March 25, 1924. 1,488,285

H. E. RHOADS

VALVE OPERATING MECHANISM

Filed Feb. 6, 1919 2 Sheets-Sheet 1

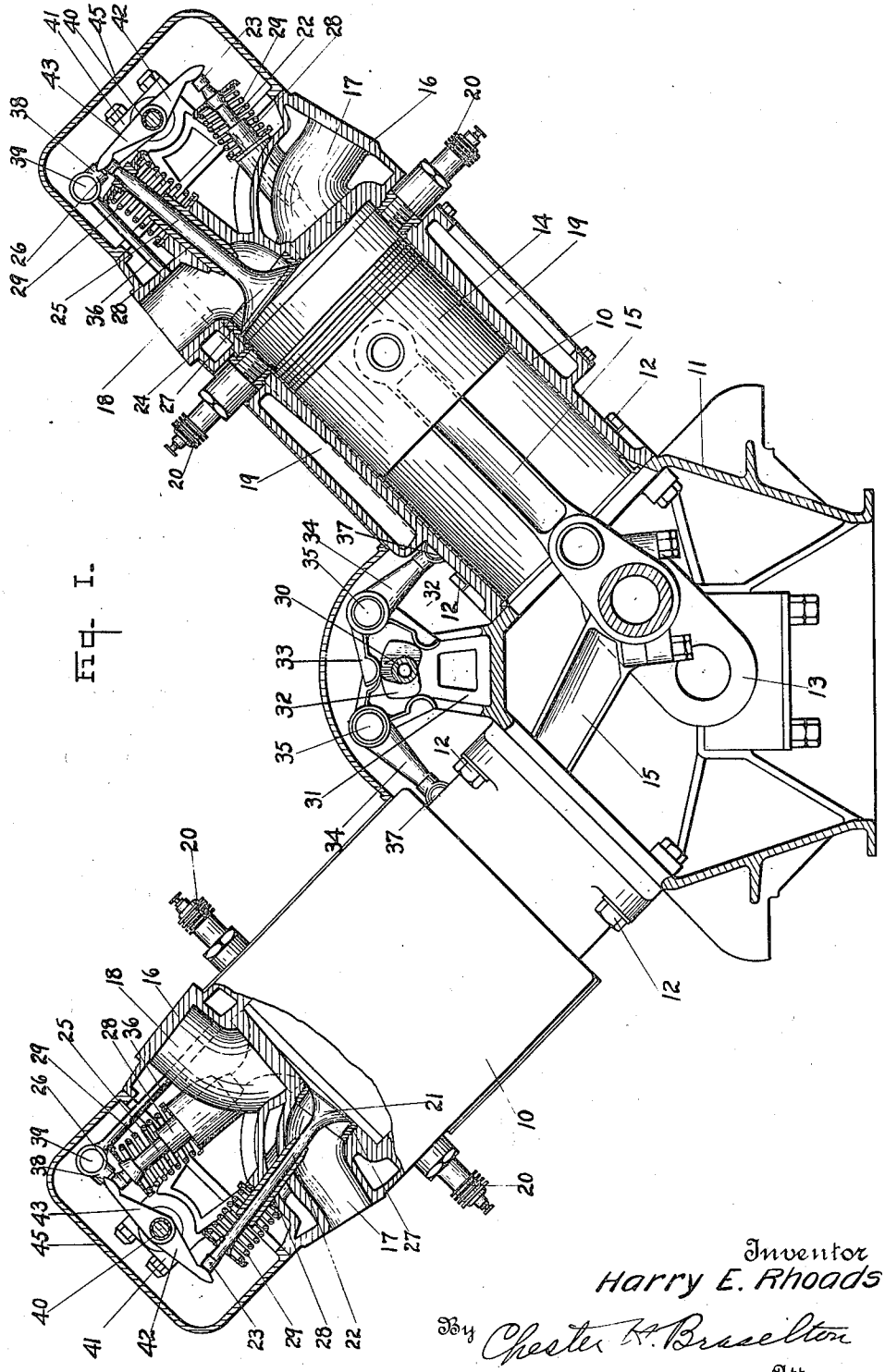


FIG. 1.

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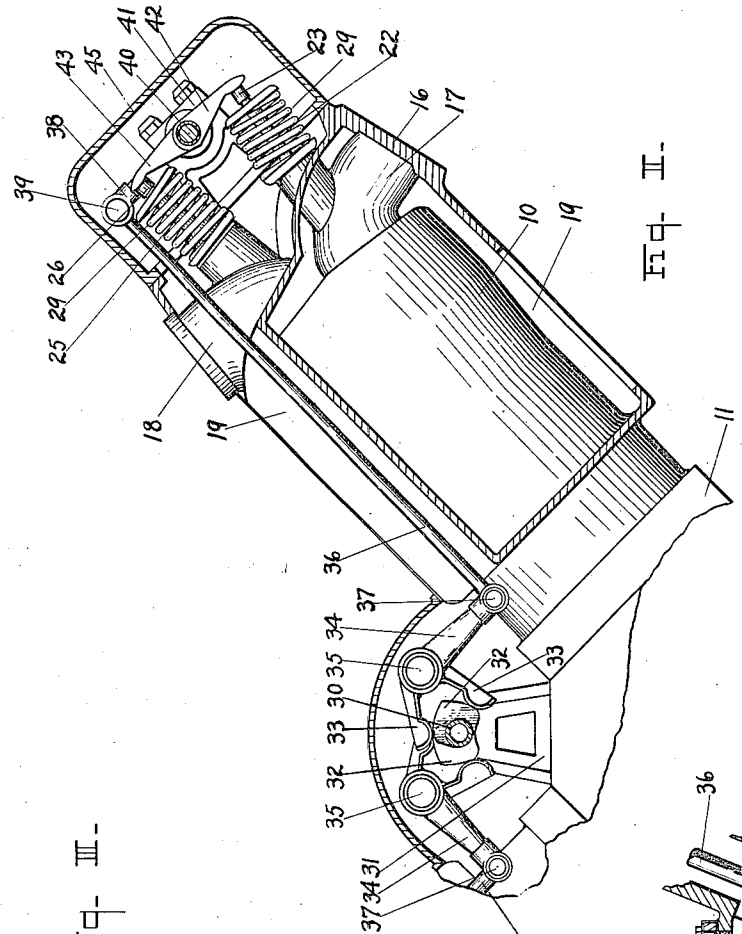


Fig. II.

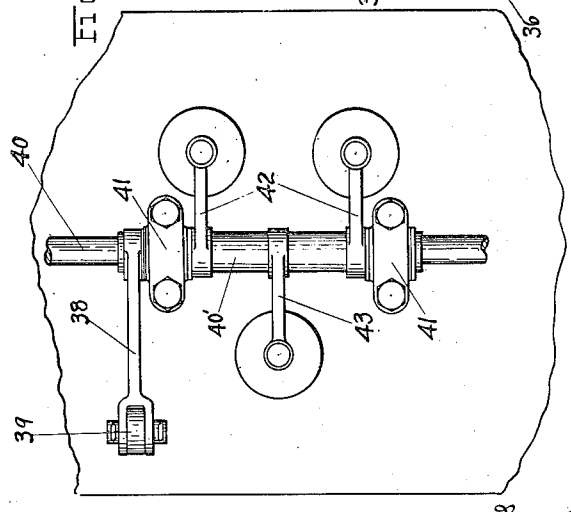


Fig. III.

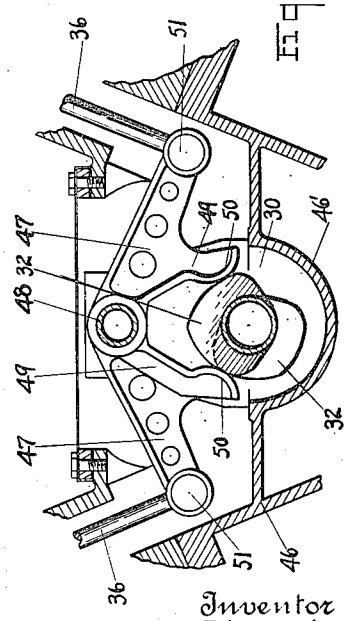


Fig. IV.

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Patented Mar. 25, 1924. 1,488,285

UNITED STATES PATENT OFFICE.

HARRY E. RHOADS, OF TOLEDO, OHIO, ASSIGNOR TO THE WILLYS-OVERLAND COMPANY, OF TOLEDO, OHIO, A CORPORATION OF OHIO.

VALVE-OPERATING MECHANISM.

Application filed February 6, 1919. Serial No. 275,466.

To all whom it may concern:

Be it known that I, HARRY E. RHOADS, a citizen of the United States, residing at Toledo, county of Lucas, and State of Ohio, have invented certain new and useful Improvements in Valve-Operating Mechanism, of which I declare the following to be a full, clear, and exact description.

This invention relates to internal combustion engines, and particularly to the valve operating mechanism therefor.

One object of the invention is to provide a mechanism of the character described which is of simple construction, and efficient in operation.

A further object of the invention is to provide a mechanism of the character described wherein the oppositely positioned valves of each cylinder are oppositely inclined with respect to each other, and may be readily and conveniently operated in such a manner that the thrust is exerted thereon in a direction axially of the several valve stems.

A further object of the invention is to provide a mechanism of the character described wherein the valve operating mechanism for each cylinder is positively operated in two directions for axially actuating both sets of valves.

A further object of the invention is to provide a valve actuating mechanism so constructed as to operate the valves on both sides of each cylinder by a single cam.

Further objects of this invention relate to economies of manufacture and details of construction as will hereinafter appear from the detailed description to follow.

The objects of the invention are accomplished in one instance by the devices and means described in the following specification, but it is evident that the same may be varied widely without departing from the scope of the invention, as pointed out in the appended claims.

A structure constituting one embodiment of the invention, which may be the preferred, is illustrated in the accompanying drawings forming a part hereof, in which:

Fig. I is a front elevational view, partially in section, of an internal combustion engine of the V-type, illustrating the relative position of the operating parts for axially actuating the valves of each cylinder.

Fig. II is a detail elevational view partially in section of a portion of an internal combustion engine of the V-type, illustrating the relative position of certain of the operating parts for operating the valve actuating mechanism.

Fig. III is a top plan view showing the top of the cylinders and the relative position of the intake and exhaust valves.

Fig. IV is a detailed sectional view showing a modified form of mounting for the cam shaft, and the arrangement of the co-operating parts.

Referring to the drawings, the engine comprises a plurality of cylinders 10 which may be arranged in rows or series, although it is to be understood that the valve operating mechanism is quite as applicable to an engine having the cylinders uprightly arranged as to an engine of the type illustrated herewith. The various cylinders of each row are shown herewith as being oppositely inclined with respect to the cylinders of the opposite row, according to the usual construction of engines of this type. The cylinders of the two rows are shown as oppositely inclined with respect to each other in such a manner that the central axes of two corresponding cylinders are positioned at an angle with respect to each other. The various cylinders are positioned upon a crank shaft casing 11, to which they are firmly secured in the usual manner by means of bolts 12. A crank shaft 13 is revolubly mounted within the crank shaft casing in the usual manner. Pistons 14 mounted within the cylinders 10 are each connected to the crank shaft by means of a connecting rod 15. Cylinder heads 16 are positioned upon the oppositely inclined rows of cylinders and firmly secured thereto in any well known manner, said heads being provided with a pair of exhaust passages 17 and an intake passage 18 for each cylinder. Each of the cylinders is provided with a water jacket 19 of the usual construction, and carries the usual spark plugs 20 properly located in the walls thereof near the upper portion of each cylinder.

Each cylinder is provided with a pair of exhaust openings or passages 17, near the outer side thereof, within each of which is positioned an exhaust valve 21 provided with a valve stem 22 extending upwardly therefrom, and being provided at its upper extremity with a head 23. Each of the cylinders is similarly provided with an inlet passage 18 adapted to be closed by an inlet

valve 24, which is provided with a valve stem 25 extending upwardly therefrom and carrying a head 26 at its upper extremity. The inlet and exhaust passages are each provided with a seat 27, upon which the several valves are adapted to rest. Valve sleeves 28 are provided within which the stems of the several valves are slidably mounted and extend upwardly therefrom. A coiled compression spring 29 surrounds the upper extremity of each valve and has its lower end seated upon a portion of the casing, its upper end bearing against a cup-shaped washer carried by the valve stem.

A cam shaft 30 is suitably mounted in brackets 31 carried by the crank shaft casing, and extends in a direction parallel to that of the engine crank shaft from which it is driven in any suitable manner at a speed proportionate to the speed of the crank shaft. The said cam shaft is provided with a plurality of cam elements 32 which are adapted to co-operate with the yoke shaped ends 33 of rocker arms 34 which are pivotally mounted at 35 upon opposite sides of the cam shaft so as to positively actuate the rocker arms 34 in opposite directions. A rod 36 is pivotally connected to each of the rocker arms at 37, each of the rods 36 being pivotally connected at its opposite end to a lever arm 38, as at 39. Each arm 38 is firmly secured to a rocker sleeve 40′ carried by the shaft 40 and rotatably mounted in bearings 41 positioned above each cylinder in such a manner that the sleeve 40′ is positioned between the oppositely inclined valve stems carried by the inlet and exhaust valves of each cylinder. A pair of outwardly extending arms 42 and an inwardly extending arm 43 are firmly secured to the sleeve 40′ and adapted to be oscillated therewith. The ends of the outwardly extending arms 42 are so positioned as to rest upon the head portions 23 of the valve stems carried by the exhaust valves of the cylinders. In a similar manner the inwardly extending arm 43 is positioned above and rests upon the head 26 of the valve stem carried by the intake valve of each cylinder. A casing 45 is secured to each cylinder head casing and serves to house the valve stems projecting above the cylinder head and the operating mechanism associated therewith.

In the modified form of cam shaft shown in Fig. IV, the intermediate casing portion 46 is provided with a recessed portion 46′ for the reception of the cam shaft 30 and cam elements 32 carried thereby, which are similar in all respects to the cam shaft and cam elements illustrated in the other figures of the drawings. In this modified form the rocker arms 47 employed for operating the valves of both rows or series of cylinders are pivotally mounted upon a common pivot point 48, positioned above the cam shaft and in substantially the same vertical plane therewith. Each rocker arm 47 is provided with a yoke shaped extension comprising arms 49 provided with circular bearing portions 50 which are adapted to rest against the faces of the cam elements so that the rocker arms will be positively actuated by the cam elements in both directions upon rotation of the cam shaft. Each of the rocker arms 47 is pivotally connected as at 51 to a rod 36 in a similar manner to that in which the rocker arms shown in Fig. II are connected to the rod 36.

In Figs. I to III inclusive the invention is illustrated as applied to an eight cylinder engine while the form shown in Fig. IV illustrates a manner of mounting the valve actuating mechanism which may be employed with advantage in employing the improved valve operating mechanism in connection with a twelve cylinder engine.

In the operation of the mechanism shown herewith, the cam shaft is rotated from the main crank shaft of the engine in any suitable manner so as to give it a speed of rotation proportionate to that of the engine crank shaft. As the cam shaft is rotated, the double acting cam elements 32 being constantly in contact with the forked ends of the rocker arms will tend to oscillate each rocker arm in alternate directions upon its pivot point 35, and consequently the connecting means 36 and 38 actuated thereby will rock the sleeve 40′ and the fixed arms 42 and 43 carried by the sleeve. As the arms 42 are depressed, they will tend to force the valve stems 22 and the valves carried thereby in a downward direction against the tension exerted by the springs 29 and thus open the exhaust ports to permit the discharge of the combustion products from the engine. As the shaft 35 is rotated in the opposite direction, the arm 43 will be depressed, thus causing the inlet valve to open and permit fuel to be drawn into the engine cylinder.

It will be observed that in the construction shown herewith, the rocker arms are positively operated in both directions for the purpose of rotating the rocker sleeve 40′ to positively operate either the inlet or the exhaust valves. This results in greatly simplifying the usual structure wherein separate operating mechanism is necessary to be employed for the purpose of operating the inlet and exhaust valves. By arranging the inlet and exhaust valves in such a manner that they are inclined with respect to each other, and their valve stems diverge outwardly, the arms 42 and 43 rotating about a common center are enabled to exert a pressure upon the upper ends of the several valve stems in a direction substantially along the longitudinal axis of each valve stem,

thus avoiding binding or bending of the valve stems within the sleeves.

By employing the double acting cam, actuating means shown herewith both the inlet and exhaust valves carried by each cylinder are operated by a single cam and its connecting mechanism, thus avoiding duplication of the cams and connections for actuating the oppositely positioned valves. It is obvious, particularly from the structure as shown in Figures I to III inclusive, that this double acting cam device for actuating the oppositely positioned valves may be applied to an engine having the cylinders arranged in a single row or series quite as readily as to an engine of the V-type and without any substantial alteration of the structure shown herewith.

While I have shown and described in considerable detail a specific embodiment of my invention, it is to be understood that this showing and description is illustrative only and for the purpose of rendering my invention more clear, and that I do not regard the invention as limited to details of construction illustrated or described, nor any of them, except in so far as I have included such limitation within the terms of the following claims, in which it is my intention to claim all novelty inherent in my invention broadly as well as specifically.

What I claim as new and desire to secure by Letters Patent is:

1. In an internal combustion engine, intake and exhaust poppet valves, a rocker pivotally mounted between said valves adapted to open them alternately, an engine driven shaft, a cam thereon, a pivotally mounted rocker arm having a pair of contact arms rigid with respect to each other arranged to be engaged one at a time by said cam, and an operative connection between said arms and said rocker.

2. In an internal combustion engine, an engine driven shaft, a cam thereon, a rocker arm having bifurcated ends straddling the shaft with the bifurcations arranged to be engaged one at a time by said cam, intake and exhaust valves and means operated by said rocker arm for actuating both of said valves.

3. In an internal combustion engine, intake and exhaust valves, a rocker having arms adapted to open said valves alternately, an engine driven shaft, a cam thereon, a second rocker having bifurcated ends straddling said shaft with the bifurcations arranged to be engaged alternately by said cam, and an operative connection between said two rockers.

4. In an internal combustion engine, intake and exhaust valves, common means operative in opposite directions for opening said valves alternately, an engine driven shaft, a cam thereon, said means carrying a pair of contact arms rigid with respect to each other arranged to be engaged one at a time by said cam for actuating said valve opening means.

5. In an internal combustion engine, intake and exhaust valves, common means operative in opposite directions for opening said valves alternately, an engine driven shaft, a cam thereon, said means carrying a pair of contact arms rigid with respect to each other arranged to be engaged one at a time by said cam for actuating said valve opening means and to remain out of contact with said cam during a portion of each revolution of said shaft.

6. In a multi-cylinder internal combustion engine of the V type, a cam shaft mounted between the cylinders, one cam on said shaft for each cylinder, an intake and an exhaust valve for each cylinder, common means for each cylinder operative in opposite directions for opening said valves alternately, said means comprising a rocker arm having a pair of contact arms rigid with respect to each other arranged to be engaged one at a time by the cam for said cylinder for actuating said valve opening means.

In testimony whereof, I affix my signature.

HARRY E. RHOADS.