R. S. MOORE & J. L. SIMMONS.

GAS ENGINE.

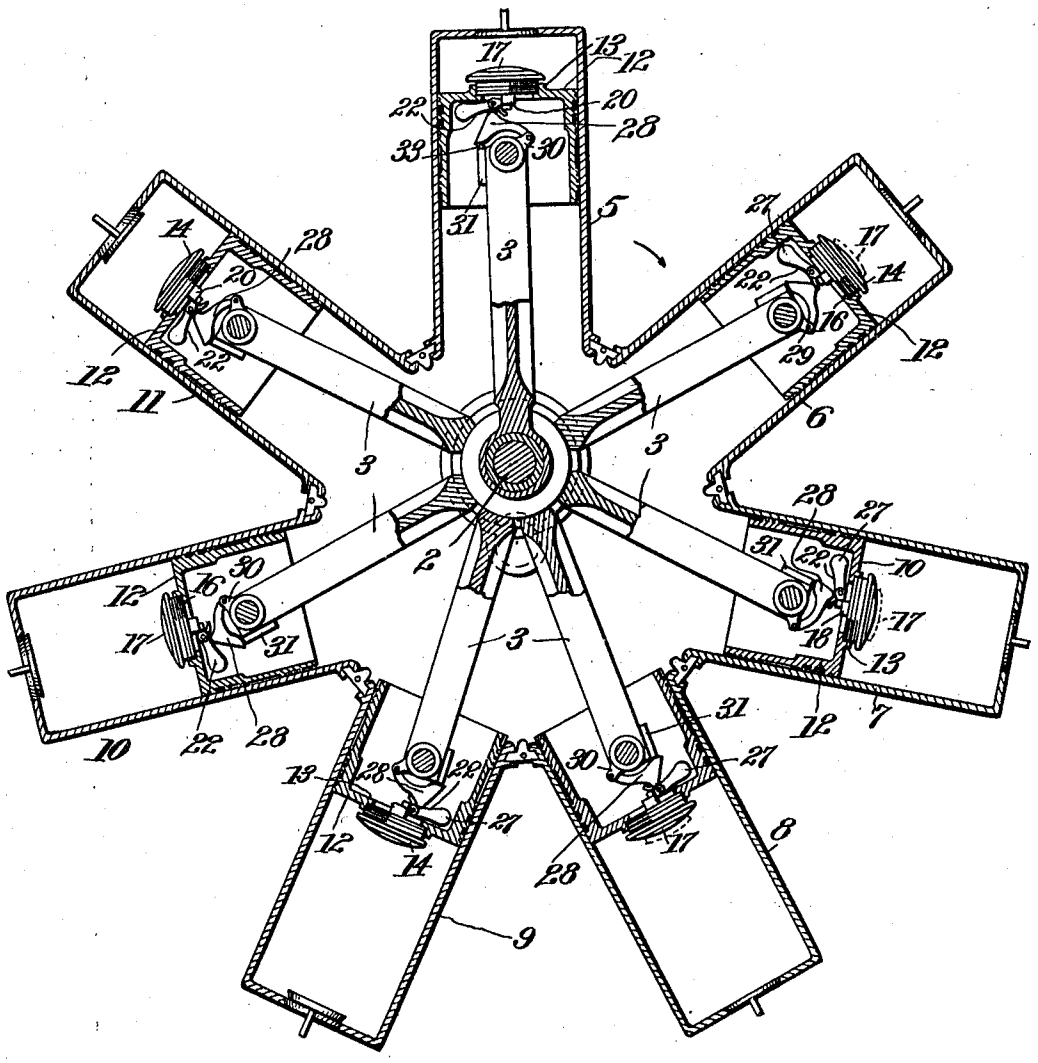
APPLICATION FILED MAR. 13, 1911.

1,004,457.

Patented Sept. 26, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



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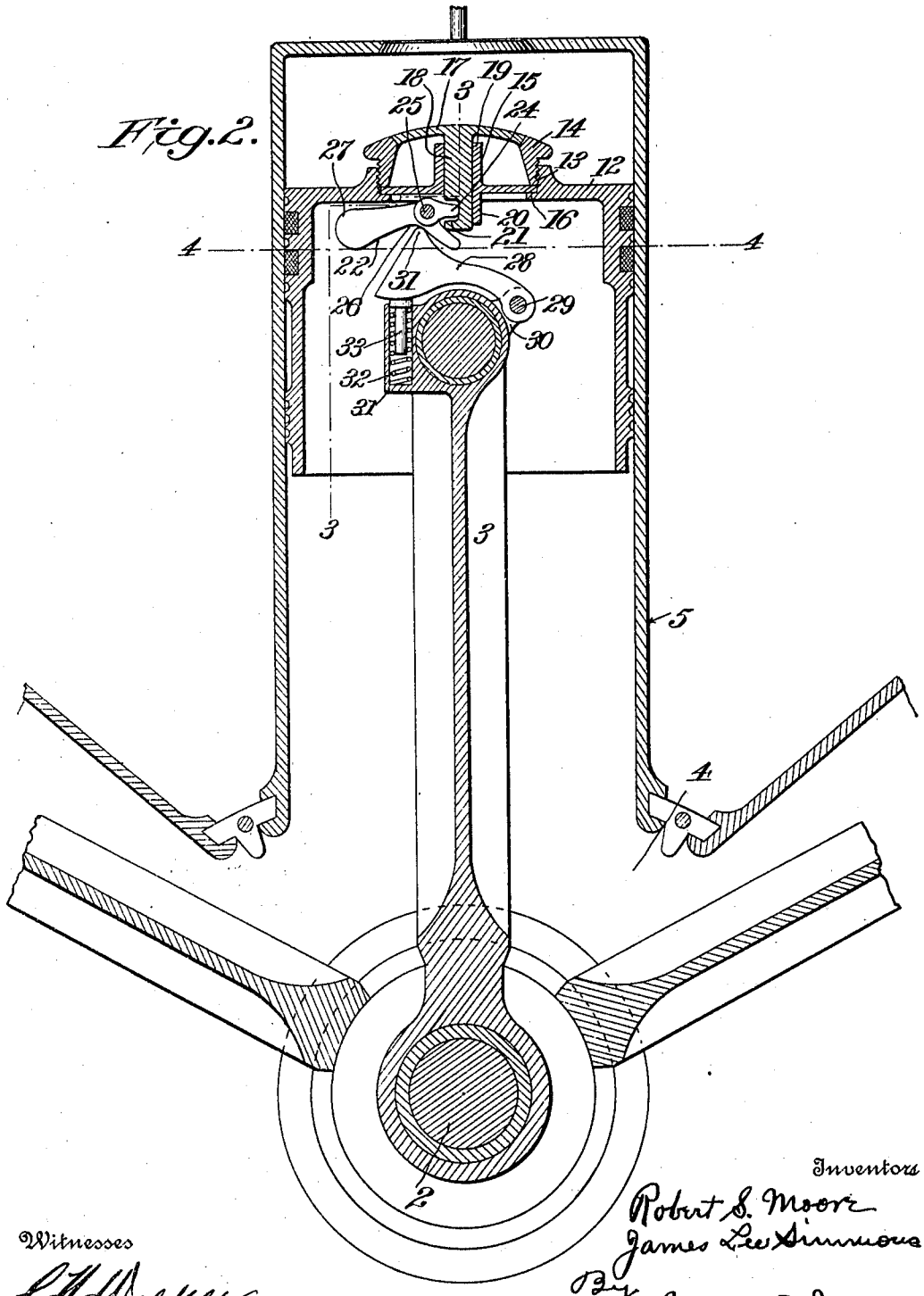
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

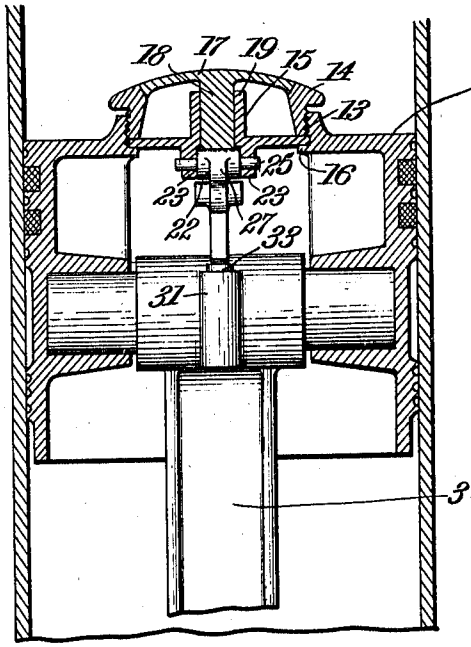


Fig. 5.

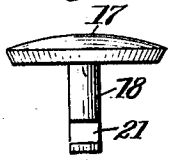


Fig. 6.

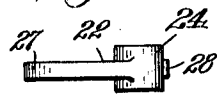
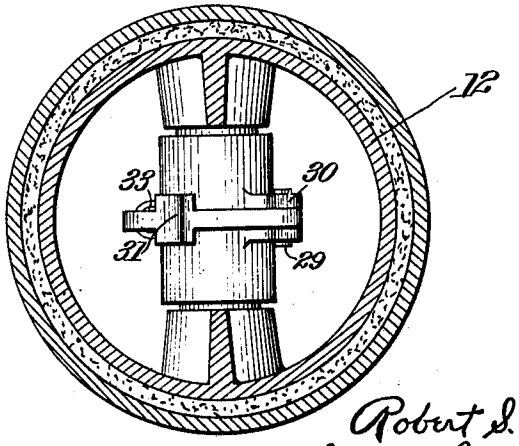


Fig. 4.



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ROBERT S. MOORE AND JAMES LEE SIMMONS, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNORS TO GYRO MOTOR COMPANY, OF WASHINGTON, DISTRICT OF COLUMBIA, A CORPORATION OF DELAWARE.

GAS-ENGINE.

1,004,457. Specification of Letters Patent. Patented Sept. 26, 1911.

Application filed March 13, 1911. Serial No. 614,258.

To all whom it may concern:

Be it known that we, ROBERT S. MOORE and JAMES LEE SIMMONS, citizens of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Gas-Engines, of which the following is a description, reference being had to the accompanying drawing and to the figures of reference marked thereon.

The invention relates to new and useful improvements in gas engines, and more especially gas engines of the type wherein the cylinders rotate about a stationary crank shaft, although it is obvious from certain aspects that the invention is also adapted to be used in connection with gas engines of other types.

An object of the invention, is to provide a valve controlling mechanism for a rotary cylinder gas engine wherein the valve is located in the piston and is opened and closed through the action of centrifugal force on a member preferably supported by and freely movable on the piston rod.

A further object of the invention is to provide a valve mechanism of the above character, with devices for counter-balancing the weight of the valve, whereby the action of centrifugal force on the valve is neutralized.

A further object of the invention is to provide a gas engine either of the rotating or non-rotating type, with a valve mechanism for the intake, wherein the valve is located in the piston and is opened and closed by a member supported on the piston rod, which member is capable of yielding so that the valve may remain closed during the expansion of the gases in the cylinder.

These and other objects of the invention, will in part be obvious, and will in part be hereinafter more fully described.

In the drawings which show by way of illustration one embodiment of the invention:—Figure 1 is a sectional view through the cylinders showing a rotary cylinder gas engine, with our invention applied thereto; Fig. 2 is an enlarged sectional view through one of the cylinders, showing our improved devices in side view; Fig. 3 is a sectional view on the line 3—3, of Fig. 2, the operating cam and controlling lever being shown in end view; Fig. 4 is a section on the line 4—4 of Fig. 3; Fig. 5 is a detail showing the valve in side view; Fig. 6 is a detail showing the controlling lever in plan view.

We have shown our invention as applied to a multiple cylinder engine, containing seven cylinders, which engine is formed with a crank shaft 1 carrying a crank arm 2, to which is connected piston rods 3, operating in connection with each cylinder. The crank shaft is preferably a stationary crank shaft, and the casing 4 carrying the cylinders is rotated about said stationary crank shaft. It will be obvious, however, from certain aspects of the invention, that the casing 4 may be stationary and the crank shaft 1 rotated by the reciprocation of the pistons. Said casing 4 is herein shown as carrying seven cylinders 5, 6, 7, 8, 9, 10, and 11. Each cylinder is provided with a piston head 12, to which the piston rod 3 is pivotally connected through suitable journal connections.

Located centrally of each piston head is an opening 13, which is threaded to receive a valve seat 14. A supporting spider 15 is clamped between the valve seat 14 and the ledge 16 on the piston head. The valve 17 is fitted to the valve seat 14, and carries a stem 18 which slides in a sleeve 19 on the spider 15. The spider is also formed with a sleeve 20 on its lower face, which is in line with the sleeve 18 on the upper face of the spider.

The stem of the valve extends through the sleeves 18 and 20, and is formed with a notch 21 at one side thereof; a controlling lever 22 is pivoted between ears 23 projecting downwardly from the lower face of the spider 15. This controlling lever is formed with a projecting shoulder 24, which engages the notch 21 in the stem of the valve. The shoulder 24 is extended laterally, so as to form a wide bearing surface on the valve stem. The controlling lever 22 extends to each side of the axis 25 of the pivotal sup-

port of the lever, as clearly shown in Fig. 2. The under face of the lever is formed with a cam surface 26, which extends on each side of the axis of the pivotal support.

The left hand end 27 of the controlling lever, as viewed in Fig. 2, extends a sufficient distance from the axis of the controlling lever, so that the weight of the parts of the lever on this side of the axis, would counterbalance the weight of the parts of the lever, the valve stem and the valve, which are centered on the other side of the axis of the lever. This counter-balancing of the valve by the controlling lever, prevents any disturbance of the valve by the centrifugal force on the valve resulting from the rapid rotation of the cylinders.

As a means for operating the valve at the proper time, we have provided a cam member 28, which is pivoted at 29 between ears 30, carried by the piston rod 3. This cam is formed with an outwardly projecting part or shoulder 31, which contacts with the cam face 26 on the under side of the controlling lever 22.

It will be noted that the projecting part 31 engages the lever 22 adjacent its fulcrum, and as the piston reciprocates, the projecting part will shift from one side of the fulcrum of the lever to the other, owing to the changing of the angular position of the piston rod, relative to the piston head. Inasmuch as this cam member 28 is freely pivoted on the piston rod, said member may move in a direction substantially radially of the cylinders through the action of centrifugal force on said member, as the cylinder rotates, and said member will therefore, be pressed against the lever by centrifugal force and the valve will be opened and closed through the action of centrifugal force on this movable member.

When the projecting part is on the left of the fulcrum of the controlling lever as in Fig. 2, the centrifugal force will swing the lever so as to close the valve. When however, the projecting part is moved to the right of the fulcrum of said lever, the centrifugal force will operate to open the valve. As above noted, the controlling lever is so proportioned as to counterbalance the weight of the valve, and neutralize the centrifugal force on the valve. The centrifugal force acting on the cam member 28, as it is shifted from one side of the fulcrum of the lever to the other, will throw the valve and controlling lever out of balance and will either open or will close the valve, according to whether the centrifugal force of the cam member is on the one or the other side of the fulcrum of the lever.

A spring 32 is seated in the pocket in the piston rod, and presses against the headed pin 33. The cam member 28 rests on the headed pin. This spring however, is a very light spring, and plays little or no part in the controlling of the valve when the engine cylinders are rotating. When the engine is at a stand-still, then there will be no centrifugal force acting on the cam member 28. The spring at this time comes into play to hold the cam member in contact with the controlling lever, and operates to open and close the valve so that the engine may be started.

In describing the operation of our device, the cylinder 6 in Fig. 1, may be considered as the second position of the cylinder 5, as it rotates about the axis of the crank shaft. The cylinder 7 may be considered the third position of the cylinder 5. Starting with the cylinder 5 in the position shown in Fig. 1, and assuming that the gases in the cylinder are compressed and that said cylinder is at the firing position; the rotation of the cylinder 5 to the position of the cylinder 6, will shift the projecting part on the cam 28 along the cam face 26 of the controlling lever 27, to the other side of the controlling lever. The action of centrifugal force on the cam member 28, would now tend to throw open the intake valve, but inasmuch as the gases in the cylinder are expanding, the force of the expanding gases overcomes the action of the centrifugal force on the member 28, which yields thereto, and allows the intake valve to remain closed. As the expansion of the gases continues, the cylinder rotates in the direction of the arrow, in Fig. 1. When the cylinder 5 has passed through the arc of 180°, the angle of the piston rod relative to the piston, will change so that the projecting shoulder on the cam member 28 will move to the other side of the fulcrum of the controlling member, and the centrifugal force on the member 28 will now throw the controlling lever to a position to hold the valve closed during the remainder of the rotation of the cylinder 5. The exhaust valve is so controlled that during the last half rotation of the cylinder 5, said valve is opened and the burned gases are forced from the cylinder by the outward movement of the piston. On the second rotation of the cylinder, the projecting part on the cam member 28 will again slide to the other side of the fulcrum of the controlling lever, and inasmuch as the cylinder is now free from expanding gases, the intake valve will be opened and allow a charge to pass into the cylinder. Again, when the cylinder has passed through an arc of 180°, the projecting part on the cam member, will shift to the opposite side of the fulcrum of the controlling lever, and close the valve.

It will thus be seen that we have provided means wherein the centrifugal force acting on a movable member freely supported by

the piston rod, is utilized to open and to close the intake valve in proper timed relation to the rotation of the cylinder. It will be further noted that if our improved valve mechanism is applied to a cylinder of the non-rotating type, that the spring supporting the cam member may be of sufficient force as to hold the cam member in contact with the controlling lever, and as the piston reciprocates, the change in the angular position of the piston rod, relative to the piston will shift the projecting part from one side of the fulcrum of the controlling lever to the other, so as to open and close the valve. This cam member 28 being freely supported on the piston rod, may yield when the gases are expanding in the cylinder, so that the intake valve may be closed during one stroke of the piston, and therefore, our improved valve mechanism is especially adapted for use in a four-cycle gas engine of any desired type.

It is obvious that minor changes in the details of construction may be made, without departing from the spirit of our invention as set forth in the appended claims.

Having thus particularly described our invention, what we claim as new and desire to secure by Letters Patent, is:—

1. A gas engine including in combination, a rotary cylinder, a piston, an intake valve located in said piston, a piston rod connected to said piston, a member carried by said piston rod and free to move thereon through the action of centrifugal force, and devices intermediate said member and said intake valve, whereby the centrifugal force acting on said member may be utilized to open and close said intake valve in proper timed relation to the rotation of said cylinder.

2. A gas engine including in combination, a rotary cylinder, a piston, an intake valve located in said piston, a piston rod connected to said piston, a member carried by said piston rod, and free to move thereon through the action of centrifugal force, a lever fulcrumed on the piston and connected to said intake valve, said member having a projecting part constructed and disposed so as to engage said lever adjacent the fulcrum thereof, and shift from one side of the fulcrum to the other as the piston rod changes its angular position relative to the piston.

3. A gas engine including in combination, a cylinder, a piston, an intake valve located in said piston, a piston rod connected to said piston, means for operating said intake valve, said means including a member carried by the piston rod and capable of yielding so as to allow the intake valve to remain closed during the expansion of the gases in the cylinder, and devices operated by said member for opening and closing said valve.

4. A gas engine including in combination, a cylinder, a piston, an intake valve located in said piston, a piston rod connected to said piston, means for operating said intake valve, said means including a member carried by the piston rod, a lever fulcrumed on the piston and connected to said valve, said member having a projecting part constructed and disposed so as to engage said lever, adjacent the fulcrum, and to shift from one side of the fulcrum to the other as the piston rod changes its angular position relative to the piston.

5. A gas engine including in combination, a rotary cylinder, a piston, an intake valve located in said piston, a piston rod connected to said piston, and devices for opening and closing said valve including an operating lever, and means for pivotally supporting said lever, the parts of said lever being so disposed as to counterbalance the weight of the valve, and means controlled by the connecting rod for operating said pivoted lever.

6. A gas engine including in combination a rotary cylinder, a piston, an intake valve located in said piston, a piston rod connected to said piston, devices for opening and closing said valve including a pivoted lever, the parts of which are disposed so as to counterbalance the valve, and a cam member carried by said piston rod, and free to move thereon through the action of centrifugal force, said cam member having a projecting part constructed and disposed so as to engage said lever adjacent the fulcrum thereof, and shift from one side of the fulcrum to the other, as the piston rod changes its angular position relative to the piston.

7. A gas engine including in combination, a rotary cylinder, a piston, a piston rod connected to said piston, an intake valve mounted in said piston, a controlling lever pivoted to said piston, a cam member carried by said piston rod, having a shoulder for engaging said controlling lever, said shoulder being disposed relative to the pivot of said lever, whereby as the cylinder rotates, said shoulder moves from one side of said pivot to the other, for opening and for closing said intake valve, and means for yieldingly holding said cam in contact with said controlling lever.

8. A gas engine including in combination, a rotating casing, a cylinder carried thereby, a stationary crank shaft, a piston, a piston rod connecting said piston and said shaft, an intake valve mounted in said piston, a controlling lever for said intake valve, said controlling lever having a cam-shaped lower face, a cam carried by the piston rod having a shoulder engaging the cam face

of the controlling lever, said shoulder being so disposed relative to the pivot of the controlling lever as to move from one side of said pivot to the other for opening and for closing said valve.

9. A gas engine including in combination, a rotating casing, a cylinder carried thereby, a stationary crank shaft, a piston, a piston rod connecting said piston and said crank shaft, an intake valve mounted in said piston, a controlling lever for said intake valve, said controlling lever having a cam-shaped lower face, a cam carried by the piston rod having a shoulder engaging the cam-face of the controlling lever, said shoulder being so disposed relative to the pivot of the controlling lever, as to move from one side of said pivot to the other, for opening and for closing said valve, and means for yieldingly holding said shoulder against said lever.

10. A gas engine including in combination, a rotating casing, a cylinder carried thereby, a stationary crank shaft, a piston in said cylinder, a piston rod connecting said piston to said crank shaft, an intake valve mounted in said piston, a valve stem connected to said valve, a controlling lever pivoted to said piston and having a positive engagement with said valve stem, said controlling lever having a cam-shaped under face, and a cam member freely movable on the piston rod and having a shoulder engaging the cam face of the controlling lever.

11. A gas engine including in combination, a rotating casing, a cylinder carried thereby, a stationary crank shaft, a piston in said cylinder, a piston rod connecting said piston to said crank shaft, an intake valve mounted in said piston, a valve stem connected to said valve, a controlling lever pivoted to said piston, and having a positive engagement with said valve stem, said controlling lever having a cam-shaped under face, a cam member freely movable on the piston rod and having a shoulder engaging said cam face of the controlling member, and means for yieldingly holding said shoulder in contact with the cam face of the controlling lever.

12. A gas engine including in combination, a rotating casing, a cylinder carried thereby, a stationary crank shaft, a piston in said cylinder, a piston rod connecting said piston to said crank shaft, said piston having an opening formed centrally thereof, a spider mounted in said opening, a valve seat threaded in said opening and engaging said spider, said spider having a central sleeve, a valve engaging said valve seat and having a stem sliding in said sleeve, a controlling lever pivotally supported by said spider, and having a positive engagement with the stem of said valve, said controlling lever having a cam-shaped under face, and an extension to counter-balance the weight of the valve, a cam member freely movable on the piston rod, and having a shoulder for engaging the cam face of the controlling lever, and means for yieldingly holding the shoulder in contact with the cam face.

13. In a gas engine, a revolving cylinder, a piston therein, an intake valve, and means including a member positioned by the movement of the engine and held in actuating position by centrifugal force for opening and closing said intake valve.

14. In a gas engine, a revolving cylinder, a piston therein, an intake valve in the piston, a connecting rod pivotally joined to said piston, and means including a member positioned by the movement of the connecting rod and held in actuating position by centrifugal force for opening and closing said valve.

15. In a gas engine, a revolving cylinder, a piston therein, an intake valve in the piston, a fulcrumed member for counterbalancing said valve, and an operating member adapted to bear by centrifugal force against said fulcrumed member on alternate sides of the fulcrum thereof for opening and closing the valve.

16. In a gas engine, a revolving cylinder, a piston therein, an intake valve in the piston, a connecting rod pivotally joined to said piston, a fulcrumed member for counterbalancing said valve, and an operating member carried by the connecting rod and adapted to bear by centrifugal force against said fulcrumed member on alternate sides of the fulcrum thereof for opening and closing the valve.

17. In a gas engine, a cylinder, a piston therein, an intake valve in the piston, a fulcrumed member connected with said valve and an operating member adapted to bear with a yielding force against said fulcrumed member on alternate sides of the fulcrum thereof for opening and closing the valve.

18. In a gas engine, a cylinder, a piston therein, an intake valve in the piston, a connecting rod pivotally joined to said piston, a fulcrumed member connected to said valve, and an operating member carried by the connecting rod and adapted to bear with a yielding force against said fulcrumed member on alternate sides of the fulcrum thereof for opening and closing the valve.

19. A gas engine including in combination, a rotary cylinder, a valve, a member rotating with said valve and free to move through the action of centrifugal force, devices intermediate the member and the valve, and means for positioning said member relative to said intermediate devices, whereby the centrifugal force acting on the member

may be utilized to open the valve in proper timed relation to the rotation of the cylinder.

20. A gas engine including in combination, a rotary cylinder, a piston therein, an intake valve in the piston, a member rotating with the cylinder and free to move through the action of centrifugal force, devices intermediate the member and the intake valve, and means for positioning said member relative to the intermediate devices, whereby the centrifugal force acting on the member may be utilized to close the valve in proper timed relation to the rotation of the cylinder.

In testimony whereof we affix our signatures, in presence of two witnesses.

ROBERT S. MOORE.
JAMES LEE SIMMONS.

Witnesses:
E. G. MASON,
E. H. PARKINS.