July 2, 1929. C. DULCHÉ 1,719,537

GAS ENGINE

Filed Jan. 28, 1926 3 Sheets-Sheet 1

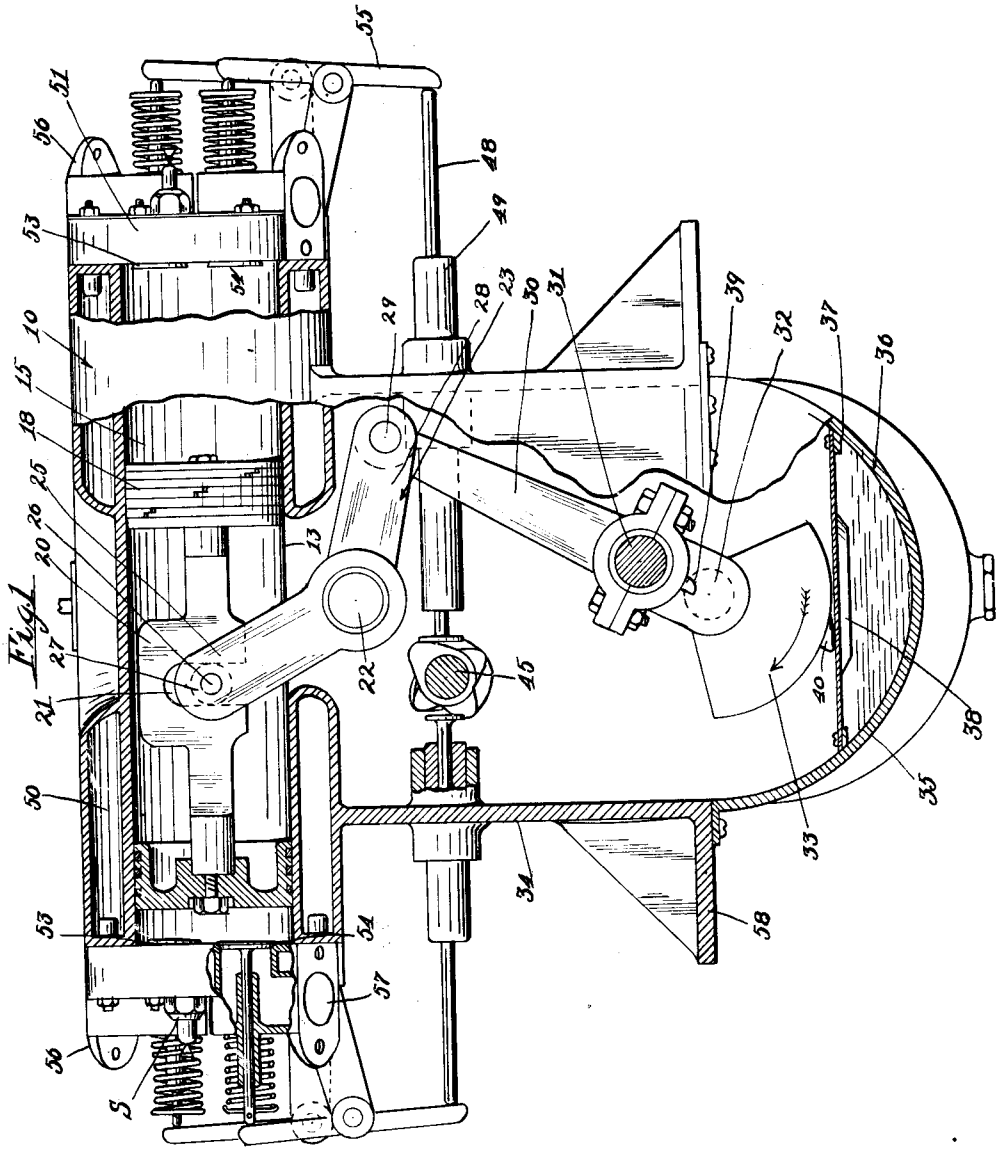


Fig. 1

Inventor
Carlos Dulché
by Hazard and Miller
Attorneys

July 2, 1929. C. DULCHE 1,719,537

GAS ENGINE

Filed Jan. 28, 1926 3 Sheets-Sheet 2

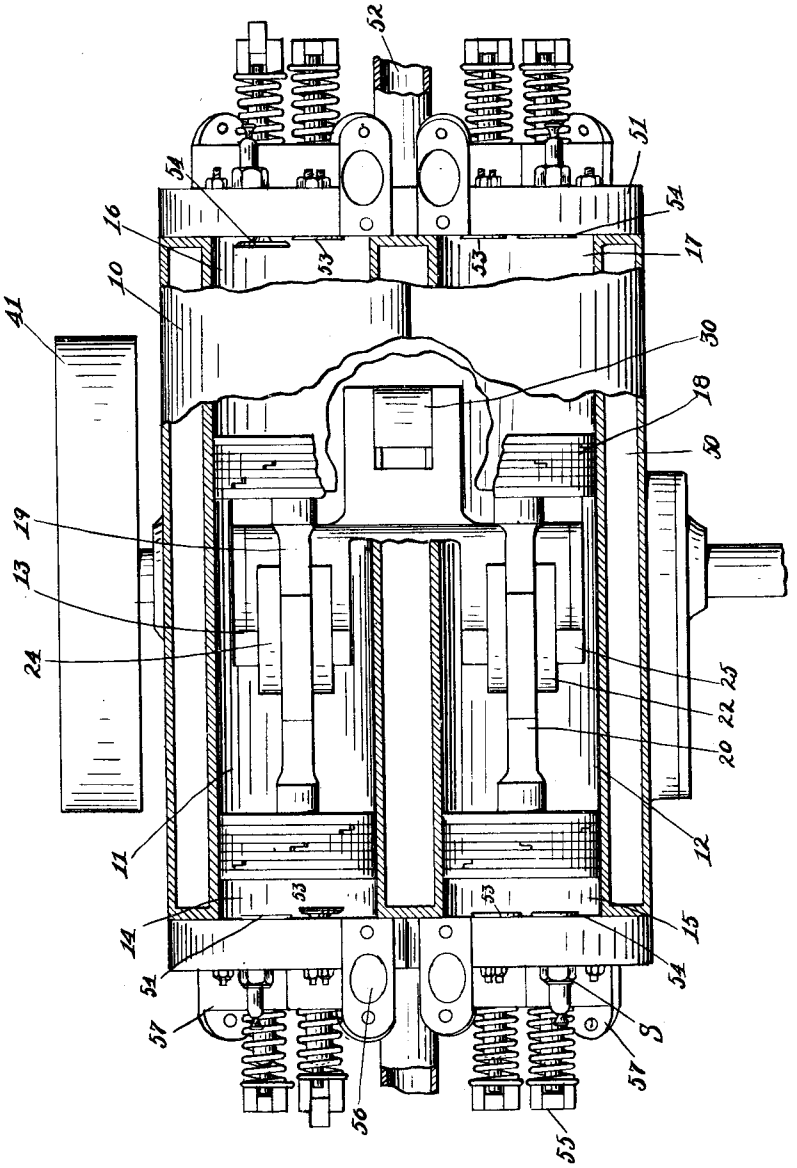


Fig. 2.

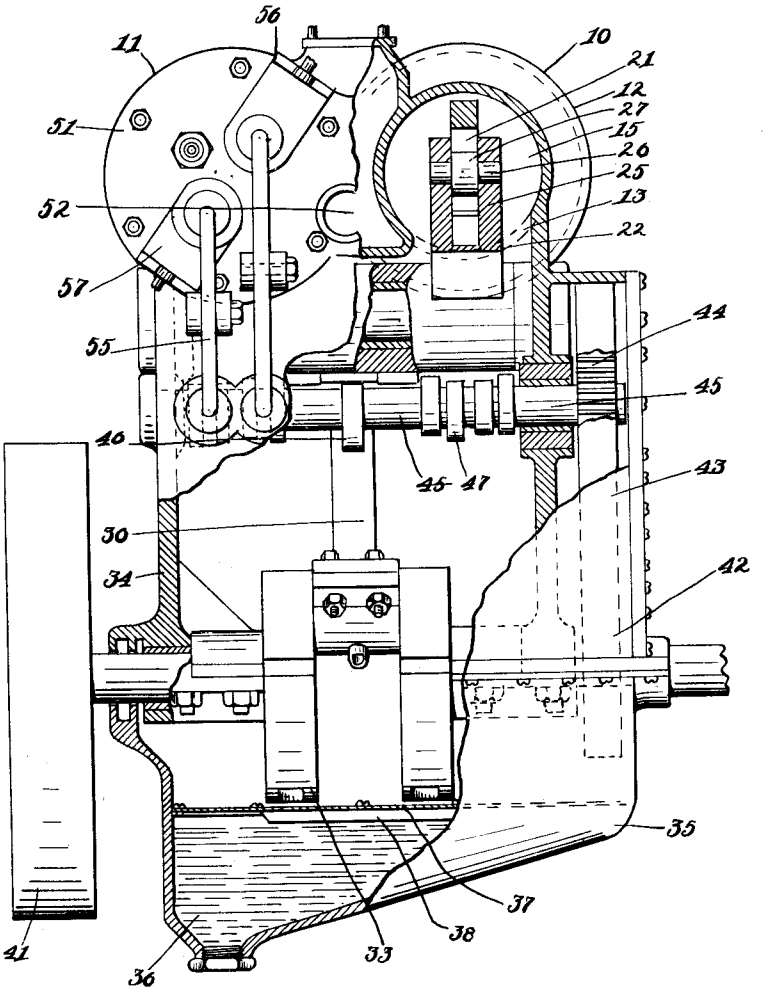
Inventor
Carlos Dulché
by Hazard and Miller
Attorneys

July 2, 1929. C. DULCHÉ 1,719,537

GAS ENGINE

Filed Jan. 28, 1926 3 Sheets-Sheet 3

Fig. 3.



Inventor
Carlos Dulché
by Hazard and Miller
Attorneys

Patented July 2, 1929. 1,719,537

UNITED STATES PATENT OFFICE.

CARLOS DULCHÉ, OF LOS ANGELES, CALIFORNIA.

GAS ENGINE.

Application filed January 28, 1926. Serial No. 84,336.

This invention relates to improvements in internal combustion engines.

An object of the invention is to provide an improved internal combustion engine, which is of extremely compact form, enabling it to be used or placed in small spaces.

A further object of the invention is to provide an internal combustion engine of the plural cylinder four cycle type, which employs several pairs of opposed cylinders, and to provide an improved construction wherein power developed by pistons reciprocating in the cylinders can be transferred or transmitted to a single crank shaft.

With the foregoing and other objects in view which will be made manifest in the following detailed description and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Figure 1 is a view in side elevation of the improved engine, a major portion of the engine being shown as having been broken away and shown in section,

Fig. 2 is a plan view, parts being broken away and shown in horizontal section, and

Fig. 3 is an end elevation, parts being broken away and shown in section.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, the improved engine consists of a body or cylinder block, generally designated at 10. In this block there are formed two parallel bores 11 and 12. Apertures 13 are formed in the bottom of the block 10 centrally of each of the bores 11 and 12 so as to define cylinders in each end of each bore, these cylinders being indicated at 14, 15, 16 and 17. A piston 18 is reciprocable in each of the cylinders, and the pistons which are arranged in the cylinders 14 and 16 are connected together by means of a piston rod 19. In a similar manner the pistons 18, which are in the cylinders 15 and 17, are connected by a piston rod 20. Centrally of each of the piston rods 19 and 20 there are formed slots or recesses 21 which extend upwardly from their lower sides. Immediately below the lower sides of the bores 11 and 12 there is mounted a fulcrum 22, and an angular lever or crank, generally designated at 23, is mounted on this rock shaft. In the present instance where there is shown four cylinders, the crank or angular lever 23 has two upwardly extending arms indicated at 24 and 25 respectively. These arms are bifurcated adjacent their ends and pins 26 are mounted between the bifurcated ends of the arms. Rollers 27 are rotatably mounted upon the pins 26 and fit within the slots 21, forming anti-friction bearing for a pin and slot connection between the piston rod 19 and the arm 24, and between the piston rod 20 and the arm 25. The crank or angular lever 23 has a single arm 28 arranged at an angle to the arms 24 and 25. This arm carries a wrist pin 29 and a connecting rod 30 connects the wrist pin 29 to the single crank pin 31 on the crank shaft 32, which is provided with counterbalance weights 33. The crank shaft 32 has its ends rotatably mounted upon bearings mounted in the ends of the crank case 34, which may be formed integral with the cylinder block 10.

A pan 35 is removably secured over the bottom of the crank case 34, serving to maintain a lubricant 36 therein. Above the bottom of the pan 35 there is mounted a plate 37 having a depression 38 adjacent its center, in which oil is adapted to collect and to be picked up by fingers 39 and 40 on the connecting rod 30 and on the counterbalance weights 33, providing a splash system of lubrication.

On the crank shaft 32 there is provided a fly wheel 41 and a timing gear or sprocket 42, which drives a belt or endless chain 43, which in turn drives a timing gear or sprocket 44. The timing gear or sprocket 44 is mounted on a cam shaft 45, which is rotatably mounted in the ends of the crank case 34. It carries a central cam 46 adapted to operate the usual oil pump, not shown, providing a force feed lubrication system for lubricating the cylinders. The cam shaft 45 also has eight cams 47. These cams actuate valve rods 48 which slide in valve rod guides 49.

As clearly shown upon Fig. 1, the cylinder block 10 may be cored out to provide water jackets 50 about the cylinders. Heads 51 are mounted upon the ends of the cylinder block 10 and these are cored out, providing water jackets which communicate with the water jackets 50. The entrance and exit to the water jackets are illustrated at 52 (see Figs. 2 and 3). Valves are mounted in the cylinder heads 51, the valves 53 constituting inlet valves and the valves 54 constituting exhaust valves. These valves are of the

usual construction and are operable by rocker arms 55. In the cylinder heads 51 there are formed passages 56 which supply fuel and which are controlled by the inlet valves 53. These passages may be connected to a carburetor in the usual manner. Exhaust passages 57 are also formed in the cylinder heads 51 and are controlled by the exhaust valves 54. These passages may lead to an exhaust pipe in the usual manner. Spark plugs S are also mounted in the heads 51, there being one spark plug for each cylinder. The engine may be supported by lateral brackets 58 provided on the bottom of the crank case 34.

The operation of the improved engine is as follows: The pistons 18 reciprocate back and forth in their respective cylinders, causing the piston rods 19 and 20 to cause the crank 23 to oscillate. This oscillatory movement causes the connecting rod 30 to produce rotation of the crank shaft 32, and power may be taken off from this crank shaft in any desired manner. In the position of the engine shown on the drawing the cylinder 14 is just beginning to take in fuel, the cylinder 15 is just beginning to have its fuel fired, the cylinder 16 is just starting to exhaust the exhaust gases, and the cylinder 17 is just beginning to have the fuel in its compressed. During the operation of the engine the various cylinders have the various events of the ordinary four cycle engine occur in them, namely, admission, compression, firing and exhaust.

From the arrangement of the parts of the above described engine, it will be readily appreciated that when any piston is upon its explosion or working stroke, the force applied thereto will be transmitted through the piston rods and the crank or lever 23 to another piston which is undergoing its compression stroke. In this way by causing the force applied to a piston during its working stroke to be transmitted to another piston which is undergoing its compression stroke, a great deal of vibration is eliminated and reduced, and the engine can be easily designed so that it will be a very high compression engine. It is, of course, understood that the broad idea of having a piston on its working stroke force another piston during its compression stroke is old in the conventional type of internal combustion engine. However, in the convention type of internal combustion engine, the force is usually transmitted through the crank shaft from the piston on its working stroke to the piston undergoing the compression stroke. When the force is transmitted through the crank shaft, heavy torsional strains are placed on the crank shaft and on the bearings for the crank shaft. By the improved construction the force is transmitted through parts other than the crank shaft, enabling the parts which do transmit the force to be easily designed to properly sustain the load. In the engine as above described practically the sole forces which the crank shaft must carry are the forces developed in delivering power from the engine.

It will be readily understood that the improved engine is not limited to the particular construction shown, but on the contrary, it may be used as a steam engine, if desirable, or can be employed as an air compressor, if found advantageous. An important feature of the improved construction resides in the fact that the engine is very compact in form, occupying a very small space, which is very desirable in many instances.

It will be understood that various changes in the detail of construction may be made without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. A four cycle four cylinder internal combustion engine comprising two pairs of aligned opposed cylinders, pistons reciprocable in said cylinders, piston rods rigidly connecting the pistons in each pair of cylinders, a lever mounted for rotation about a stationary axis and operatively connected to each piston rod, a crank shaft, and a connecting rod connecting the lever to the crank shaft, the pistons, piston rods and lever being so arranged that the force applied to any piston during its working stroke will be transmitted to another piston which is undergoing its compression stroke through the piston rods and lever.

2. An engine comprising in combination a plurality of pairs of opposed and aligned cylinders, each cylinder of a pair having a piston therein and with a common rigid piston rod connecting said pistons and each cylinder of a pair having a side opening, a rock shaft mounted on the structure stationary as regards the cylinders and forming a fulcrum, a plurality of arms fixedly secured to said rock shaft, each arm having an operative connection to one of said piston rods and extending through one of said openings to rock the rock shaft on the reciprocating movement of the pistons, a single lever fixedly secured to the rock shaft and extending outwardly therefrom, a crank shaft having a crank and a connecting rod operatively connected between the said lever and the crank, whereby on oscillating movement of the rock shaft the crank shaft has a rotary movement.

3. An engine comprising in combination a plurality of pairs of opposed and aligned cylinders, each pair having an opening in one side, a piston in each cylinder of a pair, said pistons of a pair being connected by a rigid piston rod having a transverse slot,

a rock shaft mounted in fixed journals in relation to the cylinders, a plurality of arms fixedly secured to said shaft, each arm having a pin connected thereto and operating in the slot of the piston rod, the arms extending through the openings in the cylinders, a single lever fixedly connected to the rock shaft and extending away from the cylinders, a crank shaft having a crank and a connecting rod operatively connected between the crank and the angular lever, whereby on reciprocating movement of the pistons the pins have a sliding movement in the said slots, the rock shaft has an oscillating movement and the shaft a rotary movement.

In testimony whereof I have signed my name to this specification.

CARLOS DULCHÉ.