

April 23, 1929.

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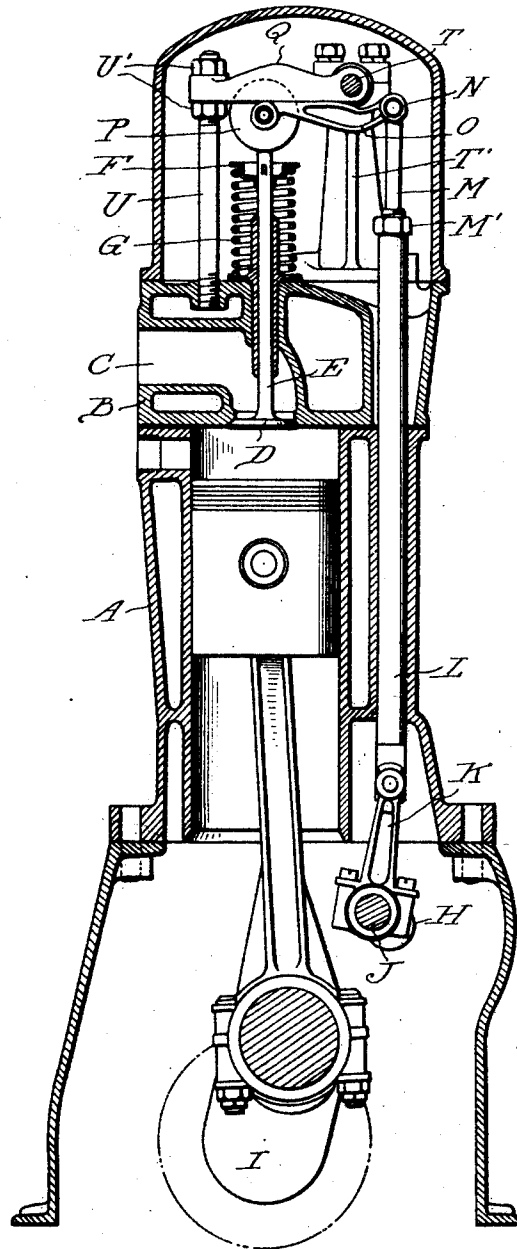
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VALVE MECHANISM FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 23, 1926

3 Sheets-Sheet 1

Fig. 1.



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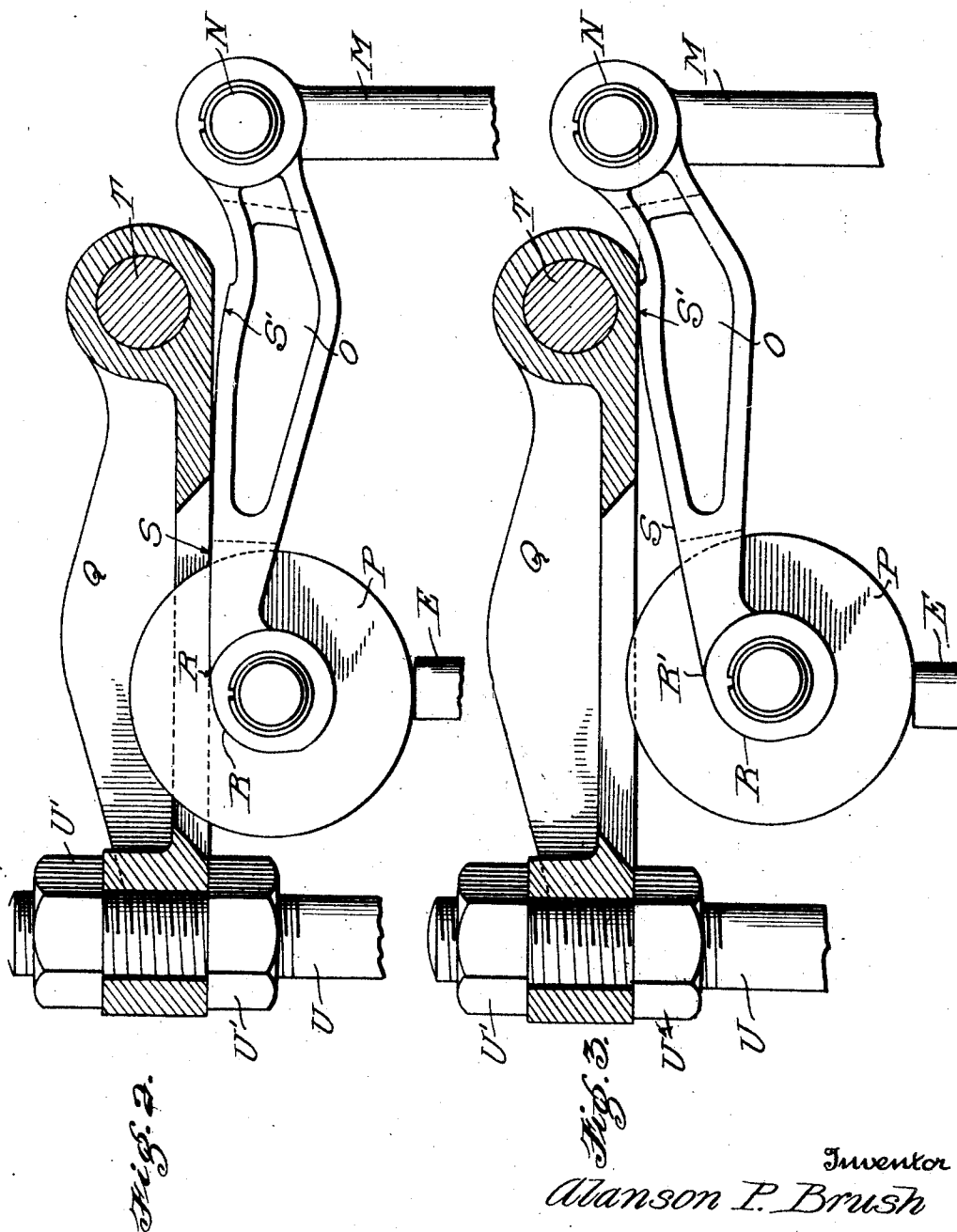
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3 Sheets-Sheet 3

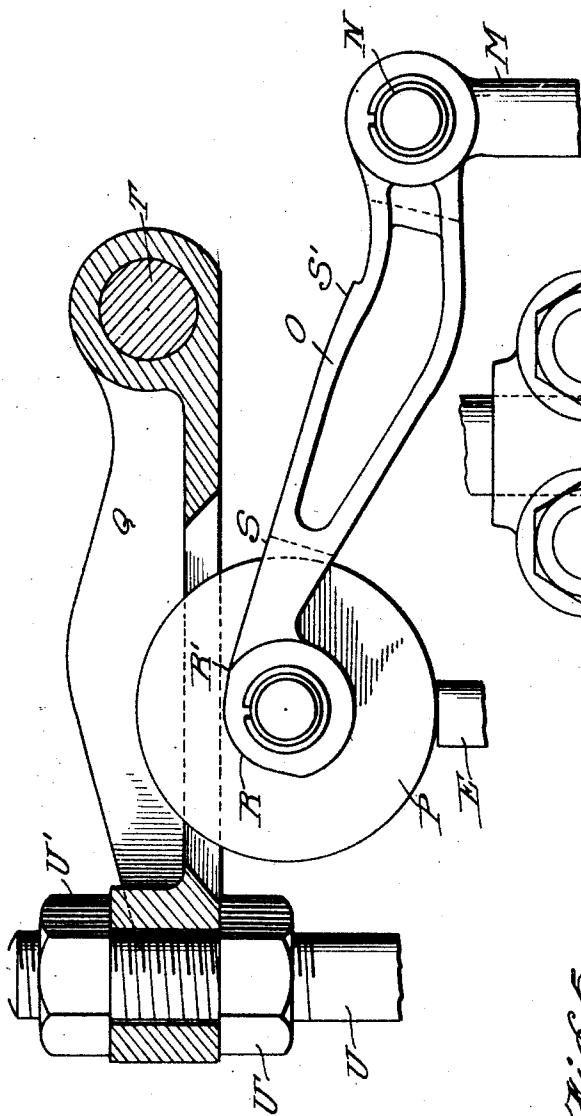


Fig. 4.

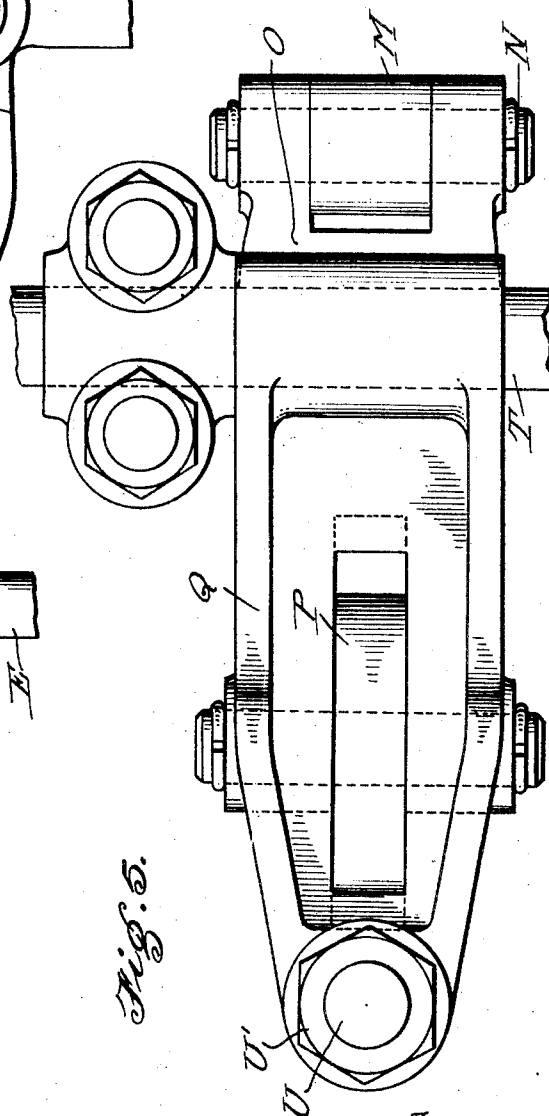


Fig. 5.

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VALVE MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

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The invention relates to valve mechanism for internal combustion engines and has for its principal object the obtaining of a simple construction for obtaining properly timed operation of the valves without the use of the usual cam shaft.

It is a further object to accomplish this result by a substantially harmonically reciprocating mechanism actuated by a crank or eccentric together with means for translating this harmonic movement into an intermittent and properly timed operation of the valve.

Other objects are the provision of means of adjustment for eliminating noise such adjustment having a negligible effect on the timing, also a simple means for permitting continuous motion of the reciprocating mechanism directly actuated by the crank while effecting the movement of the valve only during a limited portion of the cycle.

With these and other objects in view the invention consists in the construction as hereinafter set forth.

In the drawings:

Figure 1 is a vertical section through an internal combustion engine taken in the plane of the reciprocating valve actuating rod.

Figures 2, 3, and 4 are side elevations of the travelling fulcrum lever showing the same in different positions of adjustment.

Figure 5 is a plan view of this lever.

The internal combustion engine to which my improvement is applied may be of any suitable construction but preferably of the valve in the head type. As illustrated A is the cylinder having a detachable head B provided with intake and exhaust passages formed therein such as C. D is one of the valves for closing the entrance port to the cylinder from the passage C and E is the valve stem extending outward through the head. This stem is provided with the usual collar F engaged by the spring G for returning the valve to its seat.

The valve actuating mechanism comprises a crank or eccentric shaft H driven from the engine crank shaft I by suitable gearing (not shown) giving a two to one ratio. Cranks or eccentrics J on the shaft H are connected by pitman rods K to reciprocatory rods L slidably engaging bearings in the engine block and extending upward through the head. The upper end of each rod is preferably provided with an adjustable extension M which, as shown, has a threaded engagement with the rod L and is locked in adjusted position by the

nut M'. To the upper end of the extension M is pivotally attached at N a rocker lever O the free end of which is provided with an anti-friction roller P resting upon the upper end of the valve stem E.

To obtain the desired intermittent actuation of the valve D the rocker O constitutes a travelling fulcrum lever which cooperates with a bearing member Q arranged thereabove. The member Q is preferably provided on its under side with a flat or straight surface and the member O has its upper surface so fashioned that during a portion of the cycle of the crank shaft H it will rock in contact with the surface of the member Q. The fashioned surface is also of such a character that in the initial position of the movement of the valve the fulcrum or bearing point of this surface is located adjacent to the axis of the valve stem E while during the subsequent rocking movement of the member O the fulcrum travels outward towards the end pivotally connected at N to the member M. This has the effect of a low velocity opening and closing movement of the valve with positive and negative acceleration respectively during the opening and closing movements.

As has been stated the valve D remains stationary during the greater portion of the cycle of the crank H. During this interval the rocker O is out of contact with the member Q and the continuous movement of the rod L merely changes the angle of the member O and causes a short travelling movement of the roller P over the upper end of the valve stem E. This free movement is obtained by providing a clearance on the hub of the rocker O in which the roller P is journaled—such clearance being indicated at R. The clearance preferably extends to a point R' on the lever side of the axis of the roller P at which point the main arc S of the cam portion of the lever O starts. At the end of this main arc is a tangent arc S' of smaller radius which contacts with the surface of the member Q in the full open position of the valve. Adjustment of the timing may be effected by the lengthening or shortening of the extension M of the rod L through its threaded connection therewith.

To assist in the initial setting of the valve mechanism and also to provide for adjustment to eliminate noise, the member Q is provided with means for slightly raising or lowering the same. As shown one end of this lever is mounted upon a shaft T jour-

naled in bearings in a bracket member T' mounted on the head B. The opposite end of the member Q is adjustably secured to a post U, the latter being threaded at its upper end and passing through an eye in the member Q while lock nuts U' above and below said member serve to hold the same in any desired position of adjustment. Thus the under surface of the member Q may be so positioned in relation to the lever O that while permitting the full seating of the valve there is but very slight additional clearance.

The operation of the mechanism will be understood without further description but in brief it is as follows: During the portion of the cycle when the valve D is stationary the rod L moves to the position shown in Figure 4 from the position shown in Figure 2 and back again to the position shown in Figure 2. This movement causes the roller P to travel over the upper end of the valve stem E without effecting any actuation of said stem by reason of the clearance R. During the remainder of the cycle the rocker O is in contact with the member Q this contact first occurring at the point R' and then travelling outward to the portion S' and then again backward to the point R'. This completes the cycle during which only a small portion of the angular movement of the member O is effective in moving the valve. By reason of this limited angular movement there is very little lateral thrust upon the rod L due to the rolling contact of the rocker. This thrust is further minimized by reason of the fact that the fulcrum plane or under face of the member Q is substantially at right angles to the axis of the reciprocating rod L and the pivot N which connects said rod with the rocker is located at a point in relation to the rocker curve having the least lateral deflection. As a consequence the very slight lateral thrust may be taken care of either by the spring of the rod B or by clearance of said rod in its bearings or by a slight slipping of the rocker on the member Q. None of these movements is sufficient to be in any way detrimental. The spring of the rod L is facilitated by providing a clearance for said rod in its passage through the head B as indicated at V.

Some of the advantages of the construction above described are:

First.—The actuating valve shaft is located in the crank case where it is always supplied with abundant lubricant.

Second.—The actuating mechanism including the valve crank shaft, pitman and reciprocating rod is positively actuated in both directions which reduces the inertial elements reacting on the valve.

Third.—The velocity of the valve in leaving and returning to its seat is determined by the proximity to the axis of the valve of the terminal point of the travelling fulcrum

also by the velocity of the reciprocating rod V at the time such terminal point is reached. This avoids noise due to wear in the parts of the operating mechanism as it is obvious that there is negligible wear of the traveling fulcrum and wear in the bearings and joints up to the pivotal connection between the rod and the rocker will have only negligible effect on the velocity of said parts.

Fourth.—The member Q which forms the stationary bearing for the travelling fulcrum is held in rigid relation to the valve seat but is capable of a slight vertical adjustment. This member is also slotted to receive the upper portion of the roller P and forms a guide bearing for said roller and lever O holding the same from lateral displacement.

What I claim as my invention is:

1. In an internal combustion engine, the combination with an intermittently operated valve, of an actuating mechanism therefor comprising a continuously and substantially harmonically reciprocated rod, a rocker member pivotally attached at one end to said rod and having its opposite end bearing on the valve stem and a stationary member cooperating with said rocker out of contact therewith during a portion of the reciprocating cycle and contacting therewith at a point adjacent to the bearing of said rocker on said stem and provided with a travelling fulcrum for said rocker during the remainder of the cycle.

2. In an internal combustion engine, the combination with a valve in the head, of mechanism for intermittently actuating said valve comprising a crank shaft driven from the engine crank shaft in a two to one ratio, a rod continuously reciprocated by said first mentioned crank shaft, a rocker member pivotally attached at one end to the upper end of said rod and provided with an anti-friction bearing at its opposite end upon the valve stem and a cooperating member located above said rocker, said member and said rocker having their adjacent faces so fashioned as to produce a travelling fulcrum engagement during a portion of the cycle initially engaging at a point adjacent to the bearing on the valve stem and remaining out of contact during another portion of the cycle.

3. In a valve mechanism for internal combustion engines, the combination with a valve in the head having an upwardly extending stem and resilient means engaging the same for effecting the closing of the valve, of a valve crank shaft driven in a two to one ratio from the engine crank shaft, a reciprocating rod actuated by said valve crank shaft, a rocker having one end pivotally attached to said rod and provided at its opposite end with a roller resting on the upper end of said valve stem, a member located above said rocker to be out of contact therewith during a portion of the cycle, said rocker having a cammed

upper face for forming a travelling fulcrum engagement with said upper member during another portion of the cycle initially engaging therewith at a point adjacent to the bearing on said valve stem.

4. In a valve mechanism for internal combustion engines, the combination with a valve in the head having an upwardly extending stem and resilient means engaging said stem for effecting the closing of the valve, of a valve crank shaft driven in a two to one ratio from the engine crank shaft, a rod positively connected to and continuously reciprocated by said valve crank shaft extending upward parallel to said valve stem, a rocker having one end pivotally attached to said rod and provided at its opposite end with a roller bearing resting on the upper end of said valve stem, said rocker having a cammed upper face which inclines downward from adjacent to the axis of the valve stem during the greater portion of the cycle and inclines upward during the remainder of the cycle and a member having a substantially horizontal lower face arranged above and cooperating therewith to form a travelling fulcrum therefor during the last mentioned portion of the cycle initially engaging at a point adjacent to the bearing on said stem.

5. In a valve mechanism for internal combustion engines, the combination with a valve in the head having an upwardly extending stem and resilient means engaging the same for closing the valve, of a valve crank shaft driven in a two to one ratio from the engine crank shaft, a rod positively connected to and actuated by said valve crank shaft extending upward therefrom, a rocker pivotally attached at one end to said rod, a roller at the opposite end of said rocker resting on the upper end of said valve stem, a member arranged above and cooperating with said rocker to form a travelling fulcrum therefor during a portion of the cycle initially engaging at a point adjacent to said stem and means for adjusting said rocker in relation to said cooperating member to effect the timing of the operation of the valve.

6. In a valve mechanism for internal combustion engines, the combination with a valve in the head having an upwardly extending stem and resilient means engaging the same for closing the valve, of a valve crank shaft driven in a two to one ratio from the engine crank shaft, a rod positively connected to and actuated by said valve crank shaft extending upward therefrom, a rocker pivotally attached to one end of said rod, a roller at the opposite end of said rocker resting on the upper end of said valve stem, a member arranged above and cooperating with said rocker to form a travelling fulcrum therefor during a portion of the cycle initially engaging at a point adjacent to said stem and independent means for adjusting said cooperating member

to alter the clearance during the portion of the cycle where said rocker is out of contact therewith.

7. In an internal combustion engine, the combination with a valve in the head having an upwardly extending stem and resilient means engaging the same for effecting the closing of the valve, of a rod arranged substantially parallel to said stem, means for positively reciprocating said rod with a substantially harmonic movement, a rocker pivotally attached at one end to said rod and provided with a roller bearing at its opposite end for resting on the upper end of said valve stem, the upper face of said rocker being cammed and inclining downward from a point adjacent to the axis of the roller during the greater portion of the cycle, a member arranged above said rocker having a straight lower face out of contact with said cammed face during a portion of the cycle and constituting a travelling fulcrum therefor during the remaining portion of the cycle, means for adjusting the length of said rod to effect the timing of the operation of the valve and means for adjusting the position of said cooperating member to effect the clearance during the idle portions of the cycle and to quiet the action of the mechanism.

8. In a valve operating mechanism for internal combustion engines, the combination with a valve in the head having an upwardly extending stem and resilient means engaging said stem for seating the valve, of a bearing member mounted on the head above said valve stem and presenting a substantially horizontal lower face, a rocker having a cammed upper face to form a travelling fulcrum engagement with said lower face and provided at one end with a roller bearing engaging the upper end of said stem, a reciprocatory rod pivotally connected to the opposite end of said rocker and positively and continuously actuated from the engine with a substantially harmonic movement, said rocker member having a slight clearance from said bearing member during the greater portion of the reciprocation of said rod and fulcrumed on said bearing to actuate said valve during the remaining portion of the reciprocation.

9. The combination with a valve in the head internal combustion engine, of an actuating valve stem projecting upward above said head, a bearing member mounted on said head above said valve stem and presenting a substantially horizontal lower face, a rocker member having a roller at one end resting upon said valve stem with a portion of said rocker concentric with the axis of said roller providing a slight clearance from the lower face of said bearing and a cammed portion for forming a travelling fulcrum engagement with said lower face and a rod pivotally attached to the opposite end of said rocker ac-

tuated from the engine with a continuous substantially harmonic reciprocating movement.

10. In an internal combustion engine, the combination with a valve in the head, of mechanism for intermittently actuating said valve comprising a crank shaft driven from the engine crank shaft in a two to one ratio, a rod continuously reciprocated by said first mentioned crank shaft, a rocker member pivotally attached at one end to the upper end of said rod and having its opposite end engaging the valve stem, a cooperating member located above said rocker, said member and said rocker having their adjacent faces so fashioned as to produce a travelling fulcrum engagement during a portion of the cycle initially engaging at a point adjacent to said stem and remaining out of contact during another portion of the cycle.

11. In an internal combustion engine, the combination with an intermittently operated valve, of an actuating mechanism therefor comprising a continuously substantially harmonically reciprocating rod, a rocker member pivotally attached at one end to said rod, a roller journaled in the opposite end of said rocker and bearing on the valve stem and a stationary member cooperating with said rocker to provide a travelling fulcrum therefor during a portion of the cycle, said stationary member being recessed to receive the upper portion of said roller and forming a guide for preventing lateral deflection of said roller and rocker.

12. In an internal combustion engine, the combination with an intermittently operated valve, of an actuating mechanism therefor comprising a continuously and substantially harmonically reciprocated rod, a rocker member pivotally attached at one end to said rod and having its opposite end bearing on the valve stem, a stationary member cooperating with said rocker out of contact therewith during a portion of the reciprocating cycle and provided with a travelling fulcrum for said rocker movable during the remainder of the cycle to and from a point adjacent to the bearing on said valve stem whereby the velocity of movement is relatively low.

13. In an internal combustion engine the

combination with an intermittently operating valve of an actuating mechanism therefor comprising a continuously and harmonically reciprocating rod, a rocker member pivotally attached at one end to said rod and having its opposite end bearing on the valve stem, a stationary member cooperating with said rocker and so located to be initially engaged thereby at a point adjacent to the bearing of said rocker on said valve stem whereby the velocity of movement of the valve in leaving and approaching its seat is relatively low, said rocker being out of contact with said stationary member during the greater portion of its cycle.

14. In an internal combustion engine, the combination of a poppet valve having an open period and a closed period, said closed period being of relatively long duration, a lever for operating said valve having one end engaging the stem of the valve, means for applying to the other end of said valve a substantially harmonic movement, a fixed surface adjacent to the said lever, and an operating rocker surface on one side of said lever for engaging said fixed surface with a travelling contact from a point closely adjacent to the extended axis of the valve stem to a point relatively remote from said axis whereby the harmonic movement of the one end of said rocker is translated into a non-harmonic movement of the other end of the rocker and of said pocket valve.

15. In an internal combustion engine, a poppet valve having open and closed periods of different durations, a rocker lever having one end engaging the stem of the valve, means for imparting a substantially harmonic movement to the opposite end of said rocker lever, a co-operating fixed surface for engaging said rocker with a travelling contact from a point closely adjacent to the extended axis of the valve stem to a point relatively remote from said axis and so positioned that said lever is out of contact with said surface during a portion of the harmonic cycle, whereby said harmonic movement is translated into an intermittent non-harmonic movement of the valve.

In testimony whereof I affix my signature.

ALANSON P. BRUSH.