No. 842,634. PATENTED JAN. 29, 1907.

L. DENAYROUZE.

LOW PRESSURE VAPOR BURNING INCANDESCENT LAMP.

APPLICATION FILED DEC. 23, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

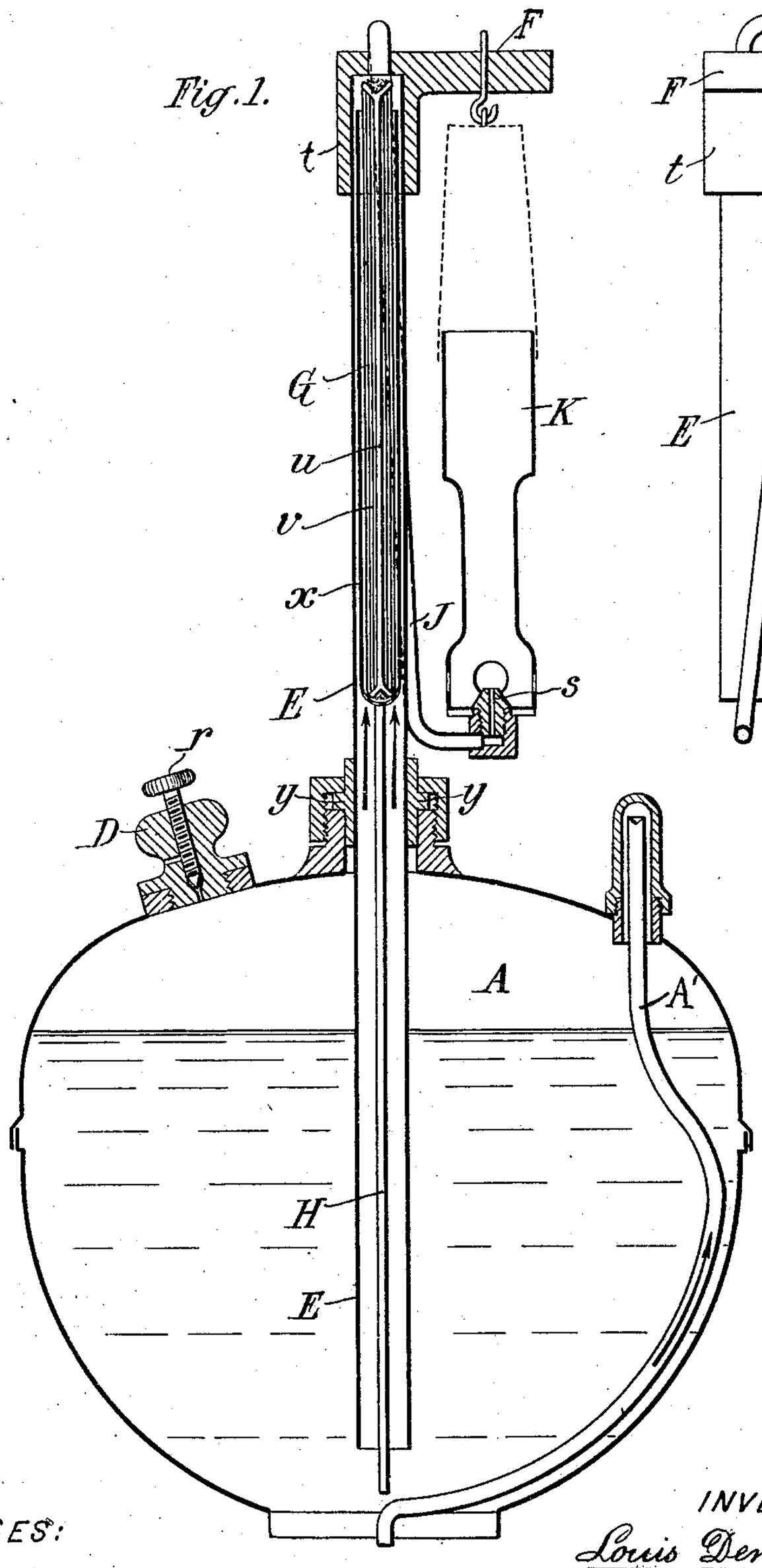
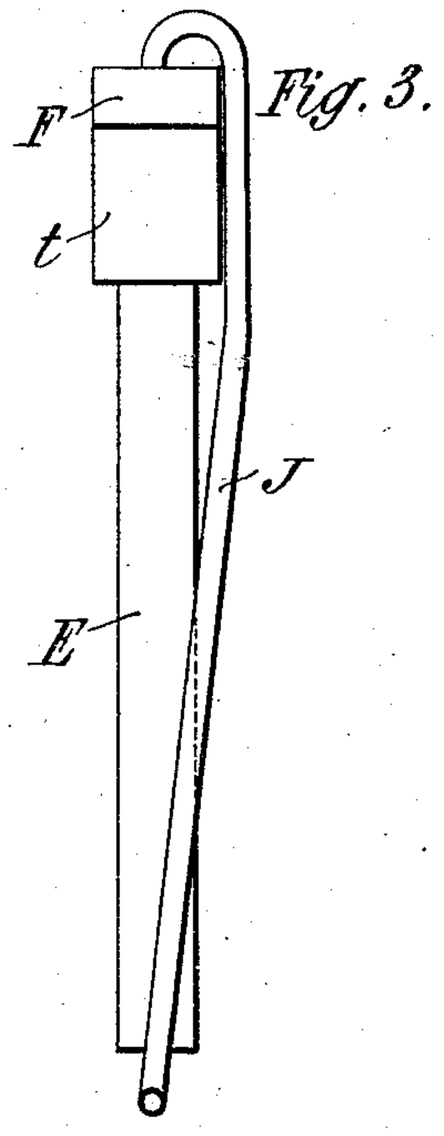


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 5.

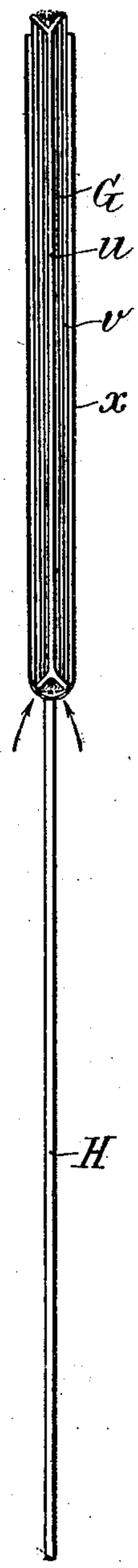
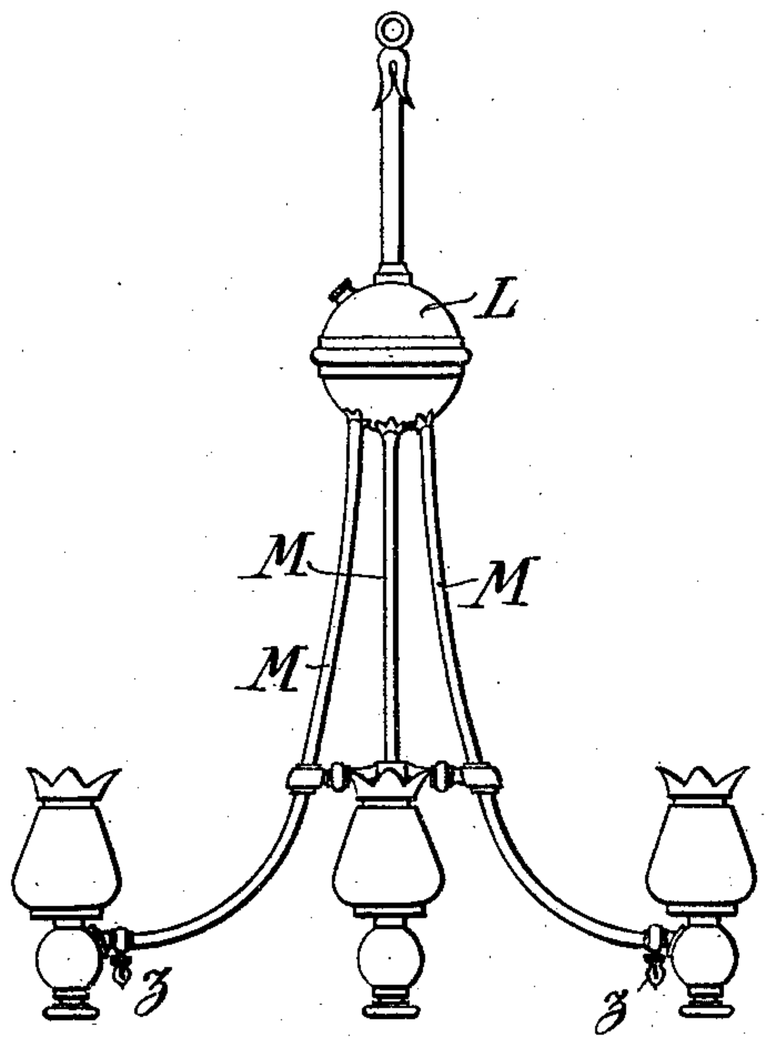


Fig. 4.

Fig. 2.



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UNITED STATES PATENT OFFICE.

LOUIS DENAYROUZE, OF PARIS, FRANCE.

LOW-PRESSURE VAPOR-BURNING INCANDESCENT LAMP.

No. 842,634. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed December 23, 1904. Serial No. 238,059.

To all whom it may concern:

Be it known that I, LOUIS DENAYROUZE, a citizen of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in Low-Pressure Vapor-Burning Incandescent Lamps, of which the following is a specification.

The employment of hydrocarbons in incandescence lamps gives results which as regards the quality of the light and the economy of the liquid combustible have a close relation to the quantity of vapor which can be made to pass in a given time under the mantle. When volatile hydrocarbons are employed, such as alcohol and spirits, it may happen that the quantity of vapor supplied may be somewhat feeble if wicks are employed in which the capillary attraction constitutes the sole cause of the conduction of the liquid to the orifice of the injector. On the contrary, this quantity may be too great, as is the case with lamps operating with pressure in which the conduction of the liquid is produced by the air or by the vapor when strongly compressed. The lamps then make a noise, the mantles are rapidly used up, and the variations of supply which correspond with the variations of the pressure render the light irregular and require the more or less frequent attention of an attendant. Lastly, and above all, if the burner accidentally cools, the jet of vapor in condensing partially into drops burns in the form of a strong jet of ordinary flame, which may constitute a serious danger of conflagration for the localities thus illuminated. Although the combustion of volatile hydrocarbons, such as alcohol and spirits, has been capable of being effected in such manner as to produce without the use of an auxiliary pressure a sufficiently intense incandescence of a mantle of the Welsbach kind, it has not been possible to obtain the combustion of petroleum under a mantle without the aid of a tolerably high pressure and in submitting the liquid forced into a narrow conduit to all the heat disengaged by the combustion of the gaseous mixture under the mantle, which action frequently causes the inconvenience of a partial decomposition of the petroleum.

The arrangements which form the subject of the present invention have for their object to produce automatically a perfectly regular supply of vapor of liquid to the injector by means of a low excess pressure (of a few centimeters of mercury) constantly maintained upon the hydrocarbon liquid which furnishes the combustible vapor.

The accompanying drawings show, by way of example, a construction of lamp working with petroleum.

Figure 1 shows a vertical section of the lamp; Fig. 2, an elevation of a group of lamps; Fig. 3, an elevation of an upper portion of the lamp; Fig. 4, a wick, and Fig. 5 such wick with a surrounding sheath and connecting-rod.

In the recipient A the petroleum liquid is subjected to an excess pressure, which may be below one-tenth of an atmosphere, obtained either by a compressed-air supply introduced through the tube A′ or by the simple weight of a column of liquid contained in a supply-reservoir situated at a suitable height, such as at the upper part of a chandelier, Fig. 2. The burner consists of a Denayrouze tube K with injector *s*, above which is an incandescence mantle and which is fed with oil in the following manner: The injector *s* is mounted upon a vapor-supply tube J, of copper or other conducting metal, which rises almost parallel to the refractory mantle and has its upper bent end fixed, as shown at the side view, Fig. 3, of the tube forming the bracket, to the top piece F of the bracket or support for the mantle, which piece is also of copper and to which the tube J is secured by brazing in order to resist a high temperature. The internal channel of the tube J opens into the central cavity existing in the piece F, forming the bracket, and which consists of two parts, the one horizontal serving to take up the waste heat of the combustion of the gases under the mantle, the other, *t*, which is vertical and very short, forming a vaporizing-chamber of small capacity. This bracket is fixed by brazing to a long tube E, which, on the contrary, is of a bad heat-conducting metal, such as nickel-silver. In this tube E is situated a metallic wick G, projecting at its upper end into the chamber *t* and shown separately at Fig. 4, which has a central stem *u* and a bundle of very fine wires *v*, surrounded, if necessary, by a sheath *x*, Fig. 5, the whole being of nickel, silver or similar metal. The tube E is fixed to a socket-piece with screw-cap *y*, adapted to form a hermetic closure with the tubular mounting of the reservoir A. This is provided with a filling-stopper D, also with hermetic closure, and having at its center a screw-plug *r*, by unscrewing which the air at low excess pressure

contained in the reservoir can be discharged, and which consequently constitutes an extinguishing-plug.

The operation of this lamp will be readily understood. The air-pressure, continuously maintained by any suitable means, causes the liquid in the reservoir A to rise in the interior of the tube E. Only a small portion of this liquid arrives in the chamber *t*, the liquid being almost entirely stopped by the wick G, which only permits an oozing of the liquid from the reservoir to the chamber *t*. In this chamber a small quantity of petroleum receives in its short travel along heated metal an amount of heat which is accurately regulated by the arrangement of the bracket *t* F. It becomes vaporized, and the vapor produced passes into the conducting-tube J, in which it flows to the injector *s*, where it enters into combustion with the air drawn in in the burner under the mantle. At the commencement of the operation a short external heating is naturally required, which is effected by any convenient heating device, such as a pad saturated with spirits or the like.

A characteristic peculiarity of the invention, which is somewhat subtle, but should be clearly defined, is as follows: In the incandescence lamps burning petroleum fed by the simple capillary attraction of a wick and vaporized the supply of vapor is insufficient for drawing in, even by means of an energetic draft, a quantity of air sufficient for obtaining an intense incandescence. In incandescence lamps with petroleum under pressure in all the known systems the necessity of having a very energetic jet of vapor acting in the injector has been the cause of excessively superheating the petroleum at some point of its travel, either when in the liquid or in the vaporous condition, before arriving under the mantle, this being effected by the direct and non-reduced application of the excessive heat of the main or auxiliary combustion gases of the vaporized petroleum or one of its elements.

In the above-described system it is to be observed that the heat of these gases does not impinge directly upon the chamber, but upon a large and flat surface of the bracket F. The latter is elongated and narrowed in such manner that there can only be concentrated at *t* the necessary and sufficient amount of heat for readily vaporizing without possibility of appreciable decomposition the series of hydrocarbons of increasing boiling-point which compose the petroleum up till and including that which is vaporized last. This quantity of heat is increased by the very small excess necessary for making good the small loss which is caused by conduction in the passage of the vapor through the tube J, which is maintained at a distance from the mantle sufficient for preventing the petroleum from becoming decomposed. Under these conditions the incrustations are avoided, which have always rendered precarious and unequal the continuous employment of petroleum as an illuminating combustible. The pulverulent carbonic deposits are at any rate reduced to such a degree as not to be more inconvenient than the slow incrustations of the cotton wicks of spirit-lamps, and when after a length of time it is necessary to pay attention thereto the metallic wick G can be withdrawn and be replaced with great facility by means of the rod H. A supply of two of these wicks, the one being clean and in reserve and the other being cleansed when changed, can suffice for obtaining a good and regular working of the lamp.

The extinction of the lamp is effected in a very simple manner by opening a screw *r*. The air in escaping produces a slight vacuum, and the small quantity of liquid remaining in the tube E is sucked down and the lamp is immediately extinguished. When instead of using air-pressure the weight of a column of liquid is employed, the only change is the supply of petroleum at the lower end of the tube E. The liquid flows, for example, Fig. 2, from an upper reservoir L, placed at the upper part of the chandelier, descending to the burners through tubes M, provided with cocks *z*. In these petroleum-lamps the distribution of the vaporized heat is regulated in such manner that the temperature at any point of the travel of the liquid or of its vapor shall not be in excess above that which is necessary and sufficient for volatilizing and maintaining in the state of vapor the least volatile of the hydrocarbons composing the petroleum until they reach the burner. In this manner the petroleum is not exposed to decomposition, producing carbonic deposits to such an extent as to interfere with the regular working of the lamp and to produce splutterings, which constitute the main inconvenience and danger of lamps working under pressure. This regulation of heat is easily obtained by the regulation of the distance at which the chamber *t* of the bracket and the vapor-supply tube J are placed from the source of intense heat, disengaged under the mantle and passing to the upper and lateral parts. This regulation of heat could be effected by the interposition of substances partially arresting the heat or by any other means producing the same effect of attenuation of the heat in view of maintaining at the necessary and sufficient temperature, as defined above, the petroleum and its vapors until just before they arrive under the mantle.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. An incandescence lamp operating with petroleum in which the vaporization of the

liquid is effected under a very low excess pressure and including in combination a bracket for supporting a mantle and having a horizontal part arranged above the mantle, said bracket being formed with a vaporizing-chamber and a hollow stem through which the liquid passes, a metallic wick in said stem retarding the flow of the liquid therethrough, and a tube extending downward from said chamber substantially parallel to the mantle to conduct the vapor to the burner.

2. An incandescence lamp operating with petroleum in which the vaporization of the liquid is effected under a very low excess pressure and including in combination a bracket for supporting a mantle and having a horizontal part F of conducting metal arranged above the mantle, said bracket having also a vaporizing-chamber *t* of conducting metal at its upper end and having a hollow stem of metal of low conductivity, said liquid passing through said stem and chamber successively, a metallic wick in said stem retarding the flow of the liquid therethrough, and a tube extending downward from said chamber parallel to the mantle to conduct the vapor to the burner.

In witness whereof I have hereunto signed my name, this 7th day of December, 1904, in the presence of two subscribing witnesses.

LOUIS DENAYROUZE.

Witnesses:

MARCEL ARMENGAUD, Jeune,

ROBERT MAURICE.