Jan. 15, 1946. M. MALLORY 2,392,933

INTERNAL-COMBUSTION ENGINE

Filed July 26, 1943 2 Sheets-Sheet 1

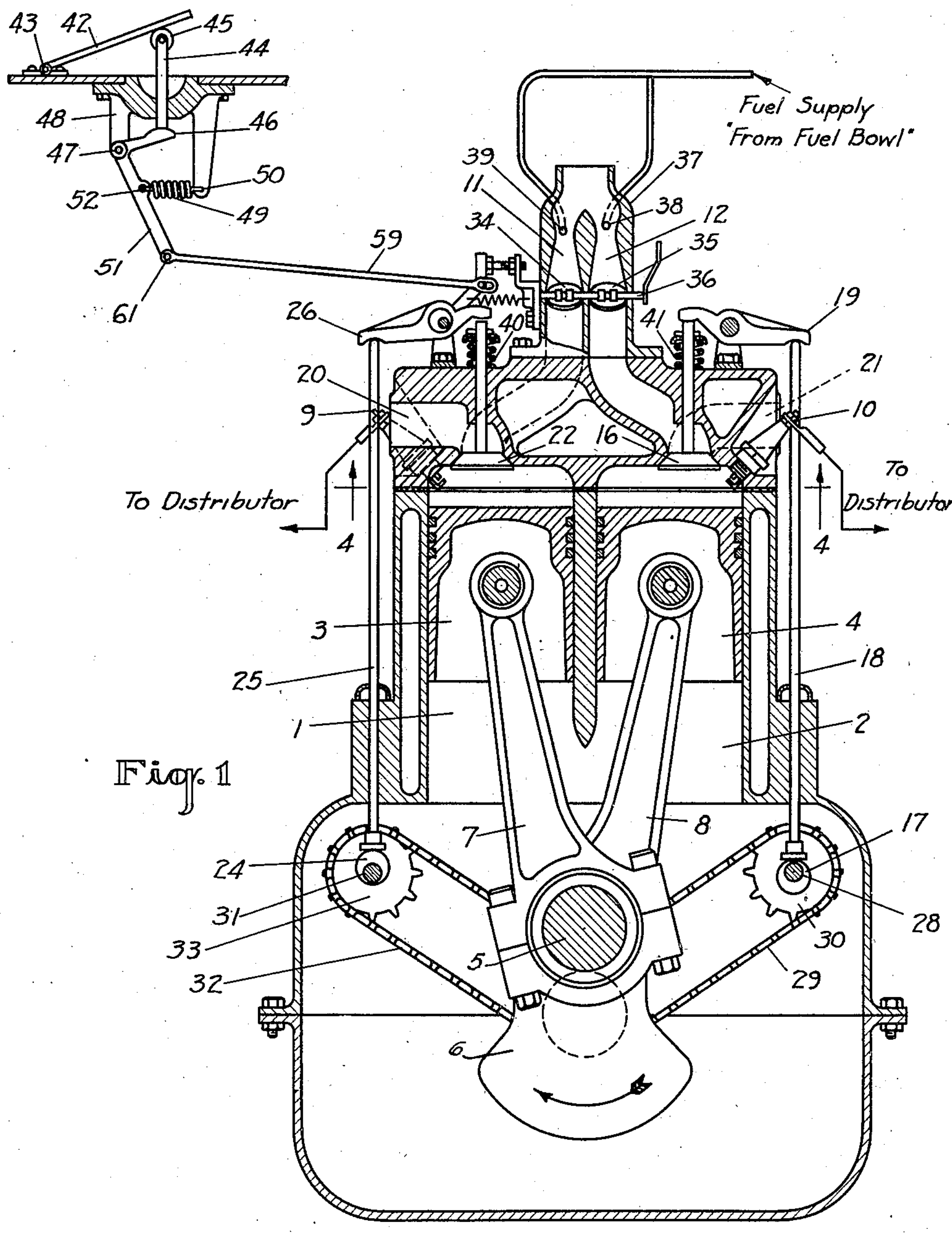

Fig. 1

INVENTOR

Marion Mallory

BY

Barnes, Kisselle, Laughlin & Raisch

ATTORNEYS

Jan. 15, 1946. M. MALLORY 2,392,933

INTERNAL-COMBUSTION ENGINE

Filed July 26, 1943 2 Sheets-Sheet 2

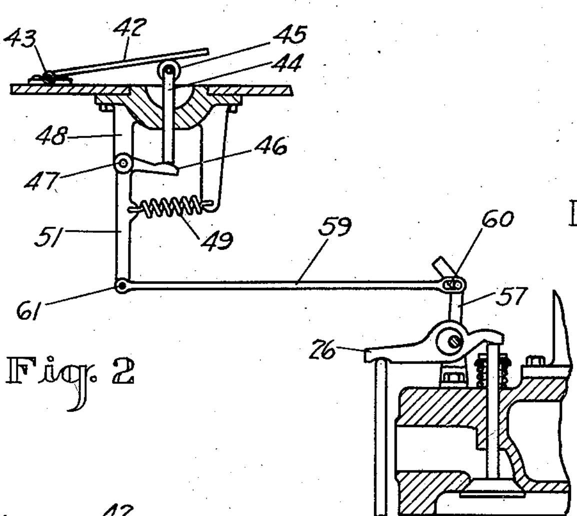

Fig. 2

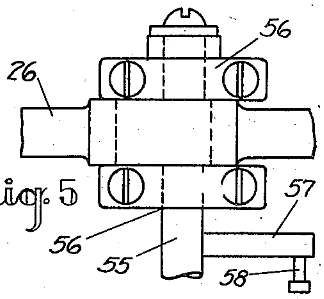

Fig. 5

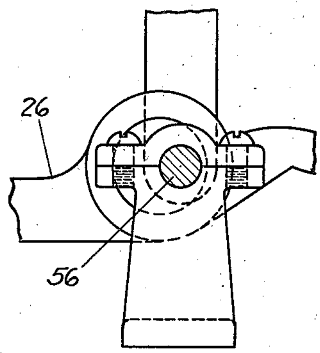

Fig. 6

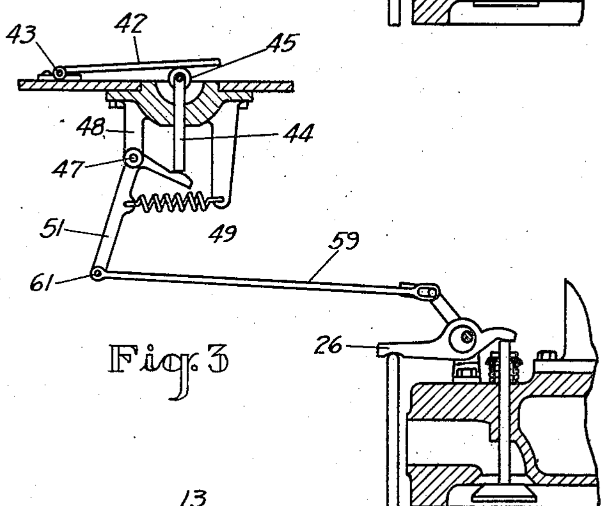

Fig. 3

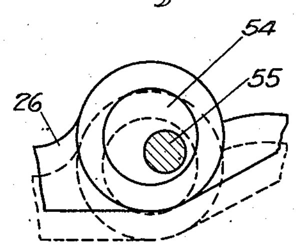

Fig. 7

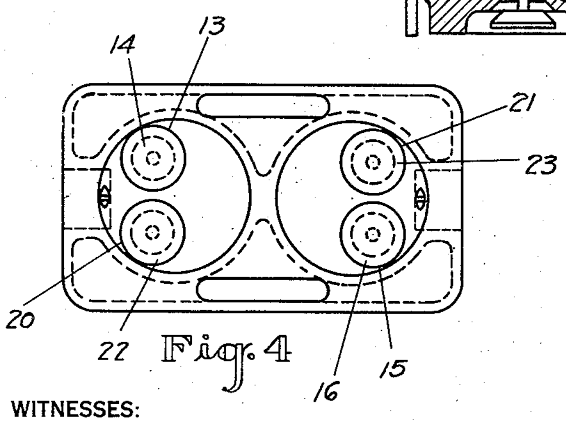

Fig. 4

WITNESSES:

INVENTOR

Marion Mallory

BY

Barnes, Kisselle, Laughlin & Raisch

ATTORNEYS.

Patented Jan. 15, 1946 **2,392,933**

UNITED STATES PATENT OFFICE

2,392,933

INTERNAL-COMBUSTION ENGINE

Marion Mallory, Detroit, Mich.

Application July 26, 1943, Serial No. 496,141

13 Claims. (Cl. 123—54)

This invention relates to an internal combustion engine.

It is well known that an internal combustion engine develops more horse power 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 would still receive power but only from half the number of cylinders. 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 drawings:

Fig. 1 is a vertical section through my engine.

Figs. 2 and 3 are detail views illustrating one mechanism for cutting in and out one of the cylinders of a power unit.

Fig. 4 is a section along the line 4—4 of Fig. 1.

Figs. 5, 6 and 7 are details showing the eccentric mounting for the valve rocker arms.

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. 4. The two intake valves 14 and 16 are opened by cams 17 (only one of which is shown) which act through the usual tappets 18 and rocker arms 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 22 and 23 are arranged to be opened by cams 24 (only one cf which is shown), the usual tappets 25 and rocker arms 26. Cams 17 are mounted on cam shaft 28 which is driven off of the main crankshaft by means of chain 29 and sprocket 30. Cams 24 are mounted on cam shaft 31 which also is driven off of the main crankshaft by chain 32 and sprocket 33.

Manifold passageway 11 is controlled by the usual butterfly throttle valve 34 and manifold passageway 12 is controlled by the usual butterfly throttle valve 35. Throttle valves 34 and 35 are fixed to a common shaft 36 and opened and closed in unison.

The engine is provided with a duplex carburetor generally designated 37, having a fuel bowl (not shown) connected with a source of liquid fuel in the customary manner. The carburetor is provided with fuel nozzles or jets 38 and 39 positioned in the venturis in passageways 11 and 12. The exhaust valves 22 and 23 are closed by the usual compression springs 40 and the intake valves 14 and 16 are closed by the usual compression springs 41.

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 keeping the exhaust valve 22 and intake valve 14 closed. This can be done in any one of several ways; it can be done manually or by connections which operate off the accelerator. By way of example rather than for purposes of illustration, I have shown an arrangement for cutting off cylinder 1 by connection with the accelerator pedal pivoted to the floor of the vehicle as at 43. Accelerator pedal 42 operates a sliding push rod 44 which carries a roller 45 at its upper end for rolling contact with the pedal 42. The lower end of push rod 44 contacts arm 46 of a bell crank lever pivoted on pin 47 carried by a fixed bracket 48. Tension spring 49 has one end connected to bracket 48 as at 50 and the other end connected to arm 51 of the bell crank lever as at 52. The rocker arms 19 and 26 for the intake and exhaust valves, respectively, of cylinder 1 are pivoted upon eccentric bearings 54 fixed on rocker arm shaft 55. Shaft 55 is journaled in bearing supports 56 so that it can be rotated to raise or lower eccentric rocker arm bearings 54. For this purpose shaft 55 is provided with a crank arm 57 having a pin 58 mounted adjacent the end thereof. A link 59 having an elongated slot 60 is interengaged in said slot by pin 58 (Figs. 2, 5). Link 59 is pivoted to bell crank arm 51 as at 61.

The operation of the engine is as follows: When the engine is idling or working with a light load and part throttle, Fig. 1, accelerator pedal 42 is in idle or part throttle position so that tension spring 49 acts through bell crank 51, link 59, pin 58 and arm 57 to rotate shaft 55 to the position shown in Fig. 1. This elevates the rocker arm bearings 54 for rocker arms 26 and 19 for cylinder 1 only of each power unit. This raised position of the rocker arm bearings 54 and the rocker arms 26 and 19 for cylinder 1 is also shown in full lines, Fig. 7. At this time valves 14 and 22 for cylinder 1 are held closed by their springs. At this time, of course, cylinder 2 operates as usual through its four-cycles but the intake and exhaust valves for cylinder 1 remain closed. Thus, on its down stroke piston 3 forms a vacuum in cylinder 1 whereas on its up stroke piston 3 is assisted by this vacuum owing to the pressure outside of the cylinder being atmospheric. Thus, the power lost on the down stroke of piston 3 tends to be compensated for on each up stroke of piston 3 as long as intake valve 14 and exhaust valve 22 for cylinder 1 remain closed.

As more power is required from the engine the accelerator pedal 42 is pressed down to open throttle valves 34 and 35 wider. When the throttle valves reach about half open position link 59 picks up crank 57 and turns rocker arm shaft 55 and its eccentric bearings 54 so that the rocker arms for the intake and exhaust valves of cylinder 1 begin to lower. As the rocker arms for cylinder 1 lower they gradually increase the amount that each valve 14 and 22 is opened on each stroke of its respective tappet. The position of the accelerator, the rocker arm and rocker arm bearings 54 at somewhat more than half throttle position is shown in Figs. 2 and 6. Further depressing of the accelerator pedal 42 opens the throttle valves still wider and acts through rocker arm shaft 55 and eccentric bearings 54 to fully lower the rocker arms for cylinder 1 at wide open throttle so that the tappets act on the rocker arms to fully open the intake valve 14 and exhaust valve 22 on their up strokes. The engine under such conditions would be operating at full or nearly full load.

In the event it is desired to reduce the load on the engine, the throttle valves will be moved toward a closed position. As the throttle valve approaches half open position spring 49, acting through bell crank arm 51, link 59, would rotate rocker arm shaft 55 to permit the valve springs to keep the intake and exhaust valves for cylinder 1 closed and thereby throw cylinder 1 out of operation. Cylinder 2 would then have to carry the load. Naturally, pulling even a light load with cylinder 2 would require more throttle opening than pulling the same load with both cylinders operating and therefore the engine would be operating on a higher compression and with greater efficiency.

In the drawings piston 3 is shown slightly leading piston 4. Naturally the valve timing and ignition timing in cylinder 2 would slightly lag behind the valve and ignition timing in cylinder 1. This arrangement of the pistons and timing is by way of illustration rather than for purposes of limitation. If the engine was built as a radial type engine, each power unit would have one cylinder set exactly behind the other and the pistons would operate together with the same valve and ignition timing.

It is understood that above I have described the preferred form and mode of operation of my engine. However, it is well within the principle of my invention to have cylinder 1 cut partly or fully into operation at other positions of throttle 35 than above described. The point at which cylinder 1 cuts in partly or fully can be varied and yet not depart from the essential characteristic of my engine, e. g., one may prefer to have throttle 35 fully or nearly fully open before cylinder 1 cuts in, or one may prefer to have cylinder 1 start to gradually cut in before half open throttle position of throttle 35 and have cylinder 1 fully cut in before throttle 35 reaches wide open position.

I claim:

1. In 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, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means for holding the intake and exhaust valves for one of said cylinders of said power unit closed whereby when only part of the potential power of said engine is desired said cylinder of each power unit can be rendered inoperative but the number of power strokes per crankshaft revolution of said engine remains the same as when all the cylinders of said power unit are operating.

2. In 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, and means for holding the intake and exhaust valves for one of said cylinders of said power unit closed whereby when only part of the potential power of said engine is desired said cylinder of each power unit can be rendered inoperative but the number of power strokes per crankshaft revolution of said engine remains the same as when all the cylinders of said power unit are operating.

3. In 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, means for opening and closing the said valves in timed relation, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means for rendering the aforesaid means ineffective to open the intake and exhaust valves for one of said cylinders of said power unit when only part of the potential power of said engine is desired whereby said cylinder is thrown out of operation and the load is carried by another cylinder of said unit.

4. In 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, means for opening said valves in timed relation, and spring means for closing said valves in timed relation, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means for rendering the aforesaid means ineffective to open the intake and exhaust valves for one of said cylinders of said power unit when only part of the potential power of said engine is desired whereby said cylinder is thrown out of operation and the load is carried by another cylinder of said unit.

5. In 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, rocker arms for opening said valves in timed relation and spring means for closing said valves in timed relation, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means for rendering the rocker arms for the valves of one of said cylinders of said power unit ineffective to open the valves of said cylinder when only part of the potential power of said engine is desired whereby said cylinder is rendered inoperative and the engine load is carried by another cylinder of said power unit.

6. In 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, an intake passageway for each of said intake ports, throttle valve means for said intake passageways, 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 effective when the throttle valve means are at idle or partly opened throttle position for holding the intake and exhaust valves for one of said cylinders of said power unit closed whereby said cylinder is rendered inoperative and the engine load is carried by another cylinder of said power unit.

7. In 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, an intake passageway for each of said intake ports, throttle valve means for said intake passageways, valves for controlling said ports, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, and means effective when the throttle valve means are at idle or partly opened throttle position for holding the intake and exhaust valves for one of said cylinders of said power unit closed whereby said cylinder is rendered inoperative and the engine load is carried by another cylinder of said power unit.

8. In 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 effective when said throttle valves are in idle or partly opened position for holding the intake and exhaust valves for one of said cylinders of said power unit closed whereby said cylinder is rendered inoperative and the engine load is carried by another cylinder of said power unit.

9. In an internal combustion engine comprising at least one power unit which consists of a plurality of 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, the cylinders of each power unit being arranged to charge, compress, fire

and exhaust approximately simultaneously, and means for holding the intake and exhaust valves for one of said cylinders of said power unit closed whereby when only part of the potential power of said engine is desired said cylinder of each power unit can be rendered inoperative but the number of power strokes per crankshaft revolution of said engine remains the same as when all the cylinders of said power unit are operating.

10. In an internal combustion engine comprising at least one power unit which consists of a plurality of 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 holding the intake and exhaust valves for one of said cylinders of said power unit closed whereby when only part of the potential power of said engine is desired said cylinder of each power unit can be rendered inoperative but the number of power strokes per crankshaft revolution of said engine remains the same as when all the cylinders of said power unit are operating.

11. In 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, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously, a rocker arm shaft for one of the cylinders of said unit having eccentric bearings thereon, rocker arms mounted for rocking on said bearings, and means for rotating said rocker arm shaft and eccentric bearings to raise said rocker arms for one of said cylinders of said power unit so that these rocker arms are ineffective to open the intake and exhaust valves for said cylinder whereby said one of said cylinders of the power unit can be rendered inoperative when only part of the potential power of said engine is desired.

12. In an internal combustion engine comprising a plurality of cylinders, a piston for each cylinder, intake and exhaust ports for each cylinder, valves for controlling said ports, and means for holding the intake and exhaust valves for one of said cylinders closed whereby when only part of the potential power of said engine is desired such cylinder can be rendered inoperative and the power lost on the down stroke of the piston for such cylinder tends to be compensated for on the up stroke of such piston while the intake and exhaust valves remain closed.

13. In an internal combustion engine comprising at least one power unit which consists of a plurality of 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, the cylinders of each power unit being arranged to charge, compress, fire and exhaust approximately simultaneously.

MARION MALLORY.