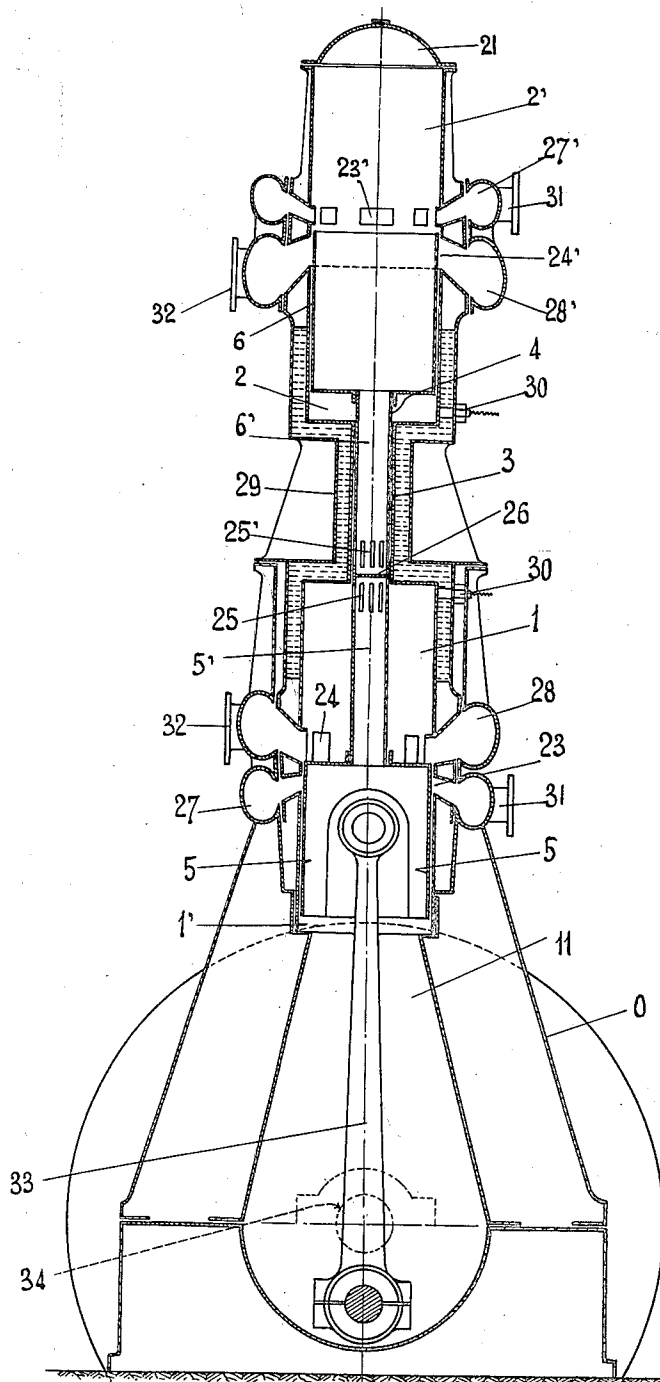


Jan. 2, 1923.

1,440,825.

A. GUAITA.
ENGINE.
FILED MAY 3, 1922.



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Patented Jan. 2, 1923.

1,440,825

UNITED STATES PATENT OFFICE.

ALFREDO GUAITA, OF TURIN, ITALY.

ENGINE.

Application filed May 3, 1922. Serial No. 553,129.

To all whom it may concern:

Be it known that I, ALFREDO GUAITA, a subject of the King of Italy, and resident of Turin, Italy, have invented certain new and useful Improvements in Engines, of which the following is a specification.

The present invention relates to two stroke internal combustion engines and has for its object an engine which comprises one or more pairs of concentric cylinders arranged in alignment with each other, and driving pistons each located in one of said cylinders and connected by pairs, these pistons acting also to control inlet and exhaust ports provided in the walls of said cylinders.

The figure of the annexed drawing shows by way of example an embodiment of the present invention in central vertical section.

In said embodiment 1 and 2 are concentric cylinders supported by a frame O in alignment with and spaced apart to some extent from each other. These cylinders are connected by a sleeve 3 which is fastened to the adjacent opposite cylinder covers and opens into the respective cylinder chambers. The upper cylinder is closed by a top cover 21 while the lower one opens into a closed chamber 11 which in this embodiment is provided by the crank case.

Within the cylinders 1 and 2 are located the respective pistons 5 and 6 which are hollow and bell shaped with their transverse walls or bottoms arranged towards each other and connected by a hollow rod 4 which reciprocates gas-pressure-tight through the sleeve 3.

The cylinders 1 and 2 are provided with ports 23—23' respectively, which are located at points spaced to equal distances from the ends of the respective cylinders located adjacent to each other and said ports 23—23' are adapted to be shut by their cooperating pistons and to remain clear therefrom on these pistons reaching one end of the stroke; other ports 24—24' are provided in the cylinders which are similarly shut by their respective pistons 5 and 6 and are arranged to remain clear therefrom on the pistons reaching the opposite end of their stroke.

In the middle portion of the hollow rod 4 is located a transverse partition 26 which provides in said rod two chambers 5', 6' opening in the respective pistons 5—6; at the two sides of said partition said hollow rod 4 has ports 25—25' hereinafter described.

The ports 23—23' open in annular cham-

bers 27—27' having a connection 31 for inlet of a combustible charge or of an air charge, the ports 24—24' open respectively in annular chambers 28—28' having an outlet 32.

The intermediate sleeve 3 and the adjacent working chambers of the cylinders 1 and 2 are preferably provided with a cooling water jacket 29.

Each cylinder is provided with igniting means which are shown by way of example in the form of sparking plugs 30.

The lower piston 5 is connected by a rod 33 with a crank shaft 34 journaled in the frame O, as usual.

The operation is as follows: assuming the reciprocating pistons 5 and 6 to be in the position shown by the diagram that is at their lower dead centre, the ports 24 of the cylinder 1 are cleared and the combustion gases of a previous operation are discharged through 28 and 32, while the ports 25 admit into the same cylinder 1 an amount of fresh charge which has been compressed in the casing 11 during the downward stroke of the piston 5, this piston 5 being hollow as described and putting in communication the casing 11 with the chamber 5' of the hollow rod 4, as described.

At this time in the cylinder 2 is being completed the compression stroke during which the ports 24'—25' are closed, while the ports 23' are open for admission of mixture or air into the space 2'.

Then the pistons 5—6 rise in their respective cylinders 1 and 2; in the first one the ports 25 are closed as soon as the lower portion of the hollow rod 4 has entered the sleeve 3 and the ports 24 are closed by the piston. Then in the cylinder 1 is made the compression of the charge and at the same time a vacuum is produced in the space 1' and in the chamber 11.

Near the end of this stroke the piston 5 clears the ports 23 and then the charge supplied through the supply duct 31 may enter the chamber 11 in which a vacuum has been produced as described.

Thereafter is promoted the ignition and combustion of the mixture compressed in the cylinder and the piston 5 is caused to make its downward stroke during which it compresses in the space 1' and the chamber 11, the charge intended to enter the cylinder 1 through the ports 25 after this stroke has been completed.

Then the engine is again in the position shown on the drawing and the same operation is repeated.

The operation in the cylinder 2 is similar to the above described one and more particularly when the piston 6 is moved upwardly by the combustion of the charge in the cylinder 2, it compresses the charge in the top portion 2' of the cylinder; at the end of this stroke the exhaust port 24' and the supply one 25' are clear from the piston so as to produce an injection of the charge into the cylinder and the exhaust of the combustion gases therefrom. Then the piston is again moved down by the operation of the engine to compress the charge in the cylinder 2 and to draw a further amount of charge into the space 2' and so on.

In each of the cylinders is thus obtained a two stroke cycle and the operations of the cylinders are so timed as to produce two driving actions with each revolution of the crank shaft, this making very even the running of the engine which operates like a double acting engine.

The described arrangement makes possible to provide the inlet and exhaust ports at two opposite ends of each cylinder and thus the combustion gases may be fully exhausted, without any loss of fresh mixture.

Further all the admission and exhaust ports are controlled directly by the driving pistons and by parts solid therewith, without any additional moving part or valve.

The engine may be operated by means of liquid fuel which is atomized or converted into gas before being supplied to the inlet ducts 31, or it may be operated by introducing a jet of liquid fuel into an air charge compressed within the cylinder, or finally a gaseous fuel may be used.

The cylinders may be arranged in different positions than that illustrated, say they may be horizontal or inclined, and many other modifications may be introduced in the construction described and illustrated, without departing from the spirit of this invention which is only defined by the appended claims.

What I claim as my invention and desire to secure by United States Letters Patent is:—

1. In an engine, a pair of cylinders arranged in alignment with each other, inlet and exhaust ports in each cylinder intermediate its ends, a hollow piston in each cylinder, a hollow rod connecting said pistons, and means connecting said pistons and hollow rod with the engine crank shaft, said pistons and hollow rod cooperating to control the admission and exhaust to and from said cylinders.

2. In an engine, a pair of cylinders arranged in alignment with each other, inlet and exhaust ports in each cylinder, a piston

in each cylinder, a hollow rod connecting said pistons, a partition in said rod, this rod having passages at the two sides of said partition leading from the hollow of each piston to the chamber of the respective cylinder, means connecting said pistons and hollow rod to the engine crank shaft, said pistons and hollow rod cooperating to control the admission and exhaust to and from the engine cylinders.

3. In an engine, a pair of cylinders arranged in alignment with each other, inlet and exhaust ports in each cylinder intermediate its ends, a sleeve connecting said cylinders, a hollow piston in each cylinder, a hollow rod sliding through said sleeve and connecting said pistons, said rod having ports adapted to open into said cylinders, and means connecting said pistons and hollow rod to the engine crank shaft, said pistons and rod cooperating to control the admission and exhaust to and from the engine cylinders.

4. In an engine, a pair of cylinders in alignment with each other, inlet and exhaust ports in each cylinder intermediate its ends, a sleeve connecting said cylinders, a piston in each cylinder, this piston being hollow and having such an extension as to close one of said ports and clear the other one when it is at one end of its stroke, a hollow rod connecting said pistons and having an intermediate partition, ports at the two sides of this partition, these ports being so located as to open into the cylinder when the piston is at one end of its stroke and means connecting said pistons and hollow rod with the engine crank shaft, said pistons and ports cooperating to control the admission and exhaust to and from said cylinders.

5. In an engine, a pair of cylinders in alignment with each other, inlet and exhaust ports in each cylinder intermediate its ends, a sleeve connecting said cylinders, a piston in each cylinder, this piston being hollow and having such an extension as to close one of said ports and to clear the other one when it is at one end of its stroke, a hollow rod connecting said pistons and having an intermediate partition, and ports at the two sides of this partition, these ports being so located as to open into the cylinder when the piston is closing said inlet ports and clearing the exhaust ones, and means connecting said pistons and hollow rod with the engine crank shaft, said pistons and ports cooperating to control the admission and exhaust to and from said cylinders.

6. In an engine, a pair of cylinders in alignment with each other, inlet and exhaust ports in each cylinder intermediate its ends, a sleeve connecting said cylinders, a piston in each cylinder, this piston being hollow and having such an extension as to close one of said ports and to clear the other one

when it is at one end of its stroke, a hollow rod connecting said pistons in such a respective position as one of them clears the inlet ports of its cylinder at the time the other one clears the exhaust ports of its own cylinder, said hollow rod having an intermediate partition and ports at the two sides of this partition, the ports of said rod being so located as to open into the cylinder when the piston is closing said inlet ports and clearing the exhaust one.

Signed at Turin, Italy, this 7th day of April A. D. 1922.

ALFREDO GUAITA.