



(11)

EP 2 339 170 A2

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
29.06.2011 Bulletin 2011/26

(51) Int Cl.:
F03C 1/02 (2006.01)

(21) Application number: **09815737.3**

(86) International application number:
PCT/IB2009/006911

(22) Date of filing: **10.09.2009**

(87) International publication number:
WO 2010/035102 (01.04.2010 Gazette 2010/13)

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL
PT RO SE SI SK SM TR**
Designated Extension States:
AL BA RS

• **Arzamkham, Nassiroodin**
Dubai (AE)

(30) Priority: **10.09.2008 UY 4240 U**
08.09.2009 UY 4298 U

(72) Inventor: **REGUSCI, CAMPOMAR**
Maldonado (UY)

(71) Applicants:
• **Campomar, Armando Miguel Regusci**
Maldonado (UY)

(74) Representative: **Jacob, Reuben Ellis**
R.G.C. Jenkins & Co
26 Caxton Street
London
SW1H 0RJ (GB)

(54) **VARIANT OF A FREE-PISTON COMPRESSED-GAS ENGINE COMPRISING PINIONS, SAID ENGINE HAVING VARIOUS DECOMPRESSION STAGES AND RETURN SPRINGS**

(57) The object of this utility model is a free-piston engine and a several-stage pinion with excellent efficiency and control.

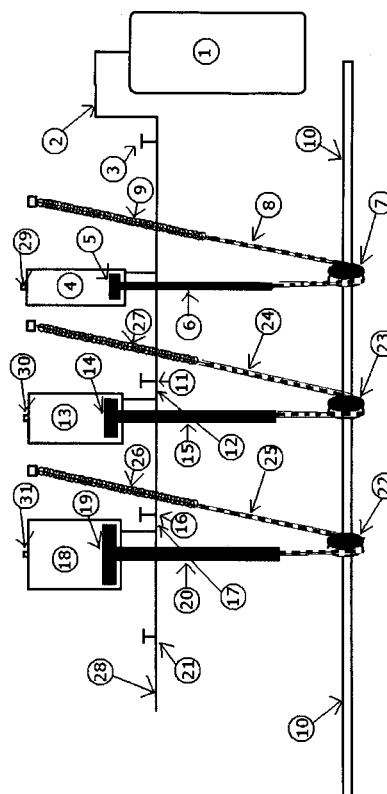


Figura 1

EP 2 339 170 A2

Description**Technical field:**

[0001] This Patent Application for a Utility Model pertains to the field of motor mechanics in general and to the use of compressed gas in particular.

Background and advantages:

[0002] The applicant is owner of several patents in the same technical field including automotive field.

[0003] The object of this invention has the advantage of granting a greater use to the energy due to the following reasons, among others:

a) Less friction due to the exclusively rectilinear movement of the pistons and their rod.

b) Use of the pressure decrease in each stage, each of them including greater diameter cylinders as $\text{Force} = \text{Pressure} \times \text{Surface}$ and decreasing pressure and increasing diameter of the piston of the following stage increases, the drive force value can be maintained.

c) When the gas expands, its temperature decreases; but when ambient air penetrates into the cylinders, usually at a higher temperature, that also leads to an increase in the pressure in the system.

Description and functioning:

[0004] The engine comprises a compressed-air tank, with an exhaust valve, pipes and valves that link said tank with motor pistons, each of them located at their respective cylinder. The rod of each cylinder is connected to a chain, which is linked at its other end to a spring. Said spring is fixed, at its other end, to a point.

[0005] The chain(s) of each piston are each connected to a pinion and these are located in a same axis that is the motor axis of the device where the engine is applied, whether it is a car, a generator or another device.

[0006] The pipe links the exhaust of the tank valve with derivations to each cylinder. Each derivation is preceded by a valve and another valve is located at the end of said pipe.

[0007] As it arises from what was exposed, the engine may be provided with several pistons, all of them located in the same side of the motor axis or half on one side and the other half on the other side, opposing the former, which allows a greater use of the energy.

[0008] The engine also includes an opening and closing command system of the valves in due time and form which may be constituted by known means such as PLC, microcomputer or mechanical means, etc.

Drawings:

[0009] In order to make it easier to understand the prior description and its functioning, a drawing of a preferred example is added, which is described next.

Functioning:

[0010] When the vehicle is stopped, tank 1 with pressure air and pistons 5, 14 and 19 being at the point of their route which is closest to the valves, valve 3 opens. The air goes from tank 1 to cylinder 4 through pipe 2 and valve 3. The air pushes piston 5, which pulls axis 6, which pulls chain 8, which makes pinion 7 turn, which makes axis 10 turn, which makes the vehicle wheel turn. When the desired amount of air has entered into cylinder 4, valve 3 shuts and valve 11 opens. The air goes from cylinder 4 to 13 through pipe 12 and valve 11. The air pushes piston 14, which pulls axis 15, which pulls chain 24, which makes pinion 23 turn, which makes axis 10 turn. Valve 16 opens, the air goes through cylinder 13 to cylinder 18 through pipe 17 and valve 16. The air pushes piston 19, which pulls axis 20, which pulls chain 25, which makes pinion 22 turn, which makes axis 10 turn. Valve 21 opens. The air of cylinders 4, 13 and 18 passes through pipes 12, 17 and 28 and valves 11, 16 and 21, and goes out into the atmosphere.

[0011] The pistons go back to their initial position, that is, the point of their route which is closest to the valves, carried by the force of springs 9, 27 and 26, which pull chains 8, 24 and 25, which pull axis 6, 15 and 20 respectively, air penetrating from the ambient to said cylinders through their respective inlets 29, 30 and 31. Valves 11, 16 and 21 close in order to repeat the cycle.

[0012] On of the ways in which to make this system work is the following:

[0013] When piston 5 gets to the end of its route, valve 11 opens. This can be done in several ways; one of them is that, when getting to the end of its route, axis 6 touches a mechanism that opens the valve mechanically. Another way is that, when getting to the end of its route, axis 6 closes an electric circuit that makes a solenoid work and opens valve 11. When air goes from cylinder 4 to 13, it makes piston 13 work, and when it gets to the end of its route, it opens valve 16, in the same way that valve 11 was opened. Now the air goes from cylinder 13 to 18, making piston 19 work. When piston 19 gets to the end of its route, it opens valve 21, thus allowing the air to escape to the atmosphere. Now the 4 pistons are brought to their initial position by the springs, that is, to the closest to the valves (allowing the entrance of ambient air in said cylinders through their inlets 29, 30 and 31). Note that more strength can be applied to spring 8, followed in strength by spring 24, followed in strength by spring 26, for piston 4 to get to the initial position in the first place, then 14 and then 19. When piston 5 gets to the initial position, it closes valve 11. When piston 14 gets to the initial position, it closes valve 16. When piston 19 gets to

the initial position, it closes valve 21. Once the three pistons get to the initial position, valve 3 may be opened in order to repeat the cycle. The ideal thing is for the air to come out at atmospheric pressure, but it can come out at a higher pressure. Also, valve 3 can be left open even after one or several pistons have finished their route.

[0014] In the case that a small amount of air has entered into the pistons and some of them or all of them did not go all the way, valves 11, 16 and 21 can be opened independently, mechanically or by another system. Then these valves will be closed in order to begin the cycle.

Another way of making this system work would be:

[0015] Placing a piston that pulls in the same direction that the other but in the opposite sense in a same axis, that is, if one pulls from the top, the other pulls from the bottom of the axis. Everything is connected in the same way, but both pistons will be linked with one another. Two advantages are accomplished in this way: not losing energy in the springs and giving higher speed to the backward movement of the piston, with which a greater power in the engine is accomplished. When a piston is working, it is taking the other to the initial position.

[0016] Note that the free-wheel and pinion engine, object of this invention, has a great number of advantages, but one of the most important ones is that it does not need a heat exchanger since the engine in itself is an excellent heat exchanger. As the air expands and cools, the piston heats. This is due to the fact that the atmosphere air, possibly at a higher temperature, penetrates into the cylinder through the vents that it has to that effect, thus increasing the temperature of the cylinder, mainly in its internal side, which will then heat the air when the piston works. Also, the piston axis is heated when going out into the atmosphere and it will heat the air when the piston works. In the high pressure piston there is a separation of 2 mm between the cylinder and the axis, which makes the system heat quickly. Besides, external ailerons can be placed for further heating.

[0017] In a car engine, for example, 12 pistons can be placed and these work in decompressions in groups of three, making them work in order; a first group of three, a second group of three, a third group of three and a fourth group of three, so that when the first group has to work again, it is already heated.

[0018] The engine can also be larger and with more pistons, in order to achieve a better functioning as a heat exchanger.

[0019] The axis with a screw where the pinions are placed may comprise a single piece. This axis can also work as a crankshaft. In order to fasten it better, some pieces screwed from the inside and flat on the outside can be placed where the ball bearings that hold the chassis go, which is equal to the conventional bedplates.

Claims

1. Free-piston compressed-gas engine variant, being the engine of several decompression stages and return spring, **characterized in that** the engine comprises a compressed-air tank, with an exhaust valve, pipes and valves that link said tank to motor pistons located each at its respective cylinder. The rod of each cylinder is connected to a chain, which is linked at its other end to a spring. Said spring is, at its other end, fixed to a point.
Each chain of each piston is connected to a pinion and these are located in a same axis that is the motor axis of the device where the engine is applied, whether it is a car, a generator or another device. The engine also includes an opening and closing command system of the valves in due time and form that may be comprised of a known means such as PLC, microcomputer, etc.
2. A system according to claim 1, **characterized in that** it has three pistons.
3. A system according to claims 1 and 2, **characterized in that** it has any number of pistons.
4. A system according to claims 1 to 3, **characterised in that** it has an electronic or mechanic or combined system which, once the piston gets to the maximum of its route, opens the valve that connects the piston to the following one and the latter connects it to the atmosphere.
5. A system according to claims 1 to 4, **characterized in that** it has a system that lets a certain amount of time go by from the moment that the piston got to the maximum of its route, in order to open the valve that connects it to the following piston, depending on the position of the accelerator, in order to accelerate the power and give more time for the air to heat before throwing it into the next piston.
6. A system according to claims 1 to 5, **characterised in that** it chooses the pistons of an engine in groups, in order to decompress them and alternate the groups to give the air more time to heat and increase efficiency.
7. A system according to claims 1 to 6, in which two pistons that work in the same direction but in opposite senses and in different pinions, are linked through its rods at 180° one from another as for the engine axis.
8. A system according to claims 1 to 7, in which tapes are used instead of spiral chains and springs or of another type.

9. A system according to claims 1 to 8 in which a twisted axis is used where the pinions are placed and where the ball bearings are placed to hold said axis on a piece which is twisted on the inside and flat on the outside, where a holding system for the ball bearing can be made, for example carcasses and caps, said ball bearings being connected to the vehicle chassis or engine. 5
10. A system according to claims 1 to 9 in which an axis with cotters is used in order to connect the pinions to the axis and where ball bearings are placed in order to fasten said axis. The diameters of the axis where the cotters go may be of different sizes, where a fastening system can be made for the ball bearing, for example, carcasses and caps, connecting those ball bearings to the car chassis or engine. 10 15

20

25

30

35

40

45

50

55

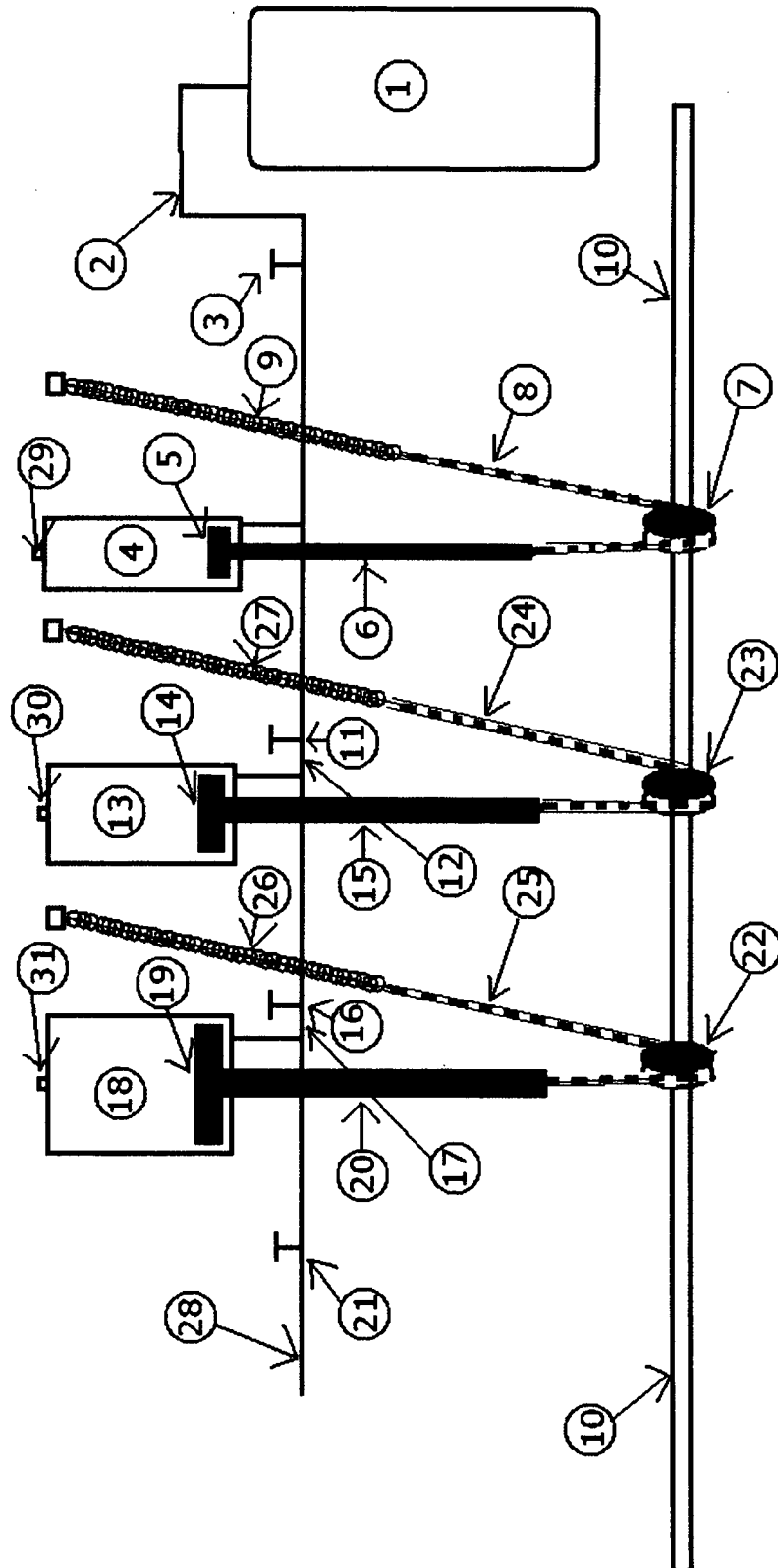


Figura 1