3 Sheets—Sheet 1.

J. H. CONNELLY.

Gas-Engine.

No. 211,836. **Patented Feb. 4, 1879.**

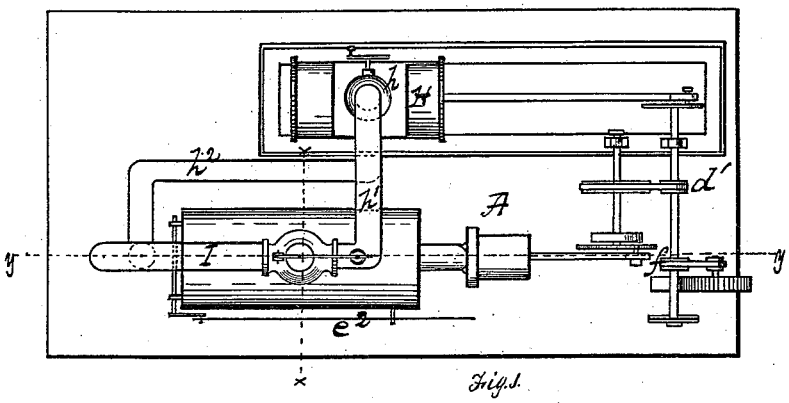

Fig. 1.

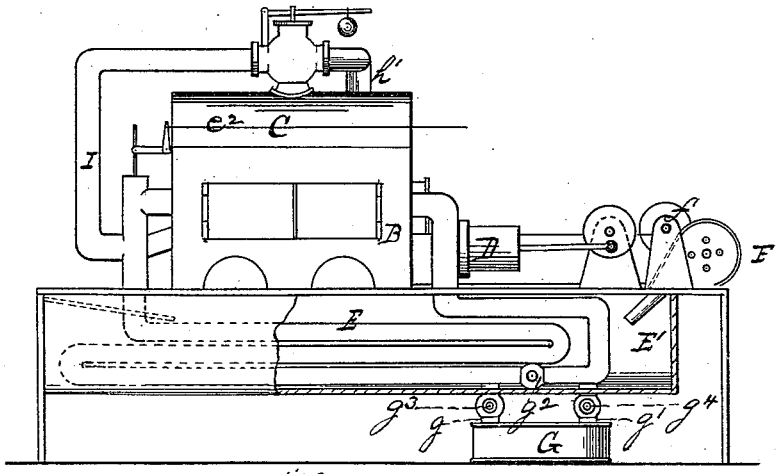

Fig. 2.

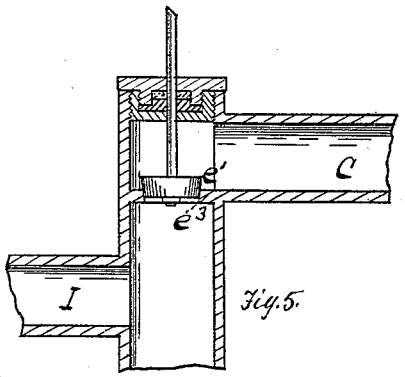

Fig. 5.

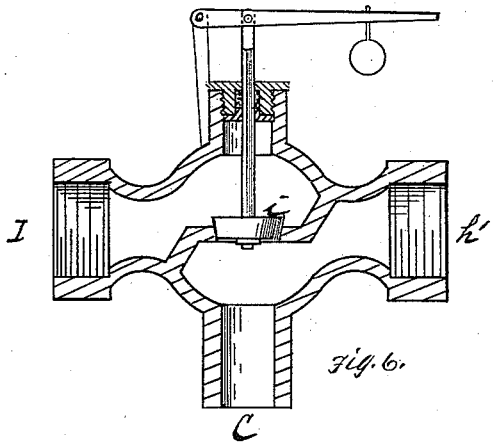

Fig. 6.

WITNESSES.
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3 Sheets—Sheet 2.

J. H. CONNELLY.

Gas-Engine.

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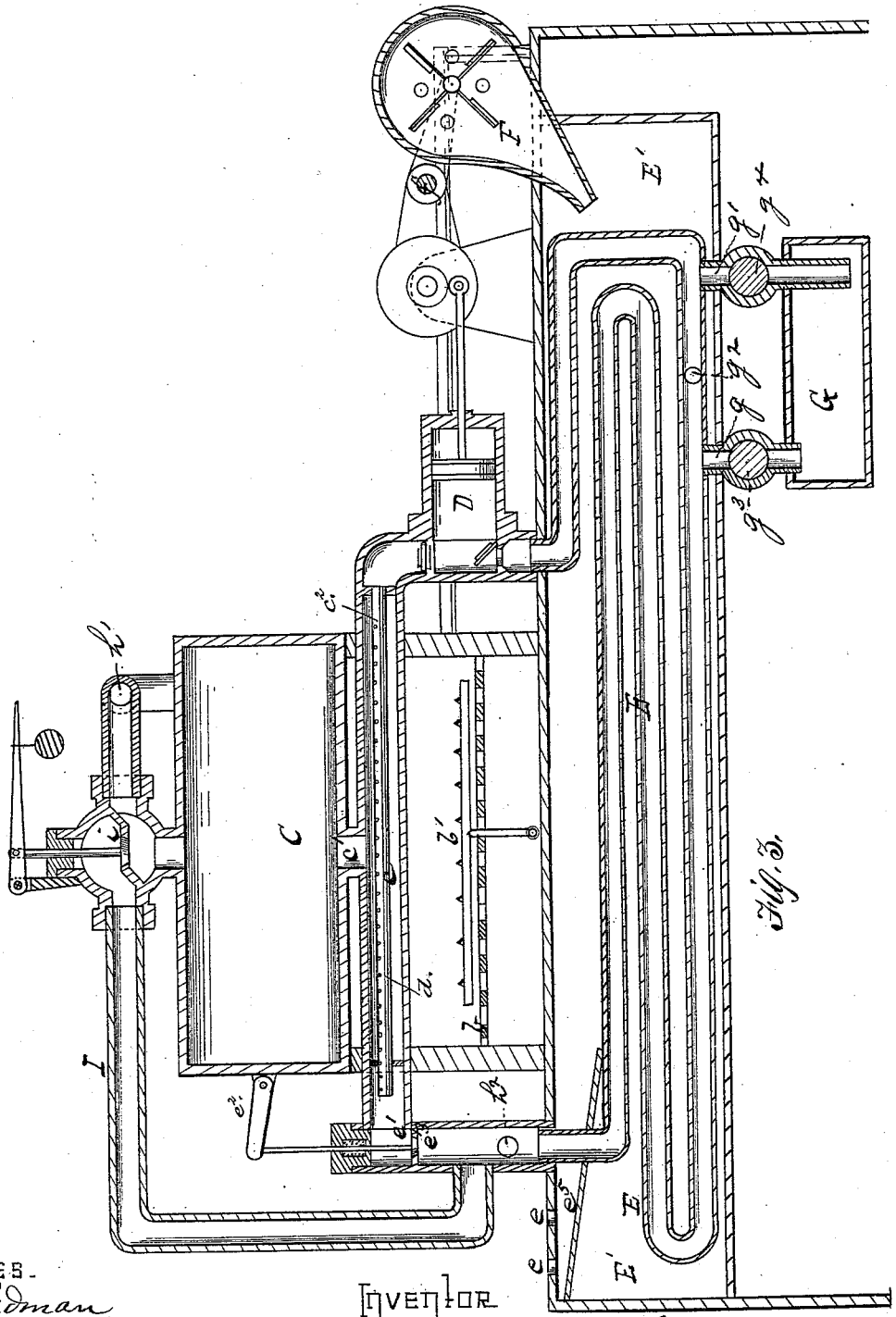

Witnesses.
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3 Sheets—Sheet 3.

J. H. CONNELLY

Gas-Engine.

No. 211,836. Patented Feb. 4, 1879.

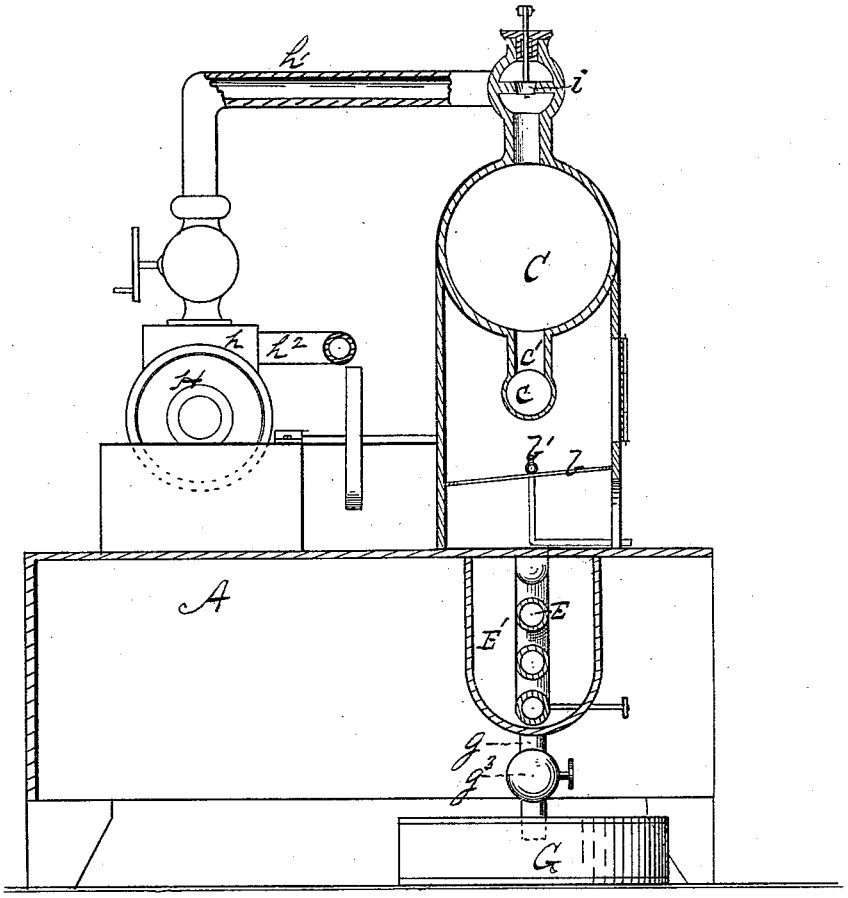

Fig. 1.

Witnesses
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UNITED STATES PATENT OFFICE.

JOSEPH H. CONNELLY, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR OF ONE-HALF HIS RIGHT TO WILLIAM FREW, OF SAME PLACE.

IMPROVEMENT IN GAS-ENGINES.

Specification forming part of Letters Patent No. **211,836**, dated February 4, 1879; application filed December 23, 1878.

To all whom it may concern:

Be it known that I, JOSEPH H. CONNELLY, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented new and useful Devices for Utilizing Gases, Vapors, and Volatile Liquids as Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a plan view of devices embodying my invention. Fig. 2 is a side elevation, partly broken away. Fig. 3 is a longitudinal vertical section of the furnace-boiler, pump, condenser, and their accessories. Fig. 4 is a transverse vertical section of the boiler, engine, connecting-pipe, and accessories. Figs. 5 and 6 are enlarged detail views.

Like letters refer to like parts wherever they occur.

My invention relates to that class of devices employed for utilizing the expansive force of gases, vapors, or volatile liquids, such as carbonic-acid gas, ammoniacal gas, and equivalent gases, bisulphide of carbon, benzine, gasoline, and other light hydrocarbons and easily-volatilized liquids, for purposes of a motor, as in running engines, &c.; and consists in combining, with the boiler and condensing-coil, a valve or valves, whereby the vapor may be directed either to the engine or like point of utilization, or back into the condensing-coil at will, and also in details of construction and special combinations, which will be hereinafter more specifically pointed out and finally claimed.

I will now proceed to describe my invention, so that others skilled in the art to which it appertains may apply the same.

In the drawings, A indicates a suitable bed or foundation, on which I erect a furnace, B, provided either with grate-bars *b* or a series of gas-jets, *b'*, as desired; but as only a low degree of heat is required, I give the preference, where circumstances permit, to the gas-jets *b'*. Built in the furnace is a boiler, C, usually cylindrical, and provided with a small supplemental cylindrical chamber or extension, *c*, connected to the main boiler by one or more branches, c^1, and into said chamber *c* projects the tube or pipe c^2, leading from the pump D.

E indicates the condensing coil or pipe, usually arranged in a closed chamber or tank, E', situated for compactness beneath the bed A, though, if preferred, it may be otherwise located. This tank E may be supplied with water, when water is the cooling medium used, and where the devices are stationary and running water can be had, suitable inlet and exit pipes (too common and well known to require illustration or further description) may be provided. In many instances a current of air will be found to be the most readily available as a cooling medium, and therefore I form a fan-chamber for fan F, which may be driven by a belt from the pulley *f* on the power-shaft, and conduct the air to the tank E', as shown.

The tank or chamber E' should be perforated, as at *e*, to permit either exit or entrance of air, as the case may be; and in order to prevent the escape of water from the tank, a deflector or partition, e^5, may be employed. Good results will be obtained by partially filling the tank with water, and causing a current of air to pass over the same.

Interposed between the condensing-coil E and the boiler is a pump, D, which may be operated from a pulley, *d'*, on the power-shaft, and can be of any approved construction, according to the work demanded of it. The end of condensing-coil E opposite the pump connects with the extension *c* of the boiler C, and, if desired, may connect directly with perforated pipe c^2, said end being guarded by a valve, e^1, controlled by a lever, e^2, so that by forcing the valve down onto seat e^3 the communication between the boiler and receiving end of the condenser will be shut off, and the elastic gas or vapor be compelled to travel toward the engine. When the gas or vapor is to be cut off from the engine the valve e^1 will be raised, thus establishing communication between the extension *c* of the boiler and the condenser, so that the gas or liquid used can circulate through the boiler and condenser without passing to the engine.

The condenser E, as before described, will suffice where the expansive force of a gas, such as carbonic acid, &c., is employed; but where it is intended to use a liquid, such as bisulphide of carbon, benzine, &c., I connect to the condenser, by short branches $g\,g^1$, a reservoir

or tank, G, which may be closed by a suitable cover provided with a man-hole, or like means of charging, cleaning, &c., and I interpose between the branch pipes $g\,g^1$ a cock, g^2, to cause the circulation of the condenser to pass through the reservoir G. In order to use the devices for either gas or a liquid, I place cocks $g^3\,g^4$ on the branch pipes $g\,g^1$, so that at any time the reservoir may be cut out of the circuit.

H indicates the cylinder of a steam-engine, whose piston-rod is connected to the power-shaft in the usual manner, said cylinder having the ordinary or any approved steam-chest and slide-valve, as at h, and connected to the boiler by the pipe h^1, and to the condenser E by the exhaust-pipe h^2. At the junction of the pipe h^1 with the boiler B a T or equivalent joint is used, and a branch pipe, I, (or relief pipe,) leads directly to the condenser E, said pipe being guarded by a valve, i, weighted in manner as a safety-valve, and performing like functions, so that the pressure in the boiler B and cylinder H can be controlled by weighting the valve i; and should the pressure in either exceed the desired amount the relief or safety valve i will be lifted, and the gas or vapor will be conducted to the condenser E.

The devices above described I employ as follows: I first fill boiler C one-half or two-thirds full of water, and where the expansive force of a gas is to be the source of power I close the cocks $g^3\,g^4$ to cut out the reservoir and open the cock g^2. I then fill the condenser E with a gas at a low temperature, (the lower the better,) permitting some gas to be absorbed by the boiler-water. I next apply heat to the boiler either by a low fire on the grate or by the gas-jets, which heat expands the gas, causing the same to pass by pipe h^1 to the cylinder H and act upon the piston by its expansive force, in the usual manner. The power thus first acquired will be sufficient to operate the pump and fan F of the condenser, and the pump will immediately draw the cold gas from the condenser E and force it through pipe c^1 into the boiler B, where it will be expanded by the heat, as before specified, and will pass by pipe h^1 to the cylinder H, from which, after having done its work, it will escape by the exhaust-pipe h^2 to the condenser E, to be cooled and again forced into the boiler, the operation being continuous. The valve i having been weighted to the desired pressure, if the pressure in the boiler or cylinder exceed the same, the valve will be lifted and the excess will pass directly to the condenser or cooler by relief-pipe I without loss or waste.

When it is desirable to cut off the gas from the engine, the rod e^2 may be pulled to lift the valve e^1 off its seat e^3, thus establishing a direct communication between the boiler and cooler or condenser E, and as the pumps will cease to operate the operation of all the devices will cease.

Where a volatile (or volatilizable) liquid, such as bisulphide of carbon, &c., is used, the reservoir G will be desirable, and may be switched into the circuit by closing cock g^2 and opening cocks $g^3\,g^4$. In all important particulars the operation of the devices will be the same as specified before when using a gas; but the coil E will now be more properly a condenser, whereas before it might be considered simply a cooler.

In some cases where volatile liquids are used, the heat of the furnace will have to be slightly increased; but this will, of course, depend to a great extent on the temperature at which the liquid employed volatilizes.

For purposes of lubrication, and to protect the machinery, I employ a suitable lubricant, preferring for that purpose caoutchouc or gutta-percha where bisulphide of carbon or other solvent thereof is used, and glycerine or any oily matter where the caoutchouc is not applicable.

The advantages of my devices are, that they are compact, easily regulated, and not likely to get out of order, are simple and effective, and are not liable to leak or waste the liquid or gas employed.

Having thus set forth the nature and advantages of my invention, what I claim, and desire to secure by Letters Patent, is—

1. In devices for utilizing gases and volatile liquids as motors, the combination of a boiler, a pump, a condenser inclosed by a tank or chamber, and a fan for causing a circulation of air around the condenser, substantially as and for the purpose specified.

2. The combination, with an engine, of a boiler, a pump, a condenser or cooling-coil, provided with a reservoir and inclosed by a suitable chamber or tank, and a fan or like mechanism for causing the air to circulate around the coil or condenser, substantially as and for the purpose specified.

3. The combination, with the engine and boiler, of a pump and condenser or cooling-coil, the cooling-coil or condenser provided with a valve, whereby the communication between the boiler and condenser may be opened or closed at will, substantially as and for the purpose specified.

4. The combination of the boiler and its extension c with the perforated pipe c^2, the condenser, and the interposed pump, the whole constructed and adapted to operate substantially as and for the purpose specified.

5. In a bisulphide-of-carbon engine constructed substantially as described, the process or method of lubricating the devices by the use of caoutchouc or gutta-percha with bisulphide of carbon or other volatile liquid solvent, substantially as specified.

In testimony whereof I, the said JOSEPH H. CONNELLY, have hereunto set my hand.

JOSEPH H. CONNELLY.

Witnesses:

JNO. K. SMITH,

R. H. WHITTLESEY.