely cut off the supply of oil to the lamp when the same is not in use.

The plug B at the top of the expansion-tube is provided with a cap B′, which can be removed at intervals for the purpose of removing the slight deposit of carbon which forms around the opening *b* in the plug after the lamp has for a long time been in use. This is also true of the vaporizing-coil, which after a time becomes filled with a deposit of carbon, and in order to obviate the trouble of cleaning out the carbon from the coil, which in some cases after a long and continued use of the lamp is almost impossible, we prefer to remove the old coil and replace it by a new one, which act is easily accomplished by the use of the tapered plugs above referred to.

The regulating-valve D is formed in two parts, there being a comparatively heavy stem portion D′ and a detachable needle portion D^2, the former being threaded at the lower end to a corresponding internal thread in the lower part of the lamp.

In operating our lamp the coil A is first heated by means of a torch, which should contain alcohol in order to more quickly vaporize the oil in the vaporizing-coil A. When the oil is sufficiently heated, the vapor therefrom passes into the plug B and out through the opening *b*, controlled by the needle-valve, into the expansion or mixing tube E. The expansion of the vapor into the tube E causes an aspiration of air through the pipes E′, which, mingling with the vapor in the tube E, passes downward into the chamber F. The chamber F forms a reservoir for containing the mixed air and vapor and acts as a cushion to regulate the discharge of mixed air and vapor to the burners, thus preventing the throbbing or pulsating which characterizes petroleum-vapor burners, and it still further relieves the strain on the delicate incandescent mantles and produces a uniform and steady flame.

By repeated experiments which we have made we find that in lamps of this character a burner of special construction is very desirable for the reason that burners of the ordinary type when provided with mantles capable of becoming incandescent have a tendency to throttle the flow of vapor to the burners, and consequently reduce the brilliancy of the light.

In carrying out our invention we provide the burners G with a central wing G′, provided at the top with a wire screen *g*, forming a recticulated opening to prevent the back firing of the flame and with an outer ring G^2, which forms an annular space communicating with the chamber F through openings g^2.

The mantles H, which are suspended from hooks *h* by depending platinum wires *h*′, surround the rings G′, so that the greater portion of the flame passes upward on the outside of the mantle, thus preventing a throttling of the flame and increasing the brilliancy of the light.

We have succeeded in obtaining good results by providing the inner ring of the burner with a conical cap g^2, of perforated metal, as shown in Figs. 3 and 7, which has a greater tendency to spread the flame than the cap shown in Fig. 1.

As shown in Figs. 1 and 2, where the lamp is exposed to drafts of air it is desirable to protect the same by a globe I, supported by a ring I′ at the base of the lamp. The upper part of the lamp is in like manner protected by a hood J, provided with one or more chimneys K to carry off the products of combustion.

Referring again to the regulating-valve D, which is of peculiar construction, we desire to state that as far as we are aware the same is entirely novel, and its application is contrary to common practice, the needle portion D^2 entering the discharge end of the valve-seat on the low-pressure side instead of the high-pressure side, thus avoiding the use of a gland or stuffing-box, which is an essential feature with the ordinary forms of valves, and in using hydrocarbon oils under high pressure we have found it almost, if not quite, impossible to make a joint oil-tight, and in the course of our experimenting we have found that where the valve was apparently tight, due to its being highly heated, the vapor thrown off produced a very disagreeable odor, which would condemn the lamp for general indoor use.

In the bottom of the chamber F is a screw-cap D^8, externally threaded to the bottom of the chamber and internally threaded to receive the valve-stem D′, and upon the stem D′ are two sets of jam-nuts d^8 and d^9 for the purpose of limiting the movement of the valve, so that the same cannot be removed from the valve-seat nor entirely closed during the operation of the lamp.

In Fig. 6 we have shown a slightly-modified form of lamp adapted to a single burner, the chief feature of difference being the manner of adjusting the valve. In this case the stem D′ is provided with a short arm d^4, which embraces a stem d^5, threaded to receive a thumb-nut d^6. Between the arm d^4 and the bottom of the lamp is a spring, by which means the stem D′ is held from its seat, so that by turning the thumb-screw d^5 the valve can be adjusted against the action of the spring d^7 and regulated to any desired position.

Having described our invention, what we claim, and desire to secure by Letters Patent, is—

1. A hydrocarbon incandescent lamp comprising a detachable vaporizing-coil, an expansion-tube provided at one end with a valve-seat and with air-inlet openings, an adjustable needle-valve extending through the expansion-tube and operated from the low-pressure side of the valve and one or more burners communicating with the expansion-tube arranged to impart heat to the vaporizing-coil, substantially as specified.

2. A hydrocarbon incandescent lamp comprising a detachable vaporizing-coil, an expansion-tube provided at one end with a valve-seat, communicating with the vaporizing-coil and having air-inlet openings, an adjustable needle-valve extending throughout the length of the expansion-tube and operated from the low-pressure end thereof, a chamber communicating with the expansion-tube adapted to hold a quantity of mixed air and vapor and one or more incandescent burners mounted upon said chamber and adapted to impart heat to the vaporizing-coil, substantially as specified.

3. A hydrocarbon incandescent lamp comprising an expansion-tube provided with a valve-seat and air-inlet openings, a detachable vaporizing-coil communicating with said valve, an adjustable needle located in the expansion-tube and operated from the low-pressure end thereof, a cushioning-chamber communicating with the expansion-tube adapted to hold a quantity of mixed air and gas, and one or more incandescent burners mounted upon said chamber and adapted to impart heat to the vaporizing-coil, substantially as specified.

4. A hydrocarbon incandescent lamp comprising an expansion-tube provided with a valve-seat and with air-inlet openings, a detachable vaporizing-tube surrounding the expansion-tube and communicating with said valve, an adjustable needle-valve located in the expansion-tube and adapted to be operated from the low-pressure side thereof, a chamber communicating with the expansion-tube adapted to hold a quantity of mixed air and gas and one or more burners communicating with said chamber adapted to impart heat to the vaporizing-coil, and one or more incandescent mantles suspended above said burners and resting between the inner and outer rings thereof, substantially as specified.

5. A hydrocarbon-lamp comprising an expansion-tube provided at one end with a detachable valve-seat and with air-inlet openings, a vaporizing-coil detachably connected to the oil-supply pipe at one end and detachably connected to said valve-seat at the other end, a needle-valve located in the expansion-tube and operated from the low-pressure side thereof, one or more burners communicating with the expansion-tube, said burner or burners having an inner portion provided with a perforated conical cap adapted to receive an incandescent mantle and an outer portion provided with a series of openings to deliver the flame to the outside of the mantle, substantially as specified.

6. A hydrocarbon incandescent lamp comprising an expansion-tube provided at one end with a detachable valve-seat and with air-inlet openings, a vaporizing-coil detachably secured to said valve-seat and to the oil-supply pipe, a valve in the oil-supply pipe, a needle-valve located in the expansion-tube and operated from the low-pressure side thereof, a chamber communicating with the expansion-tube and adapted to hold a quantity of mixed air and vapor, one or more burners communicating with said chamber, the burner or burners having an inner portion provided with a conical flame-spreader adapted to an incandescent mantle, and an outer portion provided with openings to produce a flame on the outside of the burner, said burner or burners being adapted to impart heat to the vaporizing-coil, substantially as specified.

7. A hydrocarbon incandescent lamp comprising, in combination, a vaporizing-coil, an expansion-tube provided at one end with an inlet-opening from the vaporizing-coil and a direct air-inlet contiguous thereto, an adjustable needle-valve operated from the low-pressure side of the expansion-tube for regulating the flow from said inlet-opening, a cushioning-chamber communicating with the other end of the expansion-tube, and one or more burners mounted upon said chamber, arranged to impart heat to the vaporizing-coil.

8. A hydrocarbon incandescent lamp comprising, in combination, a vaporizing-coil, an expansion-tube provided at its upper end with an inlet-opening from the vaporizing-coil and a direct air-inlet contiguous thereto, an adjustable needle-valve operated from the low-pressure end of the expansion-tube, for regulating the flow from said inlet-opening, a cushioning-chamber communicating with the lower end of the expansion-tube, and one or more burners mounted upon said chamber on a level with the lower part of the expansion-tube and arranged to impart heat to the vaporizing-coil.

9. A hydrocarbon incandescent lamp comprising a burner-head, having a reticulated opening and provided with an incandescent mantle, an expansion and mixing tube or chamber provided with an opening for the ingress of air, located alongside of and extending beneath said burner-head and communicating therewith, and a vaporizer arranged above the burner-head and communicating with the expansion and mixing chamber, the distance between said burner-head and expansion-tube being less than the diameter of said burner-head.

10. A hydrocarbon incandescent lamp comprising a burner-head, having a reticulated opening and provided with an incandescent mantle, an expansion and mixing tube or chamber provided with an opening for the ingress of air, located alongside of and ex-

tending beneath said burner-head and communicating therewith, and a vaporizer arranged above the burner-head and communicating with the expansion and mixing chamber, the distance between said burner-head and expansion and mixing tube being less than the diameter of said tube.

11. A hydrocarbon incandescent lamp comprising a hood, an expansion tube or chamber depending therefrom, having an opening for the ingress of air, a burner-head having a reticulated opening and located above the lower end of said expansion-tube and communicating therewith, and a vaporizer of substantially smaller diameter than the expansion-tube arranged above the burner-head and communicating with the top of the expansion-tube.

12. In a hydrocarbon incandescent lamp, the combination with a plurality of incandescent burners, of a vaporizer located within the heat zone of and heated by said burners, and an expansion and mixing tube arranged between and alongside of, and within the heat zone of the burners, and heated thereby, the vaporizer being arranged to discharge downwardly into the expansion-tube.

13. In a hydrocarbon incandescent lamp, the combination with a plurality of burners, each provided with an incandescent mantle, of an expansion and mixing tube or chamber provided with an opening for the ingress of air and extending vertically alongside of, within the heat zone of, and heated by said burner or either of them and communicating therewith, and a vaporizer communicating with the expansion and mixing tube, said vaporizer extending in a general lateral direction within the heat zone of and heated by the burners and mantles and being of substantially smaller diameter than the expansion and mixing tube.

14. A hydrocarbon incandescent lamp comprising a plurality of burner-heads, each having a reticulated opening and provided with an incandescent mantle, an expansion and mixing tube located in close proximity to, within the heat zone of, and heated by one or both of said burners and mantles, said tube extending from a point below the burner-heads to a point above the same and having at the latter point an opening or openings for the ingress of air, and a vaporizer of relatively small diameter located above the burners and within the heat zone of, and heated by the burners and mantles, having one of its ends arranged to discharge vapor into the expansion and mixing chamber.

15. A kerosene-burner for heating incandescent mantles, comprising the combination of an expansion and mixing chamber extending vertically alongside of and within the heat zone of, and heated by the burner, and of large diameter in respect to the vaporizing-tube, and provided at one end with a reticulated burner-opening and near the other end with an air-inlet, a vaporizing-tube within the heat zone of, and heated by the burner, and connected directly with and discharging into, and of smaller diameter than the expansion-chamber, whereby a comparatively small quantity of oil is gradually vaporized and permitted to expand along with air, substantially as described.

16. A hydrocarbon incandescent lamp comprising a burner-head, having a reticulated opening, and provided with an incandescent mantle, an oil-supply pipe, a vaporizer connected therewith, located above the burner and extending in a general lateral direction at or near the top of the mantle, and within the heat zone of, and heated by the mantle, and a combined mixing and expansion tube of relatively large diameter with respect to the vaporizer, extending downwardly alongside of the mantle and communicating with the burner and within the heat zone of and heated by the mantle, there being an air-inlet opening at the upper portion of said tube, the vaporizer being directly connected with said tube and adapted to discharge vapor into the upper portion of said tube.

17. In a hydrocarbon incandescent lamp, the combination with a hollow base, and a plurality of burners and a commingling-chamber communicating with said base, the commingling-chamber projecting upwardly above the base, and provided above the base with an opening for the ingress of air, of a vaporizing-tube which is connected through the base with the source of supply and passes in proximity to the burners and discharges into the upper end of the commingling-chamber.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES E. HEWES.
DAVID S. WILLIAMS.

Witnesses:
JOHN R. NOLAN,
F. NORMAN DIXON.