Aug. 28, 1945. F. C. HAWKINS 2,383,648

INTERNAL-COMBUSTION ENGINE

Filed July 19, 1943 2 Sheets-Sheet 1

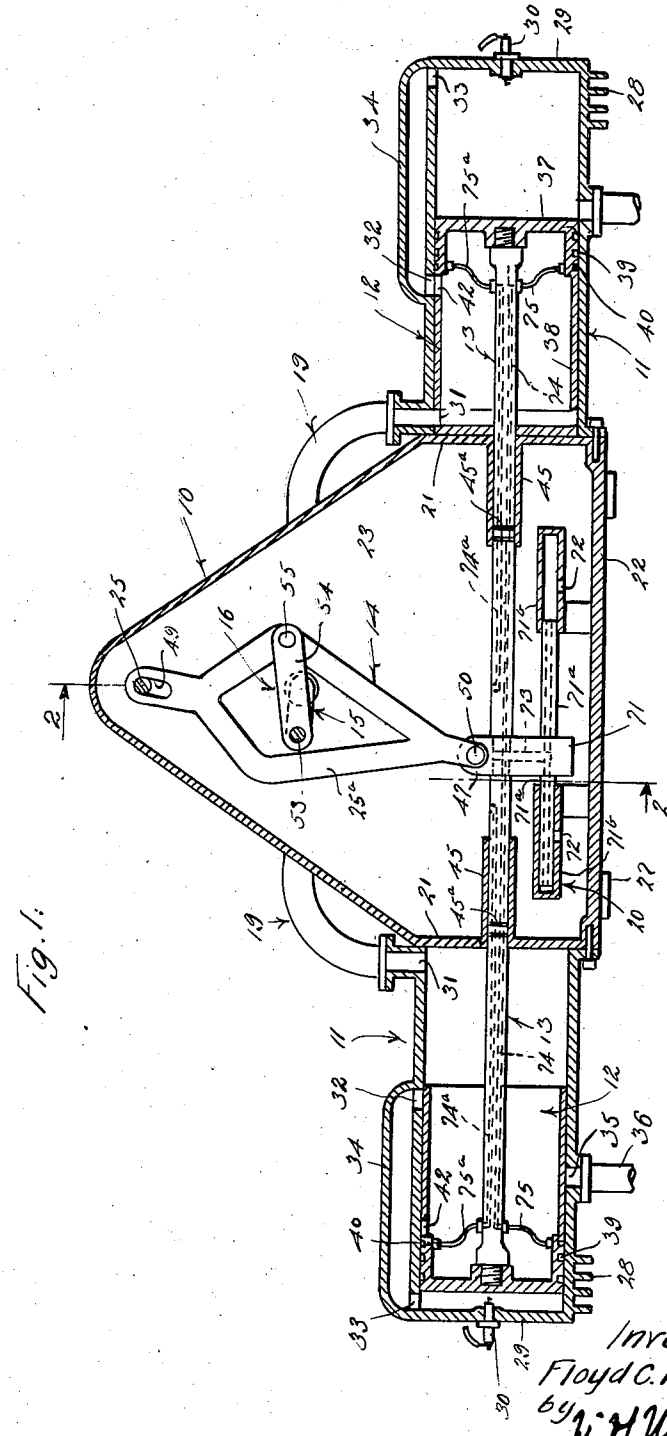


Fig. 1.

Inventor
Floyd C. Hawkins
by V. H. Mahnell
Attorney

Aug. 28, 1945. F. C. HAWKINS 2,383,648

INTERNAL-COMBUSTION ENGINE

Filed July 19, 1943 2 Sheets-Sheet 2

Fig. 2.

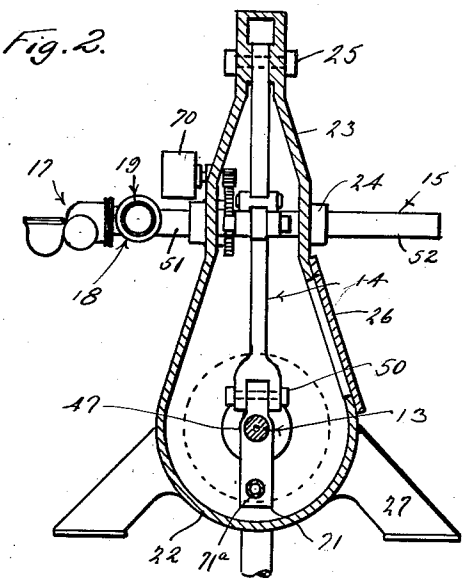


Fig. 3.

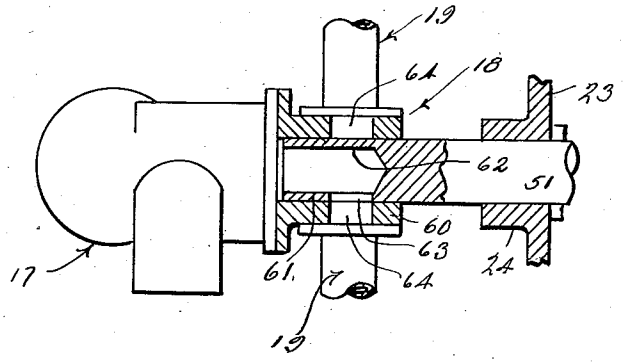
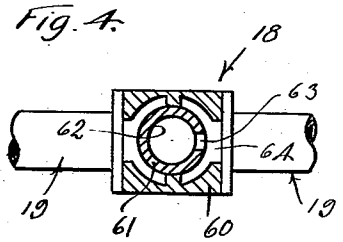


Fig. 4.



Inventor
Floyd C. Hawkins
by V. H. Maxwell
Attorney

Patented Aug. 28, 1945 2,383,648

UNITED STATES PATENT OFFICE

2,383,648

INTERNAL-COMBUSTION ENGINE

Floyd C. Hawkins, Arcadia, Calif.

Application July 19, 1943, Serial No. 495,276

9 Claims. (Cl. 123—56)

This invention relates to an internal combustion engine and more particularly to such an engine of the two cycle type. It is a general object of the present invention to provide a simple, economical and improved engine of the type stated.

Internal combustion engines are commonly constructed so that the pistons are directly connected with the crank shaft by connecting rods. This places a definite limitation on the manner in which the cylinders can be located relative to the crank shaft and also results in a leverage condition between the piston and the crank shaft limited by the characteristics of a simple crank. Further, the control of the gaseous mixture in the ordinary two cycle engine is generally limited to ports in the cylinder and piston or to valves located at these parts.

It is an object of my invention to provide an engine of the cylinder and piston type in which reciprocatory motion is converted to rotary motion by a crank shaft but which permits the crank shaft to be offset a substantial distance from the piston.

Another object of my invention is to provide an engine of the character mentioned in which the cylinders may be in opposed relation and the crank shaft offset from the line of the cylinders, making it possible to locate the center of gravity of the engine well below the axis of the crank shaft.

A further object of my invention is to provide an engine in which the gaseous mixture is controlled by a combination of ports in the cylinder and piston and a valve operated by the crank shaft.

Another object of this invention is to provide an engine of the character mentioned with a novel combination of carburetor, distributing valve and crank shaft, whereby the flow of mixture from the carburetor is initially controlled by the crank shaft.

It is another object of this invention to provide a simple, effective and dependable system for lubricating an engine of the character mentioned.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a longitudinal detailed sectional view of a typical engine embodying my invention. Fig. 2 is a view taken substantially as indicated by line 2—2 on Fig. 1. Fig. 3 is an enlarged plan view taken at the carburetor showing certain parts in section, and Fig. 4 is a sectional view taken through the distributing valve provided by the invention.

My invention is particularly applicable to two cycle, multiple cylinder engines in which the cylinders are opposed, and in its preferred form the invention is applied to a construction in which the cylinders are arranged horizontally and the crank shaft offset vertically of the cylinder.

In accordance with the broader features of the invention the engine may involve various numbers of cylinders and they may be located in various positions and, therefore, I do not wish to be understood as limiting my invention to the particular form illustrated or to the particular details which I am about to describe.

In the simple, typical application of my invention shown throughout the drawings there are two opposed and horizontally disposed cylinders acting to drive a common or single crank shaft which is disposed transversely of the axis of the cylinders and which is offset vertically from the axis of the cylinders.

The invention includes, generally, a main housing 10, opposed cylinders 11 at opposite ends of the housing, a piston 12 operable in each cylinder, connecting rods 13 extending from the pistons into the housing where they are coupled together, a pivoted drive lever 14 in the housing, a crank shaft 15 carried by the housing, a connecting link 16 operatively connecting the lever 14 and crank shaft 15, a carburetor 17, a distributing valve 18 receiving the combustible mixture from the carburetor, manifolds 19 conducting the mixture from the valve 18 to the cylinders 11, various ports in the cylinders and pistons controlling the flow of mixture from the inner or compression ends of the cylinders to the outer or working ends thereof, means 20 for lubricating the principal working parts, and various other parts and features of construction common to engines of this general character.

The main housing 10 is in the nature of a case formed so that its opposite ends 21 receive and carry the cylinders 11 in opposed relation and in alignment with each other. The bottom 22 of the housing is shaped to form a basin or reservoir for lubricating oil. The housing projects a substantial distance above the cylinder carrying portion where it has sides 23 provided with bearings 24 for carrying the crank shaft 15. The sides 23 also carry a pivot pin 25 at a point above the crank shaft 15, which pivot pin supports the drive lever 14. In practice it is to be understood that

the housing 10 may be of sectional construction or may be provided with removable sections such as the section 26, to facilitate access to the interior of the housing or to facilitate assembly of the parts of the engine. In the particular case illustrated the housing 10 is of simple construction and it is provided with legs or mounting brackets 27 to facilitate mounting the engine on a suitable support.

Each cylinder 11 is of the general construction found in internal combustion engines. For instance, it may be in the form of a casting flanged at its inner end to facilitate mounting on the housing 10 and provided with suitable means for cooling. In the case illustrated cooling fins 28 are provided on the cylinder to dissipate heat. The head 29 of the cylinder is provided with an opening to carry the usual spark plug 30.

In accordance with the present invention three fuel handling ports 31, 32 and 33 are provided in the wall of the cylinder; the port 31 is adjacent the inner end of the cylinder, the port 33 is at the outer end of the cylinder, while the port 32 is an intermediate port located between the ports 31 and 33. A by-pass manifold 34 connects the ports 32 and 33. An exhaust port 35 is provided in the side of the cylinder, preferably at a point around the cylinder opposite the ports above described. In practice a suitable exhaust manifold 36 may be connected with the port 35.

Each cylinder is provided with a piston 12 which may be of simple construction involving a head 37 and a skirt 38. In the case illustrated compressing rings 39 are carried by the head 37 and an oil groove 40 is also provided in the head. The skirt 38 of the piston slidably fits the cylinder and is of such length as to cover the port 32 when the pistons is at the outer or head end of its stroke. A port 42 is provided in the skirt 38 of the piston to register with the port 32 when the piston is at the inner end of its stroke. The exhaust port 35 is located so that it is uncovered by the piston at a suitable time prior to the piston reaching the inner end of its stroke.

The relationship of the piston cylinder and the ports in these parts will be best understood from examination of Fig. 1 of the drawings. At the left in Fig. 1 the piston is shown at the outer end of its stroke where all of the ports are closed. The port 33 is not actually closed but the port 32 is closed and, therefore, there is no flow in either direction through port 33. At the right in Fig. 1 the piston is shown at the inner end of its stroke, at which time the exhaust port is uncovered and the port 32 is uncovered so that there is communication from the interior of the piston to the interior of the cylinder above the piston through the port 32, manifold 34 and port 33.

The connecting rods 13 may be coupled or joined with the pistons in any suitable manner. In the case illustrated the rods are shown threaded into the heads of the pistons and are shown slidably carried by sleeve bearings 45 at the openings in the ends 21 of the housing. The rods may carry sealing rings 45a to seal in the bearings 45. The two connecting rods 13 are joined or coupled together in the housing 10 so that the two rods and the two pistons form a single rigid reciprocating unit. In the particular construction illustrated the rods 13 are threaded into a block or crosshead 47 which serves as a coupling.

The pivoted drive lever 14 is pivotally supported in the housing 10 on the pivot pin 25. The pin 25 is carried between the sides 23 of the housing 10 and passes through a slot 49 in the upper end portion of the lever 14. The lower end of the lever 14 is pivotally connected to the cross head 47 by a pivot pin 50. Through this construction as the crosshead 47 is reciprocated in the housing 10 the lever 14 is swung or oscillated about the pin 25. A stiffening web 25a is provided on the lever 14 to give it strength and rigidity.

The crank shaft 15 has one end portion 51 projecting from one side of the housing 10 and the other end 52 projecting from the opposite side of the housing. The latter end 52 is provided as the power take-off for the engine while the end 51 functions as will be hereinafter described. The offset portion or crank pin 53 of the crank shaft is located within the housing 10 and extends between the crank arms 54 on the shaft parts 51 and 52.

The connecting link 16 has one end pivotally connected to the crank pin and the other end pivotally connected to the lever 14 by pivot pin 55.

Through the mechanism just described the reciprocating motion of the crosshead 47 is converted to rotary motion of the crank shaft 15 through leverage which is advantageous and, in practice, the stroke of the crosshead 47 may be fairly long while the parts can be proportioned so that the crank shaft throw is small.

In accordance with my invention the carburetor 17 and distributing valve 18 are combined at the projecting end portion of the crank shaft part 51. The carburetor 17 which may be of any suitable construction is designed to supply a suitable combustible mixture to the distributing valve.

The distributing valve, in accordance with the preferred form of the invention, includes a valve body 60 held stationary between the manifolds 19 and a revolving core 61 which may be a continuation of the shaft part 51. In the preferred arrangement the carburetor 17 is located so that its outlet or discharge feeds directly into the distributing valve, that is, into the core of the distributing valve which may be formed by the end of the shaft which is provided with an axial bore 62.

A lateral port or duct 63 is provided at one side of the core of the valve to cooperate with outlet ports 64 in the valve body 60. The ports 64 communicate with the manifolds 19 which join to opposite sides of the body 60 at the diametrically opposite ports 64 of the valve body 60. The manifolds extend to the ports 31 of the cylinders.

The parts of the distributing valve are so constructed and related that a combustible charge is delivered to the manifold 19 at the left in Fig. 1, while the piston in the left cylinder is moving out, but is cut off from the manifold at the right during that time. When the piston at the left moves in on the power stroke the distributing valve closes communication with the manifold of the left cylinder causing compression under the piston in the left cylinder, but the mixture is supplied to the manifold of the right cylinder so that it enters the right cylinder as its piston moves out.

A suitable magneto or electrical generator incorporating a timer, or the like, may be provided at 70 to be driven from the crank shaft, the timing being such as to actuate the spark plugs in proper timed relation to the reciprocation of the pistons in the cylinders.

The lubricating means 20 provided by my invention provides an extension 71 of the crosshead 47 which extension depends into the reservoir portion of the housing 10 to sweep back and forth in the body of oil contained in the reservoir. Plungers 71a project from each side of the extension and operate in cylinders 71b submerged in the oil in the housing. Pickup ports 72 are provided in the cylinders to admit oil into the cylinders. The plungers have longitudinal passages which communicate with a port 73 which conducts oil through the crosshead to communicate with longitudinal ports 74 provided in the connecting rods 13. The oil thus supplied to the connecting rods may be conducted to any suitable points requiring lubrication. In the case illustrated the ports 74 are shown connected with the oil grooves 40 through suitable oil connections 75. Oil return connections 75a connect with the ports 74a which return the oil to the housing. It is to be understood, of course, that the distribution or handling of the lubricating oil from the ports 74 may vary as circumstances require.

From the foregoing description it is believed that the operation of the engine will be readily understood. As a piston 12 moves outwardly in its cylinder the charge admitted to the head end of the cylinder is compressed while a fresh charge of fuel is admitted into the lower or inner end of the cylinder through the distributing valve and manifold 19. When the piston reaches the head end of the stroke the charge is compressed and ignition occurs. The piston is driven inwardly in the cylinder by the pressure of combustion during which time the previously admitted charge under the piston is compressed and the force or work of the explosion is communicated by the piston rod 13 to the crosshead 47. This work stroke continues until the exhaust port 35 is uncovered whereupon the gases of combustion escape through the manifold 36, at which time the port 42 registers with the port 32 and the charge compressed under the piston is conducted by manifold 34 through port 33 into the head end of the cylinder.

The reciprocating motion imparted to the crosshead 47 is converted to rotary motion through the lever 14, link 16 and crank shaft 15, and the distributing valve 18 is operated in timed relationship with the other parts, as will be apparent from the foregoing description and from the drawings. As the crosshead sweeps back and forth in the oil held at the bottom of the housing oil is forced through the openings and ports in the crosshead to the ports 74 in the connecting rods from which it is distributed to the points requiring lubricating.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. An engine of the character described including, a housing, a hollow crank shaft carried by the housing and having a port therein, a cylinder carried by the housing, a piston carried in the cylinder, means operatively connecting the piston and crank shaft, there being ports in the cylinder and piston for controlling flow of a combustible charge from behind the piston to ahead of the piston, a carburetor supplying a combustible mixture to the said port, and a member cooperating with the crank shaft for controlling admission of the mixture charge from the carburetor to the cylinder behind the piston.

2. An engine of the character described including, a housing, a hollow crank shaft carried by the housing, a cylinder carried by the housing, a piston carried in the cylinder, means operatively connecting the piston and crank shaft, there being ports in the cylinder and piston for controlling flow of a combustible charge from behind the piston to ahead of the piston, a carburetor, and a distributing valve means directly operated by the crank shaft for controlling admission of a charge from the carburetor to the cylinder behind the piston the valve means including a port in the shaft supplied from the carburetor and a ported valve body around the shaft cooperating with the ported portion thereof.

3. An engine of the character described including, a housing, a crank shaft carried by the housing, a cylinder carried by the housing, a piston carried in the cylinder, means operatively connecting the piston and crank shaft, there being ports in the cylinder and piston for controlling flow of a combustible charge from behind the piston to ahead of the piston, a carburetor, and a distributing valve concentric with and operated by the crank shaft for controlling admission of a charge from the carburetor to the cylinder behind the piston, said means including a pivoted lever linked to the shaft and a connecting rod for operating the lever from the piston.

4. An engine of the character described including, a housing, cylinders supported in opposed relation from the ends of the housing, pistons in the cylinder, rods connected to the pistons and connected together in the housing forming a rigid connection between the pistons, means supplying a charge to the cylinders, a crank shaft carried by the housing offset from the cylinders, and means whereby the shaft is operated from the rods including a lever having its inner end connected with the rods, its outer end slidably pivotally supported from the housing and its middle portion connected with the shaft.

5. An engine of the character described including, a housing, cylinders supported in opposed relation from the ends of the housing, pistons in the cylinder, rods connected to the pistons and connected together in the housing to rigidly connect the pistons, means supplying a charge to the cylinders, a crank shaft carried by the housing offset from the cylinders, and means whereby the shaft is operated from the rods including a lever slidably pivoted in the housing and oscillated by the rods, and a link connecting the lever and shaft the link being connected to the lever intermediate its ends.

6. An engine of the character described including a housing, cylinders supported in opposed relation from the ends of the housing, pistons in the cylinder, rods connected to the pistons and connected together in the housing, means supplying a charge to the cylinders, a crank shaft carried by the housing offset from the cylinders, and means whereby the shaft is operated from the rods including a lever having one end slidably pivotally supported in the housing and the other end pivotally connected to the rods, and a link pivoted to the lever between its ends and pivotally connected to the pin of the crank shaft.

7. An engine of the character described including, a housing, cylinders supported in opposed relation from the ends of the housing, pistons in the cylinder, rods connected to the pistons and connected together in the housing, means supplying a charge to the cylinders, a crank shaft carried by the housing offset from the cylinders, means whereby the shaft is operated from the rods, and a part projecting from the rods into the lower portion of the housing to catch oil contained therein and deliver it to ports in the rods.

8. An engine of the character described including, a housing, cylinders supported in opposed relation from the ends of the housing, pistons in the cylinders, rods connected to the pistons, a cross head rigidly connecting the rods together in the housing, means supplying a charge to the cylinders, a crank shaft carried by the housing offset from the cylinders, and means whereby the shaft is operated from the rods including a lever having one end pivotally connected to the cross head, the other end slidably pivotally supported by the housing and its middle portion linked to the shaft.

9. An engine of the character described including, a housing, cylinders supported in opposed relation from the ends of the housing, pistons in the cylinders, rods connected to the pistons, a cross head connecting the rods together in the housing, means supplying a charge to the cylinders, a crank shaft carried by the housing offset from the cylinders, and means whereby the shaft is operated from the rods, including a lever having one end slidably pivoted in the housing and the other end pivotally connected to the cross head, and a link connecting the lever and shaft.

FLOYD C. HAWKINS.