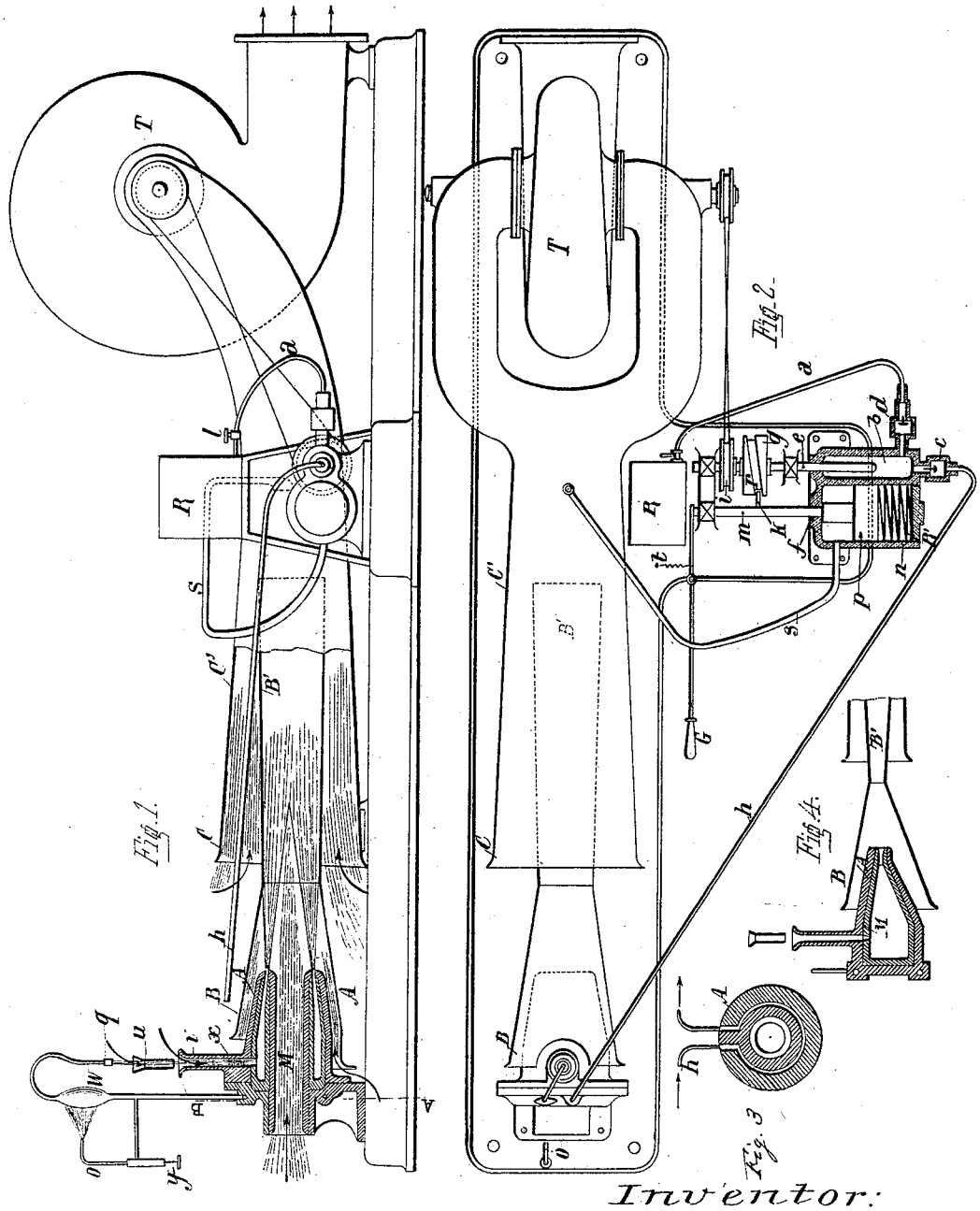
No. 611,813. Patented Oct. 4, 1898.

# G. A. MARCONNETT.

## THERMAL EXPANSION ENGINE.

(Application filed Nov. 27, 1897.)

(No Model.)




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# UNITED STATES PATENT OFFICE.

GEORGES AUGUSTE MARCONNETT, OF PARIS, FRANCE.

## THERMAL EXPANSION-ENGINE.

SPECIFICATION forming part of Letters Patent No. 611,813, dated October 4, 1898.

Application filed November 27, 1897. Serial No. 659,992. (No model.) Patented in France January 30, 1897, No. 263,582, and in Luxemburg July 29, 1897, No. 2,921.

*To all whom it may concern:*

Be it known that I, GEORGES AUGUSTE MARCONNETT, a citizen of the French Republic, residing at Paris, France, have invented certain new and useful Improvements in and Connected with Thermal Expansion-Engines, of which the following is a full, clear, and exact specification, and for which I have obtained patents in France, No. 263,582, of January 30, 1897, and in Luxemburg, No. 2,921, of July 29, 1897.

Although the efficiency or economic coefficient of gas or other explosion motors in general may be much greater than that of steam-motors, there exists, nevertheless, in these more perfected forms sources of inevitable loss of energy. It is very well known that the very high temperature produced by the explosion of a gaseous mixture (a temperature which varies from about 1,000° to 1,700° centigrade) would produce in cylinder and piston motors a heating of the walls of the cylinder and other parts which is incompatible with good working and the duration of the working parts. Recourse is therefore had to the employment of a circulation of cold water around the cylinder; but the action of this current of water causes a lowering of temperature sufficient to considerably modify the effects of expansion and the efficiency of the motors, especially during the period between the explosions, a period which is relatively long. Besides this the exhaust-gases carry off a large quantity of unutilized heat and the mechanical transmitting organs in any cylinder and piston motor absorb a considerable quantity of the power exerted.

The invention which is the object of the present application for Letters Patent relates, mainly, to a gas-mixture generator which permits of the heat produced being utilized in the most perfect manner and of a transformation into work of a greater proportion of this heat than has hitherto been effected.

This generator is intended to "totally" utilize, so to speak, the heat furnished by the production of a gaseous mass in movement of which the power may serve to work an air-propeller, a turbine, an air-compressing machine, or, if need be, a cylinder and piston motor.

This generator is diagrammatically represented partly in section and partly in elevation in Figure 1 and in plan in Fig. 2, while Fig. 3 is a section on line A B of Fig. 1, and Fig. 4 a detail of a modification.

A reservoir R, containing any convenient liquid fuel—petroleum, for example—is provided at its lower part with a pipe *a* for the passage of this liquid. This pipe *a* leads to a feed-pump *b*, whose delivery is variable, as will be hereinafter described, and which is put in motion by the motor. This pump, preferably constructed as will be hereinafter described, sends the fuel under high pressure—say one hundred to two hundred pounds per square centimeter—by a tube *h* into a capsule *w*, heated by a burner *o*. By feeding this burner by means of a pipe passing from pipe *h* the quantity of heat which it furnishes is rendered roughly proportional to the delivery of the pump. The petroleum is volatilized in this capsule *w* and escapes in the form of superheated vapor by a very small jet *q* with a velocity which is variable and proportioned to the delivery of the pump.

In line with the jet *q* is a tube *u* or a series of tubes *u v*, having one end slightly flared, the extremity of the one tube *u* entering the flared extremity of the tube *v*, placed immediately following. The flared bases of the tubes are open to the atmosphere, and it follows that the petroleum-vapor in passing into the successive tubes *u v* draws in atmospheric air and that it forms thus an increasing mass of mixed combustible gases. By making these tubes movable one with respect to the other and by adjusting their respective positions the quantity of air drawn in, and consequently the proportions of the combustible mixture, may be regulated. On the other hand, it is possible by increasing the action of the pump to increase the pressure of the combustible mixture, which latter may attain a pressure of eight, ten, or even twenty pounds per square centimeter.

The mass of gaseous combustible matter after having passed into an appropriate mixing device *x* (constituted by a network of metallic wires or the like) for the purpose of being completely broken up and mixed penetrates by a constriction, which augments its velocity,

into a combustion-chamber A. This chamber, provided with very thick walls and with cooling wings or webs and lined interiorly with a layer M of refractory matter, constitutes a true injector for the products of combustion. This injector may take an annular form, as indicated in Fig. 1, or a central jet form, as indicated in Fig. 3.

The gaseous mixture is ignited in the chamber A by means of an electric spark or by any other convenient igniting device.

Around the chamber A and so as to completely surround its longitudinal surface is a tube B, of which one end is flared and open to the atmosphere. That part of this tube B which surrounds the chamber A is of funnel shape, while the more nearly cylindrical part B′ of the said tube is in its turn surrounded by the flared part of a tube C C′ of greater diameter than the corresponding parts of the tube B B′. The flared ends of these successive tubes are all open to the atmosphere. I thus obtain a series of tubes in which the products of combustion from the chamber A are expanded, drawing in air heated between the conical surfaces B and A and C and B. This injecting system combined for the combustion of the gaseous mixture and the flow of air drawn in with the products of combustion renders any cooling-jacket unnecessary. The heat radiated is utilized for the heating of the air drawn in. The mass of gaseous mixture thus generated and put in movement may before being passed to an appropriate motor—such as a fan, turbine, reciprocating motor, or the like—be received in any suitable reservoir.

It is clear that by causing the successive tubes to slide one within another it is possible to regulate in any convenient manner the quantity of air drawn in, and thus regulate the proportion of the gases in the mixed mass.

By means of a series of detents or baffle-plates the speed of the moving gaseous mass may be diminished and the said mass greatly augmented. I thus realize a new method of utilizing the calorific effect of the combustible matter, transforming the calorific energy into a moving mass of burned or burning gas, the important factor in this quantity of moving gas being its mass.

In order to maintain constant the pressure of the gaseous mixture at its entrance into the motor and at the same time to regulate the feed of the generator, I have devised the feed-pump diagrammatically represented in Fig. 1 and 2. In the body of the pump *b*, furnished with the admission-valves *d* and the exhaust-valves *c*, moves a piston *e*. On the external extension of the piston-rod is fixed a flanged pulley *i*, rotated by the motor. A guide or cam wheel *g*, attached to the pulley *i* or fixed upon the same axle, has a groove *r*, which serves as a guide for the pin or projection *k* on the rod *m*. This rod *m* is attached to one of the faces of the piston *p*, which moves in the cylinder *n*. To the other face of the piston *p* is attached a spring R′, which tends to push the piston toward the bottom part F of the cylinder. This bottom part communicates by means of a pipe *s* with the tube through which escapes the gaseous mixture. The gases penetrating into the pipe *s* will therefore have the pressure which they have at their entrance into the motor. The pulley *i* receives from the motor a movement of rotation. The cam-wheel *g*, rotated by this movement, will cause pin *k* to follow the groove *r*, and the piston *p* will then have a tendency to compress the spring R′; but if the resistance of this spring is sufficient the pin *k* will, on the contrary, force the guide-wheel *g* and the piston *e*, attached to this guide-wheel, to be displaced. The piston will compress the aspirated gases and force them back toward the burner. This arrangement permits of the transformation of the movement of rotation communicated to the motor by the pulley *i* into a reciprocating movement of the piston, having for a result the aspiration of the combustible gas from the reservoir R and the forcing of the same toward the capsule *w* or directly into the chamber A′, heated by the combustion-chamber A when the motor is in action.

It will be readily understood that, on the one hand, the piston *e* will have a number of movements proportional to the speed or to the number of rotations of the motor-shaft, while, on the other hand, (on account of the communication given by the pipe *s*,) the course of the piston *p* will be as much feebler as the pressure of the exit gases of the generator is stronger. It results from this that the duty of the feed-pump will be inversely proportional to the pressure of the gaseous mixture and directly proportional to the number of turns of the motor. The pump will therefore tend automatically to retain constant the pressure of the gaseous mixture at its exit from the generator.

As oscillating lever G, of which the extremity bears upon the rod *m* of the piston *p*, permits of the pin *k* being displaced by hand, and thus to put the pump in motion for starting purposes. A counter-spring *t* brings the lever G back to its normal position after each stroke.

As has been indicated above, the burner *o* serves simply to volatilize the petroleum and direct its movement. As soon as the walls of the combustion-chamber A have acquired a sufficient temperature the tap *y*, feeding the burner, may be turned off, and the petroleum will be directly volatilized on the interior of the conduit made in the wall of the combustion-chamber A.

As I am able to dispose at the exit from the generator of a considerable mass of mixed gases under pressure and in motion, my apparatus may be applied not only as a generator for any convenient form of motor, but in allowing the gaseous mixture passing from the injector to escape into the atmosphere and

combining this feature with the resistance opposed by the surrounding air a reaction is created which will have for effect the displacement of the generating apparatus in a direction opposite to that of the escape of the air by the tubes B C. It is conceivable, then, that in adapting the apparatus in a convenient manner to a vehicle—such as a carriage, boat, or balloon—a motion of the vehicle may be obtained in a direction opposite to that of the escape of the expanded air. My apparatus tends, then, to move by simple repulsion in a surrounding medium after the manner of a rocket.

Having now described my invention, what I claim is—

1. In combination, the motor, the fuel-reservoir, the combustion-chamber, the connection between them, the pump in said connection, means for operating the pump from the motor, and regulating means for the pump having a pipe connection with the motor exposed to the pressure in the motor, said regulating means being mechanically connected with the pump substantially as described.

2. In combination, the motor, the combustion-chamber, the fuel-supply, the pipe connection between them, the pump in said connection, the pulley $i$ connected with the motor and the piston of the pump, the cam $g$ and pin $k$ for reciprocating the piston, the rod $m$ carrying the pin $k$, the cylinder $n$ the piston $p$ therein connected with the rod $m$, the spring R and the connection between the opposite side of the piston $p$ and the motor, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

GEORGES AUGUSTE MARCONNETT.

Witnesses:

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EDWARD P. MACLEAN.