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(54) **Piston guided by counter rotating connecting rods and cranks**

(57) The object of this invention is to improve the characteristics of the normal crank mechanism that is universally adopted on the internal combustion engines and reciprocating compressors to transform the reciprocating motion of the piston into the rotational motion of the crankshaft.

As the piston is contemporaneously constrained by two connecting rods, which are constrained by two counter rotating cranks, it is possible to eliminate the friction between the piston and the cylinder, reducing moreover the dimension of the crank mechanism and increasing the stroke value in function of the crank radius.

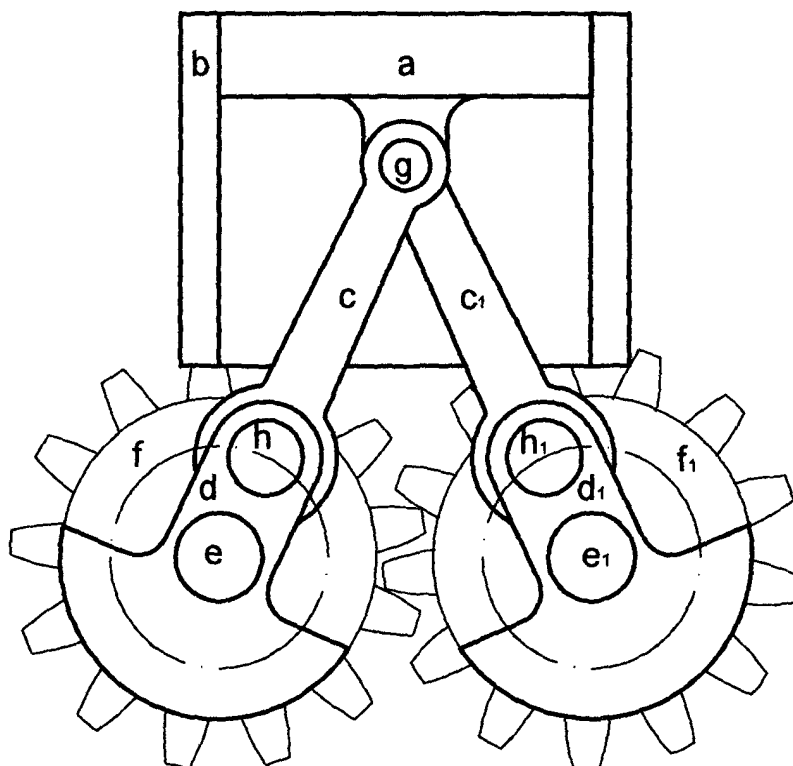


Fig. 1

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Description

[0001] In the field of the internal combustion engines and reciprocating compressors, nowadays is universally adopted the normal crank mechanism.

[0002] On the larger engines, to the purpose to eliminate the piston lateral thrust is often adopted the cross head crank mechanism which is very complicated.

[0003] Vice versa, by this new crank mechanism is possible to eliminate the piston lateral thrust reducing size and weight of the engine.

[0004] By this new crank mechanism it is possible to transform the reciprocating motion of the piston into the rotational motion, with a counter rotating system of connecting rods and cranks.

[0005] The power is contemporaneously transmitted to two counter rotating crankshafts by two connecting rods and vice versa, eliminating the piston friction that is not possible to eliminate with the normal crank mechanism.

[0006] As the driving power is subdivided equitably between two connecting rods, the piston pin and the piston, run in their stroke along the geometrical axis of the cylinder and consequently it is possible to avoid the friction between the piston and the cylinder that characterize the normal crank mechanism.

[0007] With the normal crank mechanism the piston is guided in its stroke by the cylinder and so it is not possible to eliminate the friction and the connecting rod/crank radius ratio is normally superior to 3, to avoid an excessive inclination of the connecting rod and consequent increase of the friction.

[0008] Moreover, the piston skirt surface has to be very large to avoid excessive specific pressure values.

[0009] Thanks to this invention, it is possible to reduce the piston skirt and the length of the connecting rods because it is possible to eliminate the piston lateral thrust.

[0010] In consequence of these characteristics, the size and weight of the whole crank mechanism are extremely limited.

[0011] The necessary technology to industrialize this new crank mechanism is widely acquired because it is the same of the normal crank mechanism and consequently in the following description every mention about common materials or components like bush or bearings will be avoided.

[0012] Thanks to this characteristic it will be very easy to industrialize this new crank mechanism.

[0013] The absence of friction between piston and cylinder, consent to increase life and reliability of the internal combustion engine and reciprocating compressors, simplifying their design, the choice of the materials and the technology process too.

[0014] This new invention will be described now with the aid of the drawings.

[0015] For the piston, Fig.1(a), in its stroke inside the cylinder, (b), it is possible to receive and to transmit the

driving power, by the connecting rods, (c,c¹) constrained to the piston by the piston pin (g), and to the cranks (d, d¹) by the pins (h,h¹).

[0016] It is therefore possible to transmit the motion to the counter rotating crankshaft e,e¹, connected by the counter rotating gears (f,f¹).

[0017] The figures 4, 5, 6, shows in sequence, the principle of how it works.

[0018] The Fig. 4, shows the piston (a), at the top dead centre, which start its cycle connected to the connecting rods (c, c¹) by the piston pin (g).

[0019] In Fig.5, the piston run its stroke inside the cylinder (b), connected by the connecting rods (c, c¹) which drive in a rotational motion the cranks (d d¹) and consequently the crankshafts (e,e¹) connected by gears, as previously explained.

[0020] In Fig.6, the piston (a) in its down stroke inside the cylinder(b) is arrived to the bottom dead centre, guided by the connecting rods (c,c¹), which are strongly inclined if compared with the cylinder axis, as shown in the same figure.

[0021] This characteristic joined with the strong off centre of the crankshafts axes in relation with the cylinder axis, consents to increase the stroke of the piston, in relation with the crank radius value.

[0022] The piston (a) goes in its up stroke from the position in Fig.6, to the position of Fig.4, thanks to the energy transmitted by the counterbalance (k, k¹) which are joined with the cranks (d, d¹) and so it is possible to transmit their rotational motion to the connecting rods (c,c¹) which in their translation and rotation motion, drive the piston (a) connected by the piston pin (g), to the top dead centre, concluding the cycle.

[0023] To subdivide in a perfectly symmetric way, the forces which act on the piston, it is better to have one connecting rod with a fork small end as the Fig. 2, shows.

[0024] The fork small end consents to the small ends of the respective connecting rods to be aligned on the same axis, to be joined by the same piston pin.

[0025] If it will be useful to have a larger distance between the crankshaft axes, it is possible to design the solution in Fig.3, and consequently to constrain the connecting rods by two different piston pins and therefore on two different axes without altering the principle of working in any way.

[0026] Thanks to the counter rotating crankshafts it is possible to obtain a perfect dynamic balance.

[0027] As it is possible to reduce, as previously explained, the piston skirt and the length of the connecting rods, it is possible to reduce consequently their masses, reducing the relatives forces of inertia.

[0028] In the figures 4,5,6, , the crank arm (d), and the crank arm (d¹), have respectively a clockwise rotation and an anticlockwise rotation.

[0029] It is obviously possible to reverse the rotation of the crank arms

[0030] By this invention it is possible to reduce size

and weight of the internal combustion engine and reciprocating compressors too, without any friction between piston and cylinder, increasing their life and reliability.

[0031] The application of this new crank mechanism will be particularly convenient to design the compression ignited internal combustion engine, because it is possible to reduce enormously the dimension and the weight of the piston and the cylinder too. 5

[0032] This characteristic consents to reduce size and weight of the engine, increasing the r.p.m. value. 10

[0033] It is also possible to reduce the dimension of the reciprocating compressors and the spark ignited engine.

[0034] It is possible to increase the piston stroke in function of the crank radius, increasing the inclination of the connecting rods. 15

[0035] If required by the design of the engine or compressor, it is possible to change the distance between the crankshafts axes, and the crank radius/connecting rod ratio, without altering the principle of working. 20

Claims

1. Claims 1, Crank mechanism with a piston driven by two counter rotating connecting rod and cranks, **characterized in that** the piston is contemporaneously constrained by two connecting rods. 25
2. A crank mechanism as claimed in claim 1, **characterized in that** the counterbalanced connecting rods consent to avoid the piston friction in its stroke within the cylinder. 30
3. A crank mechanism as claimed in the foregoing claims, **characterized in that** the connecting rods are constrained to two counter rotating cranks. 35
4. A crank mechanism as claimed in the foregoing claims, **characterized in that** the cranks are constrained to two counter rotating crankshafts. 40
5. A crank mechanism as claimed in the foregoing claims, **characterized in that** the counter rotating crankshafts are driven by counter rotating gears. 45
6. A crank mechanism as claimed in the foregoing claims, **characterized in that** it is possible to constrain the connecting rods to the piston by two different pins. 50

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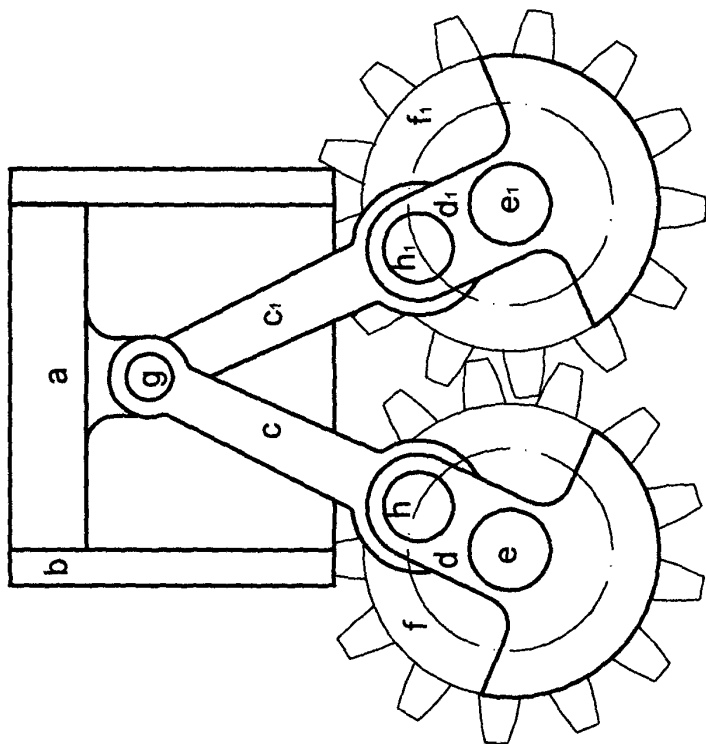


Fig. 1

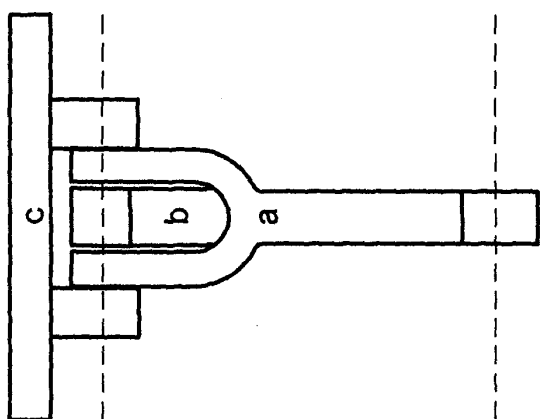


Fig. 2

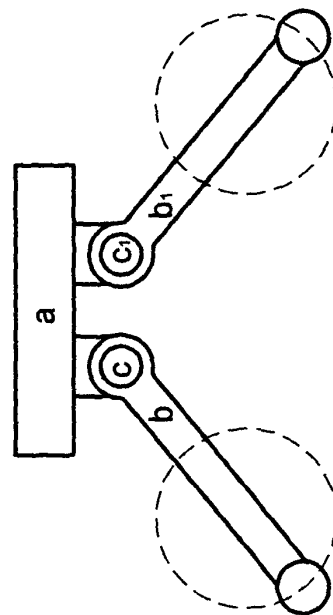


Fig. 3

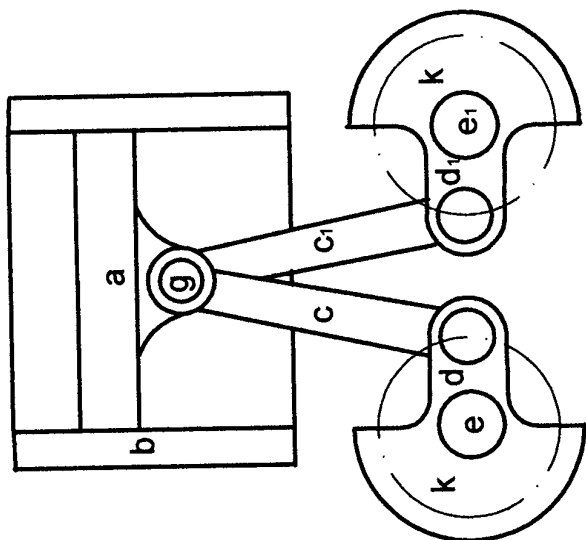


Fig. 4

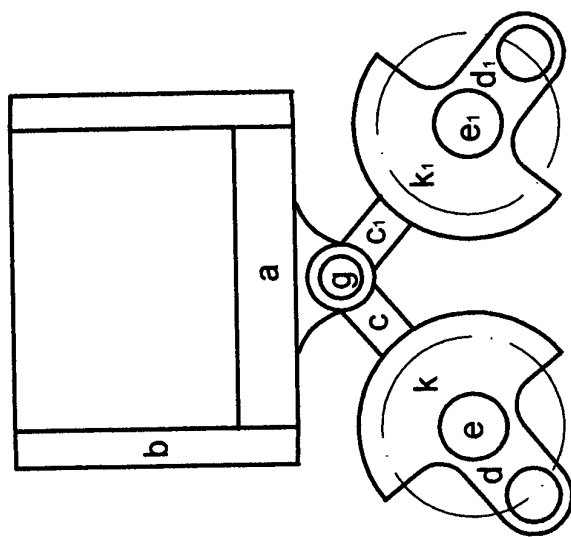


Fig. 5

Fig. 6