June 17, 1941. K. E. KYLÉN 2,246,446

INTERNAL COMBUSTION ENGINE

Filed Feb. 24, 1940 3 Sheets-Sheet 1

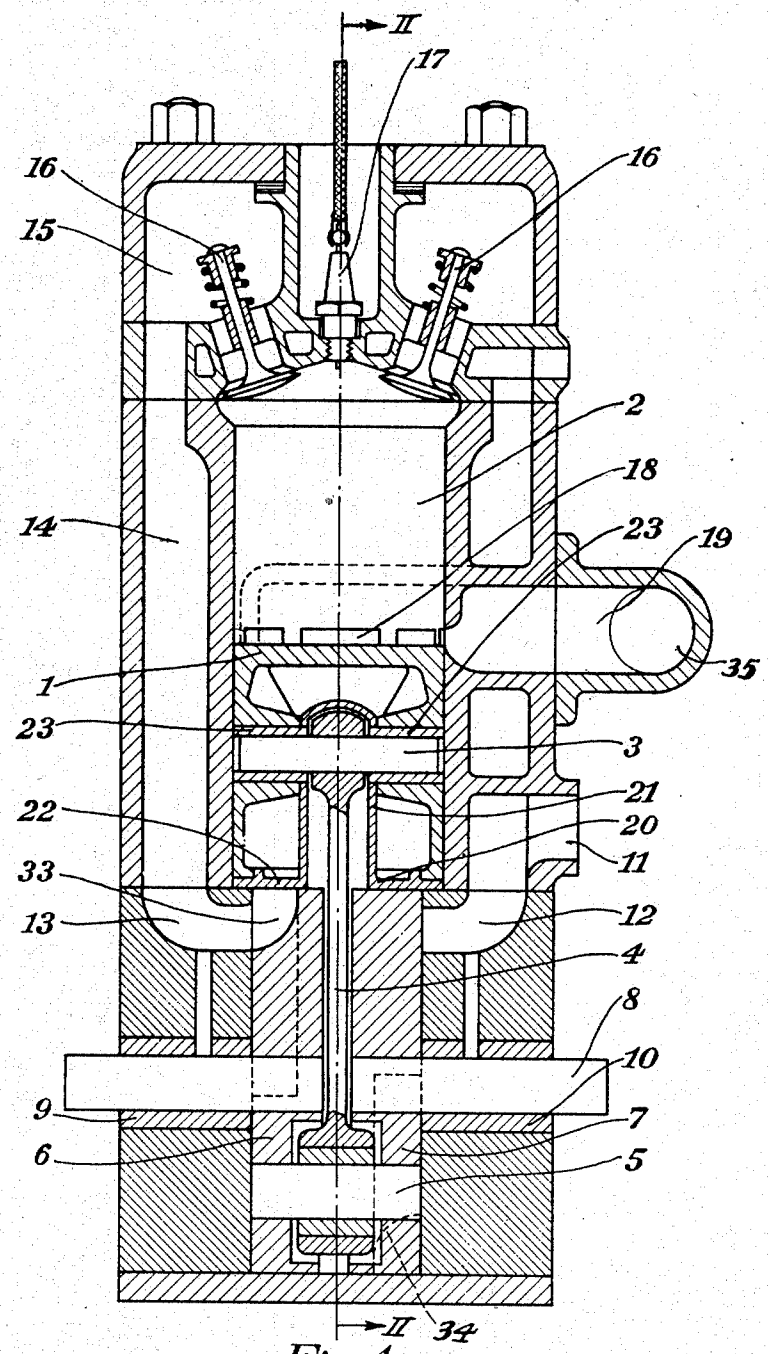


Fig. 1.

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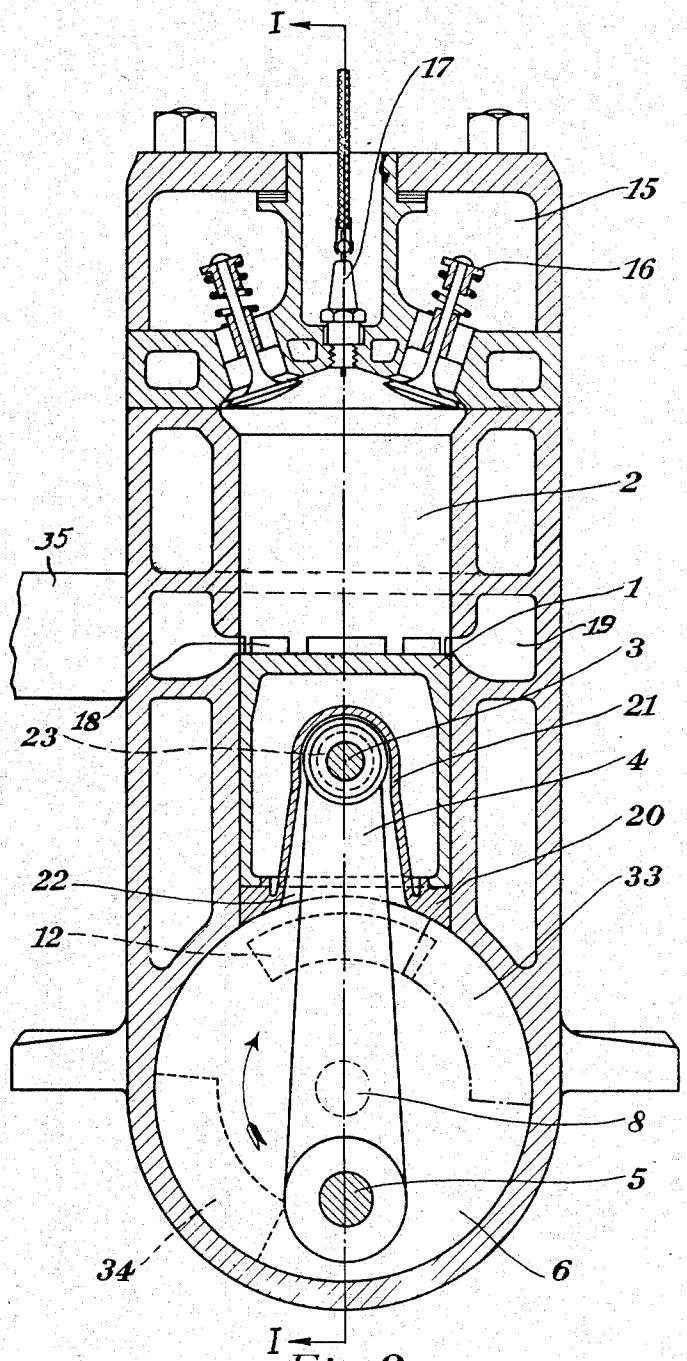


Fig. 2.

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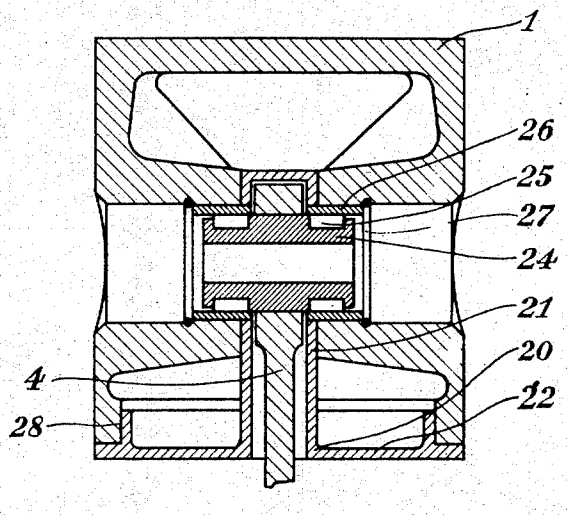


Fig. 3.

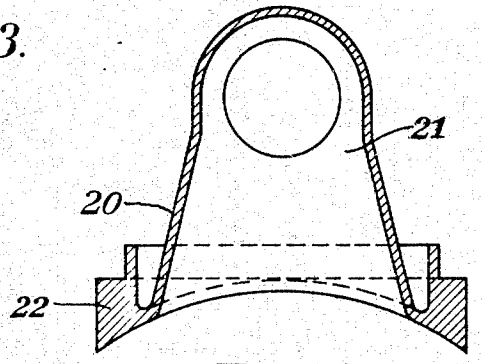


Fig. 5.

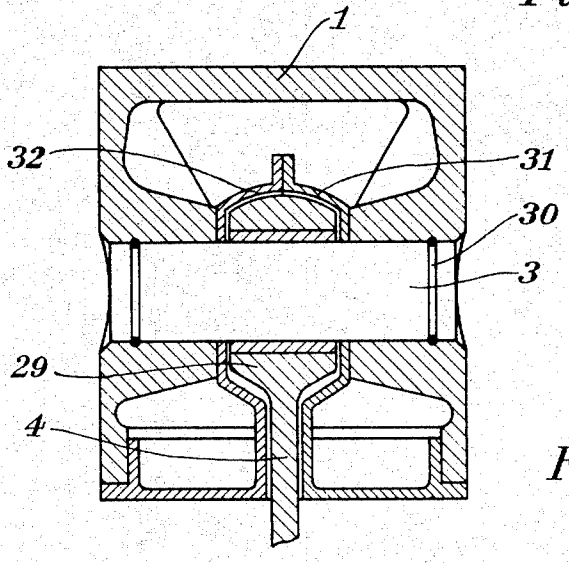


Fig. 4.

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UNITED STATES PATENT OFFICE

2,246,446

INTERNAL COMBUSTION ENGINE

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3 Claims. (Cl. 123—73)

The present invention relates to improvements in or relating to internal combustion engines in which the crank case and/or the part of the cylinder below the piston is formed as a compressor for compressing air or mixture of combustible gases to be supplied to the motor, and in which the piston is closed at its lower end by means of an insert for the purpose of diminishing the volume of the clearance in the crank case and is characterized mainly that a part of the insert enclosing the connecting rod head is provided with openings tightly fitting the piston pin or its bearings whereby the axial position of the insert in the piston is fixed. According to the invention as applied to motors, in which the crank arms are formed as circular discs, the bottom surface of the insert is formed substantially as a part of a cylindrical surface, the axis of the cylinder being parallel to the crank shaft so that such surface conforms substantially to the shape of the crank arms. Further the crank arms are provided with grooves extending along a portion of their periphery and so arranged and disposed that they periodically put the inlet conduit to the crank case in communication with the lower part of the cylinder and then put this part of the cylinder in communication with the exhaust conduit from the crank case.

The invention is illustrated on the accompanying drawings in which

Figure 1 shows a vertical section through a single cylinder motor, the section being taken along the crank shaft, and viewed in the direction indicated by the arrows I—I in Fig. 2.

Figure 2 shows a vertical section taken in a plane transverse to the cylinder and crank shaft and viewed in the direction of the arrows II—II in Fig. 1,

Figure 3 shows the device for fixing the insert to a piston and piston pin, in which the piston pin is mounted on roller bearings,

Figure 4 shows a device, in which the position of the insert is fixed by the piston pin itself, and

Figure 5 is an enlarged view in section showing the form of the piston pin insert.

In the motor shown in Figures 1 and 2 the numeral 1 designates the piston which moves up and down in the cylinder 2. The piston is connected to the connecting rod 4 by means of the piston pin 3, whereby the movement of the piston is communicated to the crank pin 5 and through the intermediary of the crank arms 6 and 7 is converted to rotary movement of the crank shaft 8 which is mounted in bearings 9 and 10.

For compressing a charge of air or gas mixture to be supplied to the cylinder, the crank case of the motor is formed as a compressor and for this purpose is provided with an air or gas inlet 11, which communicates with the crank case through a conduit 12. An outlet 13 from the crank case communicates with a conduit 14, arranged in the cooling jacket of the cylinder and leading to a distributing chamber 15 at the upper end of the cylinder. A number of inlet valves 16 are provided for permitting entrance of air or gas mixture from the distributing chamber 15 to the cylinder. A spark plug 17 is arranged at the upper end of the cylinder preferably at the centre of the group of valves.

The motor illustrated is of two-stroke cycle type and is therefore provided with a number of exhaust ports 18, through which the burnt gases exhaust to a collecting chamber 19 which suitably communicates with an exhaust pipe 35 or the like from which they may escape to the atmosphere.

It is apparent that the quantity of air at a certain pressure which the compressing device is capable of delivering depends directly upon the volume of the clearance space in the compressor. In order to diminish as far as possible the clearance, the lower end of the piston is closed by means of an insert 20, and the crank arms are made circular and the crank case formed in such a manner that it as closely as possible encloses the crank arms.

In order to permit air or gas mixture to pass through the crank case from the conduit 12 to the conduit 13 without having to flow between the crank arms when passing in or out of the crank case, the arms 6 and 7 have formed in them at their outer edges grooves 33 and 34 respectively. These grooves extend along a suitable part of the periphery of the crank arms and are arranged with their centers displaced substantially 180° relative one another. When the motor rotates in the direction shown by the arrow in Figure 2, the arrangement is such as is shown in Figures 1 and 2, that when the piston moves upwards, the groove 34 in the arm 7 puts the inlet 11 and the conduit 12 into communication with that part of the cylinder below the piston, whereby air or gas mixture is drawn into the space. When the piston has reached its top position or immediately thereafter, the arm 7 closes the communication between the conduit 12 and the space in the cylinder below the piston. As the piston moves downwards and as the arms continue to rotate, the space below the piston is put into communication with the outlet opening 13

from the crank case through the groove 33, and the air or gas is therefore forced into the conduit 14 and the chamber 15, where it is compressed and from which it is forced through the valve 16 to the cylinder 2. When the piston again begins its upward movement or immediately thereafter, the groove 33 has passed the open end of the cylinder, and the arms 6 and 7 again close the communication between the cylinder space below the piston and the inlet and outlet to and from the crank case respectively, the cycle being repeated upon continued rotation of the arms.

The insert 20 comprises a pocket shaped portion 21 extending into the piston and enclosing the connecting rod head and which is otherwise so shaped that it leaves only sufficient space for the oscillation of the connecting rod upon rotation of the crank shaft. The lower part of the insert is disc shaped, see Figure 5, and is formed to fit the inner surface of the piston. This portion of the insert is thus held in position by the piston. The pocket shaped portion 21 of the insert 20 is provided with openings which fit the piston pin or some of the bearing members for the piston pin. In the embodiment illustrated in Figures 1 and 2 the piston pin 3 is provided with bearings 23 fitting the piston. The bearings 23 extend inwardly from the piston bosses adjacent to the piston rod head, and the extending portions of the bearings 23 form the supporting members for the insert 20 which is provided with openings fitting to the bearings.

The device is assembled by inserting the insert 20 into the piston after which the bearings 23 are pressed into the piston bosses from the sides of the piston, the openings in the pocket shaped portion 21 at the same time being fitted to the bearings 23. The insert 20 is thereby fixed in axial position in the piston at the same time as it is guided by the piston at the periphery of the disc shaped portion 22. The insert 20 thus assembled forms a unit with the piston 1.

In the embodiment illustrated in Figure 3 the piston pin 24 runs on rollers 25 which run directly on a race formed in the piston pin 24 and the outer race rings 26 fitted in the piston. The outer race rings 26 are inserted in the piston in such a way that their inner ends project inwardly a distance from the piston bosses. The openings in the pocket shaped portions 21 of the insert 20 are so shaped and dimensioned that they fit on the outer cylindrical surfaces of the rings 26. The bearing rings 26 are retained in position in the piston by means of rings 27. The disc shaped portion of the insert is provided with a special guiding surface 28.

In the embodiment illustrated in Figure 4 the connecting rod head 29 has bearings cooperating with the piston pin 3 which is fixed to the piston 1 by means of rings 30. The insert is here divided into two halves 31 aind 32 fitted to one another and which are held together in any suitable manner, for instance by means of screws or bolts, not shown in the drawings. The members 31 and 32 can therefore be so formed that they more closely conform to the shape of the connecting rod and thus further diminish the clearance. In this embodiment the openings in the members 31 and 32 fit directly upon the piston pin 3. The device is assembled by placing the insert members 31 and 32 together about the connecting rod head 29 and connecting them in a suitable manner. The connecting rod head 29 and the insert members 31 and 32 are thereafter introduced as a unit into the piston, after which the piston pin 3 is inserted from the side of the piston and locked in position by means of the rings 30.

In all forms shown, the insert is fixed in position by means of parts which are stationary relative to the piston.

In order to diminish as far as possible the size of the clearance space, the insert has been formed at its lower part to conform as closely as possible to the shape of the crank arms. The shape of the insert is shown in Figure 5 which gives a cross section through the insert perpendicular to the sections shown in Figures 3 and 4. The bottom surface of the insert is shaped as a portion of a cylinder, the insert being formed in such a manner that the axis of the cylinder is parallel to the crank shaft so that the insert conforms substantially to the form of the crank arms.

Although certain forms of my invention have been illustrated in the drawings and description, yet it will be apparent that many changes may be made within the scope of my invention without departing from the spirit of my claims which are appended.

Having thus described my invention, I claim and desire to secure by Letters Patent:

1. In a combustion motor having a crank case and a piston, a piston pin, a connecting rod, roller bearings for the piston pin having outer rings which are fixed to the piston, there being formed below the piston a compressor, an insert within the piston at its lower end diminishing the volume of clearance in the compressor, a part of the insert enclosing the connecting rod head and tightly fitting the outer rings of the piston pin bearings, whereby the axial position of the insert is fixed by the roller bearing rings.

2. In a combustion motor having a crank case and a piston, a piston pin, a connecting rod having a head formed with bearings embracing the piston pin, there being formed below the piston a compressor, an insert within the piston at its lower end diminishing the volume of clearance in the compressor, being provided with a circular lower part (bottom) which is centered in the piston, a part of the insert enclosing the connecting rod head and tightly fitting the piston pin bearings, whereby the axial position of the insert is fixed.

3. In a device of the character specified, the combination with a cylinder, of circular crank arms, below it, an inlet conduit and an exhaust conduit, the crank arms being provided with grooves extending along a portion of their periphery and so arranged and disposed that they periodically put the inlet conduit to the crank case in communication with the lower part of the cylinder and then put this part of the cylinder in communication with the exhaust conduit from the crank case.

KARL ERIK KYLÉN.