

April 19, 1927.

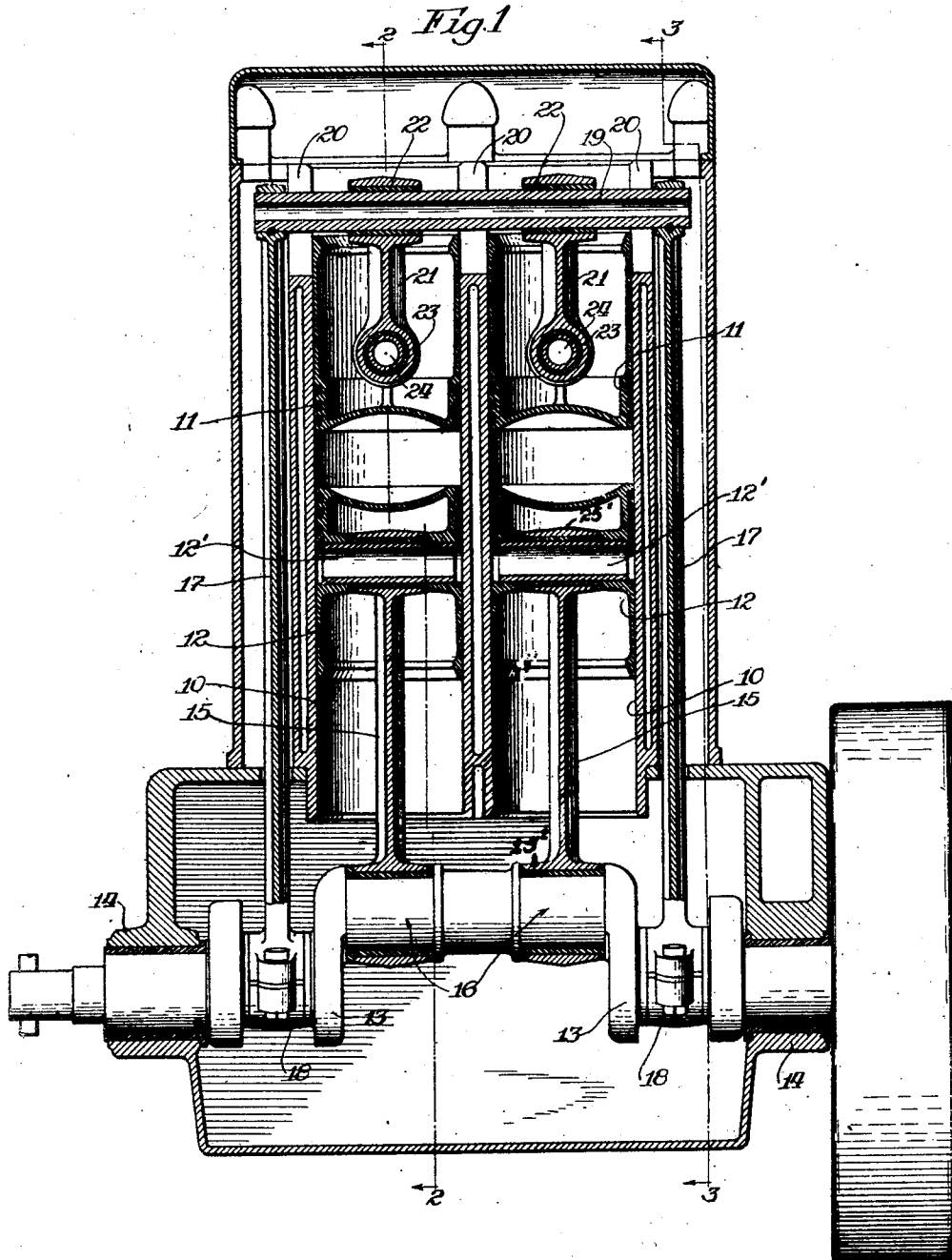
T. G. JACKSON

1,624,952

INTERNAL COMBUSTION ENGINE

Filed March 19, 1923

2 Sheets-Sheet 1



Inventor:
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Fig. 2.

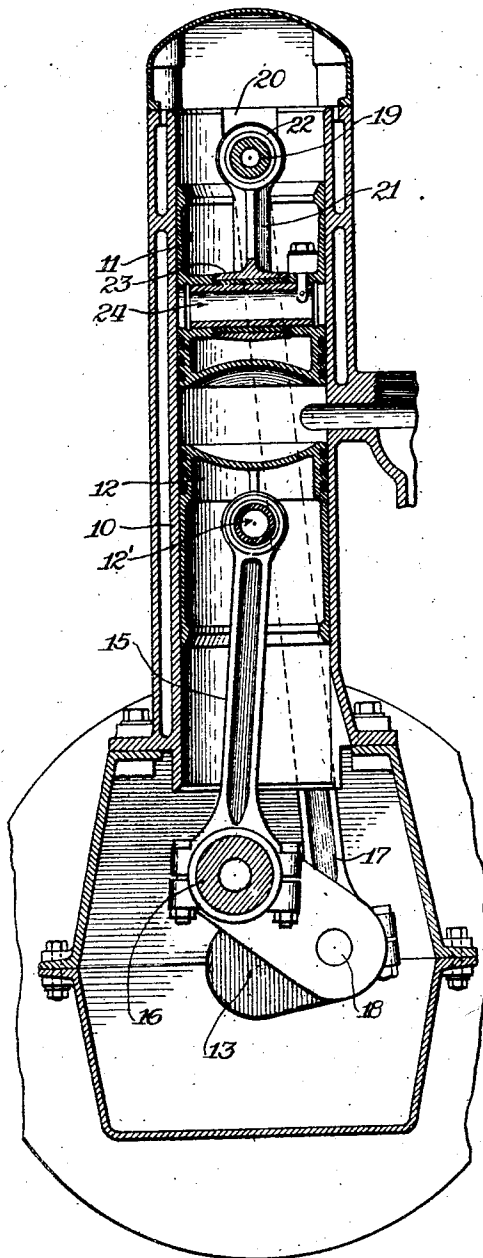
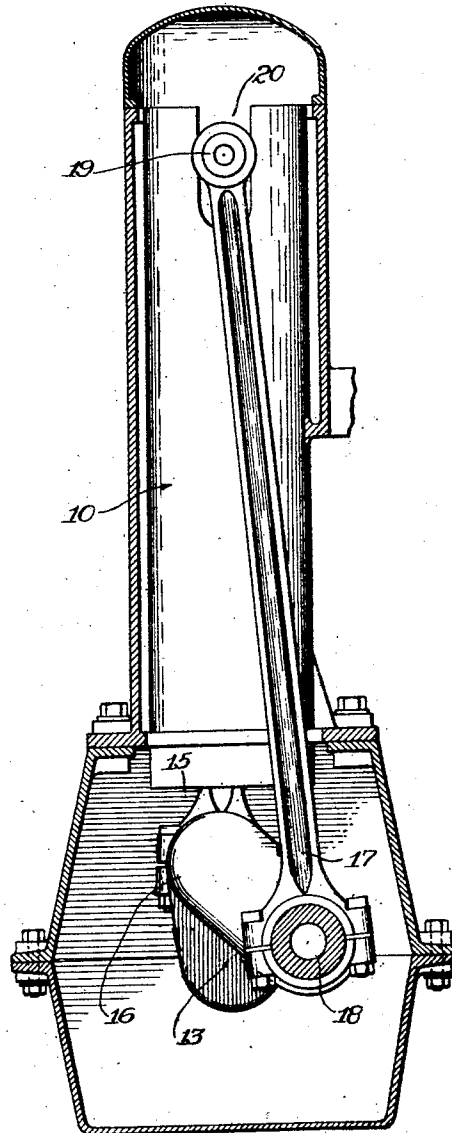


Fig. 3.



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UNITED STATES PATENT OFFICE.

TERENCE G. JACKSON, OF ROCKFORD, ILLINOIS, ASSIGNOR TO THE JACKSON PETROLEUM MOTOR COMPANY, OF AUGUSTA, MAINE, A CORPORATION OF MAINE.

INTERNAL-COMBUSTION ENGINE.

Application filed March 19, 1923. Serial No. 626,005.

This invention relates to improvements in opposed piston internal combustion engines and refers more particularly to an improved connection between the crank shaft and the outer piston or pistons designed to afford a more flexible connection of the outer piston or pistons with the crank shaft and to avoid the necessity of using guides for guiding the connections between the outer piston and the parts associated therewith for giving movement to the piston or pistons, and thereby reduce friction occasioned by such guides and loss of power due to such friction.

The present improvements are herein shown as adapted to the type of engine shown in the patent to George B. Jackson, No. 1,191,311, granted on the 18th day of July, 1916, and as designed for a two cylinder engine, but the improvements are adaptable to other types of opposed piston engines.

The object of the invention is to produce a flexible connection between the outer piston or pistons and the crank shaft which avoids retarding friction in said connections; to produce a construction in engines of this type which permits interchangeability of the inner and outer pistons and thereby reduce the production cost of the engine, and to otherwise improve and simplify engines of this type.

The invention consists in the combination and arrangement of the elements shown in the drawings and hereinafter described in detail in respect of a selected embodiment thereof, and the invention is pointed out in the appended claims.

In the drawings:
Figure 1 is a longitudinal sectional view of a two cylinder engine in a plane passing through the axes of both pairs of pistons.

Figures 2 and 3 are transverse vertical sections on the respective lines 2—2 and 3—3 of Figure 1.

As shown in the drawings, 10, 10 designate the two cylinders of the engine, shown as made of a single casting and cored to provide the usual cooling passages; 11, 11, the upper or outer pistons which travel in the outer ends of the cylinders; 12, 12, the inner pistons; 13 the crank shaft mounted in suitable bearings 14 of the engine frame and provided with a balance wheel; 15, 15, the connecting rods which directly connect the

inner pistons with one pair of the crank pins 16, said connecting rods 15 being formed with upper and lower elongated bearings 15', 15² mounted respectively for rocking connection with piston pins 12' of the inner pistons and said crank pins 16, and 17, 17, a pair of exterior connecting rods which connect another pair of crank pins 18 with the outer pistons 11.

The present invention is involved primarily in the connection between the outer ends of the connecting rod 17 with the outer pistons 11. Said connection embraces a cross head 19 which extends transversely across the outer end of the cylinder frame, and is fixed at its outer ends to the upper ends or hubs of the connecting rods 17 in any suitable way; being herein shown as fixed to said connecting rods by non-rotative attachment. The cylinder casting is slotted at diametric positions across the cylinder frame to receive and through which plays the crosshead 19.

21, 21 designate the upper piston connecting rods that afford connection between the cross head 19 and said upper pistons. As herein shown, said connecting rods are made short and are provided at their upper ends with bearings 22 elongated in the direction of the axis of the cross head 19 and mounted to rock on said cross head. Said upper connecting rods are also provided at their lower ends with elongated bearings 23 which are mounted for rocking movement on piston pins 24 which are mounted in the upper pistons 11, as best shown in Figure 2, being elongated axially of said piston pins 24.

A comparison of Figures 1 and 2 shows that the said piston pins 24 are disposed with their axes substantially at right angles to the plane of the axes of the cross head 19. The result of this construction, and the arrangement of the long connecting rods 17 for connecting the outer pistons with the crank pins 18 is such as to give a flexibility of transmission movement to the outer pistons due to the right angle or substantially right angle relation of the outer piston pins 24 and the cross head 19, as to thereby avoid tendency of binding of the outer pistons, and their connections to the cross head in and on the cylinder walls, that would occur if the connections between the cross head and outer pistons were rigid in one direction. The connection illustrated and described is

universal in its nature so as to give the greater freedom of movement desired of the outer pistons in their cylinders.

A further advantage of the construction shown and described is that, while increasing the flexibility of the connections between the outer pistons and their associated crank pins, said connection does not require guiding engagement between parts of the connection and the cylinder wall as has heretofore been proposed in prior engines of this general type. This latter advantage is due to the fact that the axes of the outer crank pins and the cross head are at right angles to each other and to the fact that there is substantially long bearings between the inner ends of the connecting rods 21 and the crank pins, and also like bearings between the upper ends of said connecting rods 21 and the cross head 19. The substantial bracing function of said bearings can be increased by elongating the hub or sleeve-like bearings 22, 23. Inasmuch as these bearings are rocking bearings minimum friction is developed due to said bracing or guiding function as compared to the arranging or designing of guide bearings between the outer short connecting rods 21 and the cylinder walls.

The absence of a frictional binding or guiding resistance in the connections between the outer piston connecting rods and the cylinder walls materially reduces the retarding friction found in prior constructions, with a consequent decrease of power loss due to such friction.

Another advantage of the construction described is that the pistons of each cylinder are interchangeable so that the patterns, jigs and other manufacturing accessories to produce the pistons are adapted to both pistons of a cylinder. This construction simplifies and reduces the cost of manufacture of the pistons and also reduces the cost of tools, patterns, jigs, etc., for equipping the engine with pistons.

I claim:

1. An opposed piston internal combustion engine comprising a cylinder open at its ends, inner and outer pistons reciprocable therein, a crank shaft, a connection between the inner piston and said crank shaft, said shaft being provided with two crank pins for operating the outer piston, and a connection between said latter crank pins and the outer piston embracing connecting rods connected to the crank pins and lying exterior to the cylinder, and means to connect the outer ends of said connecting rods to the outer piston, including pivot elements having their pivotal axes disposed in permanent angular relation with respect to each other to afford non-guided universal flexibility between said connecting rods and said outer piston.

2. An opposed piston internal combustion engine comprising a cylinder open at its ends, inner and outer pistons reciprocable therein, a crank shaft, a connection between the inner piston and said crank shaft, said shaft being provided with two crank pins for operating the outer piston, and a connection between said latter crank pins and the outer piston comprising connecting rods connected to the crank pins and lying exterior to the cylinder, a cross head extending between and connecting said connecting rods, and a short connecting rod within the outer end of the cylinder rockingly connected to the said cross head and to the outer piston pin with respective angular dispositions to afford non-guided movement to said latter connecting rod and a flexibility in said connection to avoid binding of said outer piston in said cylinder.

3. An opposed piston internal combustion engine comprising a cylinder open at its ends, inner and outer pistons reciprocable therein, a crank shaft, a connection between the inner piston and said crank shaft, said shaft being provided with two crank pins for operating the outer piston, and a connection between said latter crank pins and the outer piston comprising connecting rods connected to the crank pins and lying exterior to the cylinder, a cross head extending between and connecting said connecting rods, a short connecting rod within the cylinder for connecting the cross head to the outer piston pin, and means to connect the said latter connecting rod to the cross head and to the outer piston pin adapted to give flexibility to said connection to avoid binding of the outer piston in the cylinder and to also afford means to maintain the connection between said cross head and outer piston pin against flexion in the plane of the longitudinal axis of the crank pin connected to the outer piston.

4. An opposed piston internal combustion engine comprising a cylinder, inner and outer pistons reciprocable therein and having piston pins, a crank shaft, a connection between the inner piston and the crank shaft and a connection between the outer piston and the crank shaft comprising connecting rods rockingly mounted on crank pins of said shaft, a cross head having its longitudinal axis in a plane at a right angle to the axis of the outer piston pin and connecting the outer ends of said rods, and a short connecting rod between and having rocking bearing on said cross head and the outer piston pin.

5. An opposed piston internal combustion engine comprising a cylinder, inner and outer pistons reciprocable therein and having piston pins, a crank shaft, a connection between the inner piston and the crank shaft, and a connection between the

outer piston and the crank shaft comprising connecting rods rockingly mounted on crank pins of said shaft, a cross head whose longitudinal axis is in a plane at a right angle to the axis of the outer piston pins and connecting the outer ends of said connecting rods, and a short connecting rod between and having rocking bearing on said cross head and the outer piston pin, the axes of the crank pins for said outer connecting rods being parallel to said cross head.

6. An opposed piston internal combustion engine comprising a cylinder, inner and outer pistons reciprocable therein and having piston pins, a crank shaft, a connection between the inner piston and the crank shaft and a connection between the outer piston and the crank shaft comprising connecting rods rockingly mounted on crank pins of said shaft, a cross head having its axis in a plane at a right angle to the axis of the outer piston pin and connecting the outer ends of said rods, and a short connecting rod between and having rocking bearing

on said cross head and the outer piston pin, the rocking bearing between the latter connecting rod and the piston pin being elongated axially of said piston pin.

7. An opposed piston internal combustion engine comprising a cylinder, inner and outer pistons reciprocable therein and having piston pins, a crank shaft, a connection between the inner piston and the crank shaft and a connection between the outer piston and the crank shaft comprising connecting rods rockingly mounted on crank pins of said shaft, a cross head whose longitudinal axis is in a plane at a right angle to the axis of the outer piston pin and connecting the outer ends of said rods, and a short connecting rod between and having rocking bearing on said cross head and the outer piston pin, said cylinder being slotted at its outer end to receive said cross head.

In witness whereof I claim the foregoing as my invention, I hereunto append my signature this 2nd day of March, 1923.

TERENCE G. JACKSON.