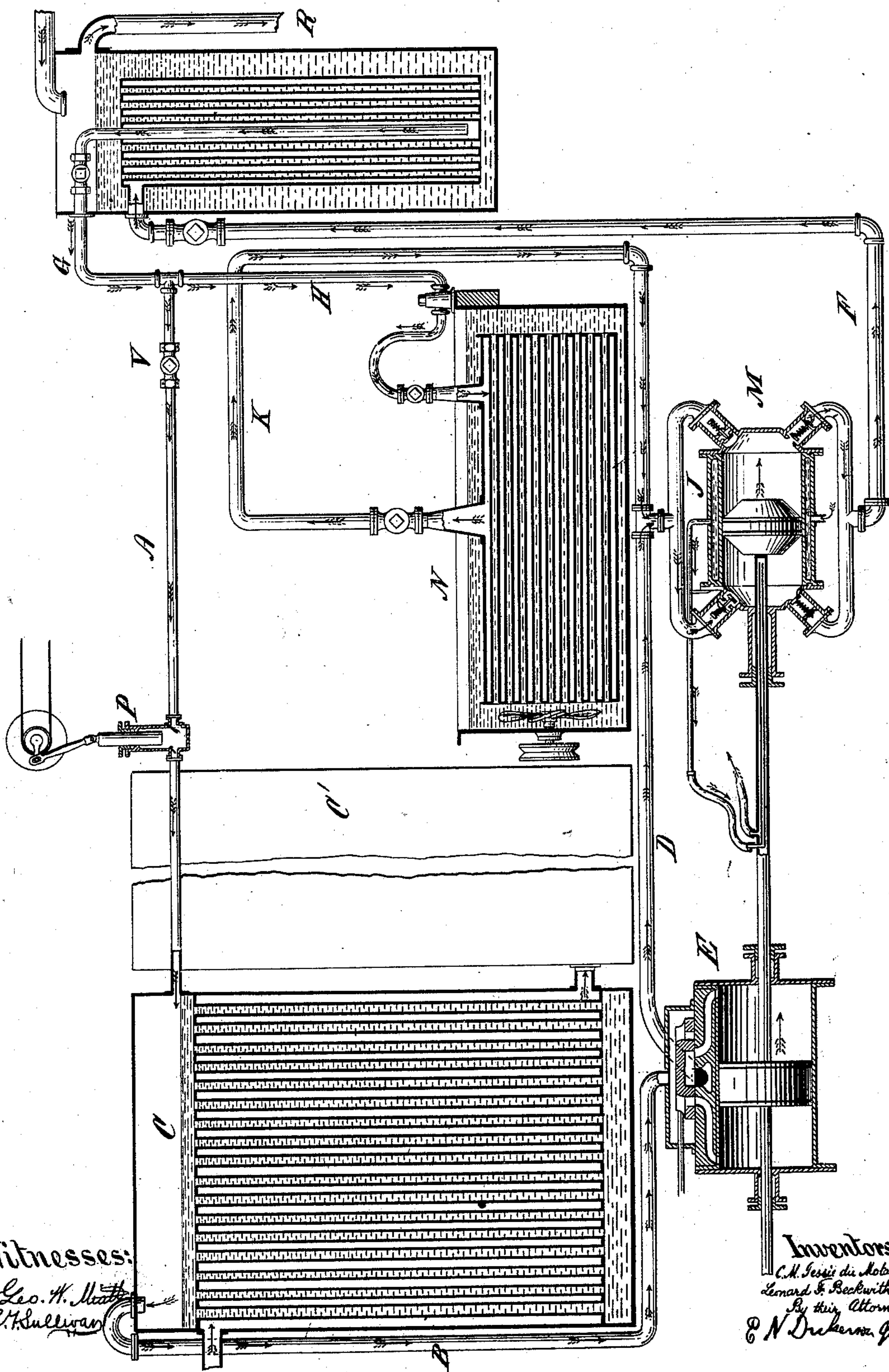


C. M. TESSIÉ du MOTAY & L. F. BECKWITH.  
Differential Gas-Motor.

No. 223,555.

Patented Jan. 13, 1880.



Witnesses:

Geo. H. Mather  
S. H. Sullivan

Inventors:

C. M. TESSIÉ du Motay  
Leonard F. Beckwith,  
By their Attorneys  
P. N. Decker & Co.



# UNITED STATES PATENT OFFICE.

CYPRIEN M. TESSIÉ DU MOTAY, OF PARIS, FRANCE, AND LEONARD F. BECKWITH, OF NEW YORK, N. Y.

## DIFFERENTIAL GAS-MOTOR.

SPECIFICATION forming part of Letters Patent No. 223,555, dated January 13, 1880.

Application filed June 3, 1879.

*To all whom it may concern:*

Be it known that we, CYPRIEN M. TESSIÉ DU MOTAY, of Paris, France, resident of the city of New York, and LEONARD F. BECKWITH, of the city, county, and State of New York, have invented a new and useful method of utilizing the waste-heat of a steam-engine for the production of power, and a new and useful method of using the power so obtained in the production of low degrees of temperature, in a manner to be hereinafter described.

It is a well-known fact that the condensing-water taken from the condenser of a steam-engine carries off with it a great amount of heat, which is at too low a temperature to be useful in the formation of steam from water; and we have devised a method by which such waste-heat can be utilized in vaporizing sulphurous acid or other volatile liquids, and of utilizing the power so obtained in the production of low degrees of temperature for ventilation, refrigeration, &c., or for restoring the power so obtained to the steam-engine, thus increasing its efficiency.

In putting our invention into practice we cause the steam coming from the cylinder to pass around tubes containing a certain amount of sulphurous acid, &c., thereby vaporizing said acid and giving to it a tension of several atmospheres. It is estimated that a tension of seven atmospheres can be readily obtained from the water of condensation of most large ocean steamers. This sulphurous acid-vapor is then taken to an engine suitably constructed to be operated by it, and after it has passed from thence is taken to a compressing-pump, whereby, in connection with an acid-condenser, it is reduced to a liquid condition, and is forced by a feed-pump back into the boiler-condenser tubes, previously referred to. These condenser-tubes should be so situated as to receive the steam when it first passes from the cylinder. When used to produce cold the force-pump, previously referred to, not only operates on the exhaust-vapor of the original engine, but also upon a certain amount of the same vapor which is used in the ice-machine, preferably one of the kind employed by Pictet, so that this same pump serves the double pur-

pose of compressing the sulphurous acid to be returned to the condenser-tubes, and also of compressing that which is used in the ice-machine, where it is allowed to expand and produce the requisite degree of temperature.

Our apparatus will be clearly understood from the accompanying drawings.

C represents a series of tubes, through which the steam from the steam-cylinder passes. Surrounding these tubes is a certain quantity of sulphurous acid or other volatile liquid. The steam, after passing through the tubes of this condenser, will go to C', which represents the main condenser of the engine.

It is obvious that this principle can be used as well with jet as with surface condensers, or even with high-pressure engines.

The sulphurous acid or other liquid is fed into what we call the "condenser-boiler" C by means of the supply-tube A. It is forced in by the feed-pump P, which may be driven in any suitable way, but, by preference, should be connected with the sulphurous-acid engine E. The liquid in C passes into a state of vapor at considerable tension, escapes down through pipe B, and enters the engine E, which is suitably constructed. After operating this engine, the piston of which is represented as traveling toward the right, the exhaust-vapor passes along through pipe D to the compressor-pump M, by which it is compressed. This pump is shown with a cooling-water jacket J, and with a water-circulation through the piston and piston-rod. The sulphurous acid, leaving this compressor-pump in a gaseous form under pressure, through pipe F, passes into the tubes of an acid-condenser, R, from whence it escapes by tube G. This condenser of acid is cooled, in preference, by the sea-water, and the sulphurous acid is condensed in it into a liquid state. Passing down the pipe G, the condensed liquid acid divides, part descending by tube H and part going off to the condenser-boiler by the tube A. That part which passes down by tube H passes into the ice-machine refrigerator N, where it is allowed to expand, and in passing into the gaseous state produces a low degree of temperature in the method well known. From thence it passes,



by pipe K, back to the suction or compressor pump M. All these tubes are, of course, provided with suitable valves (not shown) to regulate the varying supply.

5 It will thus be seen that the compressor-pump M serves the double purpose of compressing the gas from the engine E and also from the ice-machine refrigerator N, and that it supplies the liquid sulphurous acid both to  
10 the ice-machine and to the condenser-boiler.

It is obvious that many different arrangements of apparatus may be used to carry out the operation herein described, and we do not limit ourselves to the precise form here shown.

15 We are aware that attempts have been heretofore made to utilize the waste-heat of condensation in evaporating liquids which vaporize at a low temperature; and we do not claim, broadly, that idea, our new principle  
20 being the employment of a substance permanently gaseous excepting when compressed into a liquid form by a compression-pump.

It is plain that our apparatus can be readily applicable to any of the purposes to which a  
25 low temperature is required on shipboard, whether for the purpose of preserving food, or for purposes of ventilation, or for the production of ice; and it is plain also that our method of producing power can be used independent  
30 of the low-temperature producer combined with it. When not employed for refrigerating, the power generated by the condenser-boiler and developed by the acid-engine can be restored to the steam-engine, using the steam  
35 which supplies the condenser-boiler, thus restoring to the engine the power carried off by the steam, and realizing a notable economy, either by diminishing the amount of coal  
40 burned to produce a given power or by increasing the power obtained from a given consumption of coal.

The power generated by the gas-engine, instead of being restored to the main engine directly, may be applied to supplying the con-  
45 denser-pumps and other apparatus, instead of supplying them with steam direct. A more perfect condensing of steam is also obtained in the condenser-boiler by the prompt cooling action of the cold produced by the volatilizing of the acid or the volatile liquid employed;  
50 and the condensing apparatus of the steam-engine can be much diminished in size.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. An apparatus for utilizing the waste-heat 55 of condensation, which consists of a chamber for vaporizing a liquid at a low temperature by means of the exhaust-steam of an engine, of an engine or motor operated by means of such vapor, and of a compression-pump acting 60 upon the exhaust-vapor from such vapor-motor, for the purpose of condensing the same into a liquid before it is returned into the vaporizing-chamber, and arranged for operation substantially as described. 65

2. In combination with a machine for producing a low temperature, a vaporizer operated by the waste-heat of the steam-engine, producing pressure in a gas which is used to operate the compressing-pump of a low-temperature 70 producer, substantially as described.

3. In an apparatus for producing low temperature by means of the waste-heat of a steam-engine, an engine operated by the pressure or tension of the vapor produced by such waste- 75 heat, and a pump operated by said engine, and serving to compress both the exhaust-vapor of the engine and the expanded vapor of the low-temperature producer, substantially as described. 80

4. The combination, in an apparatus for utilizing the waste-heat of an engine in vaporizing a liquid boiling at a low temperature, of an engine operating a vapor-compressing pump, a liquid-condenser cooling the compressing 85 liquid passing from such compressor-pump, and a low-temperature producer or refrigerator, all combined and operating substantially as described.

5. The process of obtaining power from the 90 waste-heat of the condenser of a steam-engine, which consists in vaporizing sulphurous acid in said condenser, utilizing its tension in a gas-engine, and condensing it by a condensing-pump before it is returned to the boiler, 95 substantially as described.

C. M. TESSIÉ DU MOTAY.  
LEONARD F. BECKWITH.

Witnesses:

S. F. SULLIVAN,  
WM. J. SAWYER.