(No Model.) 2 Sheets—Sheet 1.

N. ROSER & J. MAZURIER.

MOTOR.

No. 597,888. Patented Jan. 25, 1898.

FIG. 1.

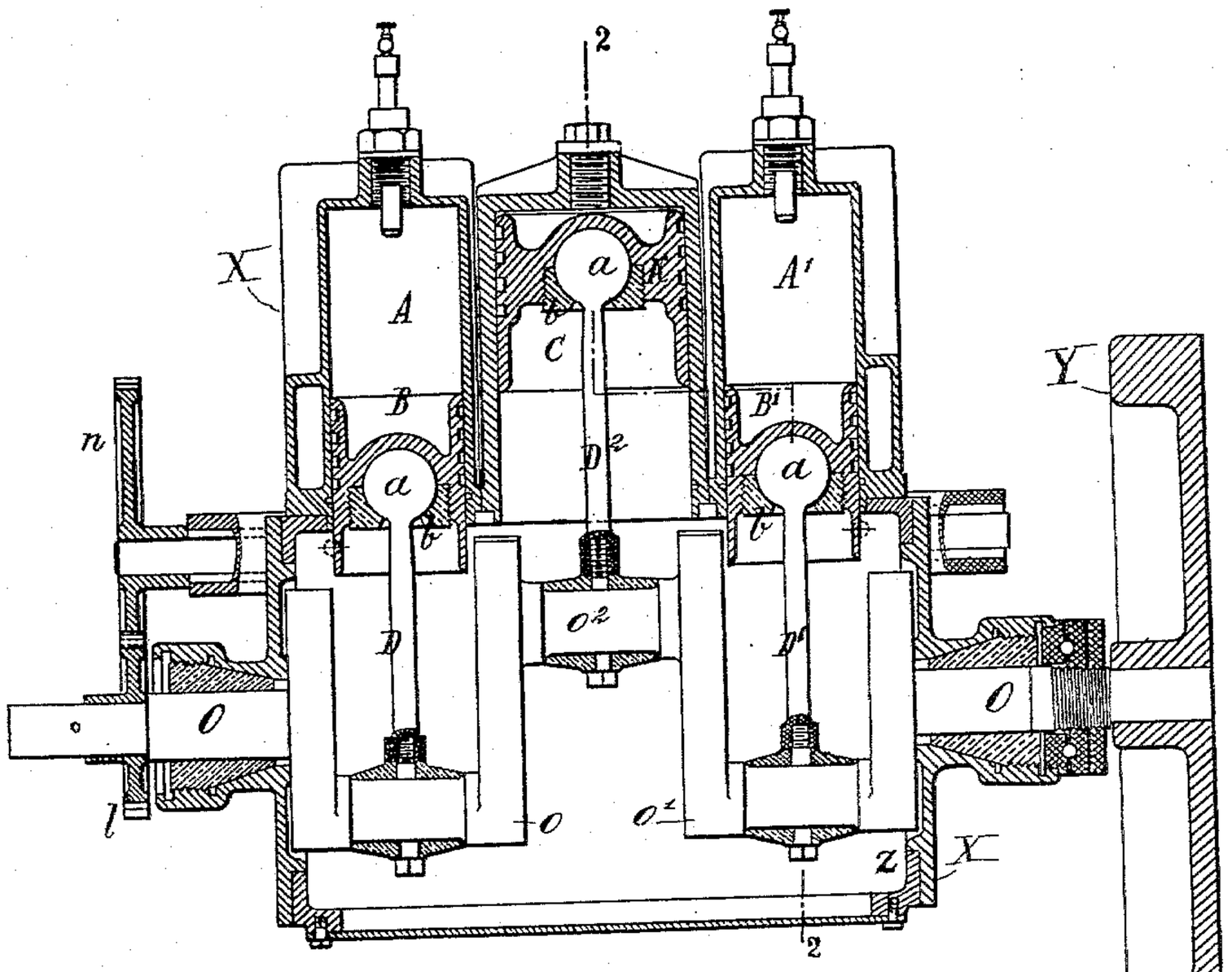
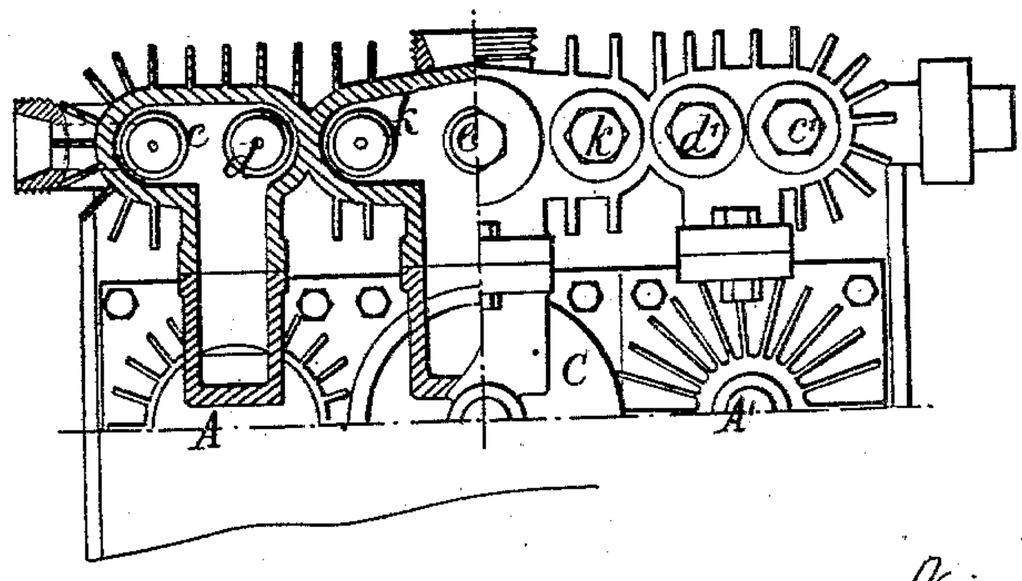


FIG. 3.



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(No Model.) 2 Sheets—Sheet 2.

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FIG. 2.

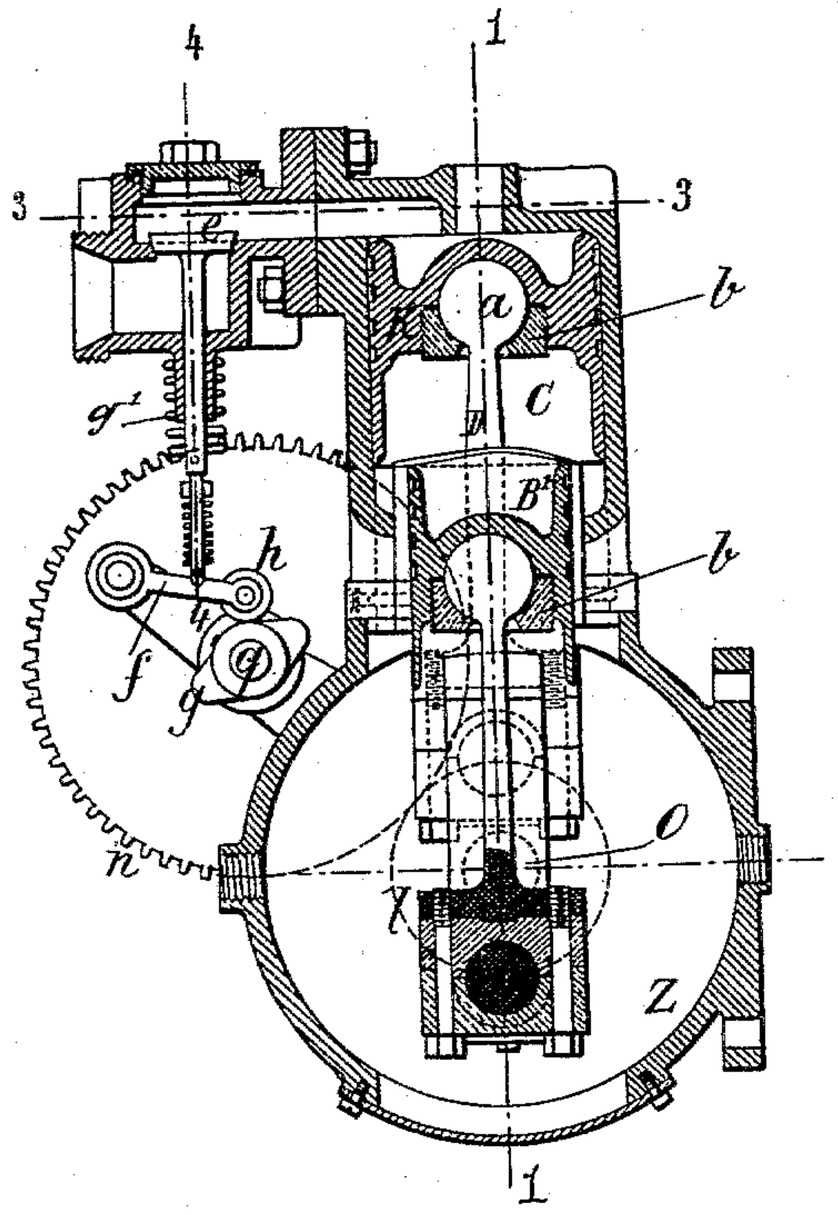
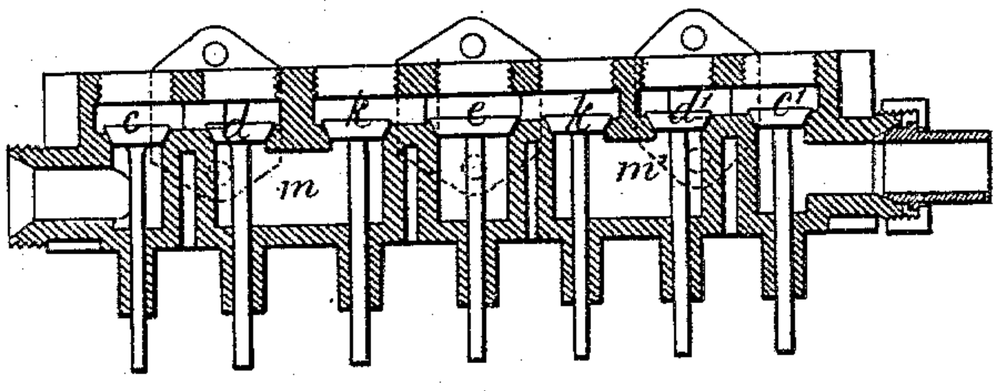


FIG. 4.



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UNITED STATES PATENT OFFICE

NICOLAS ROSER AND JULES MAZURIER, OF ST. DENIS, FRANCE.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 597,888, dated January 25, 1898.

Application filed June 18, 1897. Serial No. 641,278. (No model.) Patented in France October 3, 1896, No. 260,420, and in Germany October 27, 1896, No. 92,553.

To all whom it may concern:

Be it known that we, NICOLAS ROSER and JULES MAZURIER, citizens of the Republic of France, residing at St. Denis, (Seine,) France, have invented certain new and useful Improvements in Motors, (for which patents have been granted in France, No. 260,420, dated October 3, 1896, and in Germany, No. 92,553, dated October 27, 1896,) of which the following is a specification.

This invention relates to the class of motors wherein a gaseous liquid under tension acts on a piston for the conversion of the reciprocating motion of the piston into rotary motion of a crank-shaft; and the object of the invention is to utilize the heat of the hot gases generated by the explosion of gas or petroleum vapor in one cylinder to heat the gases in another cylinder of the compound motor.

In the motor illustrated and described herein there are two explosion-engines and an engine of the hot-air type coupled to cranks on the main shaft, the cranks of the explosion-engine being opposite to that of the hot-air engine, and the hot gases resulting from the explosion in the gas-engine are led to and heat the compressed air or gaseous charge behind the piston of the hot-air engine, thus materially augmenting the tension of the charge, as will be understood. The purpose is to obtain the maximum advantage from the employment of the hot gases of combustion of the explosion or gas engine.

In the accompanying drawings, which illustrate an embodiment of the invention, Figure 1 is a vertical section along the axes of the several engine-cylinders in the plane of the line 1 1 in Fig. 2. Fig. 2 is a similar section in the plane of the broken line 2 2 in Fig. 1. Fig. 3 is a section, as to the left side, in the plane of line 3 3 in Fig. 2 and a plan as to the right side. This view extends forward only to the axes of the engine-cylinders. Fig. 4 is a vertical section in the plane indicated by line 4 4 in Fig. 2.

A and A′ are the cylinders of the two like gas or petroleum engines of the motor. The pistons B B′ of the respective gas-engines are coupled through their piston-rods D and D′ to cranks *o* and *o′* in a main crank-shaft O, which is mounted rotatively in a suitable frame X. On this shaft is a fly-wheel Y.

Between the cylinders of the gas-engines is mounted the cylinder C of the hot-air engine, the piston K of which is coupled by its piston-rod D^2 to a crank o^2 in the shaft O. This crank o^2 is set oppositely to the cranks *o* and *o′*.

The several piston-rods are coupled to their respective pistons by ball and joints, formed of a ball *a* on the rod resting in a hollow in the piston and held in place by a hollowed screw *b*. The pistons, as shown, are trunk pistons.

The construction is balanced by the opposite arrangement of the cranks and by the piston of the hot-air engine being of exactly the same weight as the two pistons of the gas-engines combined.

The cylinders A and A′ are furnished, respectively, with inlet-ports for the explosive charge controlled by valves *c* and *c′*, and there are ports *m* and *m′*, Fig. 4, which lead the gases from the explosion to the cylinder C, these being controlled, respectively, by valves *d* and *d′*. The cylinder C has valves *k*, which control the admission to it of the hot gases, and a valve *e*, which controls the exhaust to the atmosphere. The valves are opened by cams *g*, Fig. 2, on a cam-shaft *q*, which shaft is rotatively mounted in bearings on the frame or casing X and is driven from the main crank-shaft O by a pinion *l* on the latter gearing with a wheel *n* of twice the diameter of the pinion on the cam-shaft *q*. The stems of the valves are coupled to levers *f*, each of which has a roller *h* at its free end which rests on the cam *g*. The cam lifts the valve from its seat at exactly the proper time, and a suitable spring *g′* on the valve-stem seats the valve when the cam passes. We have not deemed it necessary to show all of the cams, as their mounting is clearly within the knowledge of any skilled workman.

The valve *e*, which serves as a retaining-valve for the compressed gases during the compression of the gas in the cylinder C by the piston K, and the valves *d* and *d′*, which permit the gases from the explosion to pass from the cylinders A and A′ to the cylinder

C, are so constructed and arranged that the gases compressed in the cylinder C cannot escape when the hot gases from the cylinders A and A′ arrive.

The volume of gas in the cylinder C is compressed on reaching the dead-point, or when the cranks are on centers, to a degree greater than that which it should have when it receives the heat from the gases of combustion, this in view of causing to act the maximum force produced by the hot-air motor not at the dead-point, but beyond it—that is to say, under more advantageous conditions.

The cylinders A and A′ are furnished with jackets for cooling them.

The operation is as follows: The mixture of atmospheric air, hot air, and petroleum is effected in a carbureter, and this mixture or charge is drawn into the cylinder A, for example, during the first or out stroke of its piston. Then it is compressed during its second or in stroke. Then at the end of this stroke the charge is ignited by any one of the known devices for this purpose. The third or out stroke is effected by the expansion due to the explosion, and on the fourth or in stroke the hot gases are driven out and into the cylinder C. The piston in the other cylinder A′, for example, makes the same cycle, but reversed—that is, when one is aspiring a charge the other is doing work; or, to express it according to the above description, when the piston in A is making its first outstroke of the cycle the piston in A′ is making its outstroke under the influence of the explosion. The piston K of the hot-air engine makes its first outstroke under the influence of the compressed gases behind it, heated by the hot gases from the two explosion-engines, and on the instroke or second stroke it forces out a part of the gases freely during the first part of the stroke; but then the exhaust-valve closes, and during the last part of the stroke the piston compresses the remaining gas in order that it may in its turn receive and absorb the heat of the gases from the explosion-engines.

It will be seen that the engine is very compact, and it may be inclosed in its casing, as illustrated best in Fig. 2, where the lower part V of the casing is shown as cylindrical. The motor may of course have the axes of its cylinders arranged vertical, horizontal, or inclined.

Having thus described our invention, we claim—

1. In a motor, the combination with an explosion-engine of the gas or petroleum type, of an engine of the hot-air type, both having their pistons coupled to cranks in the same crank-shaft, said crank-shaft, valves adapted to admit the hot gases produced by the explosion in the gas-engine to the cylinder of the hot-air engine for heating the charge in same, mechanism for operating said valves, an exhaust-valve for controlling the escape of the gases in the hot-air engine to the atmosphere, and mechanism which operates said exhaust-valve so as to permit a part only of the gases to escape from said engine and that part only during the first part of the instroke of the engine, substantially as and for the purpose set forth.

2. In a motor, the combination with the casing and the crank-shaft O, rotatively mounted therein and having the cranks o, o' and o^2, set as described, of the two engines of the explosion type, coupled to the respective cranks o and o', the hot-air engine, coupled to the crank o^2, the cam-shaft q, intermediate mechanism whereby the crank-shaft drives the cam-shaft at one-half its own speed, the cams on the cam-shaft for operating the valves which control the inflow of the charges to the cylinders of the gas-engines and the outflow therefrom of the hot gases to the hot-air engine, the said valves, the valve e which controls the exhaust of the hot-air engine, and mechanism which opens said valve e only during the first part of the instroke of the hot-air engine, substantially as set forth.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

NICOLAS ROSER.
JULES MAZURIER.

Witnesses:
EDWARD P. MACLEAN,
AUGUSTE MATHIEU.