

Nov. 14, 1944.

M. MALLORY

2,362,838

INTERNAL-COMBUSTION ENGINE

Filed Dec. 31, 1942

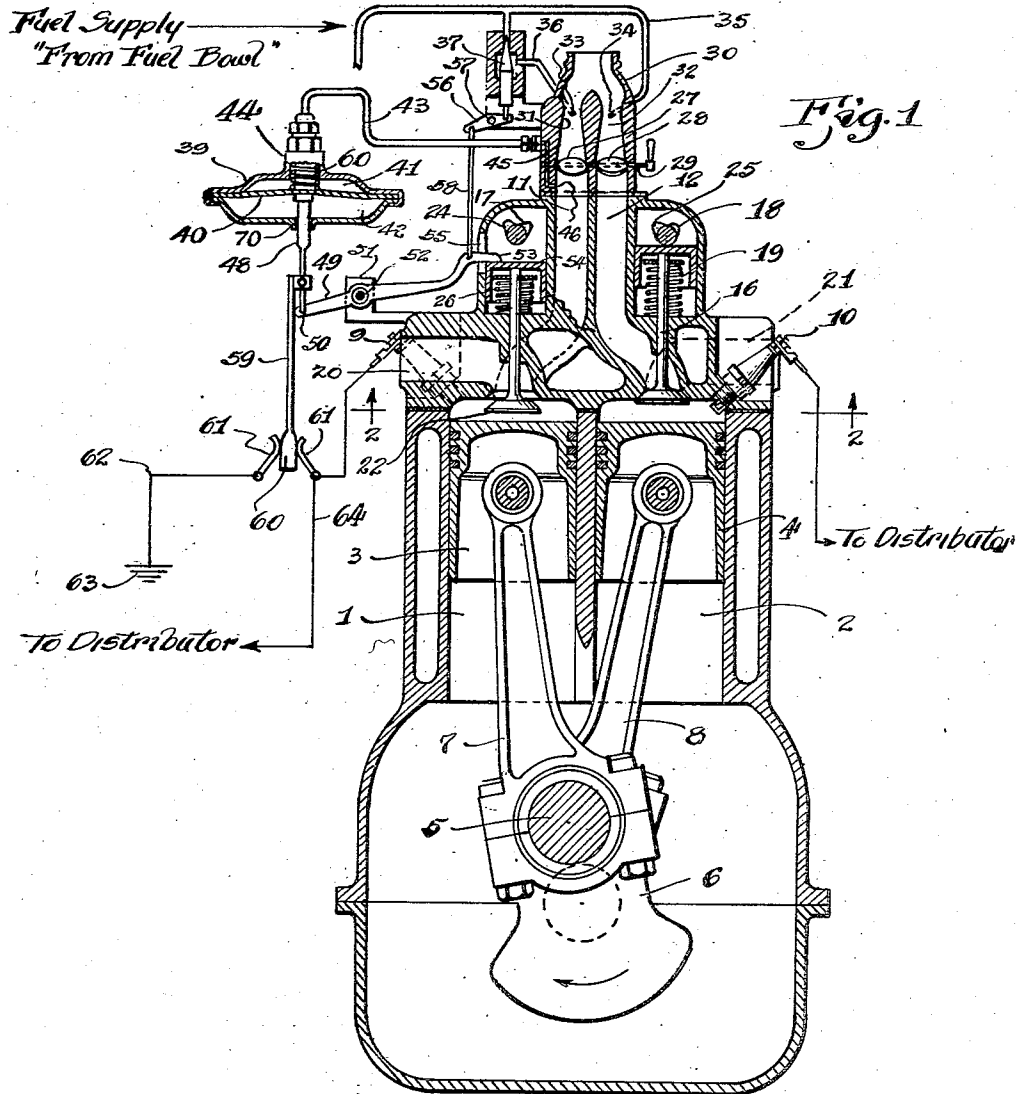
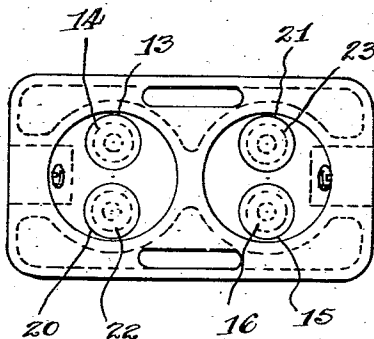


Fig. 2

INVENTOR.

Marion Mallory

BY Barnes, Kiesel, Laughlin & Kirsch
Attorneys.

UNITED STATES PATENT OFFICE

2,362,838

INTERNAL-COMBUSTION ENGINE

Marion Mallory, Detroit, Mich.

Application December 31, 1942, Serial No. 470,765

11 Claims. (Cl. 123—52)

This invention relates to an internal combustion engine.

It is well known that an internal combustion engine develops more horsepower per pound of fuel used when operating on wide open throttle than it does on part throttle. It is for this reason that a small engine gives better efficiency when used in a vehicle than a large engine does. For example; supposing a large engine having 400 cu. in. displacement was used in a vehicle having a certain load, and the engine would move that load at 40 miles per hour with the throttle only one-fourth open and the mileage was 15 miles per gallon. Then supposing a small engine was put in the same vehicle, geared to the vehicle with the same ratio as the large engine was, and more weight was added to the vehicle to make up the difference in weight of the large and small engine, it would be necessary to open the throttle on the small engine much further than the throttle was opened on the large engine to maintain a speed of 40 miles per hour. Naturally, with the greater throttle opening on the small engine, it would be operating with much higher compression at 40 miles per hour than the large engine, which means the small engine would move the vehicle more miles on a gallon of fuel than the large engine would.

The object of this invention is to provide an engine whereby less cubic inch displacement is used when the engine is operating under light loads and more cubic inch displacement can be used when full load or full power is desired. In other words, when the engine is operating on part throttle, it is a small engine, and, when operating on wide open throttle, it is a large engine. This gives the operator a large engine for acceleration and hard pulls, and at the same time gives him a small engine for economy when operating under light loads.

A further object of this invention is to maintain a sufficient number of power pulsations per crankshaft revolution when the engine is changed from a large engine to a small engine. For example; if one-half of the cylinders were cut out on the conventional eight-cylinder four-cycle engine, two of the downward strokes of the crank or crank power strokes would receive no power, but if one-half of the cylinders were cut out on my engine, the downward crank strokes that were receiving power when all of the cylinders were working still receive power but only from one piston instead of two. This maintains smoothness.

A still further object is to provide an engine having the above objects that is compact and takes up little more space than the ordinary engine.

In my engine, the cylinders are arranged in pairs close together and parallel to each other. The pistons are connected to the crankshaft so that they operate practically simultaneously or together. The cylinders are charged, ignited and exhausted in the same manner; each cylinder being charged and exhausted independent of each other, as well as ignited independent of each other.

In my engine, two cylinders consist of one power unit, and, for example, supposing my engine having one power unit was installed in a motorcycle, both cylinders, will be delivering power when the throttle was open or nearly open, and there would be a power pulsation every fourth revolution of the crankshaft. If one cylinder were cut out, there still would be power delivered to the crankshaft every fourth cycle.

In the drawing:

Fig. 1 is a vertical section through my engine. Fig. 2 is a section along the line 2—2 of Fig. 1.

The engine herein shown comprises cylinders 1 and 2. These cylinders can be of the same size or different sizes, but for purposes of description rather than by way of limitation they are herein shown as the same in size. Cylinders 1 and 2 are provided with the usual pistons 3 and 4, respectively, which are connected to the same throw 5 of a common crankshaft 6 by connecting rods 7 and 8, respectively. The connecting of each pair of pistons 3 and 4 to a common crankshaft is preferred but not essential provided the pistons of each pair travel substantially together on their intake, compression, power, and exhaust strokes. For purposes of description and not by way of limitation, piston 4 is shown as lagging a very few degrees behind piston 3.

Cylinders 1 and 2 are provided with spark plugs 9 and 10, respectively, for igniting the fuel and air mixture in the combustion chambers of their respective cylinders. Spark plugs 9 and 10 are arranged to fire cylinders 1 and 2.

Cylinders 1 and 2 are provided with intake manifold passageways 11 and 12, respectively. Manifold passageway 11 communicates with cylinder 1 through an intake port 13 controlled by intake valve 14 and manifold passageway 12 communicates with cylinder 2 through an intake port 15 controlled by intake valve 16, Fig. 2. The two intake valves 14 and 16 are opened by cams 17

and 18, respectively, and closed by the usual compression springs 19.

Cylinders 1 and 2 are provided with exhaust passageways 20 and 21, respectively, which are controlled by the usual poppet valves 22 and 23, respectively. The exhaust valves are arranged to be opened by cams 24 and 25 and closed by the usual compression springs 26 when both cylinders of the engine are operating. Manifold passageway 11 is controlled by the usual butterfly throttle valve 27 and manifold passageway 12 is controlled by the usual butterfly throttle valve 28. Throttle valves 27 and 28 are fixed to a common shaft 29 and opened and closed in unison.

The engine is provided with a duplex carburetor generally designated 30, having a fuel bowl (not shown) connected with a source of liquid fuel in the customary manner. The carburetor is provided with venturis 31 and 32 which communicate with the intake manifold passageways 11 and 12, respectively. The carburetor venturis 31 and 32 are provided with fuel nozzles or jets 33 and 34, respectively. Fuel nozzle 34 is connected at all times by means of fuel line or passageway 35 with the fuel bowl of the carburetor. Nozzle 33 is connected by means of fuel line 36 with the carburetor bowl. However, fuel line 36 is arranged to be closed off, as described below, at certain times by valve 37 connected into fuel line 36.

In the event that the engine is idling or working with light load and part throttle, it is proposed to reduce the cubic displacement of the engine by cutting out one cylinder in each power unit. As above described, each power unit comprises two cylinders, such as 1 and 2. Therefore, it is proposed under such condition to cut out cylinder 1 of each power unit by holding exhaust valve 22 open and shutting off fuel jet 33 and spark plug 9. This can be done in any one of several ways; it can be done manually or by connections which operate off the throttle or by connections operated from the instrument board by hand. By way of example, rather than for purposes of limitation, I have shown an arrangement for cutting off cylinder 1 by the use of manifold suction. To this end there is provided a suction device comprising a housing 39, a flexible diaphragm 40 which divides the housing into chambers 41 and 42. Chamber 42 opens to atmosphere through opening 70 through which rod 48 passes with a clearance as shown whereas chamber 41 communicates with the intake passageway by means of conduit 43, one end of which is connected to the housing as at 44 and the other end of which communicates with passageway 45 in the carburetor housing. Passageway 45 communicates at one end with orifice 46 in the intake passageway on the engine side of throttle 27.

A rod 48 has one end fixed to the flexible diaphragm 40 and the other end is pivotally connected to lever 49 as at 50. Lever 49 is pivoted on support 51 as at 52. The other end of the lever 53 contacts the valve insert plate 54 and is free to move up and down in slot 55 in the valve housing. Valve 37 is connected to one end of a lever 56 pivotally supported as at 57. The other end of lever 56 is connected by link 58 with lever 49 so that whenever lever 49 is actuated to hold exhaust valve 22 open link 58 and lever 56 close valve 37 to shut off the fuel supply to nozzle 33.

Rod 48 has connected thereto a rod 59 which carries at its lower end switch contact 60 which is arranged to contact the spring leaf switch ter-

minals 61 which are connected by line 62 with the ground 63. Switch terminals 61 are connected to the wire or line 64 which carries the current from the distributor to the spark plug 9.

The operation of the engine is as follows: When the engine is idling or working with a light load and part throttle, the vacuum in the intake manifold will be high. This vacuum will be impressed upon diaphragm 40 through orifice 46, conduits 45 and 43, thus causing diaphragm 40 to raise thereby swinging lever 49 clockwise so that lever 49 opens exhaust valve 22 and at the same time acting through link 58 and lever 56 closes valve 37 to close off the fuel supply to nozzle 33. Also at this time diaphragm 40 acts through rod 59 to close switch 61 which grounds or cuts out spark plug 9.

Since the exhaust valve 22 is held open, there will be no compression or suction in cylinder 1 and therefore no pumping loss will be caused. The engine will now be operating on cylinder 2 only of each power unit. Cylinder 1 of the power unit will, of course, always be cut out at idle and the point at which cylinder 1 of the power unit is cut in will depend upon the performance and the economy of operation of the engine which is desired. To effect greatest economy it will, of course, be desirable to have cylinder 2 operate as near to maximum compression as possible at all times and to have cylinder 1 whenever it is cut in to also operate at the highest compression possible.

The operation of the engine can be described by assuming a hypothetical case where the engine has only two cylinders, each cylinder having 50 cu. in. displacement. Supposing the engine was idling, the throttles would be almost closed and the vacuum would be high at orifice 46, which would raise diaphragm 40, holding the exhausting valve 22 open, shutting off the fuel and cutting off the ignition to cylinder 1. Then supposing it was desired to pull a load with the engine, the throttle would be moved towards an open position. Naturally, the vacuum would drop at orifice 46, permitting spring 60 in the suction device to throw exhaust valve 22, spark plug 9 and fuel jet 33 back into operation. The engine would immediately change from a 50 cu. in. displacement engine into a 100 cu. in. displacement engine.

In the event it was desired to reduce the load on the engine, the throttle valves would be moved towards a closed position, which would increase the vacuum at orifice 46, throwing cylinder 1 out of operation. Cylinder 2 then would have to carry the load. Naturally, pulling a light load with cylinder 1 would require more throttle opening than pulling a light load with both cylinders, and the engine would be operating on higher compression with greater efficiency.

I do not wish to be limited to the construction shown in the drawing in carrying out my principle. In my drawing, I show one cylinder slightly leading the other. Naturally, the valve timing and ignition timing in cylinder 2 would slightly lag behind the valve and ignition timing in cylinder 1. The power pulsations would slightly overlap each other. I prefer this construction because a two row in-line engine of this type can be built making the engine only a little wider than the single row conventional in-line engine. My engine would be too long if all the cylinders were in one single row, and by setting them in two rows side by side, one must slightly lead the other. However, if the engine was built

in a radial type, one cylinder could set exactly behind the other and the pistons would operate simultaneously 100% and there would be no lag. In other words, the valve timing of the two cylinders would be identical as well as the ignition timing.

I claim:

1. An internal combustion engine comprising at least one power unit which consists of a plurality of cylinders, a piston for each cylinder, intake and exhaust ports for each cylinder, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, a source of fuel for said intake ports, and means for holding open the exhaust valve, for closing off the fuel charge and shutting off the ignition means for one of said cylinders of said power unit when only part of the potential full power of said engine is desired whereby the number of power strokes per crankshaft revolution remains the same as when all the cylinders of said power unit are operating.

2. An internal combustion engine comprising at least one power unit which consists of a plurality of independent cylinders, a piston for each cylinder, a crankshaft, connecting rods connecting each of the pistons of said power unit to the same crank-throw of the crankshaft, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means for cutting out one of the cylinders of said power unit whereby the number of power strokes per crankshaft revolution remains the same as when all the cylinders of said power unit are operating.

3. An internal combustion engine comprising at least one power unit which consists of a plurality of independent cylinders, a piston for each cylinder, a crankshaft, connecting rods connecting each of the pistons of said power unit to the same crank-throw of the crankshaft, intake and exhaust ports for each cylinder, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means for cutting out one of the cylinders of said power unit when only part of the potential power of said engine is desired whereby the number of power strokes per crankshaft revolution remains the same as when all the cylinders of said power unit are operating.

4. An internal combustion engine comprising at least one power unit which consists of a plurality of independent cylinders, a piston for each cylinder, a crankshaft, connecting rods connecting each of the pistons of said power unit to the same crank-throw of the crankshaft, intake and exhaust ports for each cylinder, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, a source of fuel for said intake ports, and means for holding open the exhaust valve and for closing off the fuel supply to one of said cylinders of said power unit when only part of the potential full power of said engine is desired whereby the number of power strokes per crankshaft revolution remains the same as when all the cylinders of said power unit are operating.

5. An internal combustion engine comprising at least one power unit which consists of a plu-

5 rality of independent cylinders, a piston for each cylinder, a crankshaft, connecting rods connecting each of the pistons of said power unit to the same crank-throw of the crankshaft, intake and exhaust ports for each cylinder, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, a source of fuel for said intake ports, and means for holding open the exhaust valve, for closing off the fuel charge and shutting off the ignition means for one of said cylinders of said power unit when only part of the potential full power of said engine is desired whereby the number of power strokes per crankshaft revolution remains the same as when all the cylinders of said power unit are operating.

6. An internal combustion engine comprising at least one power unit which consists of a plurality of cylinders, a piston for each cylinder, intake and exhaust ports for each cylinder, separate intake passageways for each of said intake ports, a throttle valve for each of said intake passageways, the throttle valves for each power unit being arranged to open and close in unison, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means for cutting out one of the cylinders of said power unit when only part of the potential power of said engine is desired whereby the number of power strokes per crankshaft revolution remains the same as when all the cylinders of said power unit are operating.

7. An internal combustion engine comprising at least one power unit which consists of a plurality of cylinders, a piston for each cylinder, intake and exhaust ports for each cylinder, separate intake passageways for each of said intake ports, a throttle valve for each of said intake passageways, the throttle valves for each power unit being arranged to open and close in unison, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, a source of fuel for said intake ports, and means for holding open the exhaust valve and for closing off the fuel supply to one of said cylinders of said power unit when only part of the potential full power of said engine is desired whereby the number of power strokes per crankshaft revolution remains the same as when all the cylinders of said power unit are operating.

8. An internal combustion engine comprising at least one power unit which consists of a plurality of cylinders, a piston for each cylinder, intake and exhaust ports for each cylinder, separate intake passageways for each of said intake ports, a throttle valve for each of said intake passageways, the throttle valves for each power unit being arranged to open and close in unison, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, a source of fuel for said intake ports, and means for holding open the exhaust valve, for closing off the fuel charge and shutting off the ignition means for one of said cylinders of said power unit when only part

of the potential full power of said engine is desired whereby the number of power strokes per crankshaft revolution remains the same as when all the cylinders of said power unit are operating.

9. An internal combustion engine comprising at least one power unit which consists of a plurality of cylinders, a piston for each cylinder, intake and exhaust ports for each cylinder, separate intake passageways for each of said intake ports, a throttle valve for each of said intake passageways, the throttle valves for each power unit being arranged to open and close in unison, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means including a suction operated device connected into the intake passageway for one of said cylinders on the engine side of the throttle valve for opening the exhaust valve and shutting off the source of fuel for one of the cylinders of said power unit whenever the manifold vacuum is less than a predetermined value.

10. The combination as claimed in claim 9 wherein the suction device is also connected into

the said intake passageway on the atmosphere side of said throttle valve.

11. An internal combustion engine comprising at least one power unit which consists of a plurality of cylinders, a piston for each cylinder, intake and exhaust ports for each cylinder, separate intake passageways for each of said intake ports, a throttle valve for each of said intake passageways, the throttle valves for each power unit being arranged to open and close in unison, valves for controlling said ports, ignition means for firing the compressed charge in each cylinder, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, a source of fuel for said intake ports, and means including a suction operated device connected into the intake passageway for one of said cylinders on the engine side of the throttle valve for opening the exhaust valve and shutting off the source of fuel for one of the cylinders of said power unit whenever the manifold vacuum is less than a predetermined value, the said suction device being also connected into the said intake passageway on the atmosphere side of said throttle valve.

MARION MALLORY.