Sept. 10, 1968 G. SIDING 3,400,693

VALVE GEAR FOR AN INTERNAL COMBUSTION ENGINE

Filed June 10, 1966

FIG. 1

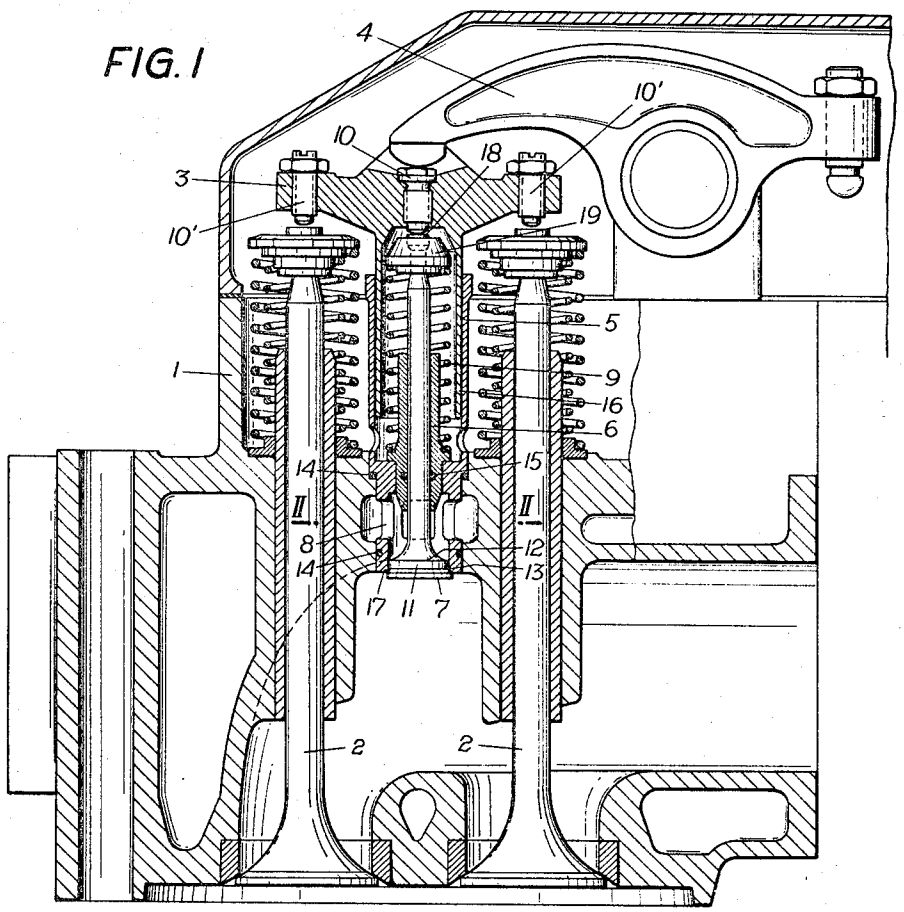


FIG. 2

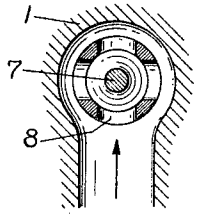
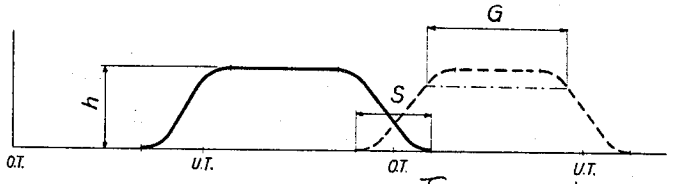


FIG. 3



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United States Patent Office 3,400,693
Patented Sept. 10, 1968

3,400,693

VALVE GEAR FOR AN INTERNAL COMBUSTION ENGINE

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Filed June 10, 1966, Ser. No. 556,776
Claims priority, application Austria, June 11, 1965, A 5,329/65
2 Claims. (Cl. 123—27)

ABSTRACT OF THE DISCLOSURE

A valve gear for an internal combustion engine with each cylinder of the engine having two intake valves and a gas valve parallel to each other and a guide means for each valve and a valve bridge slidably guided in parallel relation to the valves two stops are mounted in the valve bridge coaxially arranged as to the intake valves and a third stop is in coaxial relation to a stem of the gas valve.

The invention relates to a valve gear for internal combustion engines, comprising two intake valves operated by means of rocker arms via a common valve bridge arranged on the cylinder head in parallel relation to the valve stems, and a gas valve for each cylinder.

Gas is generally delivered to the cylinders of gas engines and binary engines via a separate gas valve controlled either by a separate cam gear or by an operating mechanism derived from the rocker arm of the intake valve. The inherent drawback of similar operating systems resides in the partly considerable structural expense on the one hand and in the difficulty of accommodating the gas valve with its operating mechanism on the cylinder head, particularly where the cylinder head comprises a plurality of valves.

In a conventional valve gear of the type hereabove described and comprising two intake and two exhaust valves operated in pairs via a valve bridge, the valve assembly is operated by means of three rocker arms located on the same axis, each rocker arm being controlled by one cam of the common camshaft, one of the said rocker arms cooperating with the valve bridge of the intake valves, the second with the valve bridge of the exhaust valves and the third with the gas valve preferably arranged in the longitudinal central plane of the internal combustion engine and eccentrically in relation to the cylinder axis. The axis of rotation of the rocking levers forms an acute angle with the longitudinal central plane of the engine. The drawback inherent in this conventional design resides in the fact that the rocker arms present considerable differences in the dimensions and length of their arms which makes the most convenient arrangement of the three cam gears impossible and compels the designer to compromise. Moreover, owing to the limited availability of space the objectionable, highly eccentrical arrangement of the gas valve will have to be accepted. Furthermore, the oblique position of the axes of the rocker arms precludes the use of a rocker arm shaft extending through all of the cylinders.

These shortcomings of valve gears of conventional design are eliminated by the present invention which provides for a valve gear of a design assuring compactness while permitting the most convenient arrangement of the cam gear. In addition, a more practical layout of the gas valve is obtainable. For the purpose, the gas valve can be operated according to the invention via the valve bridge. Consequently, special operating means for the gas valve will not be required so that considerable space will be saved and construction greatly simplified. This offers the designer greater leeway for the arrangement of the valves in the cylinder head and for the design of the rocker gear.

According to another feature of the invention, the gas valve and the guide means for the valve bridge are arranged in a coaxial relation preferably midway between the two intake valves. The valve opening force exerted upon the valve bridge by the rocker arm is uniformly transmitted to the two intake valves and to the gas valve without producing eccentricities.

According to a further feature of the invention, the gas valve is located within a hollow shaft of the valve bridge in order to reduce the overall height of the valve gear as far as possible, the said shaft being slidably arranged in a guide bushing of the cylinder head carrying both the valve guide and at its inner extremity the seat of the gas valve. Thus, the gas valve and the guide means for the valve bridge form a single structural unit of minor dimensions offering the additional advantages of simplicity of assembly and easy exchangeability.

The forces are transmitted to the gas valve according to another feature of the invention by the provision of a contact piece on the valve bridge in coaxial relation to the gas valve, cooperating with the extremity of the stem of the gas valve, preferably with the interposition of a spring element. The valve clearance of the gas valve is adjusted independently from the separately adjustable valve clearance of the intake valves by means of the adjusting screw of the rocker arm.

Further details of the invention will appear from the following description of an embodiment of the invention with reference to the accompanying drawing in which:

FIG. 1 is a vertical cross-sectional view of the cylinder head of an internal combustion engine equipped with a gas valve according to the invention,

FIG. 2 a horizontal cross-sectional view of the above on line II—II of FIG. 1, and

FIG. 3 a valve stroke diagram for the embodiment of the invention shown in FIGS. 1 and 2.

Within the cylinder head **1** the two intake valves **2** are arranged symmetrically in relation to the longitudinal central plane of the internal combustion engine. They are operated in the usual manner by means of the camshaft (not shown) via the rocker arm **4** and the valve bridge **3** comprising a centrally located hollow-cylindrical shaft **16** slidably arranged within an essentially cylindrical guide bushing **5** inserted in an appropriate bore of the cylinder head **1** with the interposition of gaskets **14**. Inside the guide bushing **5**, the gas valve **7** is located with its valve guide **6** inserted in the central bore of the guide bushing **5** and resting on the same with a collar. The gas valve is sealed by means of a gasket **15** arranged in an annular groove in the central bore of the valve guide **6**.

The guide bushing **5** carries the annular seat **17** of the gas valve **7** at its inner extremity protruding into the suction chamber in front of the intake valves and presents four radial perforations **8** in the area between the seat **17** and the valve guide **6**, through which gas is delivered to the cylinder. The valve spring **9** of the gas valve **7**, supported in a manner known per se by the spring plate **19** connected with the extremity of the stem **18** is also located within the hollow shaft **16** of the valve bridge **3**.

The downward motion of the valve bridge **3** initiated by the rocker arm **4** is transmitted via a contact piece or element **10** to the extremity of the stem **18** of the gas valve **7** and via adjusting screws **10'** to the two intake valves **2**. During the descending movement of the rocker arm **4** the gas valve **7** is thus pressed downwards in conjunction with the two intake valves **2** and opened. In order to prevent gas from flowing into the cylinder already during the scavenging period S (see FIG. 3) and from escaping unused through the exhaust, the gas valve

7 is provided with a collar 11 interrupting the gas supply to the cylinder during the initial stage of the valve opening motion. The gas supply is resumed only after the valve edge 12 has passed the seat edge 13. In the diagram of FIG. 3 the strokes of the exhaust valves (solid line) and the common stroke of the intake valves and of the gas valve (dotted line) are plotted as coordinates above the crank angle. The maximum valve stroke is designated by reference letter *h*. The scavenging period extends over the area of the intersection of the two curves before and after the top dead center. As a result of the measure as hereabove described, the beginning of the blow-in period G is delayed so as to coincide with the end of the scavenging period S.

In lieu of the operation hereabove described, retardation of the blow-in period can also be accomplished by means of an embodiment of the invention (not shown) wherein a spring element is inserted between the contact piece 10 and the extremity of the stem 18 of the gas valve, travel, prestress and resilience of the said spring element being selected with a view to ensuring the increase of the resilience of the said spring element during the downward motion of the valve bridge 3 starting from a minimum value and attaining at the end of the spring travel a value corresponding approximately to the prestress of the valve spring 9. Only from this position onwards the opening motion of the gas valve 7 is also initiated as the downward motion of the valve bridge 3 continues. Preferably the gas valve opening motion is enforced by means of abutments or the like stops provided on the valve bridge.

I claim:

1. A valve gear for an internal combustion engine, each cylinder of which comprises two intake valves arranged in suspension in the cylinder head in spaced and parallel relation to each other, a common inlet port for the two intake valves, a gas intake located in the cylinder head between the said intake valves, a bore provided between the intake valves in parallel relation thereto and extending from the top of the cylinder head through the said gas intake as far as the inlet port, a guide bushing inserted in the said bore and having apertures connecting the interior of the guide bushing with the said gas intake, a valve seat at the inner extremity of the said guide bushing, a valve guide coaxially arranged in the said guide bushing, a gas valve slidably guided in the said valve guide and cooperating with the said valve seat, a valve bridge having a hollow cylindrical shaft protruding into the said guide bushing and slidably guided therein, the said shaft surrounding the said valve guide of the gas valve, two thrust elements mounted on the valve bridge each in coaxial relation to the shaft of one of the said intake valves, a third contact element arranged in coaxial relation to the shaft of the said gas valve, a valve rocker for the joint operation of the said two intake valves and of the said gas valve, one arm of the said valve rocker cooperating with the said third contact element of the valve bridge.

2. A valve gear according to claim 1, in which the said gas valve and the said guide bushing are arranged centrally in relation to the said two intake valves.

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