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(11) **CA 322073** (13) **A**

(40) **03.05.1932**

(12)

(21) Application number: **322073D**

(51) Int. Cl:

(22) Date of filing: ..

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(54) **ENGINE WITH OPPOSED PISTONS**

(57) **Abstract:**

(54) **MOTEUR A PISTONS OPPOSES**

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This invention relates to improvements in engines of the well-known kind in which two pistons move in opposite directions in the same cylinder and in which a twin or double beam is pivoted intermediate of its ends to one of the pistons (in a vertical engine it would be the upper piston), for example by being pivoted in the end of a piston-rod fixed in relation to its piston, and has a pivot comprising a pivot-pin that is fixed on the beam, which beam is connected at its opposite ends to parallel cranks.

In practice, it has been found that there is in these engines more wear in the bore of the liner in which the upper piston works as compared with the amount of wear in the liner arising from the movement of the lower piston. This wear caused by the upper piston takes place in a fore-and-aft direction, that is to say in the direction in which the main shaft extends. It is due to fore-and-aft lateral oscillations imparted to the upper piston by way of the beam. These oscillations, which are of small amplitude and high frequency, are believed to be mainly due to the reactions of the piston, hereinafter referred to for convenience as the upper piston, and of the mechanism coupling it with the parallel cranks, to variations of the torque in the main crank-shaft of the engine.

Though it has been customary to pivot the twin or duplex beam to the top end of the rod that extends up from the upper piston such pivoting having the object of enabling the beam to make these small oscillations without oscillating the piston, this custom as heretofore carried out has proved to be ineffective even when the bearings have been in good order, and still more ineffective when conditions have arisen which affected the freedom of the pivotal connection of the beam and piston, such as the access of salt water to the bearing from engine-room skylights, or the accidental access of water thereto from a piston-cooling system. It is the object of the present invention to obviate or, at any rate, to materially reduce the wear on the liner in which the upper piston works by employing bearings of ampler total area than heretofore, and so disposed as to form with the pin a pin-joint whose freedom even under adverse conditions shall be much greater than heretofore, and so shall be such that there will always be sufficient freedom of movement of the beam about the pin-joint to prevent any risk that the beam when oscillating will adhere sufficiently to its pin-joint on the piston rod to bring about such oscillation of the latter as heretofore has resulted in excessive wear of the liner by the upper piston.

Accordingly, this invention consists in the employment in engines of the kind described of the combination of a twin or duplex beam with that one of the pistons which is remote from the shaft, and a
5 connection which connects that twin or duplex beam and piston to one another, said connection being a pin-joint that comprises a pin connected by its middle to the piston but is distinguished from the pin-joint previously employed in this situation by the fact
10 that two or more co-axial bearings are comprised in it and that each bearing permits oscillatory motion of the beam in relation to the piston.

The beam is a twin or duplex beam constituted by two parallel members and the bearings
15 may be ball-bearings, roller-bearings, or plain rings free to rotate.

In the accompanying diagrams which show two constructions according to the present invention,

Figure 1 is a side elevation of the
20 principal parts of a single "line" of an engine of the well-known kind hereinbefore referred to with its cylinder in section;

Figure 2 is a vertical sectional
25 elevation on the line 2-2 of Figure 1, showing the upper piston and the pin of the joint in elevation and the duplex beam in section; and

Figure 3 is a view similar to Figure 2 but with a pin-joint, differing from that shown in Figure 2.

30 Figures 2 and 3 are to a scale larger than that of Figure 1.

Like reference-numerals indicate like parts throughout the drawings.

5 With reference first to Figures 1 and 2 which show one construction according to this invention the engine comprises two pistons 4 and 5 which move in opposite directions in the same fixed cylinder 6.

10 The lower piston is connected directly by an ordinary connecting rod 7 to a crank 8. The other two cranks 9 and 10 are connected by connecting rods 11 and 12 and rods 13 and 14 to the upper piston 4, that is remote from the cranks, the rods 13 and 14 being coupled to the opposite ends of a twin beam 15 which has a pin-joint midway of its ends that connects it with the upper end of the piston rod 16 that is fixed to the upper piston 4; as thus far
15 described in this description of the drawings the engine is of a well-known type. The pin 17 of the pin-joint is fixed by the middle of its length against rotation in its fixed support which is the top end of the piston-rod 16 that is borne by the piston 4 and said pin has its opposite
20 ends 18 and 19 on opposite sides of that support and carries fixed on those ends two co-axial roller bearing tracks 20 and 21 on which run rollers 22 and 23 supporting two portions 24 and 25 of the twin beams that engage by these rollers with, and oscillate in company around, the said ends 18 and
25 19 of the pin.

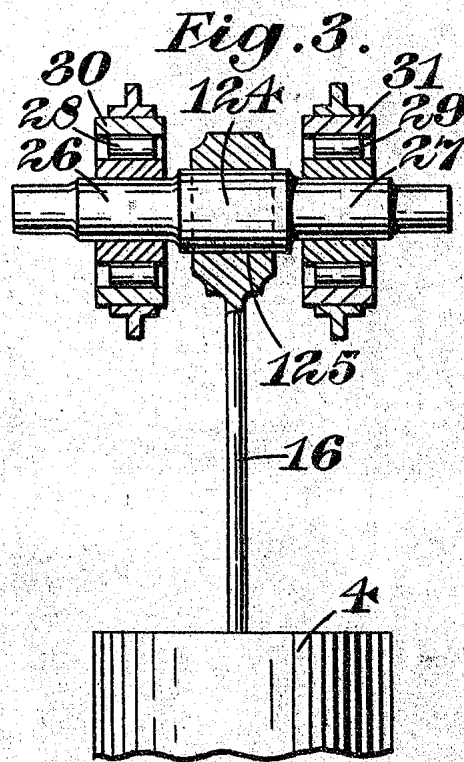
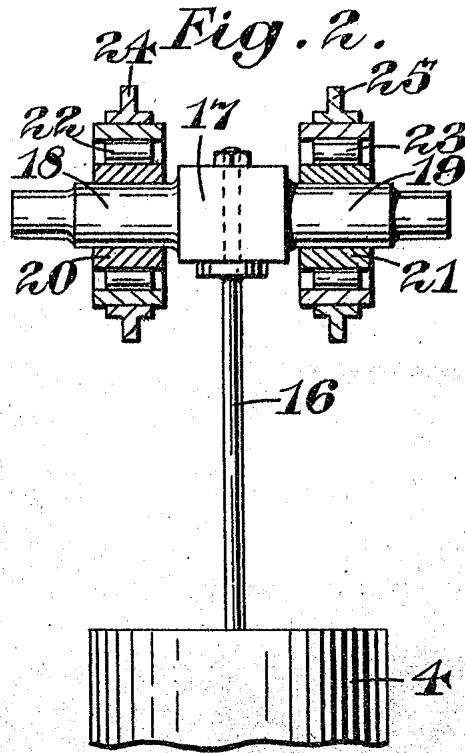
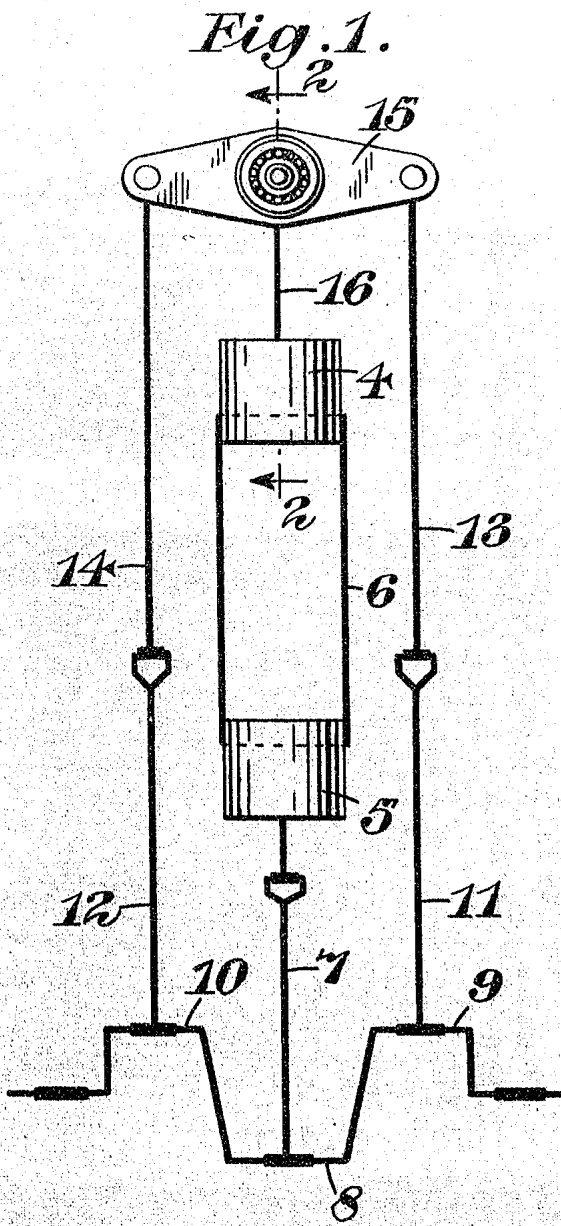
In the alternative shown in Figure 3 the pin
124 of the pin-joint is supported midway of its ends by, and is rotatable in, a support which is a plain bearing 125 that is fixed in the top end of the piston-rod 16 and said
30 pin has its opposite ends 26 and 27 on opposite sides of that support and carries on rollers 28, 29 on those ends which are bearings co-axial with the bearing 125 two co-axial portions 30 and 31 of the twin beam that can oscillate around the ends of the pin 24; in this case the pin 124 itself can
35 turn in the support 25.

CLAIMS.

In an internal-combustion engine in
combination a cylinder, a crank-shaft, opposed pistons
in that cylinder, a connecting-rod that directly
operatively connects to said crank-shaft that one of
5 the two pistons that is the nearest to the crank-shaft,
twin connections that constitute an operative con-
nection which couples to said crank-shaft that one of
the two pistons that is remote from said crank-shaft,
a twin beam that forms a part of said twin connections,
10 a pin-joint that connects said twin beam and said
remote piston to one another, a pin in the pin-joint
which pin is operatively connected at the middle of its
length to said remote piston, also a plurality of
coaxial bearings upon said pin, each of the said
15 bearings permitting oscillatory motion of the beam
at said pin-joint in relation to the piston.

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REFERRED TO BE THE DRAWINGS REFERRED TO
IN THE SPECIFICATIONS HERETO ANNEXED.

TORONTO, Oct. 27th 1931.