

May 21, 1929.

J. F. IRWIN

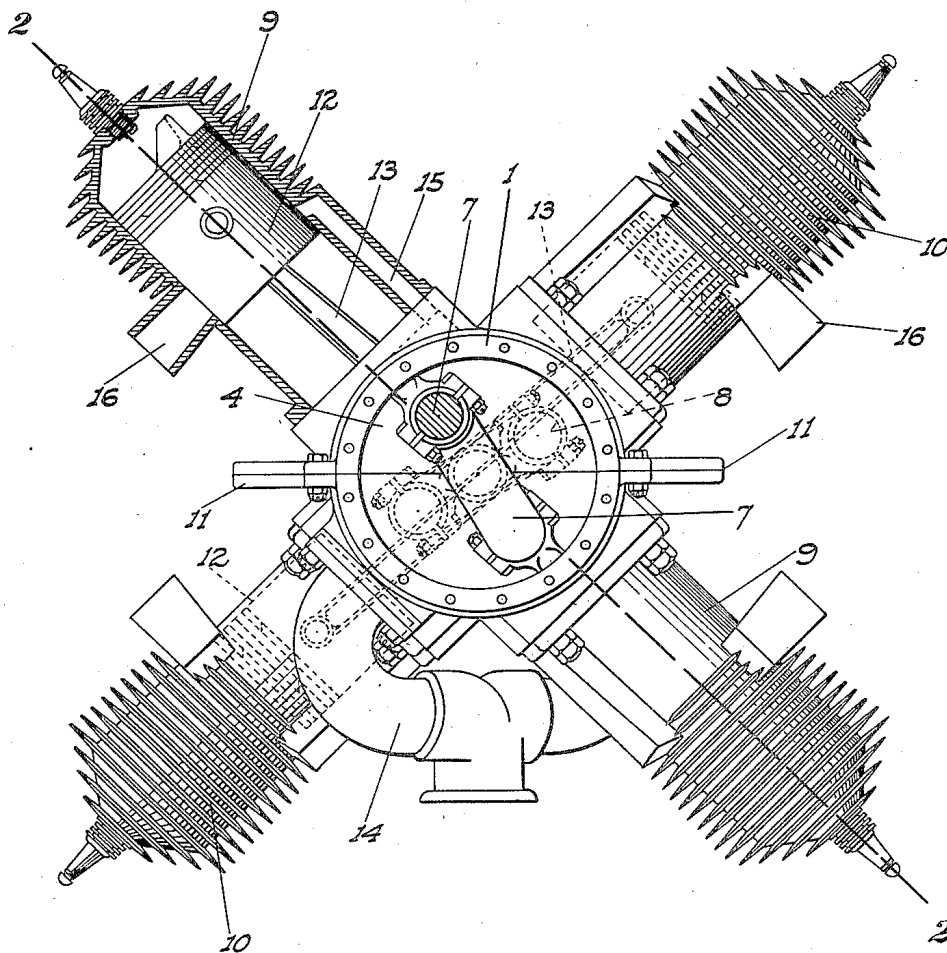
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INTERNAL COMBUSTION ENGINE

Filed April 4, 1927

2 Sheets-Sheet 1

*Fig. 1*



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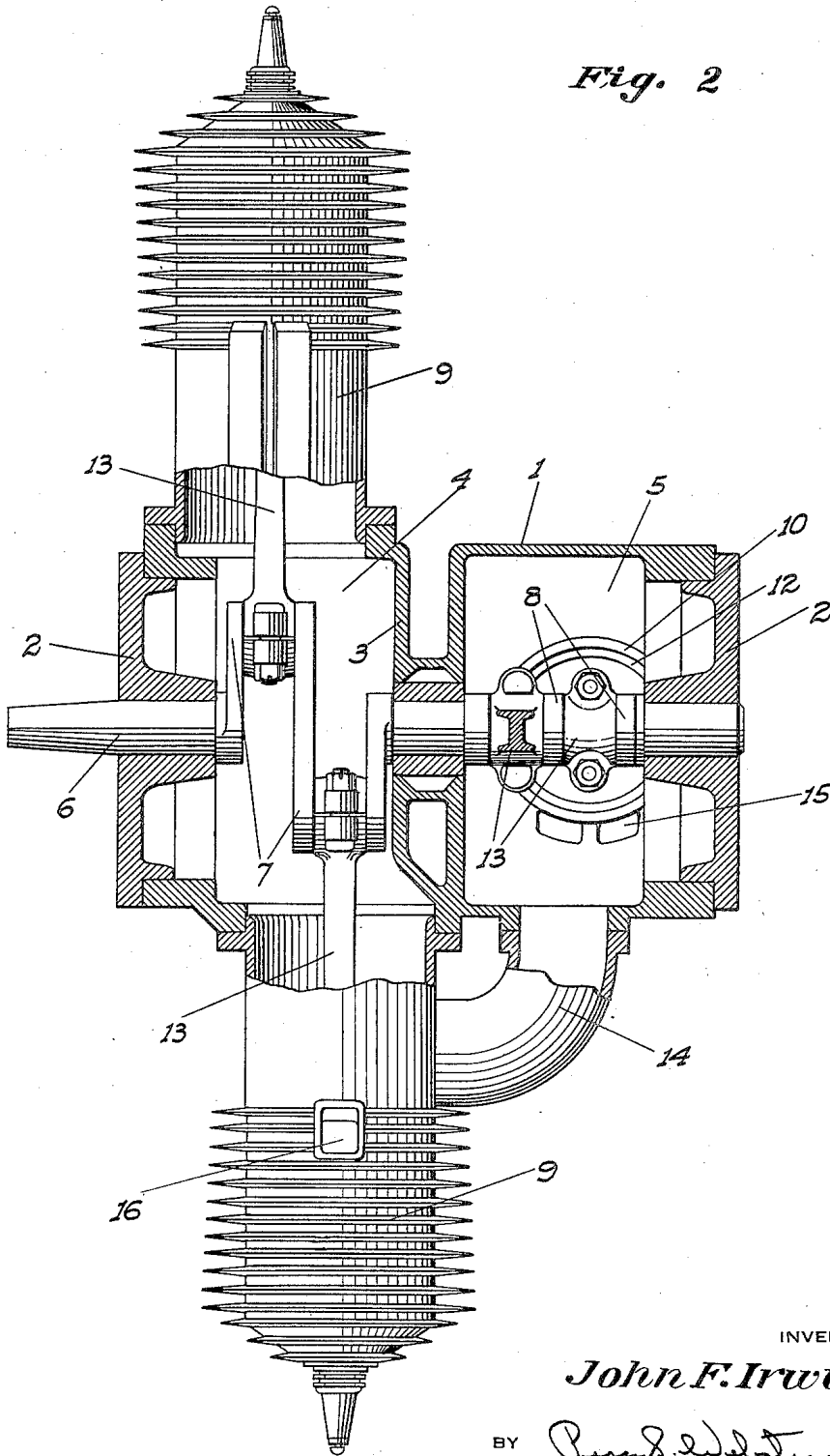
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Fig. 2



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# UNITED STATES PATENT OFFICE.

JOHN F. IRWIN, OF SACRAMENTO, CALIFORNIA, ASSIGNOR OF ONE-FOURTH TO E. S. BRAINARD AND ONE-FOURTH TO O. L. BRAINARD, BOTH OF SACRAMENTO, CALIFORNIA.

## INTERNAL-COMBUSTION ENGINE.

Application filed April 4, 1927. Serial No. 180,826.

This invention relates to improvements in internal combustion engines of a type especially adapted to airplane use, in which the cylinders are arranged radially about their crank-shaft.

The principal object of my invention is to provide a two-cycle engine of this general type in which the cylinders and crank-shaft are so disposed relative to each other that a very high cylinder compression is easily obtained and in which the firing of the cylinders relative to each other takes place in such order that the strains due to such firing are counterbalanced or equalized and vibration reduced to a minimum.

I am therefore enabled to make the engine very light and yet run it at a high speed, as is necessary in airplane service.

A further object of the invention is to produce a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Fig. 1 is an end view of the engine with the front crank-case cover removed and with certain parts broken out or in section.

Fig. 2 is a longitudinal section of the same on the line 2—2 of Fig. 1.

Referring now more particularly to the characters of reference on the drawings, the numeral 1 denotes the crank-case, a substantially cylindrical member. This member while preferably formed of two parts suitably connected together, may be and hereinafter is considered as a single unit. End plates 2 mounted on the crank-case and an intermediate transverse wall structure 3 divide the crank-case into two separate chambers 4 and 5, and also form supports for the bearings of the crank shaft 6.

This shaft has a pair of diametrically opposed cranks 7 in the compartment 4 and a pair of similar cranks 8 in the compartment 5, the latter cranks being disposed in a plane at right angles to the line of the cranks 7.

Projecting outwardly from the crank-case in longitudinal alinement with the cranks 7 and radially of the shaft 6 are cylinders 9 arranged in opposed relation to each other.

Likewise projecting outwardly from the crank-case in longitudinal alinement with the cranks 8 and radially of the shaft are cylinders 10. These cylinders are likewise diametrically opposed to each other but lie in a plane at right angles to the plane of the cylinders 9. The engine therefore has four cylinders spaced ninety degrees apart about the crank-case, the latter having side supporting pads 11 arranged so that the cylinders are set forty-five degrees on each side of a horizontal or vertical line.

Each of the cylinders has a piston 12 from which a connecting rod 13 extends to the corresponding crank.

As previously stated the engine is of the two cycle type and is therefore provided with a branched intake manifold 14 which at its ends is connected with the chambers 4 and 5; and centrally between such ends has a flange-surrounded opening for connection to a carbureter.

The charge for the cylinders is therefore admitted to the crank-case, where it is compressed in the individual compartments with the inward movement of the pistons in such compartments. Very high compression is thus obtained, since as will be evident both pistons move inwardly at the same time. The compressed charge is then caused to enter the cylinders above the pistons through the usual form of passage 15 which leads from the crank-case to the cylinders, at points in the latter located so that the compressed gases can enter the cylinders only when the pistons are in their lowermost position. Exhaust ports 16 are disposed substantially opposite to the connection of the passages 15 with the cylinders as is customary.

Since a two cycle engine fires once with each reciprocation of a piston, the arrangement of cranks of each opposed cooperating pair of cylinders will cause the firing strokes of such opposed cylinders to take place simultaneously. This operation will cause the strains of the crank-shaft due to the firing impulses, to be counterbalanced and equalized, and hence the vibrations exhausted with unequal strains will be neutralized.

I am therefore able to operate the engine at high speed, while employing a desired high compression and retaining extreme lightness of parts.

While I have here shown and specified a certain intake arrangement, this may be

changed, and a rotary-valve control device, a three-port passage means, or any other equivalent arrangement may be substituted therefor, since the invention does not reside in the means for admitting the fuel to the cylinders, but in the particular arrangement of the cylinders and crankshaft.

From the foregoing description it will be readily seen that I have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described my invention what I claim as new and useful and desire to secure by Letters Patent is:

1. An internal combustion engine comprising a crank case, a crank shaft projecting therethrough, a partition in the crank case to divide the same into a pair of longitudinally spaced chambers, a pair of cranks on the shaft in each chamber, the cranks of each pair being disposed in diametrically opposed and longitudinally spaced relation to each other and the cranks of the two pairs being disposed in radial planes at right angles to each other,

cylinders for the various cranks projecting radially from the crank case arranged in diametrically opposed and longitudinally spaced pairs; the cylinders of each pair being longitudinally offset so that their axes are disposed centrally of the longitudinal planes of the respective cranks, pistons in the cylinders, and connecting rods between the pistons and the corresponding cranks.

2. In an internal combustion engine, a crank shaft, said shaft comprising aligned axial portions, and longitudinally separated pairs of cranks interposed between said portions, the cranks of one pair being arranged in longitudinally adjacent but diametrically opposed relation to each other and the cranks of the other pair being likewise arranged in longitudinally adjacent and diametrically opposed relation to each other; the axes of the cranks of the two pairs lying in radial planes at right angles to each other.

3. In an internal combustion engine, a crankshaft having four cranks, two of said cranks being diametrically opposed to each other and the other two cranks being also diametrically disposed to each other but lying in radial planes at right angles to the planes of the first two named cranks.

In testimony whereof I affix my signature.  
JOHN F. IRWIN.