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(Under International Convention.)

Date claimed for Patent under Patents and Designs Act, 1907, being date of first Foreign Application (in Germany), } 15th Apr., 1911

Date of Application (in the United Kingdom), 13th Apr., 1912

At the expiration of twelve months from the date of the first Foreign Application, the provision of Section 91 (3) (a) of the Patents and Designs Act, 1907, as to inspection of Specification, became operative

Accepted, 1st Aug., 1912

COMPLETE SPECIFICATION.

Improvements in Four-stroke Cycle, Oscillating Cylinder Internal Combustion Engines.

I, WILHELM MAYBACH, of 9, Freiligrathstrasse, Canstatt, in the Kingdom of Württemberg, German Empire, Engineer, do hereby declare the nature of this invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

5 This invention relates to oscillatory internal combustion engines and particularly to those having a four-stroke cycle, and the object of the present invention is to simplify the construction of such engines and of the valve mechanism therefor.

10 According to the present invention the closed end of the cylinder is carried by a secondary crank shaft so that, in conjunction with the oscillatory movement imparted to the cylinder from the main or driving crank shaft, the closed end of the cylinder is caused to move in an irregular circuitous path.

15 The cylinder is provided with a single port formed in a flat disc-shaped valve face on the side of the cylinder, this valve face cooperating with a similar stationary valve face provided with inlet, exhaust and ignition ports adapted to successively register with the port in the cylinder.

20 The throw of the secondary crank shaft is preferably equal to or approximately equal to the compression space in the cylinder and the secondary crank shaft is adapted to be rotated in the opposite direction to the main crank shaft and at half the angular velocity thereof, so that when the piston is at the end of its in-stroke, the axis of the cylinder is in or approximately in the plane containing the axis of the crank shafts and its closed end nearest the axis of the main crank shaft or in its most remote position therefrom, so that the scavenging of the cylinder during the exhaust stroke is perfectly attained.

25 In order that the invention may be more clearly understood, reference is made to the accompanying drawings, whereon the invention is illustrated by way of example as applied to a twin-cylinder motor.

[*Price 8d.*]

Impts. in Four-stroke Cycle, Oscillating Cylinder Internal Combustion Engines.

Figure 1 is a diagrammatic view representing the valve movements,

Figure 2 is a vertical section through one of the engine cylinders,

Figure 3 is a vertical section at right angles to Figure 2, and

Figure 4 is a transverse section on the line A—B of Figure 3.

a and a^1 designate the two cylinders and b and b^1 their respective pistons, 5 which terminate in bearings i on the crank pins k of the crank shaft c . The cylinders a and a^1 terminate at their upper closed ends in bearings e rotatably mounted on the crank pins f of the secondary crank shaft d , whilst the lower ends of the cylinders a and a^1 terminate in a forked part g , which serves for 10 guiding the downward extension h of the pistons b and b^1 . The cylinders a and a^1 each carry a flat valve face l provided with a port m opening into the cylinder and cooperating with the valve face l is a valve face n formed on the engine casing and provided with inlet ports p , exhaust ports o and ignition ports q . 15 r designates the ignition plugs and s guide-bars, which are adapted to maintain the valve faces l and n in contact with one another and at the same time permit the valve face l to slide over the valve face n during the oscillation of the engine cylinder. Mounted on the main crank-shaft c is a gear wheel t 20 gearing with the gear wheel u on the lower end of a vertical rotatable shaft, carrying at its upper end a gear wheel v meshing with a gear wheel w on the secondary crank shaft d , the ratio of the gearing being such that the crank shaft d is driven at half the angular velocity of the main crank shaft c and in the opposite direction thereto.

Referring now to Figure 1 of the drawings: The full line x indicates the curve described by the central point of the cylinder port m during one cycle 25 of operations of the engine, the dotted circle y indicating the position of the cylinder port m when intermediate the exhaust port o and inlet port p . The dotted circle y^1 illustrates the position of the cylinder port m at the completion of the suction stroke, whilst the dotted circle y^2 designates the position of the cylinder port at the moment of ignition when in alignment with the ignition 30 port q , it being assumed in this case that the dead-points of the two crank shafts coincide. The numbers 1 to 16 inclusive on Figure 1 of the drawings indicate the respective positions of the upper and lower crank pins and of the cylinder port respectively.

In Figure 3 the cylinder a is shown at the moment of ignition whilst the cylinder a^1 is shown in the position assumed during the change from the 35 exhaust stroke to the admission stroke.

It will be readily seen that if the crank shaft c is rotated in a clockwise direction, the secondary crank shaft d will be rotated in the opposite direction, so that the cylinder port m will describe the lower part of the curve x during 40 the lower part of its movement and during the upper part of the movement of the crank pin k and that, when the cylinder is in the position corresponding to the cylinder a^1 of Figure 3, the crank pin f of the secondary crank shaft d is in its lowest position, and the piston in its highest position, thus ensuring a complete scavenging action. On the further movement of the crank shafts 45 the piston and cylinder commence the suction stroke and on their return movement the explosive charge drawn in from the port p is compressed and ignited when the piston is almost at the end of its inward stroke, when the cylinder port m registers with the ignition port q .

It will of course be understood that if desired the crank shaft d may be arranged in advance of or lag behind the main crank shaft c . When the crank 50 shaft d is in advance of the crank shaft c , the suction stroke will be somewhat increased, whilst the expansion stroke will be correspondingly decreased.

It will of course be understood that if desired the number of cylinders and the position of the cranks may be varied according to requirements and that, 55 if desired, the ignition plugs r instead of being arranged in the engine casing, as illustrated in the drawings by way of example, may be mounted on the cylinder without departing from the scope of the appended claims.

Impts. in Four-stroke Cycle, Oscillating Cylinder Internal Combustion Engines.

Having now particularly described and ascertained the nature of the said invention, and in what manner the same is to be performed, I declare that what I claim is:—

5. 1. A four-stroke cycle internal combustion engine of the oscillatory cylinder type, in which the closed end of the cylinder is carried by a secondary crank shaft rotated at half the angular velocity of the main or engine crank shaft so that, in conjunction with the oscillatory movement imparted to the cylinder from the main crank shaft, the closed end of the cylinder is caused to move in an irregular circuitous path, and in which the cylinder is provided with a lateral
10 valve port adapted to register with inlet, exhaust and ignition ports in a stationary valve face, substantially as described.
- 15 2. An internal combustion engine as claimed in Claim 1, in which the secondary crank shaft is rotated in the opposite direction to the main crank shaft and said crank shafts so disposed that, when the piston is at the end of its in-stroke, the axis of the cylinder is in or substantially in the plane con-
taining the axes of the crank shafts, and its closed end either nearest or approxi-
mately nearest the axis of the main crank shaft or most or approximately most
remote therefrom, substantially as and for the purpose set forth.
- 20 3. The improved internal combustion engine, substantially as hereinbefore described with reference to the accompanying drawings.

Dated April 13th, 1912.

JENSEN & SON,
Agents for the Applicant.

Fig. 1

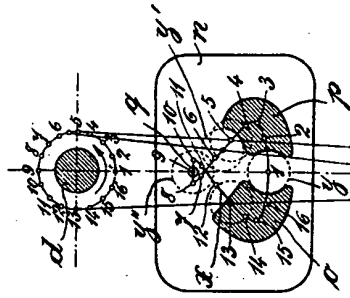


Fig. 2

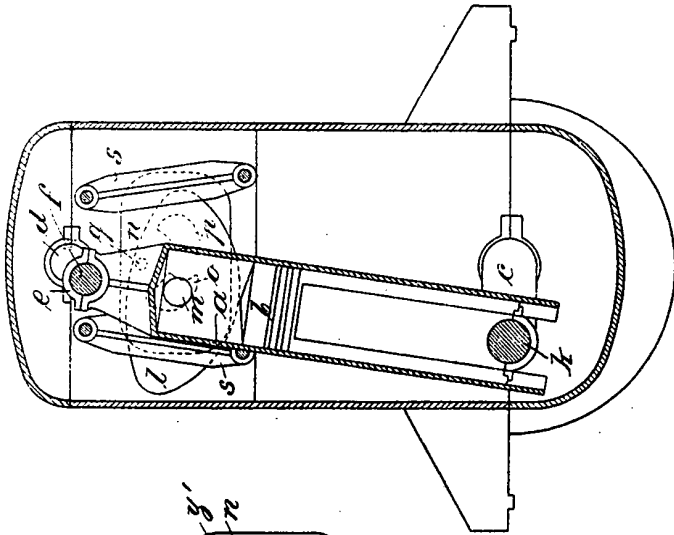


Fig. 3

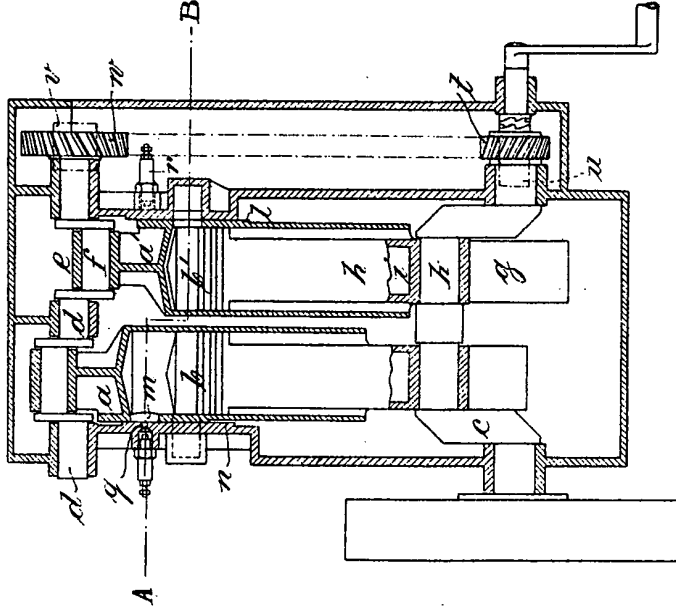
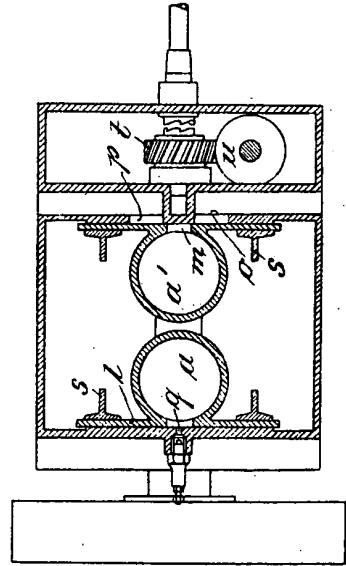


Fig. 4



[This Drawing is a reproduction of the Original on a reduced scale.]