2 Sheets—Sheet 1.

H. S. MAXIM & J. RADLEY.

LOCOMOTIVE HEADLIGHT.

No. 95,498. Patented Oct. 5, 1869.

Fig. 1.

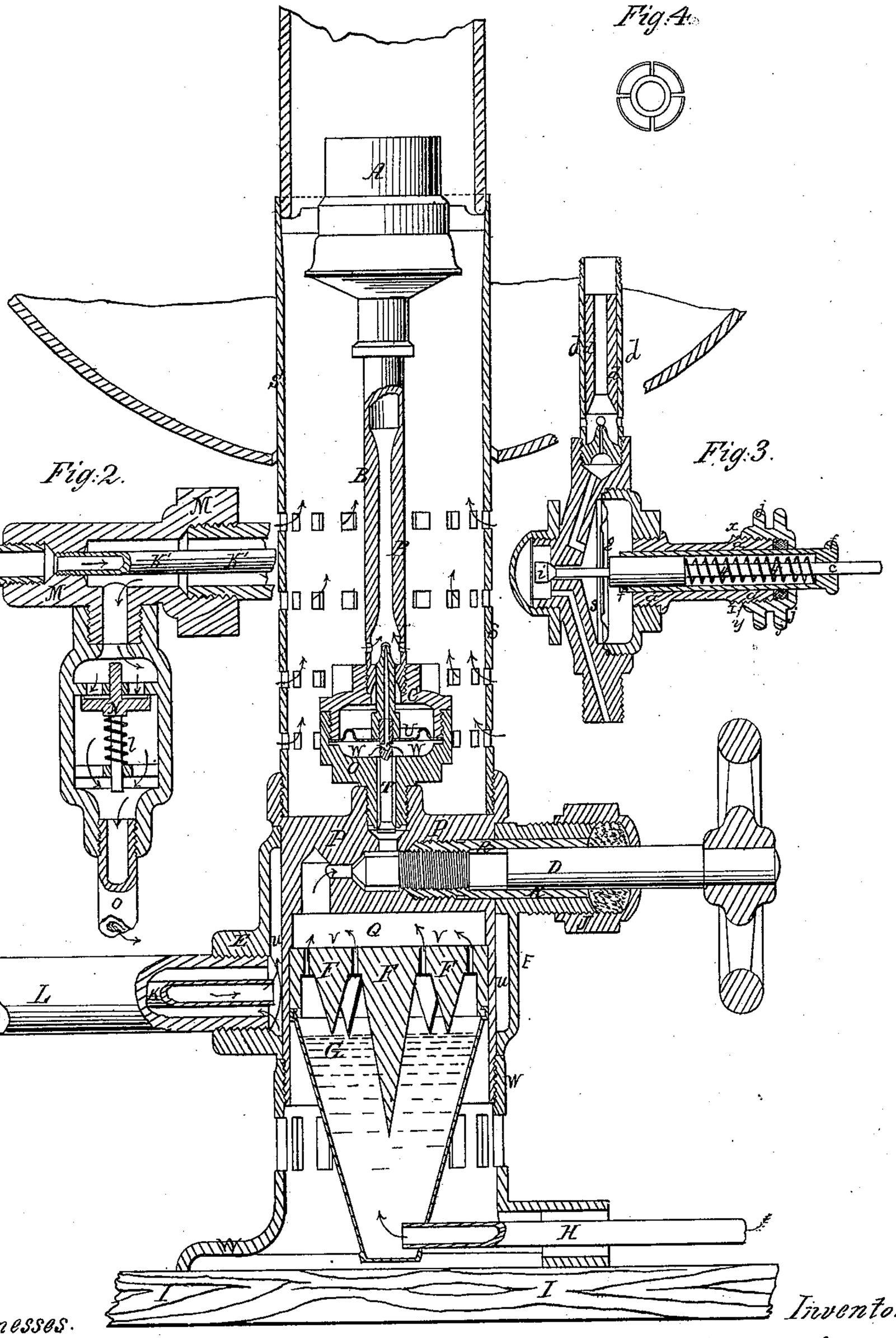

Fig. 4.

Fig. 2.

Fig. 3.

Witnesses.

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2 Sheets—Sheet 2.

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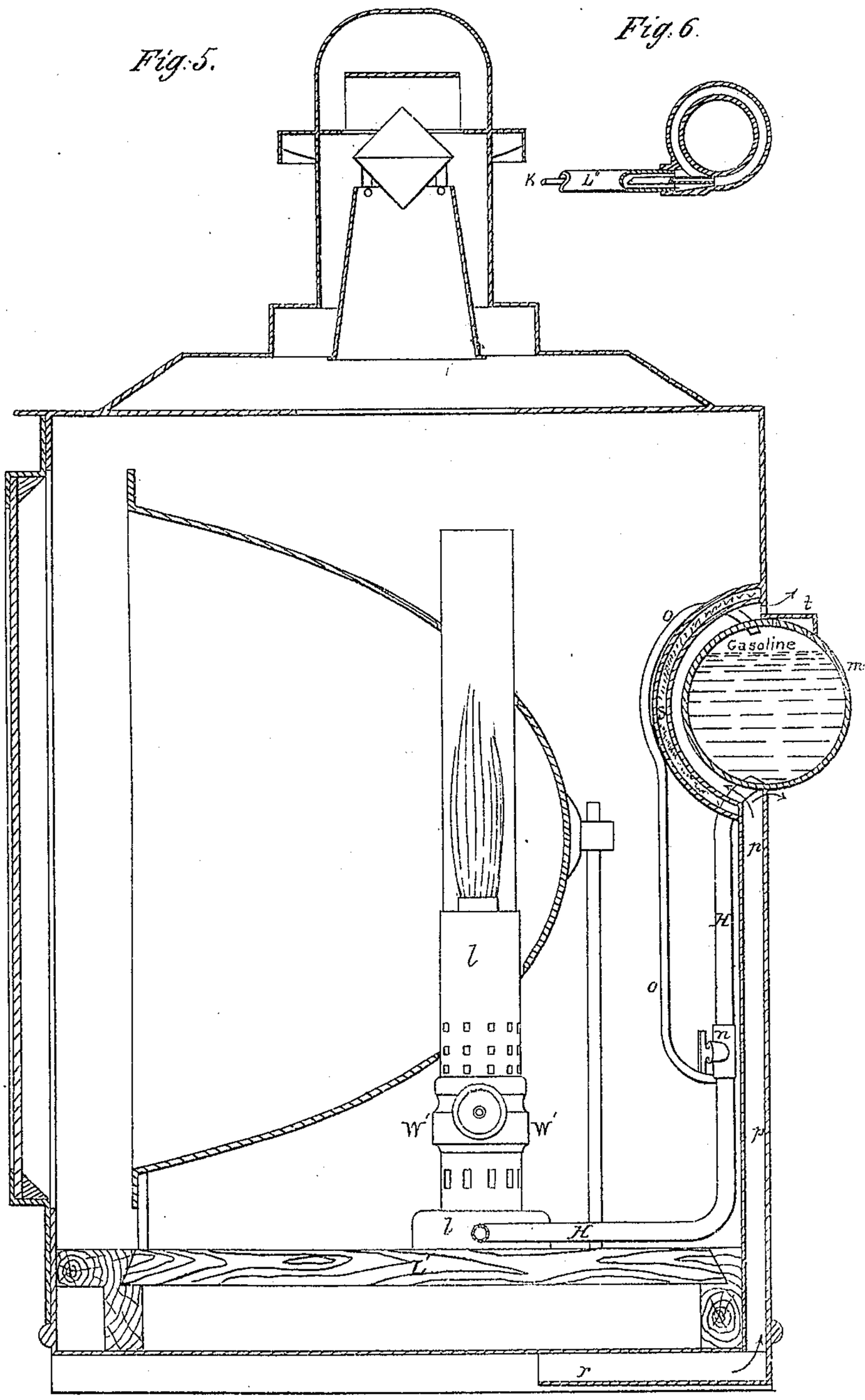
Fig. 5.

Fig. 6.



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Letters Patent No. 95,498, *dated October* 5, 1869.

IMPROVEMENT IN LOCOMOTIVE HEAD-LIGHTS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that we, HIRAM S. MAXIM and JAMES RADLEY, of New York, in the county and State of New York, have invented certain new and useful Improvements in Gas Locomotive Head-Lights; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, and to the figures and letters marked thereon, and in which—

Figure 1 is a vertical central section of the apparatus, as cut by a plane at right angles to the axis of the reflector.

Figure 2, a vertical and longitudinal section of the induction and eduction-steam connections, which are outside of the head-light case.

Figure 3, a vertical section of a modified arrangement of the regulator for controlling or governing the flow of gas to the flame, according to its pressure in the generating-chamber.

Figure 4, a front elevation of the nozzle of the tubular socket *a a*, fig. 3.

Figure 5, a vertical section of the head-light case and apparatus, as cut by a plane passing through in the axis of the reflector.

Figure 6, a horizontal section of the steam-jacket and generating-chamber, through the line *w' w'*, fig. 5.

This invention relates to the gas-illumined head-lights for locomotive-engines, in which steam is the generating-agent; and consists in an elevated gasoline tank, in combination with a steam-generating chamber, for converting light hydrocarbon-fluids into vapor, and in the construction of the parts, hereinafter more fully described.

To enable others skilled in the art to make and use our invention, we will proceed to describe its construction and operation.

We take the ordinary head-light case and its parabolic reflector, and adapt our improvements to them, as shown in figs. 1 and 5.

The gasoline, from which the vapor is to be produced, is carried in a small cylindrical vessel or tank, *m*, fig. 5, which tank should be filled or nearly so with the fluid, and it should be placed at the back of the case, and in an elevated position, as shown in fig. 5; and it should be kept cool by means of a current of air, which may be conveniently accomplished by taking in the air at the lower part of the front of the case by a suitable opening and passage for that purpose, as shown, into which opening the air will readily enter, by the forward motion of the locomotive, as indicated by the entering arrow at that place.

The air thus collected, passes along the passage *r*, and up the passage *p p*, which partly encloses the tank, and then outward, as indicated by the exit arrow, above the tank. (See fig. 5.)

From the bottom of the tank, a pipe, H, passes down, and conveys the fluid to the lower part of the chamber G, fig. 1, the flow of the gasoline or fluid through this pipe being controlled by the cock *n*.

There is also a second pipe, *o*, connecting with the pipe H, below the cock *n*, to the upper part of the tank, as shown in fig. 5, which is called the return-pipe, and is to convey back to the tank, when the cock *n* is closed, or nearly so, the fluid which may be forced out of the generating-chamber by excess of vapor or undue pressure.

The tank *m* should also have a few small holes at top, to permit air to enter, as the fluid diminishes within it, but these air-vents must be on the outside of the case, and they should be so constructed or protected as to prevent any wastage of the fluid through them.

The generating-chamber G, fig. 1, is in the form of an inverted cone, and the top covering F of this chamber is a casting of copper, or some other good conductor of caloric, and has upon its under side one or more pendent conducting-points, extending to some short distance below, so as to transmit or conduct the heat a little way under the surface of the fluid or gasoline, contained in the chamber G, and by these means vaporize the fluid at the top of the chamber only, while the fluid at the bottom remains cold, thus heating, vaporizing, and consuming the fluid from the top of the vessel, and in quantity sufficient for the support of the flame of the head-light only, thereby preventing that deterioration of the fluid which always takes place when heated in large quantities, or at the bottom of the vessel.

The vapor, as it is evolved in the generating-chamber, passes up to the superheating-chamber Q, through small holes, made for that purpose, in the conducting-plate F, as shown in fig. 1, in which superheating-chamber the vapor is made very hot before passing up through the carburetting-tube B to the burner of the lamp.

Around the conducting-plate F and superheating-chamber Q, there is a steam-space, *u u*, enclosed by the steam-jacket E E, into which space the steam from the boiler of the locomotive is admitted, by means of the connecting steam-pipe K K, which enters the circular space *u u* at a tangent, as shown in fig. 6, thus causing the steam to revolve around the superheating-chamber and conducting-plate, till it enters the eduction-pipe L, which encloses the steam-pipe K K, and thus passes off.

That part of the apparatus through which the steam is admitted and discharged, is shown in fig. 2, and should be outside of the head-light case.

In said part M M is a triple branch-piece, and connects with the boiler by the steam-pipe *t*, and with the steam-jacket E by the eduction or exhaust-pipe L.

within which pipe L the small steam-pipe K passes to the steam-jacket, and is secured to the branch-piece M M in the same branch with the steam-pipe *t*, and connecting with the pipe *t*, so as to convey the live steam from the boiler, by the tube K, within or through the eduction-pipe L to the steam-jacket E, as shown in figs. 1 and 6.

The steam from the steam-jacket having been returned to M M, passes out through the lower branch of M M and the valve N, and then outward, or into the smoke-box of the locomotive, by the pipe O.

The valve N closes upward, and is held to its seat by the spiral spring *l*, which should have sufficient force to resist a pressure on the valve of about one pound; the purpose of this valve being to keep a uniform pressure, and consequently a uniform heat in the steam-jacket E of the apparatus around the conducting-plate and superheating-chamber.

The hot vapor of the gasoline passes up from the superheating-chamber Q, through a small passage, which is controlled by a conical valve on the stem D, and then up through a passage, which is controlled by the hanging valve T, into the regulating-chamber *w w* in the lower part of the shell or case C C, below the flexible diaphragm U. The hot vapor from below this diaphragm enters into and passes up the tube *v v*, which is attached to the upper side of the diaphragm, by means of the lateral branches in the shank of the valve T, as shown in fig. 1.

The contracted vent of the pipe *v v* is directed centrally up the carburetting-pipe B B, which is attached to the diaphragm-case C, and carrying, at top, the burner A of the head-light.

Around the base of the pipe B B, and in the same level with the vent of the interior pipe *v v*, are a few small holes to admit the atmospheric air to be mixed with the vapor of the gasoline as it passes up from the vent of the pipe *v v*.

The burner A is of the argand-pattern, and should be of large size, and is enclosed by a glass chimney, as usual, which chimney is attached to and carried by the enclosing-pipe S S, fig. 1.

In the lower part of the enclosing-pipe S S, that is, below the reflector of the head-light, there are numerous holes, for the admission of air to support combustion at the burner A, and to supply the carburetting-pipe B B; the air so drawn in, being heated in its passage up between the enclosing-pipe and the diaphragm-case C, these parts being at a high heat, from their proximity to and immediate connection with the steam-jacket E.

The apparatus being thus arranged and constructed, and the tank *m* being filled or nearly so with the hydrocarbon-fluid, on turning the cock *n*, the fluid will run down from the tank through the pipe H into the generating-chamber G, fig. 1. If now steam be admitted by the tube K into the steam-jacket E, the conducting-plate F and the whole of the apparatus connecting with the said steam-jacket, including the enclosing-pipe S S, will become highly heated, and the pendent conducting-points of the plate F passing downward into the fluid contained in the chamber G, will quickly vaporize the upper portion of such fluid, and the vapor so evolved will pass upward through the small holes or vents in the conducting-plate F, into the superheating-chamber Q immediately above it, as indicated by the arrows at such part in fig. 1.

The chamber Q being full of the superheated vapor, and the valve D being open, the vapor will pass up into the regulator-chamber *w w*, the passage to which chamber is controlled by the hanging valve T, attached to the centre of the flexible diaphragm U, so that any increase of pressure on the diaphragm will tend to draw up and close the valve T. The vapor passes from below the diaphragm up and through the tube *v v*, which is also attached to the centre of the diaphragm, from which tube or tip *v v*, the hot vapor issues with a high velocity through its contracted vent directly up the centre of the tube B B, and causing, by such velocity, a vacuous action at the base of the said pipe, which, in turn, causes the atmospheric air to rush into said pipe through the perforations at its base, which air is immediately carburetted or combined with the gasoline-vapor, and passes up to the argand-burner A, as a gas of great illuminating power.

The atmospheric air, which enters the carburetting-tube B B, and which passes up within the enclosing-pipe S S, to support the combustion of the gas at the burner A, is previously heated by passing up through the perforations in the lower part of S S, and between it and the shell C of the regulating-chamber, all of which parts are maintained at a high heat by their connection with the steam-jacket E, as already explained.

The apparatus is made self-regulating, by means of the valve T and the flexible diaphragm U, for the vapor pressing upon the under side of the diaphragm, will lift this valve, and thus partially close the opening or passage for the vapor, and therefore the greater the pressure of the vapor upon the diaphragm, the vent or passage at the valve will be so much the more contracted; that is, the size of the vent will be inversely as the pressure of the vapor, and the relation of these parts being thereby so adjusted, that, while the valve D remains open, the same quantity of vapor shall, at all pressures, pass up to the burner, and thus maintain the flame at a uniform height and power in the lamp.

An improved form of regulator is shown in fig. 3. In this the diaphragm is made very light, its tension being such as to allow the valve *i* to be opened sufficiently to give a flame of only about half an inch in height, at the burner of the lamp.

The valve *i*, in fig. 3, it will be observed, corresponds with the valve T in fig. 1, and is acted upon by its diaphragm *g g* in the same manner that T is acted upon by the diaphragm U; but in fig. 3, an adjustable spring is combined with the diaphragm, and thus allowing the size of the flame of the lamp to be adjusted or regulated to any desirable height or power.

The socket *a a*, which contains the adjustable spring, is made to protrude or project through the enclosing-pipe S S, fig. 1, so as to be within reach when required.

In the socket *a a* is a sliding tube, *f*, having a shoulder or bearing for the spiral spring at the outer end, and a small central hole for a steady bearing to the sliding rod *e*, which rod has an enlarged portion at its inner end, to fit the tube *f*, and forming a bearing for the spiral spring to act on, which enlarged portion of the rod *e*, also bears upon the centre of the diaphragm *g g*.

By pressing upon the sliding tube *f*, the spiral spring will be compressed between the outer end of the tube *f* and the enlarged portion of the rod *e*, thereby transmitting such additional pressure to the diaphragm, and communicating to it a corresponding power of resistance to the pressure of the vapor admitted by the valve *i* to the other side of the diaphragm, thus raising the flame, at the burner of the lamp, to any desired height. The sliding tube *f* is then secured to its place by the compression of the nozzle of the part *a* upon it by the screwed nut *j*, the screws being taper in both, and the nozzle of *a* being quartered to admit of compression, as shown in fig. 4.

To prevent the leaking of the steam from the steam-jacket E, fig. 1, into the vapor-passages, we introduce the bush or lining R R around the valve-stem D in the casting P P, and to which it is secured, as shown in fig. 1, and leakage of gas around the valve-stem D is prevented by packing under the gland J, in the usual manner.

The gas is admitted to or shut off from the burner

A by the valve D, which is rotated in its screwed bearing in R R for that purpose, by the hand-wheel at the outer end of the stem, as shown in fig. 1.

We hereby disclaim anything in this application that may in any way conflict with an application now pending for a somewhat similar invention.

Having thus described our invention,

What we claim as new, and desire to secure by Letters Patent of the United States, is –

1. The combination of the elevated tank with the steam gas-generator and the burner of the lamp, substantially as described.

2. The arrangement of the perforated metallic conducting-plate F, between the generating-chamber G and the superheating-chamber Q, substantially as described.

3. The lining R R, which encases the stem of the valve D, in the manner and for the purpose substantially as described.

4. Enclosing the regulator-chamber or case C and the carburetter B within the pipe S S, so as to heat the atmospheric air in the passage thus formed, which goes to the carburetter B, and to support the combustion of the gas at the burner A, substantially as described.

5. The tangential arrangement of the steam and exhaust-pipes with the steam-jacket, by which a rotary motion of the steam is produced within the steam-jacket, around the superheating-chamber and the conducting-plate of the generator, substantially as described.

6. The arrangement of the return-pipe *o* with the tank and pipe H, below the cock *n*, in the manner and for the purpose substantially as described.

7. The combination of the steam-valve N and spring *l*, with the eduction-pipe L and waste-pipe O, in the manner and for the purpose substantially as described.

8. The combination of the sliding tube *f* and its spiral spring and sliding rod *e*, with the diaphragm *g g*, in the manner and for the purpose substantially as described.

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