CLAIMS

1. An engine with an active chamber, comprising at least one piston ~~(2)~~ slidably mounted in a cylinder ~~(1)~~ and driving a crankshaft ~~(5)~~ by means of a traditional connecting-rod/crank device ~~(3, 4)~~ and operating on a four-phase thermodynamic cycle comprising:

- an isothermal expansion without work;
- a transfer-slight expansion with work referred to as near-isothermal;
- a polytropic expansion with work;
- an exhaust at ambient pressure;

preferably supplied with compressed air or with any other compressed gas contained in a high-pressure storage reservoir ~~(12)~~, via a buffer volume referred to as the working volume ~~(11)~~ which is supplied with compressed air, or any other compressed gas, contained in a high-pressure storage reservoir ~~(12)~~, which is expanded to a medium pressure referred to as the working pressure in a working volume ~~(11)~~, preferably via a dynamic regulator device ~~(13)~~,

~~characterized~~wherein:

-~~in that~~ it comprises at least one piston ~~(2)~~ slidably mounted in at least one cylinder ~~(1)~~ of which the volume swept by the piston is divided into two distinct parts namely a first part constituting the active chamber ~~(CA)~~ which is included in the cylinder and a second part constituting the expansion chamber ~~(CD)~~;

- ~~in that~~ the volume of the cylinder ~~(1)~~ which is swept by the piston ~~(2)~~ is closed at its upper part by a cylinder head ~~(6)~~ comprising at least one intake duct and ~~port (7)~~ one intake valve and at least one exhaust duct and ~~port (9)~~ one exhaust valve and which is set out in such a way that, when the piston ~~(2)~~ is top dead center, the residual volume left between the piston and cylinder head ~~(6)~~ is, by construction, reduced to only the minimum clearances

that allow operation without contact between piston and cylinder head;

- ~~in that~~ the compressed air or the pressurized gas is admitted to the cylinder on top of the piston and, under the continuous thrust of the compressed air or any other gas, at constant working pressure, the volume of the active chamber ~~(CA)~~ increases, producing work representing the near-isothermal transfer phase;

- ~~in that~~ the admission of the compressed air, or of the pressurized gas, into the cylinder is closed off as soon as the maximum volume of the active chamber ~~(CA)~~ is reached, and that the amount of compressed air, or of a pressurized gas, contained in said active chamber then expands, driving back the piston over the second part of its travel which determines the expansion chamber ~~(CD)~~, thereby producing work that thus brings about the expansion phase;

- ~~in that,~~ when the piston has reached bottom dead center, the exhaust port is then opened to allow the exhaust phase to take place during the upstroke of the piston over its entire travel.

2. The engine with active chamber as claimed in claim 1, ~~characterized in that~~wherein the maximum volume of the included active chamber ~~(CA)~~ and the volume of the expansion chamber ~~(CD)~~ are sized so that, at the nominal operating pressure of the engine, the pressure at the end of expansion at the bottom dead center is close to atmospheric pressure.

3. The engine with active chamber as claimed in claims 1 and 2, ~~characterized~~wherein:

- ~~in that~~ it comprises several consecutive cylinders ~~(1; 1A; 1B)~~ of increasing cylinder capacity, each operating on the same principle that has just been described;

- ~~in that~~ the first cylinder of smallest cylinder capacity is supplied with compressed air, or with the pressurized gas, by the working volume ~~(11)~~ and ~~in that~~ the next cylinder or cylinders are each supplied with the exhaust ~~(8A, 8B)~~ from the preceding cylinder;

- ~~in that~~ one or more heat exchanger(s) for exchanging heat with the atmosphere is/are positioned between each cylinder allowing the air temperature of the exhaust from the preceding cylinder to be increased to bring it back close to ambient temperature and thus increase the volume of the air exhausted.

4. The engine active chamber as claimed in any one of claims 1 to 3, in its dual-energy application, ~~characterized in that~~wherein the working volume ~~(13)~~ comprises a heating device ~~(17)~~ operating on additional energy, either fossil or other than compressed air or than pressurized gas, at constant pressure, said heating device making it possible to increase the temperature of the air or of the gas passing through it and to increase the amount of available and usable energy as a result of the fact that the compressed air or the pressurized gas, before being introduced into the active chamber, will increase in temperature and increase in volume thereby making it possible to increase the range of a machine fitted with the engine according to the invention, in proportion with said increase in volume.

5. The engine with active chamber as claimed in claims 3 and 4, ~~characterized in that~~wherein a heating device at constant pressure is positioned between the last two of said consecutive cylinders, after the exchanger, said device making it possible to increase the temperature of the air or of the gas passing through it and to increase the amount of available and usable energy through the fact that the compressed air, or the pressurized gas, before being introduced into the

active chamber, will increase in temperature and increase in volume, thereby increasing the range of a machine equipped with the engine according to the invention.

6. The engine with active chamber in its dual-energy application, as claimed in one of claims 4 and 5, ~~characterized in that~~wherein the heating device ~~(25)~~ comprises a parabolic solar collector focusing in the working volume to increase the temperature of the compressed air or of the pressurized gas and increase the amount of usable and available energy through the fact that the compressed air, or the pressurized gas, before being introduced into the active chamber, will increase in temperature and increase in volume thereby increasing the range of a machine equipped with the engine according to the invention.

7. The engine with active chamber as claimed in any of the preceding claims, ~~characterized in that~~wherein the torque and the speed of the engine are controlled by controlling the pressure in the working volume ~~(11)~~.

8. The engine with active chamber as claimed in any one of claims 4 to 6, ~~characterized in that~~wherein, when operating in dual-energy mode with additional energy, an electronic computer controls the amount of energy supplied as a function of the pressure of the compressed air or of the pressurized gas, and therefore of the mass of air or of gas introduced into the working volume.

9. The engine with active chamber as claimed in any one of the preceding claims in its autonomous dual-energy application, ~~characterized in that~~wherein the engine is coupled to and drives an air or gas compressor that, when operating with additional energy, allows the

storage reservoir to be supplied with compressed air or with pressurized gas.

10. The engine with active chamber as claimed in the preceding claim, ~~characterized in that~~wherein a heat exchanger is positioned between the compressor and the storage reservoir so that the compressed air or the gas at high pressure and high temperature leaving the compressor reverts in the reservoir to a temperature close to ambient temperature.

11. The engine with active chamber as claimed in any one of the preceding claims, ~~characterized in that~~wherein it operates in three modes that can be made separately or in combination:

- mono-energy zero pollution operation, with air or gas previously compressed and contained in the high-pressure storage reservoir;
- dual-energy operation with air or gas, previously compressed contained in the reservoir plus the additional energy supplied by a heating device;
- autonomous dual-energy operation with air or gas compressed in the reservoir by a compressor driven by the engine plus the additional energy supplied by the heating device.