TWO-CYCLE GAS ENGINE

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My invention relates to two-cycle gas engines and has for its object to provide a gas engine of this type wherein two or more cylinders have their piston rods and the crank shaft extending into a common crank shaft chamber and provide double pistons and double cylinders, one part of each said piston and cylinder operating as a charging chamber.

Heretofore in two-cycle engine construction, each piston and the piston rod and crank shaft associated with it has operated in a separate closed cylinder, and the charge of fresh gas is drawn in to the lower part of the cylinder as the piston moves upward, at the same time compressing the charge of gas above the piston, and as the piston moves downward the gas drawn into the lower part of the cylinder is compressed and pushes into the upper part of the cylinder aiding exhaust, and the operation is repeated from firing point to firing point. It has been found desirable and efficient to mount in a two-cycle engine two pistons, cylinders, and gas feeding appliances, so that as one piston goes up the other goes down. But each piston operates in its own cylinder throughout and both draws gas from the carburetor below the piston and charges the cylinder above the piston so that each of the units thus operates independently of one another.

I have discovered that greatly improved operation is possible where the fuel gas is introduced into an enlarged cylinder about the piston proper as the piston moves outwardly under the force of explosion to be followed by compression of that gas so drawn in as the piston moves inwardly, the compressed gas being forced into the other of two cylinders. In this manner, each of the cylinders receives its fuel charge from the piston of the other cylinder, the piston rods of each piston operating in a common crank chamber on a common crank and perfectly balanced operation and increased efficiency result.

It is a principal object of my invention, therefore, to provide a two-cylinder two-cycle gas engine with a piston having two different sizes operating in two different cylinders, the smaller piston in the smaller cylinder being the power means and the larger portion of the piston and larger cylinder providing intake means for delivering a charge of explosive mixture to the other power cylinder.

It is a further object of my invention to provide a two-cycle two-cylinder gas engine having a single crank casing with crank shaft bearings at each side, all of the crank shaft and the piston rods of the two cylinders operating in said single chamber.

It is a further object of my invention to provide pairs of superposed cylinders for each of the two cylinder units of the two-cycle gas engine, the upper of said cylinders being of smaller diameter than the lower cylinder, with a power piston of considerable length operative in the smaller cylinder and a piston of greater diameter attached to the bottom of the lower cylinder and operating in the larger cylinder so as to provide an annular space for inlet gas about said smaller cylinder at its outward stroke, where gas will be compressed in said annular chamber upon reverse movement of the piston.

It is a further object of my invention to provide a passageway connecting the annular chamber about the smaller piston part with the other smaller power cylinder.

It is a further object of my invention to form the opening from the passageway leading from the annular chamber of one cylinder to the power chamber of the other cylinder so that it will be completely closed by the piston during its outer stroke until substantially the end of said outer stroke, at which time the gas charge in the annular chamber of the second unit will have been very greatly compressed and will in expansion blow into the lower part of the other power cylinder against the customary baffle therein, thus acting to provide a succeeding fuel charge and at the same time scavenging the power cylinder of the remnants of combustion gas mixture.

It is a further object of my invention to provide an exhaust passage running from the lower part of the chamber in each smaller or power cylinder, and to provide an inlet passage running to the upper part of each annular chamber with suitable check valve means therein to hold the gas within the inlet passageway and the annular chambers during the up or compression stroke of the larger piston part.

The full objects and advantages of my invention will appear in connection with the detailed description thereof given in the appended specification, and the novel features by which the above-noted advantages and valuable results are secured will be particularly pointed out in the claims.

In the drawings illustrating an application of my invention in one form:

Fig. 1 is a sectional elevation view of a gas engine embodying my improvements, taken along the line of the crank shaft.

Fig. 2 is a transverse sectional view taken on
line 2—2 of Fig. 1, and viewed in the direction of the arrows.

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 1, and viewed in the direction of the arrows.

As illustrated the motor comprises a cylinder head casting 18 which provides cylinder walls 11 and 12 having integral therewith cylinder heads 13 and 14 through which extend open seats 15 and 16 for spark plugs 17 and 18.

The cylinder walls 11 and 12 enclose explosion chambers 19 and 20 in which operate pistons 21 and 22 and it will be apparent that the charge of fresh gas will be fully compressed in the annular compression chamber 33 at the moment that the outward movement of the opposite piston uncovers the opening 41 or 42 of port 37. This is at the end of power expansion from explosion when the explosion gases have reached one or the other of the openings 37 or 38 and the pressure within the explosion cylinder has therefore dropped, so that the rush of gas from the compression chamber against the baffle 38 will cause the explosion chamber 19 or 20 to be filled with inlet gas mixture and at the same time scavenge out the remainder of the explosion gas going to the exhaust.

In a customary manner the pistons 21 and 22 are made hollow and are provided with wrist pins 54 which are connected by piston rods 55 with crank bearings 58 on a single crank shaft which has its ends 57 and 58 mounted in frame pieces 59 and 60 on ball bearings 41 and 42. Starter mechanism indicated generally at 53 is connected with the crank end 53 in a known manner. A pan 44 closes the crank case chamber 42 at its bottom in a customary manner.

From the foregoing it will be apparent that the piston rods and crank shaft for both cylinders of the two-cylinder engine operate in a single crank case chamber, which greatly facilitates lubrication, simplifies construction, and produces the balance which is requisite for a multiple cylinder engine. It will be clear that while only two cylinders are shown and described herein, cylinders in any multiple of two, as four, six, eight or twelve may be employed. A customary breather, not shown, going to the crank case chamber 42 may be applied in any desired manner.

The advantages of my invention have appeared quite fully from the foregoing specification. A primary advantage is a perfectly balanced operation of a two-cylinder two-cycle gas engine. This balance is produced by reason of the fact that as one piston operating in its double cylinder responds to the power explosion and simultaneously draws in a fresh charge of gas mixture, the other piston in the second cylinder is compressing the charge in the explosion cylinder and also the charge drawn in by it at the time of the preceding explosion. The power stress of explosion in one cylinder is therefore to some degree compensated by the elastic compression stresses of the other cylinder. This balance in operation gives a remarkably smooth flow of power with a high degree of economy for the gas burned.

A further very great advantage which flows from that above-noted, is that my invention admirably adapts a two-cycle principle of operation of a gas engine to use in a multiple cylinder explosive engine.

I claim:
1. A two-cycle gas engine, comprising a block having formed therein a pair of power cylinders, each of said cylinders being continued into an enlarged cylinder portion, said enlarged cylinder portions opening directly into a common crankcase chamber, an enlarged piston part in said enlarged cylinder, a source of explosive mixture, a valve controlling movement of said explosive mixture in one direction only, a passageway leading from said valve and having extensive openings into each of said enlarged cylinders said passageway being positioned relative to the enlarged cylinder portions so as to open severally thereinto along a common plane at substantially the upper limit of the stroke of
the enlarged piston, and charging passageways in the block connecting the tops of each enlarged cylinder with the bottoms of opposite power cylinders, whereby explosive mixture will be drawn into an enlarged cylinder from said first-named passageway upon outward movement of its enlarged piston, and return movement of the enlarged piston will cause compression of the gas mixture about the explosion piston and the compressed gas mixture will flow through the charging passageway to the opposite power cylinder at termination of the down movement of one and the up movement of the other piston.

2. A two-cycle gas engine, comprising a block having formed therein a pair of power cylinders, each of said cylinders being continued into an enlarged cylinder portion, said enlarged cylinder portions opening directly into a common crank-case chamber, an enlarged piston part in said enlarged cylinder, a source of explosive mixture, a valve controlling movement of said explosive mixture in one direction only, a passageway leading from said valve and having extensive openings into each of said enlarged cylinders said passageway being positioned relative to the enlarged cylinder portions so as to open severally thereinto along a common plane at substantially the upper limit of the stroke of the enlarged piston, and charging passageways in the block connecting the tops of each enlarged cylinder with the bottoms of opposite power cylinders, an exhaust passageway having enlarged openings into the bottoms of the power cylinders, said openings being directly opposite the openings from the said charging passageways, whereby explosive mixture will be drawn into an enlarged cylinder from said first-named passageway upon outward movement of its enlarged piston, and return movement of the enlarged piston will cause compression of the gas mixture about the explosion piston and the compressed gas mixture will flow through the charging passageway to the opposite power cylinder at termination of the down movement of one and the up movement of the other piston, and exhaust will take place through said exhaust passageway at the same time that the gas is entering the power cylinder from the charging passageway and will act to scavenge the exhaust gases from said power cylinder.

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