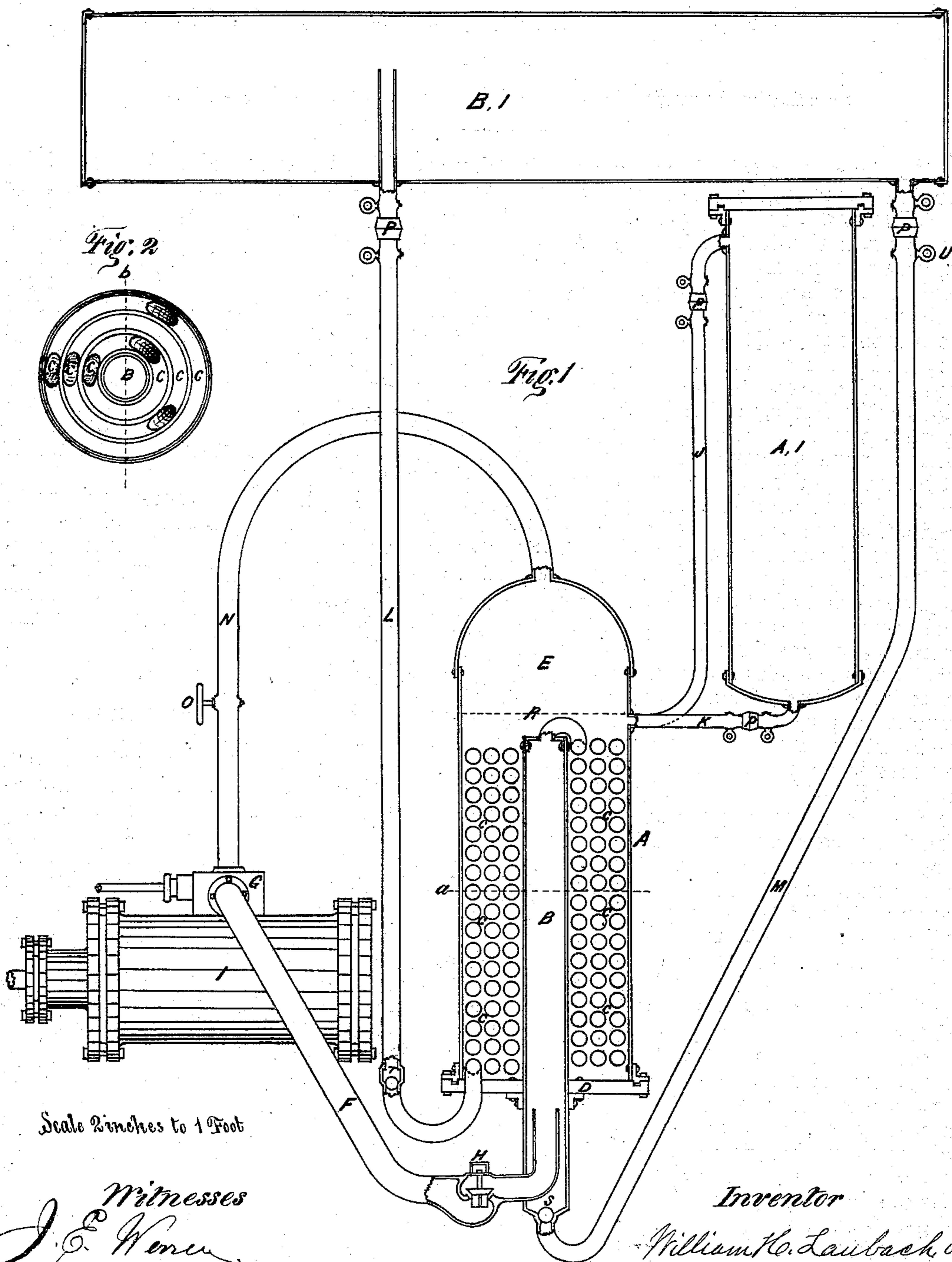


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## Improvement in Ammonical-Gas Engine.

No. 127,250.

Patented May 28, 1872.



Scale 2 inches to 1 Foot

Witnesses  
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# UNITED STATES PATENT OFFICE.

WILLIAM H. LAUBACH, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN AMMONIACAL-GAS ENGINES.

Specification forming part of Letters Patent No. 127,250, dated May 28, 1872.

Specifications of certain Improvements in Ammoniacal-Gas Engines, invented by WILLIAM H. LAUBACH, of the city and county of Philadelphia, in the State of Pennsylvania.

Apparatus for the manipulation of liquefied ammoniacal gas in order to vaporize it, and with the vapor to actuate an engine similar to the steam-engine, have been invented by others; and such apparatus have been so arranged and constructed that the ammoniacal gas, after having given its impulse to the piston, would be absorbed by a weak solution of aqua ammonia in order that it might be preserved and again used after being restored to the liquefied form; and, furthermore, that the latent heat contained in the exhaust of ammoniacal gas, and which would be rendered sensible by its union with the weak solution of aqua ammonia, should be used to promote vaporization of the liquefied ammoniacal gas for the driving of the engine. But all such apparatus have been found to be seriously defective, expensive in construction and operation, and comparatively inefficient; and the object of these improvements is to perfect them and render them more efficient.

The first part of my invention relates to the form and construction of a vaporizer in the apparatus, having convenient and controllable connections with both the engine to be driven and the reservoir containing a supply of the liquefied ammoniacal gas, and a form and position most favorable to the rapid transmission of heat from the heater or condenser into the liquefied ammoniacal gas contained therein.

The second part of my invention relates to the form, construction, and location of the condenser, which is a vessel having its position mainly in the interior of the vaporizer above mentioned, and is surrounded by a pipe, coiled several coils deep around it, and the one into which the exhaust of ammoniacal gas from the engine and the solution of aqua ammonia are made to commingle and unite, in order that the latent heat of the former may be developed and in part transmitted directly through the walls of the con-

denser, while the saturated and heated fluid, which is the result of the union, rises, by reason of its higher temperature and diminished gravity, and flows out at the top of the condenser into the pipe before mentioned, and then flows, from the impulse thus received, through the pipe, winding around and around the condenser, imparting its heat through the pipe to the liquefied ammoniacal gas, which fills all the interstices between the coils, until it reaches the bottom of the vaporizer, whence, having been deprived of its heat, it is conducted to a removable reservoir provided for it.

The third part of my invention relates to the construction and arrangement of a reservoir to contain a supply of the liquefied ammoniacal gas, with two pipe-connections with the vaporizer, in such a manner that, whether such reservoir be full or nearly empty, the liquid in the vaporizer shall maintain the same level, always covering the coils of pipe belonging to the condenser.

The fourth part of my invention relates to the combination of a reservoir for the weak solution of ammonia before mentioned with two or more pipes connecting it with the condenser above mentioned, so constructed and arranged that, when filled for use, it will feed the condenser from its bottom, but will receive the saturated fluid, after its passage through the condenser, at a point near its top, so that the saturated fluid, which is much lighter than the weak solution, will remain on top of the weak solution until the latter shall have been all conducted away, when, of course, the reservoir will be emptied and then refilled with another supply of the weak solution.

In the accompanying drawing, Figure 1 represents a vertical longitudinal section of an apparatus embracing my improvements, while Fig. 2 represents a horizontal section of the vaporizer and condenser in the plane indicated by the line *a*, Fig. 1.

The letter A indicates the walls or shell of the vaporizer; D, the lower head, while the upper head is shown as inclosing the upper end, and having a feed-pipe, N, to conduct the gas to the gas-chest G. The dotted line

R indicates the line of surface of the liquid in the vaporizer; the space E above that line is the space for the gas. The sides and heads of this vaporizer are made of boiler-iron, or lap-welded iron tubing, of sufficient strength to bear an outward pressure from within of eight hundred pounds to the square inch. The head, indicated before as the upper one, is permanently attached to the body, as shown, while the opposite one, D, is jointed to the body in a peculiar manner, with a view to its easy removal when desired. It is provided with a groove in its inner face, extending entirely around and outside the shell, as shown in Fig. 1, and a flanged ring, provided with an annular tongue, is permanently attached to the outside shell, near its lower end. The annular groove in the head D being partially filled with hard India rubber or tin, the annular tongue of the flanged ring is inserted therein, and then the flanged ring and head D are drawn down tightly together with screw-bolts, so as to make a joint that is gas-tight. This vaporizer is provided with a central opening, having a packing-box in the lower head D, through which the condenser B is inserted to the extent, say, of two-thirds of the height or length of the vaporizer, and around the part of the condenser so inclosed, the pipe C, connected with it at the top, is wound spirally, several coils deep, down to near the head D, where it passes through the shell of the vaporizer, and up outside, as shown at letter L. Thus four-fifths or even a greater proportion of all the space in the vaporizer below the dotted line R is occupied by the condenser B and its coiled pipe c. In the lower part of this condenser a most important chemical action takes place, and my peculiar construction conduces to perfection in that action.

The pipe M conducts the weak solution of ammonia from the bottom of the reservoir B', containing a supply of it, down to the lower end of condenser B, where it is admitted through cock S, while the pipe F conducts the exhaust of ammoniacal gas from gas-chest G up to a point near where the condenser B enters the vaporizer, and there sets it free where it commingles with the inflowing weak solution, and, by reason of its strong affinity for it, a chemical union takes place, and the latent heat of the gas becomes sensible, and the mass of the saturated liquid becomes heated and flows in a current into and through the pipe c, as before stated, imparting its sensible heat, as it flows, to the shell of the condenser, and to the coil of pipe, and they, in turn, impart it to the liquefied ammoniacal gas, and vaporize the same.

It will be observed that only a remarkably small quantity of the liquefied gas, in proportion to the extent of the heating-surface to which it is exposed, is contained in the

vaporizer at any one time, and the same proportion is true of the condenser and the fluid which it contains; and that the vaporizer and condenser are so well adapted to each other, and co-operate so perfectly to produce rapid vaporization, that no other furnace than the condenser, no other fuel than the exhaust, and the weak solution are required to produce all the heat necessary for vaporization; and that the apparatus will set itself in motion upon opening the pipe N into the gas-chest G.

The reservoir A', from which the vaporizer is fed, is made of similar material and has the same form with the vaporizer itself, the upper plate being removable at convenience.

The pipes J and K have each a coupling, P, with cocks on each side of such couplings, to render the removal of the reservoir convenient. In like manner the pipes L and M are provided with like couplings, provided each with a check-valve, T and S, to prevent the fluids from flowing back in contrary directions from those intended.

Two or more reservoirs like B' may be used—one to feed the weak solution to the condenser, the other for the reception of the saturated solution—and, should vaporization at any time become too rapid, the supply of weak solution of aqua ammonia to the condenser may be regulated by means of the cock U.

The machines of Lamm and Tillier, heretofore patented, are amenable to this serious objection, namely, after running for a considerable time the whole body of the liquefied gas becomes so much heated that vaporization and accumulation of gas continue long after the engine has been stopped. But a machine constructed with my improvements is almost entirely free from that objection, since so very small a quantity is admitted into the vaporizer at a time that its total loss would be inconsiderable.

It will be observed that in the drawing my vaporizer, condenser, and reservoirs are in the cylindrical form, and in a vertical position, (except the reservoirs B';) but these exact forms and positions are by no means essential.

I will add that such is the structure and position of all the joints of the machine herein described that expansion and contraction will not injure or destroy them, and that they cannot be penetrated by ammoniacal gas, which is the most subtle of all gases; and still another important consideration is that they are few in number.

#### Claims.

What I claim as my invention is—

1. The vaporizer A, having the pipe-connections N, J, and K, and an opening for the insertion of the condenser, as shown, con-

structed substantially in the manner and for the purpose described.

2. The condenser B, enwrapped in its spiral coils of pipe, c, inserted in the vaporizer, substantially as shown, constructed substantially as and for the purpose shown and described.

3. The combination of the reservoir A' with the pipes J and K, having their described couplings P P, substantially as and for the purpose described and set forth.

4. The combination of the reservoir B' with the pipes M, c, L, and F, constructed and arranged substantially as and for the purpose shown and described.

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Witnesses:

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