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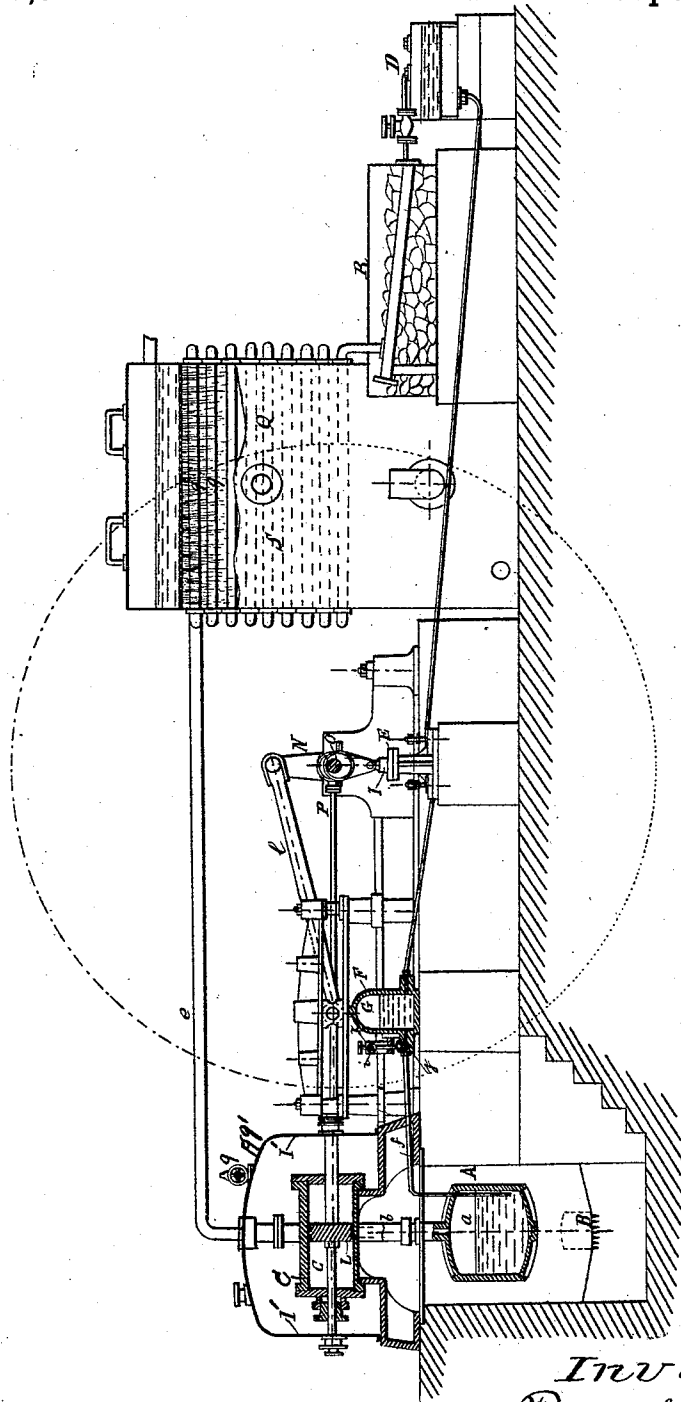
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P. DE SUSINÉ.
ETHER ENGINE.

No. 459,317.

Patented Sept. 8, 1891.

Fig. 1.



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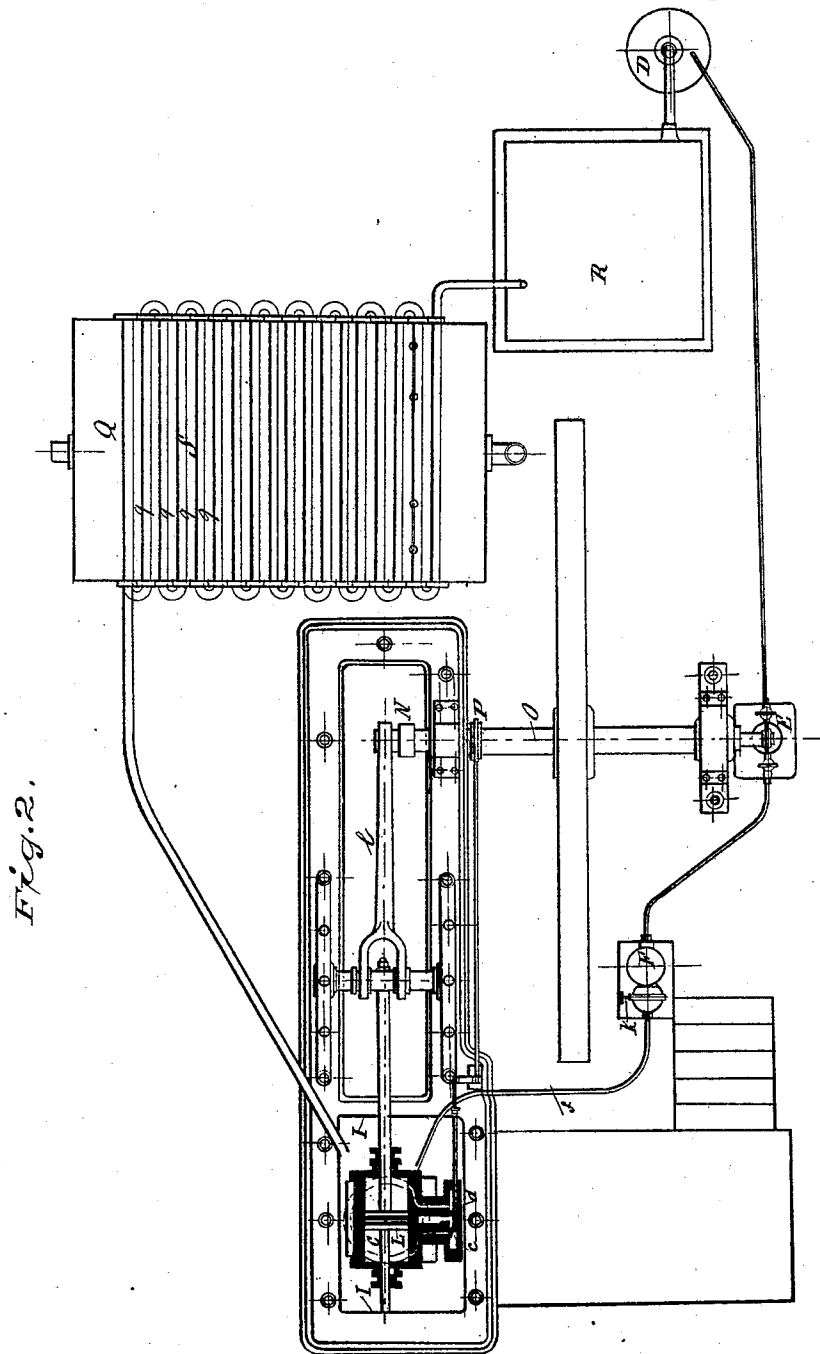
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(No Model.)

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Fig. 3.

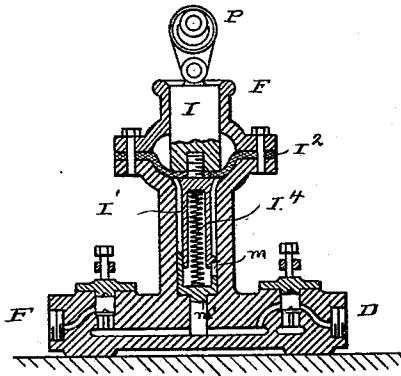


Fig. 4.

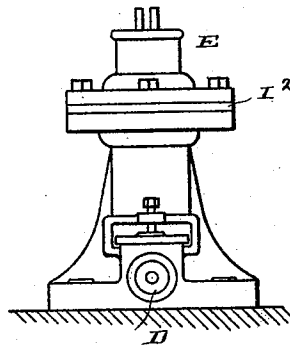
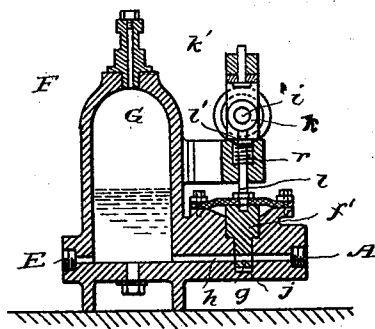


Fig. 5.



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UNITED STATES PATENT OFFICE.

PAUL DE SUSINÉ, OF PARIS, FRANCE.

ETHER-ENGINE.

SPECIFICATION forming part of Letters Patent No. 459,317, dated September 8, 1891.

Application filed January 9, 1890. Serial No. 336,455. (No model.) Patented in France April 5, 1889, No. 197,234.

To all whom it may concern:

Be it known that I, PAUL DE SUSINÉ, doctor of medicine, a citizen of France, residing at 6 Rue de Sfax, Paris, France, have invented a new and useful Improved Motor-Engine Worked by Ether-Vapor, (for which I have obtained a patent in France, dated April 5, 1889, No. 197,234,) of which the following is a specification.

This invention relates to ether-engines, and the novel features thereof will be hereinafter set forth, and then particularly defined by the appended claims.

The construction of the engine is shown on the accompanying drawings, in which Figure 1 shows a general side elevation of the entire engine, condenser, &c.; Fig. 2, an enlarged longitudinal section of the engine. Fig. 3 is a vertical section of the forcing-pump to an enlarged scale. Fig. 4 is an elevation of the same, and Fig. 5 is a vertical section of the accumulator.

The vapor generator or heater consists of a simple closed vessel A containing a bath of glycerine *a* and placed directly over a fire-place B and below the engine-cylinder C. The liquid-ether supply being contained in the recipient D is drawn thence by a pump E, which forces it into the accumulator F, where it compresses a layer of air G until the pressure is slightly above the working pressure in the generator A. At this moment the piston or plunger I of the pump E is compressed during the forcing stroke, as will be presently described, so that there is no feed until the air in the accumulator F has had its pressure reduced to a certain extent by the discharge of liquid from the accumulator. It will be seen that by this means the accumulator F is continuously automatically charged by the working of the pump E, and that liquid ether can at each stroke be injected through pipe *f* and valve *j* into the vapor-generator A. The valve *j* is actuated by a cam or eccentric *i*, so as to regulate the injection of ether into the generator A automatically, for which purpose the cam *i* is mounted on an axis *k*, actuated by a suitable governor.

Figs. 3 and 4 show an enlarged vertical section and elevation of the pump E. The piston or plunger consists of the upper part I, with hollow stem I' connected by a caout-

chouc diaphragm I² to the casing E and actuated by the eccentric P on the engine-shaft, and of the part *m*, within which the part I' is capable of sliding, the two parts being connected together by a pin on I' entering a slot in *m*. The latter has a cylindrical stem *m'*, forming the actual pump-plunger extending down into the passage for the liquid ether. Within the hollow stem I' is a strong helical spring I⁴, which tends to press downward the part *m*, keeping it in the position shown. Thus on the upstroke of the pump the stem I' draws the part *m* up with it by the before-mentioned pin, and on the downstroke the part *m* is forced down by the spring. The strength of the spring is so calculated that so long as the maximum pressure to which the apparatus is adjusted is not exceeded the spring will cause the plunger *m'* to force liquid ether into the accumulator; but as soon as the maximum pressure is attained in this, which is slightly above the working pressure of the generator, such pressure in overcoming the strength of the spring will prevent this from forcing down the plunger *m m'* during the downstroke of I, and consequently the supply of liquid ether to the accumulator will be intercepted until by the consumption of ether-vapor from the generator the pressure has sunk again to the working maximum.

In the accumulator G (shown to an enlarged scale at Fig. 5) the valve or slide *j* consists of a cylindrical stem having a hole *g* bored through it of the same size as the channel *h* for the discharge of liquid ether to the generator A. The stem *j* has an enlargement *f*, to which is attached a rod *l*, that is pressed upward by a helical spring *r*, bearing against a collar *l'* on the rod, so that the upper end of the rod *l* is made to press upward against the eccentric *i* on the axis *k*. When the engine is working with the normal consumption of ether-vapor, the eccentric *k* is in the position shown at Fig. 5, pressing the rod *l* and slide *j* down, so as to fully open the passage *h* for the discharge of ether. When the engine exceeds the normal speed, a governor of any known construction actuated thereby is made to partially turn the eccentric *k* either by a pulley *k'* or by a lever, so as to allow the spring *r* to press upward the slide *j* more or

less, and thus in throttling the passage *h* restrict the supply of liquid ether to the generator. The enlargement *f'* of the slide is connected by a caoutchouc diaphragm to the valve-casing, so as to prevent any escape of ether-vapor. The vapor produced by the contact of the ether with the glycerine *a* in the generator *A* passes through the pipe *b* to the slide-valve chest *c* of the engine-cylinder, and is distributed by the slide-valve *d*, of ordinary construction, in the cylinder *C*, where it acts expansively upon the piston *L*, the motion of which is transmitted by a connecting-rod *l* in the usual manner to the crank *N* of the engine-shaft *O*. On the latter is fixed the eccentric *P*, that works the plunger *I* of the injection-pump *E*. The exhaust vapor from the cylinder passes through a pipe *e* into a group of tubes *S*, contained in a condenser *Q*, from which it passes in the form of liquid ether into the refrigerator *R*, and thence to the recipient *D*, from which it is again drawn by the pump, as above described, for feeding the accumulator and vapor-generator. The group of tubes *S* has a spray of water continually playing over it from the upper part of the condenser *Q*, and the evaporation produced by the contact with the tubes *g*, heated by the exhaust-vapor, produces sufficient cold to at once effect the condensation thereof. In order to increase the efficacy of the condenser *Q*, I may employ an exhaust-fan for drawing off the steam resulting from the evaporation as soon as it is generated. The working-cylinder is inclosed in a bath of glycerine contained in a casing *I'*, and this glycerine being directly heated by the fire at *B* prevents any condensation of the ether-vapors in the cylinder and the slide-valve chest, while at the same time any ether-vapors that may leak through the joints of these parts are retained by the casing *I'* and are led by a pipe *g'* to the condenser *Q*. Thus it will be seen that with this improved construction of ether-vapor engine the whole of the operations are carried on within closed vessels, so that no ether-vapors can escape into the outer air, a safety-valve on the vapor-generator being also inclosed in a box communicating with the condenser by a pipe, so that any escape of vapor, owing to excess of pressure, will also be caught and condensed.

Having thus described the nature of my invention and the best means I know for carrying the same into practical effect, I claim—

1. In an ether-vapor engine, the combination, with the engine-cylinder, of a vapor-gen-

erator and fire-place in immediate proximity thereto, a refrigerator for completing the cooling and liquefaction of the ether coming from the condenser, a recipient for the condensed and liquefied ether, and a force-pump for forcing regulated quantities of the liquid ether into the vapor-generator at a pressure slightly in excess of the working pressure of the engine, substantially as herein described.

2. In an ether-vapor engine, the combination, with a vapor-generator, of a pump with piston or plunger having spring action, so as to force liquid ether into the generator only at or below a pressure which is slightly in excess of the working pressure of the engine, and an accumulator consisting of a closed vessel with air-cushion, into which the liquid ether is forced by the pump and from which the liquid passes through a valve or slide controlled by a governor to the vapor-generator, substantially as described.

3. In an ether-vapor engine, the combination of a vapor-generator heated by a fire supplying the ether-vapor to the engine-cylinder, an accumulator or closed vessel with air-cushion for supplying the liquid ether to the vapor-generator, a pump for supplying the accumulator with liquid ether at a constant pressure, and a surface-condenser refrigerator and recipient for condensing and cooling the ether-vapor coming from the engine to a liquid state and storing the same for the supply of the said pump, substantially as herein described.

4. In an ether-vapor engine, the combination of a working-cylinder, an evaporative surface condenser for condensing the exhaust ether-vapor from the engine, a refrigerator for cooling the liquid ether coming from the condenser, a recipient for storing the condensed ether, a force-pump for drawing the liquid ether from the recipient, a closed vessel or accumulator with air-cushion for receiving the liquid ether under pressure from the force-pump, and a vapor-generator receiving regulated quantities of liquid ether from the accumulator and heated so as to vaporize the ether for supplying the working-cylinder, substantially as herein described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 19th day of December, A. D. 1889.

P. DE SUSINÉ.

Witnesses:

J. L. RATHBONE,
S. MOREL.