L. E. RAUSENBERGER.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC 12, 1919.

1,401,442. Patented Dec. 27, 1921.

Fig. 2.

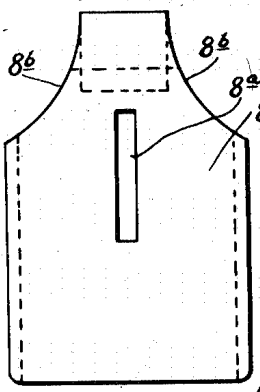
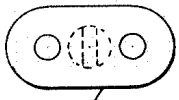


Fig. 1.

Fig. 3.



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INTERNAL-COMBUSTION ENGINE.

1,401,442. Specification of Letters Patent. Patented Dec. 27, 1921.

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To all whom it may concern:

Be it known that I, LARENCE E. RAUSENBERGER, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to an improved design and construction of internal combustion engines, and has for its particular object to provide an engine of improved design, simpler construction and more effective operation than what is now common practice in this art.

An object of the invention is to provide an engine of suitable construction with overhead valves and a cam shaft and cams to actuate the valves arranged in their operting relation within greatly reduced space from the present common practice in engine construction and in which many parts consisting of rocker arms, shafts, bearings, rollers, pins, etc., are eliminated and a more positive action of the valves is accomplished.

It is an object of the invention to provide valves and valve actuating mechanism all self-contained within the valve and cam shaft casing as distinguished from the present practice of having a considerable part of the mechanism outside the casing.

In the construction here shown the valve plungers differ from ordinary construction by being cup-shaped, the walls of the cup extending downwardly over the valve stem and valve actuating springs, thus providing the plungers with ample bearing surface to guide them in their operating movements within the valve casing. The distance between the end of the valve stem and the cam being very short, the action of the cam on the plunger and valve stem is more direct, thereby minimizing the side thrust on the plungers and effecting a more positive action of the valve.

The inverted cup-shape of the valve plungers also serves as a protection or safeguard for the valve adjusting mechanism which is contained within the plunger cup and is inaccessible except by removing the valve and cam shaft casing. Thus when the valve is properly adjusted to insure proper performance of the engine, tampering or experimenting with the adjustment by inexperienced persons which is a common experience where the adjusting mechanism is readily accessible, is not likely to occur under the present construction because of the normal inaccessibility of the adjusting parts.

It is also a feature of the present invention to provide an oil-tight valve and cam shaft casing in which the mechanism may run in oil, or the required amount of oil is constantly supplied to the mechanism by an automatic oiling system. Thus the mechanism will be kept free from dirt and normal, dependable action of the valves will be maintained.

With the elimination of rollers, pins, rockers, etc., the common difficulty experienced of unequal timing of the parts is greatly reduced, and a more synchronous, positive functioning of the valve mechanism is effected.

Generally considered the improved valves consist of simple, compact construction, self-contained in an oil-tight casing; the operable parts being substantially made, not easily rendered out of adjustment or subject to rapid wear; the mechanism as a whole functioning by direct positive action under the usual conditions of operation.

In the accompanying drawings:—

Figure 1 is a sectional view taken longitudinally through a valve unit of the motor and a detail of one of the cylinders;

Fig. 2 is a detail view of a valve plunger; and

Fig. 3 is a detail of the plunger guide or retaining pin.

The invention, as here shown, consists of a suitable cylinder 1 of an internal combustion engine having intake and exhaust ports respectively, 2 and 3, the construction shown being of conventional form for the purposes of illustration, no novelty being claimed as to the cylinder construction.

Mounted on the top of the cylinder 1 is a valve and cam shaft housing 4^a—4^b which, as here shown, is preferably cast integrally and is secured to the cylinder casing by stud bolts 5, a copper gasket 4^d being employed to form a tight joint between the housings. The upper portion of the housing 4^a is cylindrical shaped and constitutes the cam shaft housing, the cam shaft 6 being supported in bearings 6^a secured in the ends of the housing by lock bolts 6^b; cams 7

being secured to and suitably spaced on the shaft in operating relation with the valve plungers 8.

It will be understood that the valves are arranged in sets and in series for a multiple-cylinder engine, an intake valve and an exhaust valve being provided for each cylinder, the actuating cams for the respective valves being timed to effect the explosions and exhausts of the gaseous charges in the cylinders in proper sequence. All the valves of the motor, as here shown, are in longitudinal alinement, the intake and outlet valves being of interchangeable construction except as to the timing of their actuating cams.

An observation aperture is provided in the housing opposite each valve whereby the adjustment of the valve plunger relative to the actuating cams may be effected, the apertures being normally closed by plates 9 secured to the housing by bolts 10. As here shown, when the cam is not in operating relation with the plunger a clearance space 11 is formed between the hub of the cam and the top of the plunger. Thus the plunger will be out of contact with the cam except during the interval that operation of the plunger takes place, thereby preventing continuous wear of the contact surfaces and also preventing the possibility of slight operation of the valve between the full actions thereof.

The plunger 8, as here shown, is in the form of an inverted cup, the upper surface of the cup being engaged by the cam 7 to actuate the plunger in a downward direction, the cup being cylindrical in shape and fitting closely the valve cylinders formed in the housing 4^b. Thus a long bearing surface is provided between the plungers 8 and the valve cylinders. It will be observed that the centers of the cam shaft and valve plungers coincide. Therefore, direct action of the cams on the plungers is obtained and side thrust on the plungers is practically eliminated. Rotative movement of the plunger is prevented by a plunger lock pin 11, which has a supporting flange 12 and is secured to the housing 4^b by screws 13, the inner end of the pin being tapered as at 11^a to engage a slot 8^a in the plunger 8 which is of sufficient length to permit of the full operating movement of the plunger.

The lower portion 4^c of the valve chamber or cylinder is formed in the cylinder casing of the motor and is slightly larger in diameter than the upper portion of the valve cylinder. Thus the plungers will work freely therein, friction between the parts being eliminated without exact alinement of the two housings. Also provided in the upper portion of the cylinder casing 1 is a threaded aperture 14 concentric with the valve chamber, and having secured therein a threaded guide sleeve 15 for the valve stem 16 which has a valve head 17 formed at its lower end coöperating with the intake port 2, and a flange or washer 18 secured to its upper end by means of a slotted washer 18^a fitted into an annular groove 18^b formed in the end of the valve stem, coiled springs 19 and 20 being interposed between the flange 18 and the bottom of the cylinder 4^c which act to normally hold the valve stem and plunger in raised position to close the valve and to restore the valve to closed position after each actuation thereof. The springs are coiled in inverse direction, that is to say, right and left, which gives a balanced spring action, one spring compensating for the tortion or twist of the other under compression. The inverse coils also prevent meshing of the coils of the opposite springs when the same are compressed. A further advantage in using the double springs is obtained in the event that one of the springs should break, as the action of the other spring will still be sufficient to operate the valve until replacement of the broken spring can be made.

Inside the head of the valve plunger means are provided for adjusting the plunger relative to the actuating cam. In the present construction substantially .0020″ clearance between the parts is provided. Thus the plunger is in contact with the cam only during the operation of the valve.

The adjustment of the plunger in this respect is highly important as it influences or determines very largely the smoothness and general effectiveness of operation of the motor.

As here shown the means for adjusting the valve plunger consists of a set screw 21 threaded into the head of the plunger and adapted to be raised or lowered relative to the plunger to maintain the space between the plunger and the cam at the required dimension for the proper timing of the valves. To effect the adjustment of the plungers the plate 9 is removed from the observation aperture in the casing and a thickness gage is inserted between the plunger and the cam to measure the clearance space therebetween. If the space is in excess of the established dimension the adjusting screw 21 is lowered; and if the space is less, the adjusting screw is raised, to effect the adjustment, the adjustment of the screw being maintained by very thin shims 22 inserted under the head of the adjusting screw. When the screw is to be raised the required number of shims are removed and when the screw is to be lowered additional shims are added, to compensate for the adjustment.

The adjustment of the valves may be made through the observation aperture by means of suitable tools adapted to be in-

serted through apertures 8ª in the plunger head to engage the head of the adjusting screw. Adjustment of the valves when once properly timed is ordinarily unnecessary except when the valves are reground which will vary the space between the plunger and the cam; adjustment should then be made, as above described, to reëstablish the space between the plunger and cam to normal dimension.

The valve plungers and stems are preferably made of steel or other suitable metal, the weight to be overcome by the valve springs being minimized by the improved construction and the live action of the mechanism. The motor cylinders are preferably made of aluminum to obtain lightness, the valve and cam shaft housing being made of cast iron, aluminum, or other metal suited for the working conditions of the housing.

Lubrication of the valve mechanism is effected by an improved oiling system which forms the subject matter of a separate application for Letters Patent and is therefore not shown or described in detail in the present application. Briefly stated, the oil is delivered to the valve mechanism by an automatic pumping mechanism which delivers the oil through the hollow cam shaft 6, oil ports 6ª being provided opposite each valve plunger, thus causing oil to flow over the head of the plunger upon each rotation of the cam shaft, the oil being of sufficient quantity to properly lubricate all working parts of the valve.

Motors of the character here shown are designed and constructed for high power and high speed operation, where the maximum H. P. is required with the minimum of weight, the motors being especially adapted for airplane equipment for both commercial and military service. It is, therefore, of first importance that the proper functioning of the valves should be positive and dependable under extreme conditions of operation. To this end the novel features of the present invention consisting of an improved design, elimination of numerous detail parts, compact and self-contained mechanism and direct positive action of the valves, constitute improvements of far reaching importance in the advancement of this art which in their combined effect substantially improve and increase the general effectiveness and dependability of operation of the motor.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a valve mechanism the combination with a housing comprising a cylinder, an inverted U-shaped plunger operable therein, a hollow cam shaft mounted in said housing having a cam in direct operative relation with said plunger and an oil aperture in said shaft whereby oil delivered therethrough will be discharged upon the plunger, of means within the plunger comprising an adjusting screw and a plurality of shims coöperating therewith whereby the space between the plunger and the cam may be adjusted to a predetermined position.

2. In a valve mechanism, the combination, with a valve cylinder, of an inverted cup-shaped plunger operable therein, a cam in direct operative relation with said plunger, means within the plunger comprising an adjusting screw and a plurality of shims cooperating therewith whereby the space between the plunger and cam may be adjusted to a predetermined dimension, and suitable apertures in the valve housing and said plunger whereby to effect said adjustment.

In testimony whereof I affix my signature.

LARENCE E. RAUSENBERGER.