Oct. 15, 1946. M. L. FORREST 2,409,350

INTERNAL-COMBUSTION ENGINE

Filed March 26, 1945 2 Sheets-Sheet 1

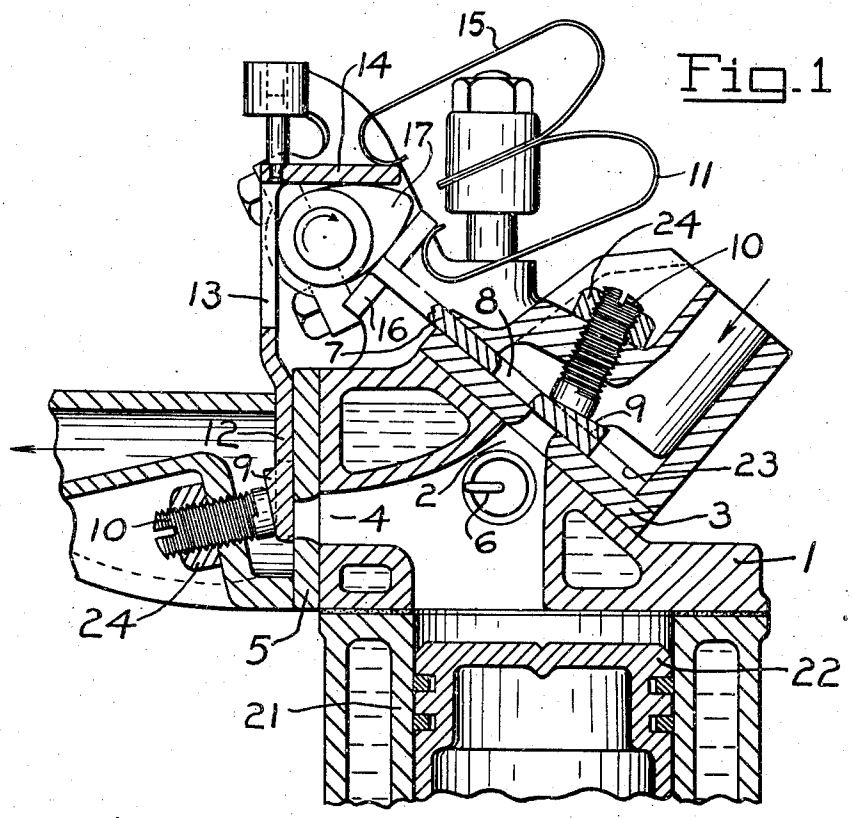


Fig. 1

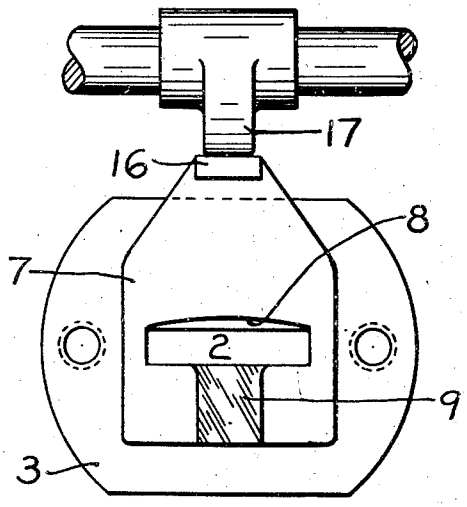


Fig. 2

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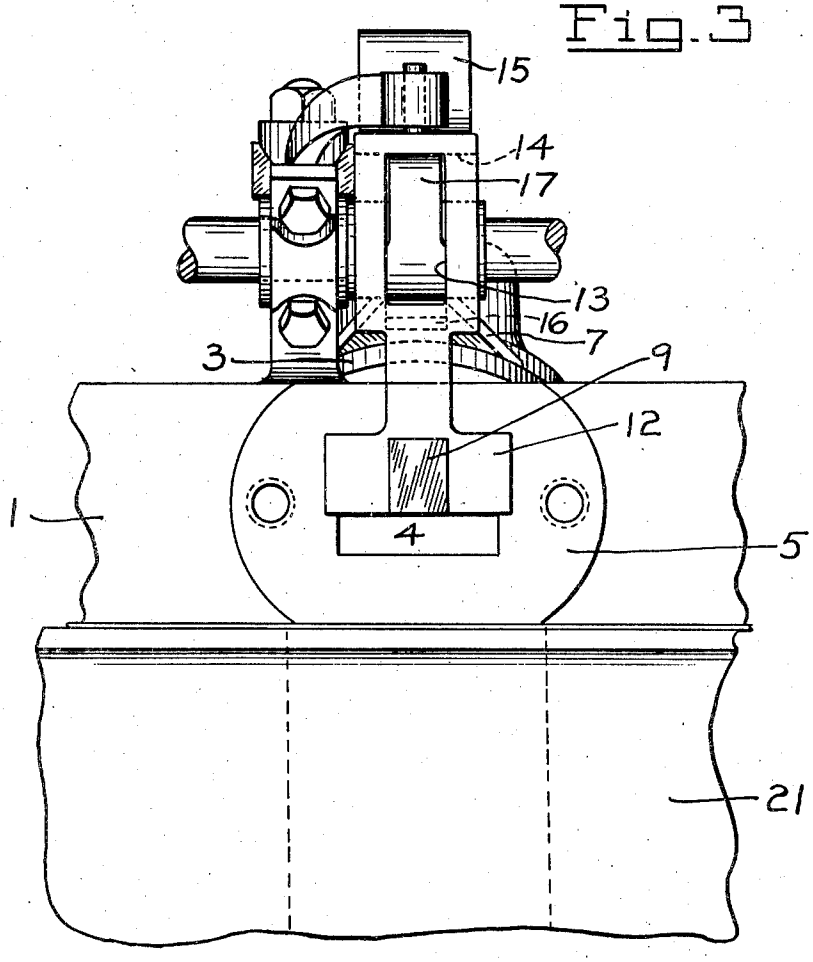
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Fig. 3



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INTERNAL-COMBUSTION ENGINE

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9 Claims. (Cl. 123—188)

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The present invention relates primarily to the valve mechanism of an internal combustion engine, and certain of its principles may be incorporated in either a two-cycle or a four-cycle engine.

Among the objects of the invention are: to simplify the valve structure and the valve-operating mechanism in such ways as by arranging the ports so that the gases may pass more or less straight through, without the necessity of changing direction around sharp bends or breaks; to provide sliding valves of which only a small portion is exposed to the combustion chamber temperature and pressure; to provide means readily adjustable as needed, even during operation of the engine, whereby such valves may be securely held to their seats when closed, by pressure equalized about the entire seating area, yet without creating difficulties in unseating them to open, or, indeed, to make them in a sense self-releasing, according to their design and the residuary cylinder pressure at the time the valve is released to open; to arrange the valves and the valve operating means, particularly for four-cycle operation, in such a way that a single cam may control both the intake and the exhaust valves.

With these and other objects in mind, as will shortly appear, my invention comprises the novel parts, and the novel combination and arrangement thereof, as shown in the accompanying drawings, as more fully described in this specification, and as will be defined by the claims which terminate the same.

In the accompanying drawings I have shown my invention in a typical form, not necessarily that form which is most preferred by me, but sufficient, however, to illustrate and explain the principles of my invention.

Figure 1 is a general axial section through the upper part and head of an internal combustion engine, illustrating my invention incorporated therein.

Figure 2 is an elevation of the intake valve, and of the associated mechanism, and Figure 3 is a similar view of the exhaust valve.

The engine includes a head 1 set upon a cylinder block 21, wherein is reciprocable a piston 22, the head 1 being ported to define an intake port 2 and an exhaust port 4. These ports are interrupted by plate-like sliding valves. Thus the intake valve 7, having a through port 8, is guided at 23 in the head for movement transversely of the port 2, and a fixed wear plate 3 may be provided to constitute a seat for the valve 7. A similar seat 5 is provided for the exhaust

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valve 12, and this valve is similar to the intake valve 7 except that the valve action is obtained by movement of the edge of the plate-like exhaust valve 12 across the port 4.

Upstanding from the outer face of each valve is an incline or wedge 9, which slopes upwardly from the outer face of the valve in the direction of closure of the valve. Fixed in the head 1 and projecting within the respective ports is a stud 10, having a lock nut 24 to secure it in adjustment, the point of which stud cooperates with the wedge 9, and is so positioned and so inclined that the end of the stud and the wedge will just engage and produce sufficient pressure to urge and hold the valve to its seat along its inner face when the valve reaches closed position. This requires a little care in the adjustment of the position of the stud 10, but because the lap of the valve past the port is not critical, the proper adjustment is not difficult to obtain. Moreover, because the outer end of the stud projects exteriorly of the engine, adjustment may be accomplished while the engine is running.

It may be considered that the parts can not well be kept in adjustment because of wear. I have found that if the end of the stud and the surface of the incline 9 which it contacts are coated with a very hard material, such as Stellite, they can be kept in adjustment without appreciable wear over long periods of time.

The slope of the wedge or incline 9 is rather gentle, but this is a matter of design, and the slope may vary in accordance with the pressures intended to be produced within the engine. If the slope were high, and the cylinder pressure similarly high, the pressure itself would tend to cooperate with the inclined surface to open the valve, that is, outward pressure acting upon the incline would produce a component in a direction tending to open the valve. With any incline there is some such component, but its value becomes a function of the steepness of the incline and of the internal pressure. By designing the incline to the expected pressures there may be produced upon closure of the valve sufficient pressure to hold the valve securely to the seat upon its inner face, and yet a sufficient component tending to open the valve may remain that the valve will not stick, but will open easily.

Sliding valves having wedges associated with them have been known heretofore, but in most instances such wedges have been employed primarily to take up wear in the guides. Such devices may be used here, but have not been illustrated. The wedges here used are for a differ-

ent purpose, namely, to hold the valve seated. Moreover, the pressure thus produced to hold the valve seated should be inwardly, not outwardly, directed, for if it is outwardly directed there is a gap left between the inner face of the valve and its seat, which is exposed to the temperatures and to the carbon produced within the combustion chamber, and inevitably the seat will be damaged and the operation of the valve hindered by deposits of carbon. My valve is tightly seated when closed, and only a small area is exposed to the cylinder temperatures and pressures. The stud's end is centralized relative to the port aperture, and consequently the closing pressure is substantially equalized about the valve's entire seating surface, and there is minimum likelihood of lifting or lessening of seating pressure at any point about the port or valve. Escape of pressure, deposit of carbon, leakage or sticking of the valve, are virtually impossible. The major portion of the valve contacts water-jacketed surfaces, and maintains the whole cool. The valve being cool, and kept free from fouling, always moves freely.

While the valves may be reciprocated and timed by any suitable means, such valves lend themselves admirably to an arrangement such as that illustrated, wherein the valves are in planes at approximately 45° to one another, and their outer ends, provided with the heads 14 and 16 respectively, are arranged to be contacted successively by a single rotative cam 17, which is common to the two valves. Springs 11 and 15, respectively, hold the valves in closed position, and the rotation of the cam in the direction of the arrow causes, first, opening of the intake valve 7, then its closure, and, approximately 270° removed from the intake valve opening, there is caused opening of the exhaust valve 12. The plate of which the valve 12 is constructed is slotted, as indicated at 13, to accommodate the cam in its rotation.

It will be noted that the intake and exhaust ports are substantially straight through ports, when the respective valves are open. In the ordinary poppet type valve the gases must pass around the edge of the valve, and then change direction again to follow down the stem of the valve, and then change direction laterally into or from the chamber. Here the valve ports are substantially straight through, affording the greatest possible freedom of access to or escape from the cylinder, the least chance of fouling, and the least tendency to burn out.

The valve arrangement may be incorporated in a Diesel or semi-Diesel type engine, or in a conventional type of spark fired gasoline engine. A spark plug has been indicated at 6.

I claim as my invention:

1. In an internal combustion engine having a valve port affording communication with the combustion chamber, a valve, means guiding said valve for movement in a plane transverse to the port to open or to close the same, and cooperating with the valve to afford a seat for that face of the valve which is nearest the combustion chamber, a single incline upon and facing outwardly from the valve, and a single means fixedly disposed to engage said incline as the valve reaches closed position, and arranged relatively to the incline to hold the valve securely seated when so engaged, but disengageable from the incline by opening movement of the valve.

2. In an internal combustion engine having a valve port affording communication with the combustion chamber, a valve, means guiding said valve for movement in a plane transverse to the port to open or to close the same, and cooperating with the valve to afford a seat for that face of the valve which is nearest the combustion chamber, means carried by the valve at its outer face, and complemental means fixedly disposed to engage the first means in a single small area centralized relative to said port, as the valve reaches closed position, said complemental means being organized and arranged to thrust and hold the valve securely to its seat by pressure substantially equalized about the port, so long as it remains closed.

3. In an internal combustion engine having a valve port affording communication with the combustion chamber, a valve, means guiding said valve for movement in a plane transverse to the port to open or to close the same, and cooperating with the valve to afford a seat for that face of the valve which is adjacent the combustion chamber, an incline formed upon the outer face of the valve, and a member fixedly mounted upon the engine in position to engage said incline, but only as the valve reaches its closed position, and by cooperation with said incline to thrust and hold the valve securely to its seat, so long as it remains closed.

4. In an internal combustion engine having a valve port affording communication with the combustion chamber, a valve, means guiding said valve for movement in a plane transverse to the port to open or to close the same, and cooperating with the valve to afford a seat for that face of the valve which is nearest the combustion chamber, an incline formed upon the outer face of the valve, a member fixed in position to engage said incline as the valve reaches its closed position, and by cooperation with said incline to thrust and hold the valve securely to its seat, so long as it remains closed, and means extending exteriorly of the engine for adjustment of said fixed incline-engaging member towards and from the final valve-closed position of the incline.

5. In an internal combustion engine having a valve port affording communication with the combustion chamber, a plate-like valve, guide means supporting said valve for rectilinear sliding movement, transversely of the port, between open and closed positions, a wedge upstanding from the outer face of the valve, sloping upwardly from the valve in the closing direction, a fixed stud depending within the port to position its point for engagement with the wedge as the valve reaches closed position, to thrust the valve securely to a seat along its inner face.

6. An internal combustion engine comprising a combustion chamber, a piston reciprocable therein, ports affording communication to and from said combustion chamber, a plate-like valve guided for movement transversely of each port, to open or close the same, and means including a wedge and a presser engageable therewith at a point centralized relative to the port, one on the valve and the other on the engine, to thrust each valve securely to a seat upon its inner face, and entirely about its seat, as such valve reaches its closed position, and means to open and close each valve.

7. In an internal combustion engine having a valve port affording communication with the combustion chamber, a plate-like valve, valve seating and guiding means externally of said port supporting said valve for reciprocatory movement, across the port, between open and closed

positions, a wedge and a cooperating stud, of which one projects from and moves with the outer face of said valve, and the other projects within the port into position to engage the first, the valve, its seat, the stud, and the wedge being relatively so organized and arranged that the valve is pressed against its seat and towards the combustion chamber, to seal off the latter from said seat and the port, by the wedging engagement of the stud and wedge, as the valve reaches its closed position.

8. In an internal combustion engine having a valve port affording communication with the combustion chamber, a plate-like valve, valve seating and guiding means supporting said valve for reciprocatory movement across the port between open and closed positions, a wedge upstanding from the outer face of the valve, a stationary stud having its point centralized relative to said port, the slope of said wedge being such, and said stud depending within the port

to such extent as to engage the wedge as the valve reaches closed position, to thrust the valve securely and with substantially equally distributed pressure to a seat at its face nearest the combustion chamber.

9. In an internal combustion engine having a valve port affording communication with the combustion chamber, a valve, means guiding said valve for reciprocation transversely of said port to open and close the same, and affording a seat for that face of the valve which is nearest the combustion chamber, an incline formed upon the face of the valve which is away from the combustion chamber, and a stud threadedly mounted in the engine in position such that its end may be engaged by the incline as the valve reaches its closed position, by cooperation with said incline to thrust and hold the valve securely to its seat, so long as it remains closed.

MARK L. FORREST.