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[54] **VALVE ACTUATING ARRANGEMENT FOR INTERNAL COMBUSTION ENGINES**

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[51] **Int. Cl.**.....**F01l 1/26**

[58] **Field of Search** ...123/90.23, 90.22, 75 B, 90.27, 123/90.48; 74/569

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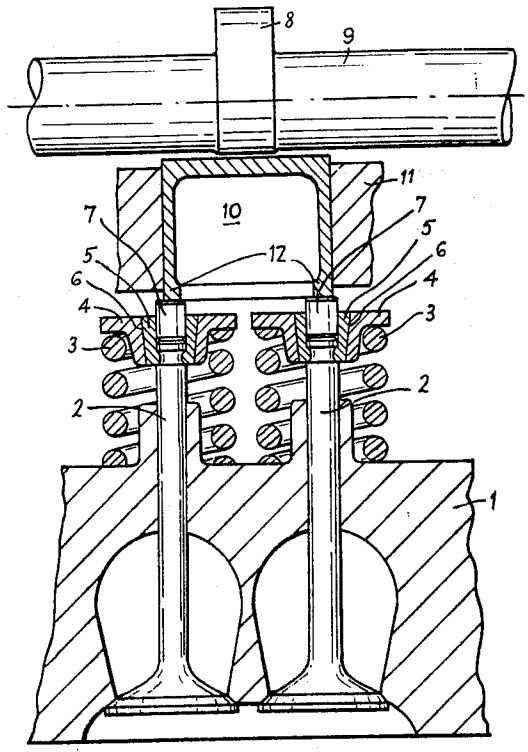
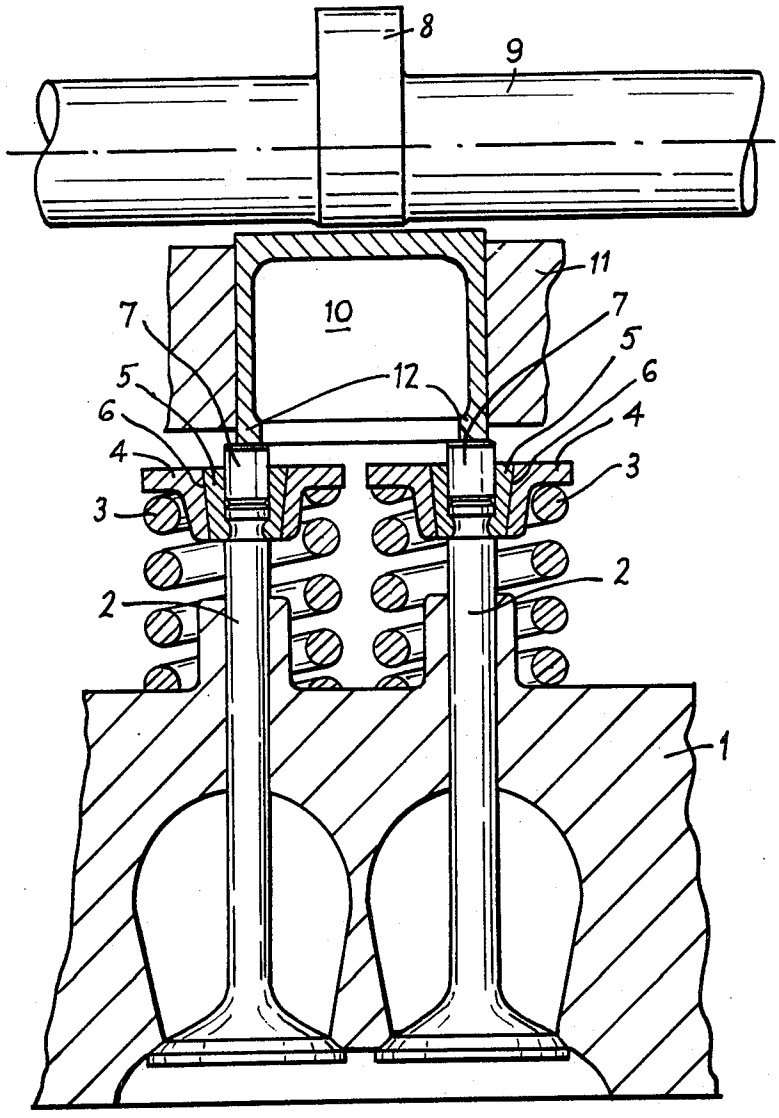
[57] **ABSTRACT**

This invention relates to a valve actuating arrangement for an internal combustion engine having plural parallel-operating poppet valves associated with the or each combustion chamber of the cylinder head of the engine, wherein said valves are actuated by a common cam via a common tappet, cooperating with, and interposed between, the cam and the valves. The tappet is tubular and has a transverse wall closing one end, which is engaged by a cam. The rim, at the open end of the tubular member, engages the parallel valves.

6 Claims, 1 Drawing Figure

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VALVE ACTUATING ARRANGEMENT FOR INTERNAL COMBUSTION ENGINES

The present invention relates to internal combustion engines of which the or each combustion chamber is fitted with plural inlet valves and/or plural exhaust valves.

The valves which fulfill the same function, for example, the plural inlet valves are actuated simultaneously and in parallel, and are submitted to the same law of movement governed by the rotation of cams. Each valve is opened by the opening side of the profile of the cam, and is returned to its closed position by means of a valve spring attached to the valve stem.

In one known arrangement, as applied to an overhead valve engine, there is interposed between each cam and the end of each valve stem remote from the valve head, a cylindrical slidably mounted tappet of generally inverted cup shape, which is coaxial with, and surrounds the valve stem, and engages the end thereof. In the case of plural valves which work in parallel, the distance between the valve axes restricts the maximum diameter of the tappets, which, in turn, restricts the maximum valve lift for a given type of cam profile. This is one of the disadvantages of the known arrangement.

It is an object of the present invention to provide a valve actuating arrangement which avoids this disadvantage.

According to one aspect of the present invention, there is provided a valve actuating arrangement for an internal combustion engine having plural parallel-operating poppet valves associated with a combustion chamber thereof, wherein said valves are actuable by a common cam via a common tappet.

The invention also consists in an internal combustion engine, particularly an overhead valve engine, provided with one or more valve actuating arrangements as above described.

In order that the invention may be more readily understood, reference will now be made to the accompanying drawing, in which the single FIGURE is a fragmentary section of part of a cylinder head of a multi-cylinder overhead valve, overhead camshaft, internal combustion engine employing a valve actuating arrangement embodying the present invention.

Referring to the drawing, the cylinder head **1** is designed to accommodate two parallel-operating poppet inlet valves **2** per combustion chamber. These valves are mounted with their axes parallel and spaced apart by a distance determined by the diameter of the valve heads. Each valve is normally urged towards its closed position shown in the drawing by a coil spring **3** which is maintained in a compressed state between the cylinder head **1** and a valve-spring retaining washer **4**. The washer **4** is secured to the valve stem adjacent the upper end thereof by segments **5** of an axially split, frusto-conical cotter, which are located around the valve stem in a frusto-conical cavity **6** in the washer **4**.

Mounted within the cotter of each valve **2** is a replaceable cylindrical spacer **7** of predetermined length which engages the upper end of the valve stem the valve clearance being adjusted to the required value by selecting and fitting a spacer **7** of the required length.

The two valves **2** are actuated simultaneously and in parallel by the profile of the same cam **8** carried by a camshaft **9**. To this end, there is interposed between the cam **8** and the two valves **2**, a common tappet **10** slidably mounted in a member **11** secured to, or integral with, the cylinder head **1**. This tappet **10**, which is formed from a suitable metal, is cylindrical and tubular in form, and is closed at its upper end, thus resembling an inverted cup. The cam **8** is co-operable with the upper face of the closed end of the tappet, whilst the spacers **7** of both valves **2** are co-operable with a thickened and accurately machined rim **12** extending around the lower open end of the tappet **10**.

Only the inlet valves and their associated actuating mechanism have been shown in the drawing for the sake of clarity. It will be understood, of course, that the or each combustion chamber will additionally be fitted with one or more exhaust valves, actuated by a suitable mechanism.

The valve actuating arrangement described possess a number of advantages over prior arrangements in which individual inverted cup-shaped tappets are fitted over the end of the stem of each parallel-operating valve, with the end of the stem co-operating with the underside of the closed end of the tappet. In this respect, the maximum diameter of the tappet, and therefore the maximum valve lift for a given cam profile, is not restricted, to the same degree, by the spacing between the valve axes. Moreover, since the tappet does not surround the valve stem, the valve spring and its retaining washer do not have to be dimensioned to fit within the tappet.

Additionally, since the tappet does not shroud the upper end of the valve stem, the adjustment of the valve clearances may be readily effected. For example, if spacers **7** are employed, these may be readily removed and replaced by spacers of different predetermined axial lengths by simply compressing the valve springs **3**, without the necessity of removing the tappet and/or camshaft. This advantage will also arise if other types of adjustments are employed.

Furthermore, the weight of the arrangement may be reduced, and since only one cam is employed to actuate all the parallel-operating valves in each combustion chamber, it is possible to employ a camshaft having the same number of cams, with different cylinder heads, to actuate single, or plural parallel-operating inlet and/or exhaust valves.

It will be understood that various modifications may be made without departing from the scope of the present invention as defined in the appended claims. For example, the tappet may be non-cylindrical and/or may be perforated, relieved or otherwise formed to reduce its weight. The rim **12** of the tappet need not be thickened, or may, in addition, or as an alternative, to thickening the rims to extend the rim radially inwards as shown, the rim may be thickened to extend it in a radially outward direction.

The or each combustion chamber may be fitted with plural parallel-operating exhaust valves, actuated in the same manner as the inlet valves **2**, instead of, or in addition to plural inlet valves. Alternatively, the plural parallel-operating valves which fulfil one function, and which may be more than two in number, may be employed with a single valve which fulfills the other function.

Although the embodiment illustrated embodies an overhead camshaft directly acting on the tappet, the camshaft may actuate the tappet via a rocker arm, the camshaft either actuating the rocker arm directly, or indirectly via a push-rod. Alternatively, in a push-rod engine, each of two or more parallel-operating valves per cylinder may be actuated by an individual push-rod, and a tappet, common to all the push-rods of these parallel-operating valves, and similar to the tappet illustrated, may be interposed between these push-rods and a common cam profile.

Although, in the embodiment illustrated, the valve clearances are adjusted by cylindrical spacers 7 other means for adjusting the clearance may be employed.

The valve actuating arrangement may be employed in single or multi-cylinder two stroke or four stroke internal combustion engines. The arrangement may be employed in combination with compression coil springs which surround the valve stems as shown in the drawing, or with springs which do not surround the valve stems, such as springs of the hair-pin or torsion bar type. The springs may be anchored by anchoring means other than cotters as shown in the drawing.

I claim:

1. A valve actuating arrangement for an internal combustion engine having plural parallel-operating poppet valves associated with a combustion chamber thereof, wherein said valves are actuable by a common cam via a common tappet which is tubular, having a transverse wall at one end and being open at its opposite end so as to terminate in a rim, the transverse wall being cooperable with the cam, and the rim being cooperable with the valves, the tappet being guided and mounted for sliding reciprocating movement, with respect to a mounting member by the portion of the tappet interconnecting the transverse wall and the rim.

2. An arrangement as claimed in claim 1, wherein the tappet is cylindrical and the mounting member has a circular tappet-receiving passage therein, the internal surface of the passage slidably cooperating with the external surface of the tappet, and the longitudinal axis of the tappet being generally symmetrically disposed with respect to the longitudinal axes of the valves.

3. An arrangement as claimed in claim 2, wherein the tappet is directly interposed between, and cooperable with, the cam of an overhead cam shaft and a pair of parallel-operating overhead valves, the tappet diameter approximating the inter-axial spacing of the valves, the wall thickness of the rim extending the wall thickness of the tubular body portion of the tappet interconnecting the transverse wall and the rim.

4. A cylinder head for an internal combustion engine, said cylinder head having at least one combustion chamber, a pair of parallel-operating poppet valves operatively associated with said combustion chamber, and having substantially parallel longitudinal axes, a cylindrical, tubular tappet, common to both said valves, means cooperating with the external cylindrical surface of the tappet to mount said tappet for sliding reciprocating movement relative to said head in a direction substantially parallel to the longitudinal axes of the valves, with the longitudinal axis of the tappet substantially parallel to, and equi-spaced from, both valve axes, said tappet having a lower open end which defines an annular valve-engaging rim, of a diameter approximating the inter-axial spacing of the valve axes, and an upper end closed by a transverse wall cooperating with valve operating means.

5. A cylinder head as claimed in claim 4, including a valve clearance-adjusting spacer interposed between each valve stem and said rim, and interchangably secured to the valve stem.

6. A valve actuating arrangement for an internal combustion engine having plural parallel-operating poppet valves associated with the combustion chamber thereof, said valves being actuable by a common cam via a common tappet, said tappet including a cross-member extending in a direction generally transverse to the longitudinal axes of the valves and a longitudinal member connected to the cross-member and having portions disposed generally coincident with extensions of the valve axes, the cross-member being cooperable with the cam, and the ends of the generally coincident portions of the longitudinal member remote from the cross-member being cooperable with the valves, the longitudinal member and a mounting member being provided with cooperating bearing surfaces by means of which the longitudinal member is mounted for sliding the movement relative to the mounting member, the plane of the cooperating bearing surfaces being approximately coincident with extensions of the valve axes.

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