May 5, 1931. J. J. BOLAND 1,803,459

VALVE GEAR

Filed June 25, 1928

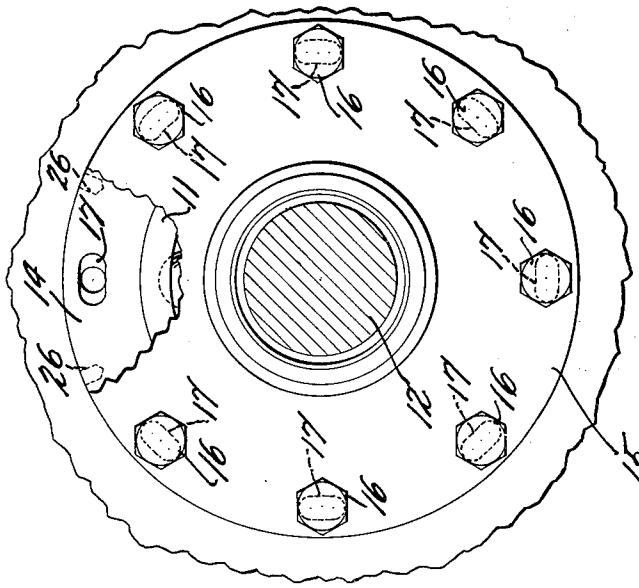


Fig. 2.

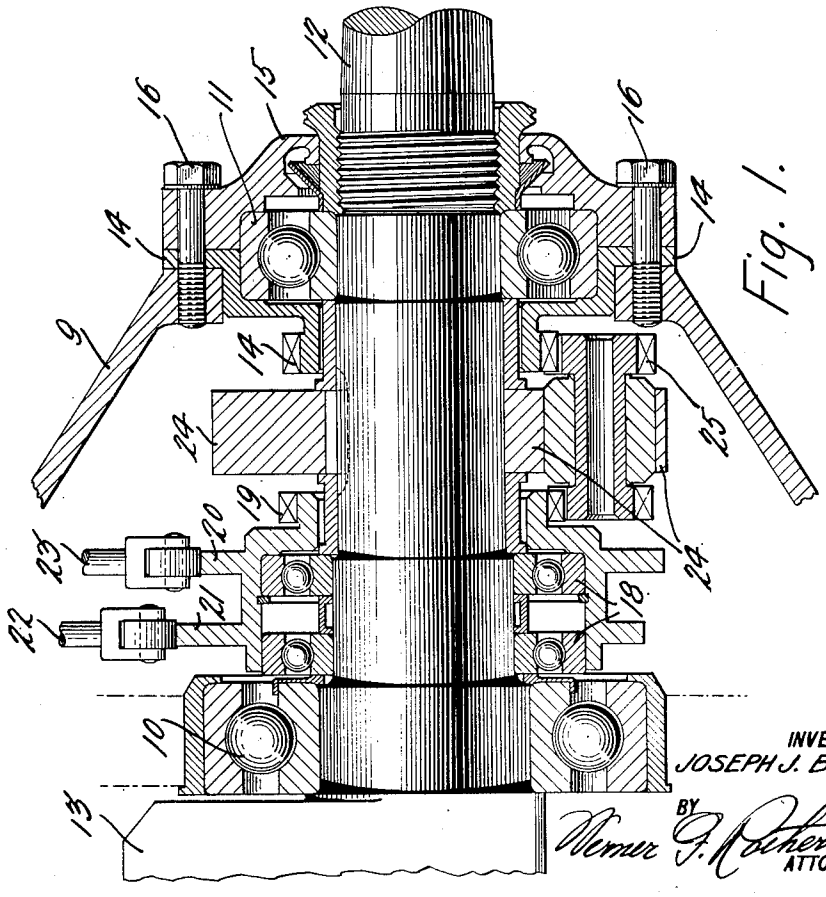


Fig. 1.

INVENTOR
JOSEPH J. BOLAND

BY Werner J. Rothermund
ATTORNEY

Patented May 5, 1931 1,803,459

# UNITED STATES PATENT OFFICE

JOSEPH J. BOLAND, OF KEYPORT, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AEROMARINE PLANE & MOTOR COMPANY, INC., OF KEYPORT, NEW JERSEY, A CORPORATION OF NEW YORK

## VALVE GEAR

Application filed June 25, 1928. Serial No. 288,193.

The present invention relates to internal combustion engines and more particularly to improvements in valve gears such as are associated with the radial type of engine.

An object of the invention is to provide a valve actuating mechanism having suitable and efficient means for the timing of the valve action in which the timing adjustments can be readily accomplished after the engine has been fully assembled.

A further object of the invention is to provide a valve gear comprising a timing mechanism composed of a minimum number of parts of reduced size and weight that is capable of being adjusted externally of the engine.

It is common practice after the final assembly of an engine and also after the engine has been a certain number of hours in service, to run the same on test for observation purposes and adjustment. Accordingly, one of the principal features of the present invention as embodied in the drawings is a new and improved valve actuating gear that is adapted for adjustment or change in the timing of the valves after complete assembly even whilst the engine is functioning. The value of this feature will be better appreciated when it is considered that after the engine has been in service for a length of time, the elements which comprise the valve gear have been subject to more or less wear, the accumulative effect of only slight wear on each of the elements causing disarrangement of the valve timing sufficient to create an undesirable "lag" in the valve action but not serious enough to warrant replacement of a number of only slightly worn parts. With the present improved construction this slight wear of the parts can readily be compensated for by the adjustment of a single element readily accessible exteriorly of the engine.

In the structures of the prior art, changes in the timing of the valves are usually effected by disengaging certain of the gears and rotating one of them relatively to the other until the proper valve timing is obtained. With the present improved construction however, it is possible to change the timing of all the valves on the engine simultaneously without disengagement of any of the gears and with infinite accuracy by the mere rotation of a sun gear normally fixed against rotation to the engine casing to which it is secured by any suitable means, said gear being readily accessible from the exterior of the casing. Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and a careful consideration of the following particular description and claims of one form of mechanism embodying my invention.

Figure 1 is a longitudinal section of the present invention.

Figure 2 is an end elevation with a portion broken away to more fully disclose the adjusting means.

With reference to the drawings, 9 designates the casing of an engine in which is rotatably supported on the bearings 10 and 11, a drive-shaft 12 having a crank 13. The bearing 11 is supported in the casing 9 by means of a normally fixed sun gear 14 having a stepped formation and a bearing cover 15 which secures it in fixed relation with the casing 9 by means of a plurality of cap screws 16 that extend through elongated openings 17 formed in the gear 14.

Upon the drive-shaft 12 there is mounted for rotation relatively thereto on the bearings 18, a gear 19 which is provided with a series of cams 20 and 21 said cams being engaged by the tappets 22 and 23 to actuate the intake and exhaust valves (not shown) of the engine.

Secured to the drive-shaft 12 by any suitable means for rotation therewith, is a pinion cage 24 in which there is rotatably supported one or more satellite pinions 25 (only one being shown on the drawings) which drivably engage both the fixed gear 14 and the driven gear 19 thus completing a planetary drive from the drive-shaft 12 to the cams 20 and 21 at a ratio of about 10 to 1 in the present disclosure, it being understood however, that the invention is not confined to any particular driving ratio.

In operation the various parts enumerated above are completely assembled with the exception of the cap screws 16 which are left

out for a time so as to permit of the gear 14 being moved rotationally with a suitable tool engaged in the openings 26 until an approximate timing of the valves is accomplished. Following this the cap screws are inserted through the elongated openings 17 but not fully tightened up so that a close and final adjustment to the extent of the openings 17 may be made, after which the tightening up process may be completed.

It will be understood that with the present embodiment the timing adjustments may be accomplished irrespective of what the angular relation of the gear teeth are, as the rotation of the normally fixed gear 14 may be carried to any point or stopped at any point. A limited movement has been provided for within the range of the elongated openings 17, but it will be appreciated that an unlimited rotational movement is possible by rotationally advancing or retracting the gear the space of one or more screw holes, there being 8 such holes shown in the gear of the present disclosure. For example, we will say that there are 27 teeth formed on the gear 14 which would mean that the location of each hole will bear a different angular relation to the nearest tooth on the gear, in fact giving a choice of timing within $5 \times 10 = 50$ degrees of the drive-shaft or 5 degrees of cam rotation as the nearest multiple of 13.3 degrees (one tooth) to 45 degrees (one hole) which is 40 degrees equal to 3 teeth.

Variations may be resorted to within the scope of the invention and portions of the improvements may be used without the others, whilst not departing from the spirit of the invention.

Having thus described my invention, I claim:—

1. In apparatus of the class described, the combination with an engine having a casing and a crank-shaft extending therethrough, of a valve gear driven from the crank-shaft in which one of the gears extends exteriorly of said casing and secured thereto in a manner as to permit rotation of same at the will of an operator.

2. In apparatus of the class described, the combination with an engine having a crank-case, drive-shaft, a cam means mounted upon the drive-shaft in concentric relation and rotatable relatively thereto, and a means adapted to transmit drive from the drive-shaft to the cam means at a different rate of speed than said drive-shaft; said means including a drive transmitting element having a portion that extends outwardly in a manner as to be accessible exteriorly of the crank-case and normally secured thereto in fixed relation and adapted for adjustment at the will of an operator so as to alter the timing of said cam means with respect to the drive-shaft.

3. In apparatus of the class described, the combination with an engine having a crank-case provided with an opening, of a valve gear including a normally fixed gear having an outer rim engaging the crank-case at said opening; said rim provided with elongated openings circumferentially disposed, and securing means extending through said openings into said crank-case; said stationary gear adapted for rotational movement when said securing means is released.

4. In apparatus of the class described, the combination with an engine having a crank-case and a drive shaft extending through an opening therein, of a valve gear comprising a plurality of rotatable gears, a relatively stationary gear concentric with the drive shaft and engaging the crank-case at said opening, a bearing means for said shaft supported by the stationary gear, and means for securing both the bearing and the gear to said crank-case; said stationary gear adapted for limited rotational movement at the will of an operator.

5. In apparatus of the class described, the combination with an engine having a crank-case and a drive shaft extending through an opening therein, of a valve timing mechanism including a normally fixed gear concentric with the drive shaft and having an outer rim engaging the crank-case at said opening; said rim provided with elongated openings circumferentially disposed, a bearing means for said shaft supported by the stationary gear, and securing means extending through said openings into said crank-case; said stationary gear adapted for rotational movement when said securing means is released.

Signed at Keyport, in the county of Monmouth, and State of New Jersey this 22nd day of June, A. D. 1928.

JOSEPH J. BOLAND.