W. WALLACE.

INTERNAL COMBUSTION ENGINE.

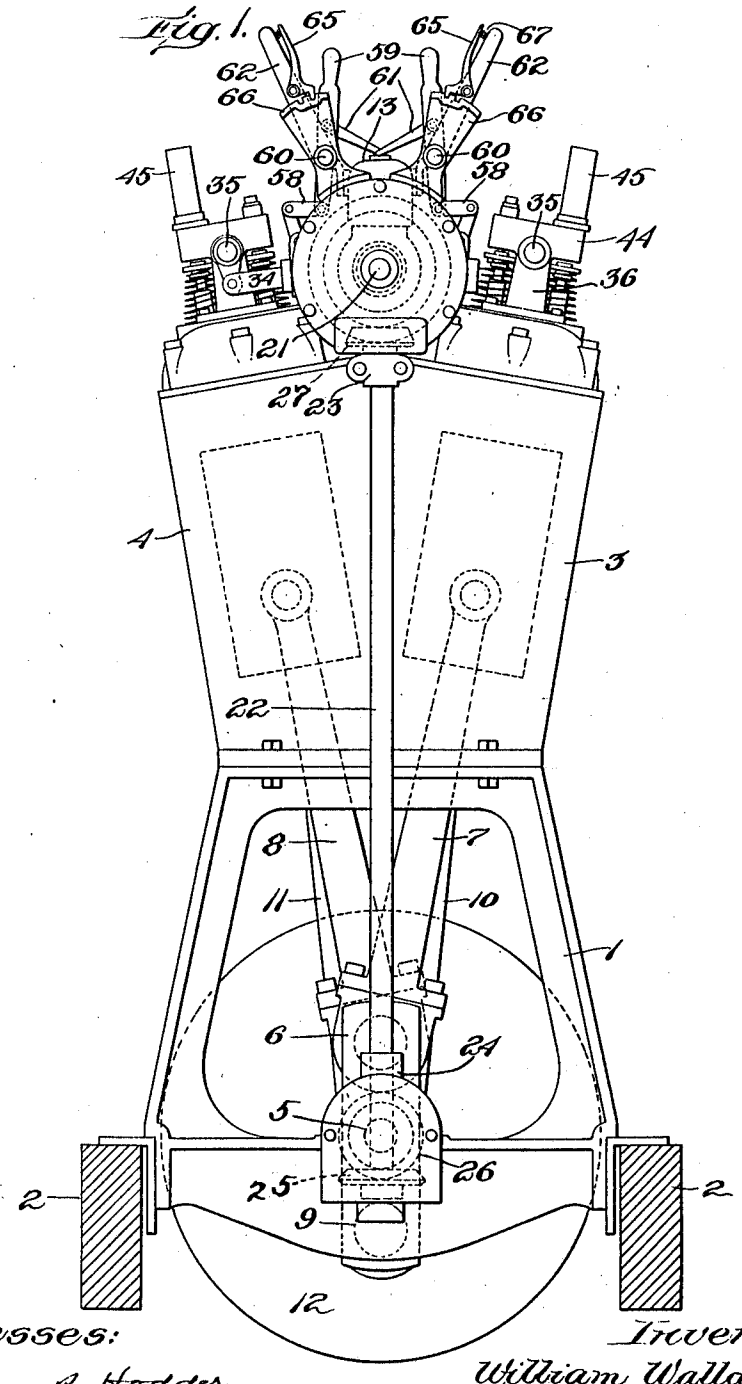
APPLICATION FILED DEC. 9, 1911.

1,048,610.

Patented Dec. 31, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

James R. Hodder

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Inventor:

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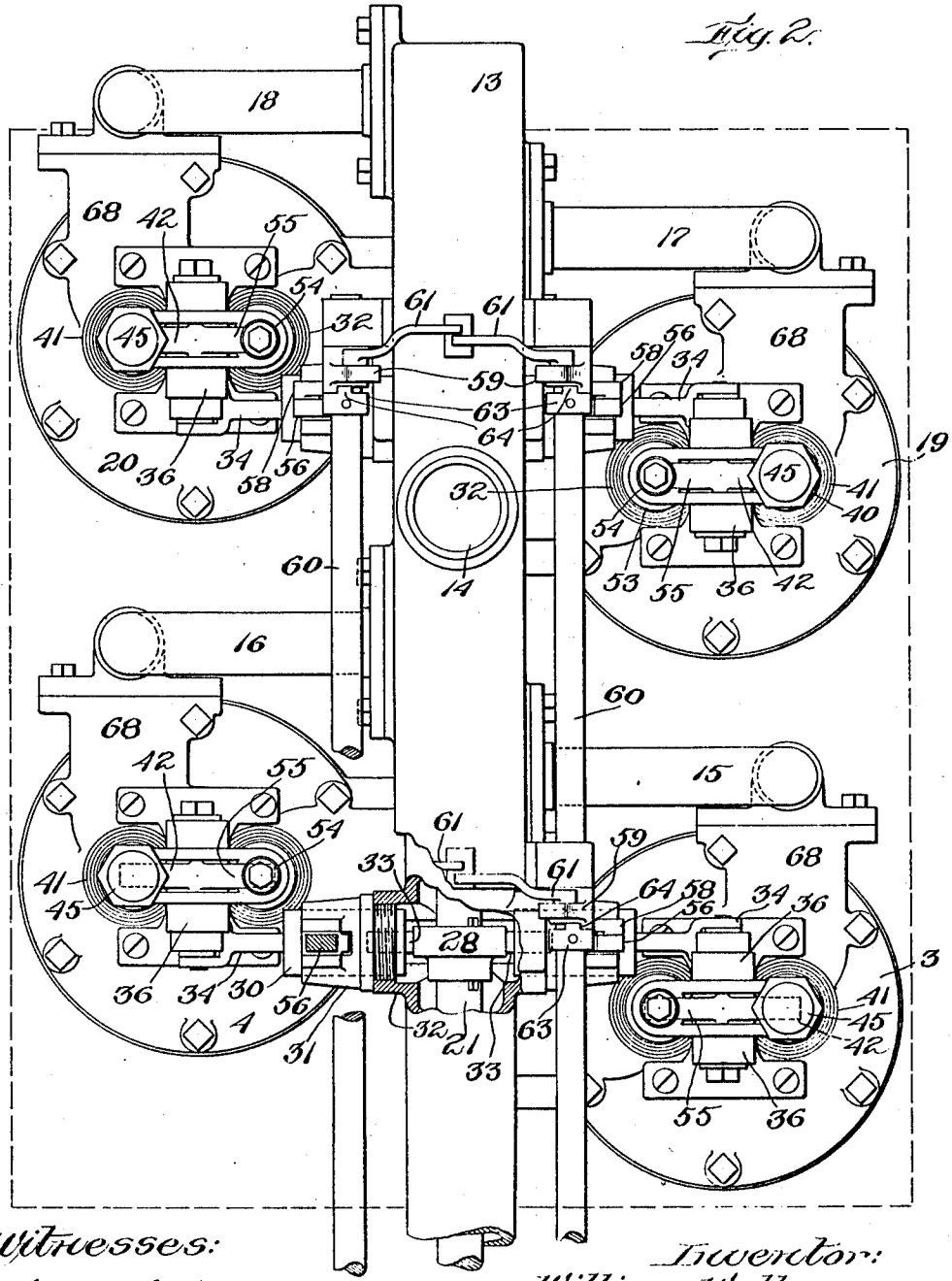
3 SHEETS—SHEET 2.

Fig. 2.



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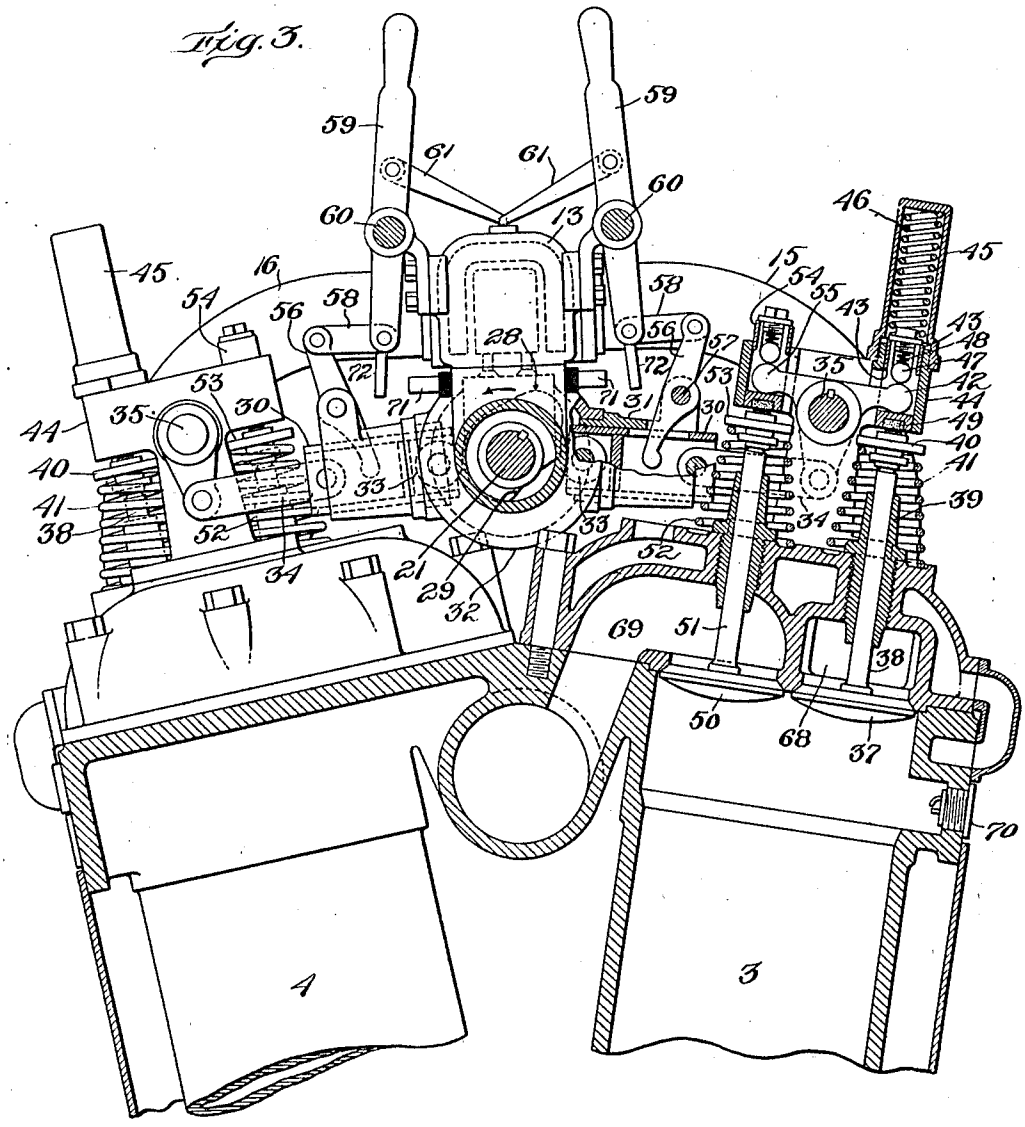
3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

WILLIAM WALLACE, OF MILTON, MASSACHUSETTS.

INTERNAL-COMBUSTION ENGINE.

1,048,610. Specification of Letters Patent. Patented Dec. 31, 1912.

Application filed December 9, 1911. Serial No. 664,816.

To all whom it may concern:

Be it known that I, WILLIAM WALLACE, a citizen of the United States, and resident of Milton, in the county of Norfolk and State of Massachusetts, have invented an Improvement in Internal-Combustion Engines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

My invention relates to internal combustion engines and particularly to engines of that type having a plurality of explosive chambers or cylinders. In explosive engines of the multi-cylinder type at present in use, it is customary to have all the explosive cylinders in the engine operate under a single controlling means and so connected and dependent upon each other that if any one cylinder or part becomes deranged or requires adjustment or repair the entire engine must be stopped.

Accordingly, one of the principal objects of my invention is to provide a single engine in which a plurality of cylinders are operatively connected to one driving shaft, with means whereby the advantages of two independent engines are substantially secured, so far as the independence of control is concerned, and the disadvantages, such as waste of space, requirement of two driving shafts, increased weight, etc., are eliminated. Chief among the features of novelty which render this result possible is the provision of means whereby each cylinder of the engine is arranged to operate either jointly with all the other cylinders, or independently thereof. For compactness the cylinders are set in staggered order and inclined or V-shaped relation to each other and to the shaft, and preferably valve controlling means is provided for permitting all the cylinders of one side to operate independently of those of the other side, when desired. Preferably also the same is true with relation to the ignition system. Therefore, if one or more cylinders of the engine should become deranged or break down, my invention provides means instantly to disconnect such cylinder or cylinders and to render the same inoperative, while the remaining cylinder or cylinders of the engine may be continuously operated. Likewise, if for any reason it is desired to operate half of the engine only, my invention provides means instantly to disconnect the entire other half, leaving one side only of the engine in operation.

Other advantages, details of construction, and combinations of parts will be hereinafter more particularly pointed out and claimed.

Referring to the accompanying drawings, Figure 1 is an end view of a preferred embodiment of my invention wherein four cylinders are employed. Fig. 2 is a plan view having a portion broken away to show the cam shaft; and Fig. 3 is a view, partly in cross section, showing the specific means to disconnect one of the cylinders.

My invention has certain special advantages applied to an internal combustion engine having a so-called V frame, and therefore it will be explained in that connection.

A framework 1 is mounted upon bed plates 2, 2 and to the upper part of the framework 1 are bolted the castings carrying the cylinders, two cylinders 3 and 4 being indicated in Fig. 1. A main driving shaft 5 has a crank 6 to which are pivotally connected piston rods 7 and 8 of the cylinders 3 and 4 respectively, and a second crank 9 is pivotally connected with the piston rods 10 and 11 of the second pair of cylinders 19 and 20. Preferably and as herein shown, the cylinders having the connecting pistons on the same crank are staggered, as clearly illustrated in Fig. 2. A fly wheel 12 is arranged near one end of the shaft 5, as is customary. Suitably arranged along the top of the cylinders is a fuel supply pipe 13 having a carbureter 14 and branch supply pipes 15 and 16 to cylinders 3 and 4 and 17 and 18 to cylinders 19 and 20 respectively. These branch supply pipes are substantially of the same length, so that each cylinder is appropriately supplied with its fuel under substantially equal conditions. Each cylinder is provided with suitable inlet and exhaust ports and with valves therefor, and to operate said valves I have provided means mounted upon a shaft 21, which shaft is suitably journaled in a casing fixed to the cylinder castings. The shaft 21 is rotated by means of a vertically arranged shaft 22, said shaft 22 being journaled in brackets 23 and 24 and having on its lower end a beveled gear 25 engaging with the beveled gear 26 on the main shaft 5, and being provided at its upper end with a bevel gear 27 engaging with a corresponding beveled gear keyed to cam shaft 21. This cam shaft 21 carries two

cams, each cam being arranged to operate an opposite pair of cylinders by regulating the inlet and exhaust valves of said cylinders. Referring to Fig. 3, wherein is shown in detail this regulating mechanism, the cam operating the valves of the cylinders 3 and 4 and its connecting mechanism will now be described. The cam, which is suitably keyed to the shaft 21, has a curved portion 28, shown in dotted line, and a concave portion 29, said cam being arranged to reciprocate a slide shown as a hollow block 30 which is mounted in a guide 31 fixed to the cam-shaft casing 32 and which slide preferably carries a roll 33 to bear upon the cam. To the other end of the slide 30 is pivotally connected a link 34, having its outer end pivoted to a three-armed lever mounted on the shaft 35, which shaft is suitably mounted in brackets 36 bolted to the top of the cylinder head.

As already pointed out, my invention resides, not so much in any particular engine mechanism *per se*, but rather in the provision of means whereby the various cylinders and their correlated parts may be independently controlled, etc., as will appear more at length farther along in this description; but before explaining my invention in detail it is necessary to describe the further details of the general engine construction. For this purpose, I have chosen to illustrate one type of spring controlled valve mechanism, but it will be understood that my invention is not confined to this type.

The cylinder 3 is shown with an inlet valve 37 to which is fixed a valve stem 38 arranged to slide through a guide 39 threaded through the cylinder head casting, and to the upper end of said valve stem 38 is affixed a flanged nut 40. A coiled spring 41 is arranged to bear between this flanged nut 40 and the top of the cylinder head casting, which spring normally serves to hold the valve stem 38 in upward position and consequently the valve 37 in closed position. One arm 42 of the three-armed lever mounted on the stud 35 is arranged loosely in a slot in a sliding block 43 which is vertically positioned in the path of the valve stem 38, the sliding block 43 being held in a guide 44 which is a part of the bracket 36. Also attached to the bracket 36 is a threaded sleeve 45 containing a strong coiled spring 46 bearing in the bottom of said sleeve 45 and against the block 43, tending to force said block downwardly and normally acting to compress the spring 41 and therefore to move the valve stem 38 downwardly and hold the inlet valve 37 open. Preferably the sliding block 43 wherein the arm 42 is arranged has a member 47 held in engagement with said arm 42 by means of a small spring 48, as clearly shown in Fig. 3. This construction prevents "backlash," so called, in the oscillation of the arm 42. The block 43 also is provided with a socket in its lower end in which a rubber or fiber plug 49 is positioned in order to yieldingly engage the flanged nut 40 on the upper end of the valve stem 38, and to eliminate noise.

The exhaust valve 50 has a valve stem 51 sliding through a valve stem member, and a spring 52 normally holds the valve stem 51 upwardly through its bearing on a flanged nut 53 in a manner similar to that just described in connection with the valve stem 38. A sliding block 54 is also vertically positioned over the valve stem 51, and the other arm 55 of said three-armed lever is positioned in a slot in this block 54. Means to prevent "backlash" on the arm 55 is also provided, which means is identical with that just described in connection with the arm 42 of said three-armed lever.

The rotation of the cam shaft 21 brings the projecting part 28 of the cam against the roll 33, forcing the sliding block 30 outwardly and rocking the three-armed lever so as to depress the arm 55, causing the block 54 to slide downwardly and move the valve stem 51 to open the exhaust valve 50. Meanwhile the arm 42 is elevated so that the spring 41 normally holds the inlet valve 37 closed. As the projecting portion 28 of the cam passes the roll 33 and the concave face 29 of said cam is moved into engagement with the roll, the strong spring 46, acting through the block 43 upon the arm 42 of said three-armed lever, rocks said lever and forces the slide 30 to move to the left, as shown in Fig. 3, holding the roll 33 into engagement with the concave surface 29 of the cam. The spring 46 also overbalances the valve spring 41, compressing said valve spring and, moving the valve stem 38 downwardly, opens the inlet valve 37. Meanwhile the upward movement of the arm 55 allows the spring 52 to close the exhaust valve 50. The cam surfaces 28 and 29 serve to operate the valves of the opposite cylinder 4 in an exactly similar manner to that just described in connection with the cylinder 3.

While my invention of providing means to render a cylinder inoperative during the continued operation of the other cylinders of the engine may be carried out in a wide variety of embodiments, I have herein illustrated a preferred embodiment thereof. In the engine of the drawings provision is made for moving the valve operating mechanism beyond the action of the actuating cam which normally operates the same. As herein shown, the slide 30 may be moved beyond the action of its operating cam through the rocking of a lever 56 which is pivotally mounted at 57 on the guide 31 and has its lower portion arranged to project through a slot in the slide 30, which slot is of sufficient length so that

the ordinary movement of the block 30 will bring no part of it in contact with the lever 56. The lever 56 may be operated by means of a link 58 connecting the upper arm of the lever to a hand lever 59, which may be conveniently mounted on a stud 60 affixed to the side of the inlet pipe 13. Movement of said handle 59 to the right in Fig. 3 rocks the lever 56 until the lower arm of said lever engages either the end wall of the slot in the slide 30 or a portion of the link 34 and thereby moves and holds the slide 30 in its extreme outward position, compressing the spring 46 and thus holding the inlet valve 37 of the cylinder 3 closed and the exhaust valve 50 open. It will be readily seen that the cylinder 3 is thus rendered inoperative while the remaining cylinders of the engine may be continuously operated. Thus the parts of the cylinder 3 may be adjusted or repaired during the continuous operation of the other cylinders of the engine. If desired, a locking pawl 61 may be pivotally attached to the handle 59 to hold said handle in desired position, the free end of said pawl being in engagement with a rack or notch in any suitable manner.

Mechanism to render each cylinder inoperative similar to that just described is preferably arranged upon each cylinder, but, as it may be desired to cause a plurality of cylinders to be rendered inoperative quickly, I have provided means to throw out of operation all the cylinders upon one side of the engine herein shown, although such means would be equally applicable to an indefinite number of cylinders in a multi-cylinder engine. Preferably the shaft 60 extends for practically the entire length of the engine over each cylinder on one side, and, by suitable connections upon said shaft 60, the handle 59, to render the cylinder 3 inoperative, and the corresponding handle to render the cylinder 19 similarly inoperative, may be actuated by a partial rotation of the shaft 60.

Referring to Fig. 1, the shaft 60 is shown with a handle 62 keyed or otherwise affixed upon its end portion so that said shaft 60 may be given a partial turn by suitable manipulation of the handle 62. A collar 63, (see Fig. 2) which may be affixed to the shaft 60 by means of a set screw, is positioned in proximity to the handle 59, and said handle is provided with a hub having a shoulder 64 to engage a corresponding shoulder on the collar 63. Movement of the lever 62 and partial rotation of the shaft 60 to the right in Fig. 1 operates the handle 59 through the engagement of the shoulders on the collar 63 and the handle 59, as will be readily understood. A similar connection between the shaft 60 and the handle to operate the disconnecting mechanism for the cylinder 19 is also provided so that, by a partial turn of the shaft 60, both cylinders 3 and 19 are instantly rendered inoperative, while the cylinders on the other side of the engine may continue in operation. In order to hold the shaft 60 in desired position, a locking device is arranged upon the handle 62, said device comprising a member 65 pivotally mounted on the handle 62 and arranged to engage teeth in a bracket 66, which bracket is affixed to the journal bearing of the cam shaft 21. The device 65 is normally held in engagement with the notch by means of a spring 67. Preferably a similar device is also provided to operate the mechanism for rendering the cylinders 4 and 20 inoperative when desired.

In order to disconnect the spark plug at the same time that a cylinder is "cut out", I preferably provide an automatic arrangement which will render inoperative the spark plug of a cylinder by the same movement which renders said cylinder inoperative. This means comprises a fixed and a movable contact, the fixed contact being conveniently attached to but insulated from the casing for the cam shaft 21, said fixed contact being indicated in Fig. 3 at 71, and the movable contact being indicated at 72, and comprising a short extension of the lower arm of the lever 59. When the lever 59 is swung to render inoperative the cylinder 3, the extension 72 will engage with the fixed contact 71 and automatically short circuit the current from the spark plug.

In order to simplify the drawings, the usual oiling attachments have been omitted and detailed description of the operation of the piston, spark plug, exhaust, etc., have also been omitted, the operation of internal combustion engines being well known. Fig. 3 clearly illustrates the inlet port 68, exhaust port 69 and spark plug 70, and it is believed that the operation of the engine will be readily understood.

By the operation of the hand lever 59, the cylinder 3 will be operatively disconnected from the rest of the engine, and this cylinder may therefore be "cut out" at any time, either during the continuous operation of the engine or before said engine is started. Also, if a cylinder is rendered inoperative during the continuous operation of the engine and the desired adjustment or repair made thereto, it may be instantly again thrown into operation by appropriate movement of the disconnecting handle so that the valve operating mechanism will be no longer withheld from the actuation of its operating cam.

It will be seen that I have provided simple and efficient means, in an internal combustion engine having two or more cylinders, to throw out of operation any cylinder which it is desired to render inoperative for any purpose. Also, in an engine having

four or more cylinders, I have provided means to render inoperative all the cylinders on one side by a single operation. In either case, a part of the engine may be in continuous running operation while another part is inoperative and I believe that this feature is a distinct novelty in the art and I therefore desire to claim the same broadly.

It will also be seen that my invention affords an engine of much greater reliability than has been possible heretofore, since in case of the derangement of any one cylinder, that cylinder may be disconnected without any other result than merely decreasing the power of the engine. It is also an important advantage of my invention that adjustments and repairs may be made to the engine during its continuous operation. Thus, for example, should the spark plug need attention in all the cylinders of the engine, it is practicable to disconnect one cylinder, adjust the spark plug, throw said cylinder again into active operation and disconnect a second cylinder and so on, so that each cylinder is successively fixed during the continuous operation of the engine.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An internal combustion engine, comprising a plurality of pairs of explosive cylinders arranged in a V-frame, a single system of valve mechanism and fuel supply pipes disposed above said V-frame, an exhaust pipe common to all said cylinders arranged between the cylinders forming the V-frame, means to operate the engine, and means to operate the cylinders forming either side of said frame independently of those forming the other side.

2. An internal combustion engine, comprising a plurality of pairs of explosive cylinders, the cylinders of each pair being set obliquely to each other, inlet and exhaust ports for each cylinder, inlet and exhaust valves for said ports, means to actuate said valves and to operate said engine, and mechanism to throw simultaneously by means of a single movement, the valves of a plurality of cylinders into such position that said cylinders will be inoperative during the continuous operation of the engine.

3. An internal combustion engine, comprising a plurality of pairs of cylinders, the cylinders of each pair being set obliquely to each other, inlet and exhaust ports for each cylinder, valves for said ports, means to explode a charge in each cylinder, a cam shaft having a cam thereon in operative connection with means to control the valves of each pair of cylinders, in combination with means to disconnect a cam from the valve controlling means of either cylinder of any pair, while said cam continues to operate the remaining cylinder of such pair.

4. An internal combustion engine, comprising a plurality of cylinders, inlet and exhaust valves for each cylinder, a cam shaft having a cam to operate the valves for each cylinder, a sliding member in engagement with said cam connected with one arm of a three-armed lever, said lever being constructed and arrranged to control the operation of said valves, in combination with means to move said sliding member out of engagement with its actuating cam whereby the cylinder is rendered inoperative.

5. An internal combustion engine, comprising a plurality of pairs of cylinders, the cylinders of each pair being set obliquely to each other, a driving shaft common to all of said cylinders, valve mechanism and ignition means common to all of said cylinders, and means to render all the cylinders of successive pairs on either side of the engine operative and the cylinders on the other side of the engine inoperative.

6. An internal combustion engine, comprising a plurality of pairs of cylinders, the cylinders of each pair being set obliquely to each other, a driving shaft common to all of said cylinders, valve mechanism and ignition means common to all of said cylinders, and manually controlled means to render all the corresponding cylinders of the successive pairs on either side of the engine operative, while leaving the cylinders on the other side of the engine inoperative.

7. An internal combustion engine, comprising a plurality of cylinders, inlet and exhaust valves for each cylinder, a cam shaft and a cam thereon to actuate one arm of a three-armed lever for operating said valves, together with means normally acting on one arm of said lever to maintain the lever in operative relation with said cam, in combination with means to oscillate said lever out of range of the actuation of said cam.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

WILLIAM WALLACE.

Witnesses:
JAMES R. HODDER,
WM. P. MCCRATE.