Jan. 13, 1925. 1,523,341

F. DELLA-FERRERA

TWO-STROKE ENGINE

Filed Nov. 22, 1923

Fig. 1

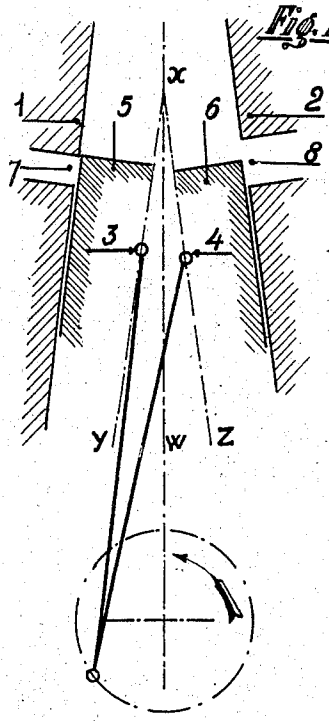


Fig. 2

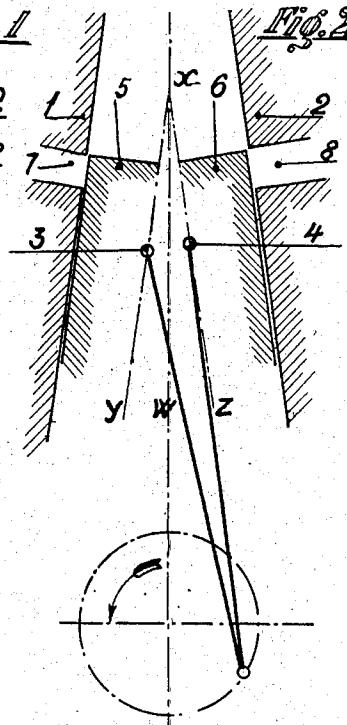


Fig. 3.

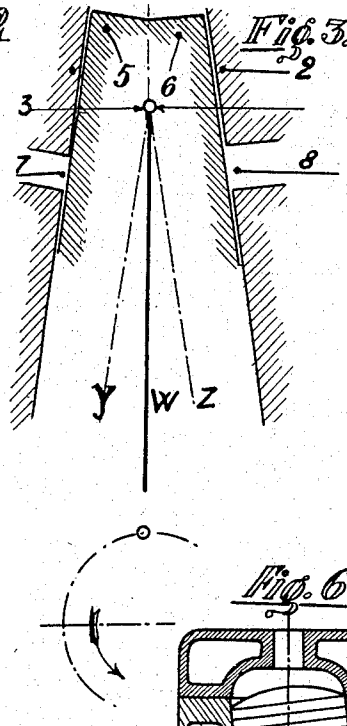


Fig. 6

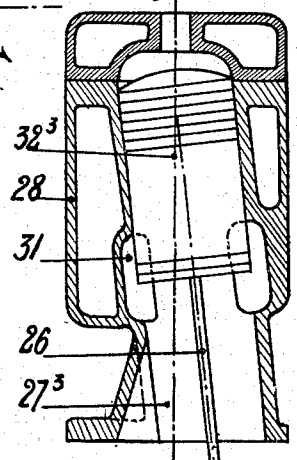


Fig. 4

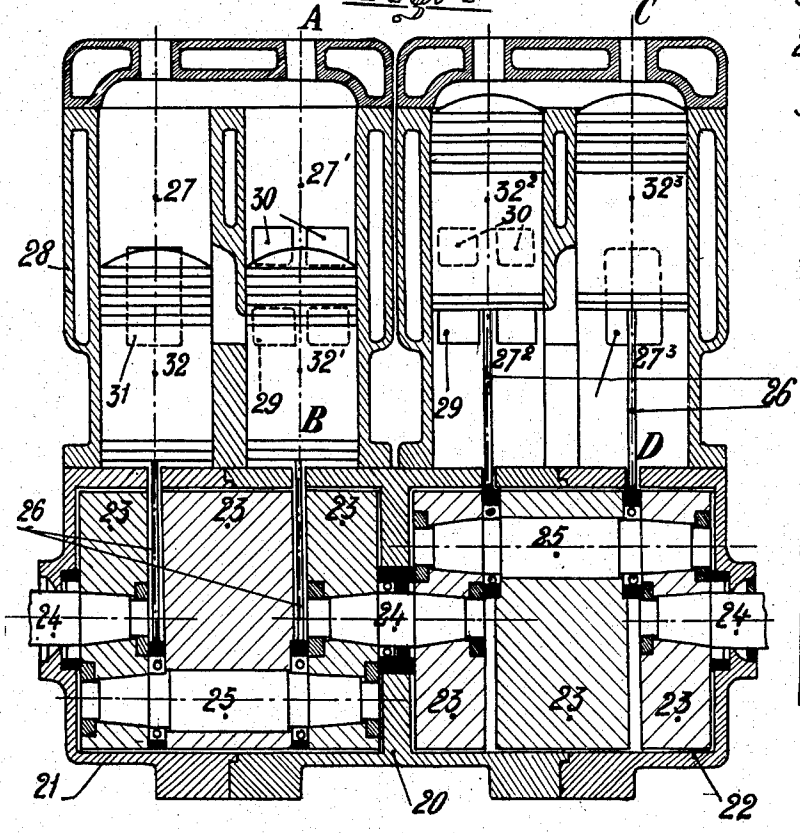
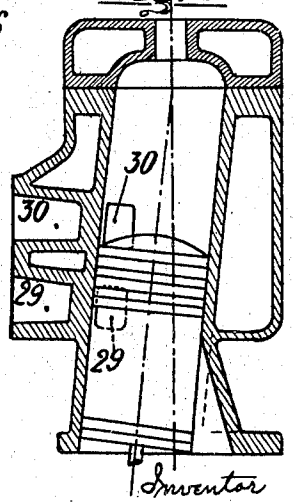


Fig. 5



Inventor

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By Henderson & Co Atty.

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UNITED STATES PATENT OFFICE.

FEDERICO DELLA-FERRERA, OF TURIN, ITALY.

TWO-STROKE ENGINE.

Application filed November 22, 1923. Serial No. 676,346.

To all whom it may concern:

Be it known that I, FEDERICO DELLA-FERRERA, a subject of the King of Italy, and resident of Turin, in the Kingdom of Italy, have invented certain new and useful Improvements in Two-Stroke Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to improvements in two-stroke engines, having their cylinders arranged in pairs with a common explosion chamber. According to the invention the cylinders of each pair are arranged across each other so that the axis of the piston pins at the end of the compression stroke meet simultaneously the line interesecting the planes passing through the axis of the cylinders and parallel to the axis of the driving shaft. Therefore the pistons connected with the same crank pin go simultaneously or nearly so through the upper dead point, and with a considerable interval (according to the divergence of the cylinders) through the lower dead point.

It is thus possible to open the outlet ports of one of the cylinders some time before the inlet or scavenging ports of the other cylinder, and to close simultaneously all the ports or to close later the inlet ports according to their relative height, so that at the explosion the pistons are practically in the same position.

This arrangement obviates the drawbacks of the engines with inverted V like inclined cylinders, connected together, or with cylinders out of phase with respect to the driving shaft. These drawbacks are due mainly to the fact that at the explosion at least one of the pistons is always in an unfavourable position for receiving the explosion pressure.

The accompanying drawing shows the engine forming the object of this invention.

Figure 1 shows the relative position of the pistons at the moment when they begin uncovering the inlet ports.

Figure 2 is a similiar view at the moment, when the inlet ports are closed.

Figure 3 shows the two pistons going simultaneously through the upper dead point.

Figure 4 is a longitudinal section showing the invention used in connection with four-cylinder engines.

Figure 5 is a cross section on line A—B of Figure 4.

Figure 6 is a section on line C, D of Figure 4.

On the drawing, 1 and 2 are the cylinders, having their axes x, y; x, z displaced positively and negatively, respectively, to the axis x, w of the driving shaft, so that their projections form an angle with the vertex x turned upwards.

The point x is placed at the highest position of the piston pins 3, 4, so that at the upper dead point the pistons 5, 6 meet at the same height, while at the lower dead point they are more or less apart from each other, according to the smaller or larger aperture of the angle y, x, z. On the drawing, the angle is of about 15° so that the inlet ports 7 open (Figure 1) when the outlet ports 8 are already half open, although the ports 8 are only about one third higher than the inlet ports 7.

The closure of the inlet ports 7 takes place just a short time before the closure of the outlet ports 8 (Fig. 2) and it is sufficient to increase slightly the degree of the angle y, x, z, in order to obtain the simultaneous or even retarded closure. The pistons always attain the dead point simultaneously with any angle, provided the vertex corresponds to the highest position of the piston to pin.

Similar results may be obtained by increasing the displacement of one cylinder and decreasing the displacement of the other down to zero, as it is exactly the relative displacement of the cylinders that determines the form of the kinematic diagram.

Figures 4, 5 and 6 show the invention used in connection with a four-cylinder, water cooled engine for motor vehicles.

The engine consists of a crank case in three parts 20, 21, 22 forming two tight closed chambers, enclosing the crank shaft consisting of six flywheels 23 connected by the crank shaft 24 and crank pins 25, against which abut the rods 26 of the pistons 32, 32^1, 32^2, 32^3.

To the crank case are secured the cylinders

27, 27^1, 27^2, 27^3 cast in two-cylinder blocks and with water jacket 28, which wholly hides the cylinder inclination, so that the engine has the outer appearance of a normal engine with four cylinders in alignment.

The cylinders 27^1, 27^2 are provided with suction ports 29, connecting the two chambers of the crank case with the carburetter, and with outlet ports 30.

The cylinders 27, 27^3 are provided with scavenging ports 31 conveying the mixture compressed in the crank case to the cylinders.

The engine differs from known engines in that the retarded opening of the inlet or scavenging ports relatively to the outlet ports depends, irrespective of the relative location of the ports, upon the relative inclinations of the cylinders which retards the closure and makes it later than would be possible by the difference of height of the inlet ports. The earlier opening of the outlet ports due to angularity of the cylinders can be reduced to zero or the opening even made later, assuming the difference in height between the outlet and inlet ports is very small or there is no difference at all, when the distance between the cylinders at their lower ends is considerable.

Identical results may be obtained by increasing the inclination of one of the cylinders and diminishing that of the other cylinder until it requires a radial position, provided the line intersecting the planes passing through the axis of the cylinders and parallel to the axis of the engine shaft, has such a position that the axes of the piston pins simultaneously meet this line where the pistons reach their upper dead point.

This arrangement allows of a better filling of the cylinder and prevents the gases from flowing out through the outlet ports by kinetic energy when the scavenging ports are still closed and producing a pressure lower than the atmospheric pressure in the mixture contained in the cylinder.

What I claim is:

1. A two-stroke engine comprising a pair of cylinders inclined with respect to one another having inlet and outlet ports and communicating at one end with a common combustion chamber, pistons in the cylinders controlling the ports, a single crank having its axis in a plane passing through the vertex of the angle formed between the axes of the cylinders and means for operatively connecting both pistons to the crank, the connecting means on the pistons arranged to simultaneously reach the vertex of said angle on the upstroke, whereby the pistons reach the upper dead point simultaneously and descend at different speeds.

2. A two-stroke engine comprising a pair of cylinders inclined with respect to one another having inlet and outlet ports and communicating at one end with a common combustion chamber, pistons in the cylinders controlling the ports, a single crank having its axis in a plane passing through the vertex of the angle formed between the axes of the cylinders, rods pivotedly connected to the crank, pins connecting the rods to the pistons, the axes of the pins being arranged to simultaneously reach the vertex of said angle whereby the pistons reach the upper dead point simultaneously, while at the lower dead point the piston operating the outlet port is in advance of the piston operating the suction port.

3. A two-stroke engine comprising a pair of cylinders, inclined with respect to one another, one of which has an inlet port and the other an outlet port and communicating at one end with a common combustion chamber, pistons in the cylinders controlling the ports, a driving shaft having a single crank arm and having its axis in a plane passing through the vertex of the angle formed between the axes of the cylinders, and rods connecting to the crank arm to the pistons at points adapted to simultaneously reach the vertex of said angle on the up-stroke, whereby the pistons reach the upper dead point simultaneously.

4. In a two-stroke engine, a driving shaft having a single crank, a cylinder arranged radially to the driving shaft, a second cylinder inclined with respect to the first cylinder, one of the cylinders having an inlet port and the other an outlet port, a combustion chamber communicating with both cylinders, pistons in the cylinders controlling the ports, and rods connecting the crank to the pistons at points adapted on the upstroke of the pistons to simultaneously reach the vertex of the angle formed between the axes of the cylinders whereby the pistons reach the upper dead point simultaneously.

In testimony that I claim the foregoing as my invention, I have signed my name.

FEDERICO DELLA-FERRERA.