United States Patent [19]

Hatz

[11] **3,757,749**

[45] **Sept. 11, 1973**

[54] **VALVE OPERATING GEAR IN INTERNAL COMBUSTION ENGINES**

[75] Inventor: **Ernst Hatz**, Ruhstorf, Germany

[73] Assignee: **Motorenfabrik Hatz KG**, Ruhstorf, Germany

[22] Filed: **Mar. 29, 1971**

[21] Appl. No.: **128,945**

[30] **Foreign Application Priority Data**

Apr. 14, 1970 Germany ..... P 20 17 823.8

[52] **U.S. Cl.** **123/90.22**, 123/90.2, 123/90.23, 123/90.48, 74/55, 74/569

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

[58] **Field of Search** 123/90.2, 90.22, 123/90.23, 90.48; 74/55, 569

[56] **References Cited**

UNITED STATES PATENTS

1,459,193	6/1923	Bugatti	123/90.27
1,406,271	2/1922	Michelsen	123/90.23
3,353,523	11/1967	Meden	123/90.23
1,910,813	5/1933	Powell	123/90.22
R15,019	1/1921	Landgraf	123/90.22
1,970,104	8/1934	Ryder	123/90.48

Primary Examiner—Laurence M. Goodridge
Assistant Examiner—Ronald B. Cox
Attorney—Larson, Taylor & Hinds

[57] **ABSTRACT**

In an internal combustion engine, the engine casing has segmental flanges defining one or more annular guideways extending generally at right angles from the camshaft. At least one correspondingly annular segmental element is slidably disposed in each guideway such that one end thereof bears against the cam and the other end provides a seat for an associated valve push rod. Reciprocation of the element along the annular guideway actuates the push rod, and hence the valve. The segmental element may include an oil reservoir which receives oil from a duct or reservoir in the casing or flanges, and conducts the oil to an oil duct in the push rod.

3 Claims, 4 Drawing Figures

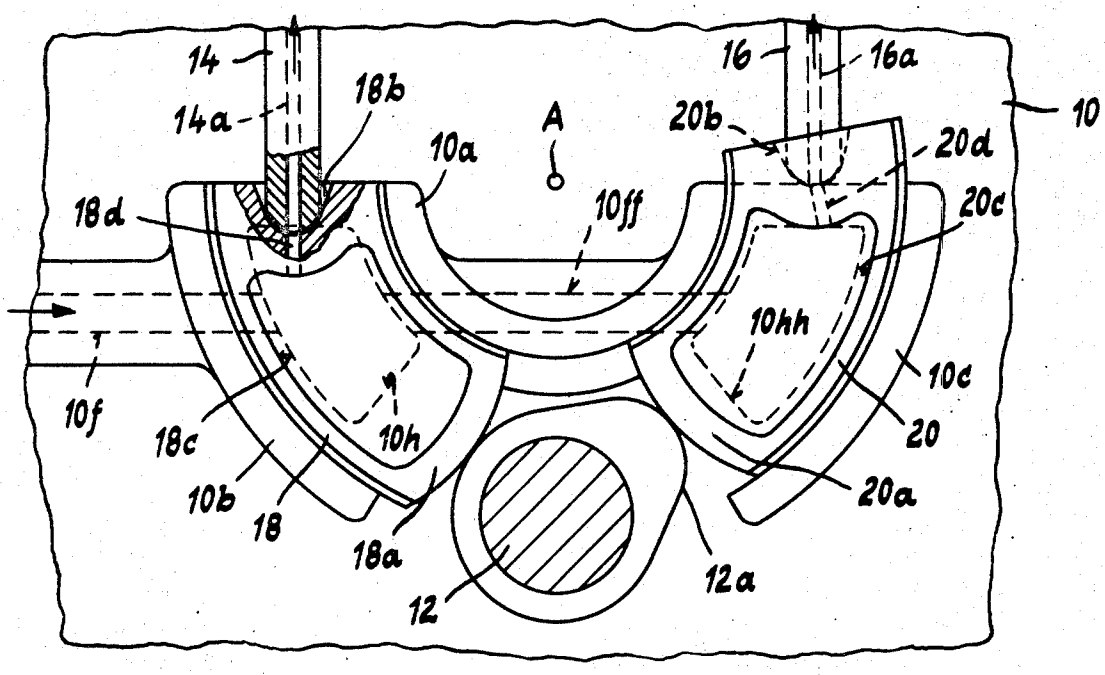
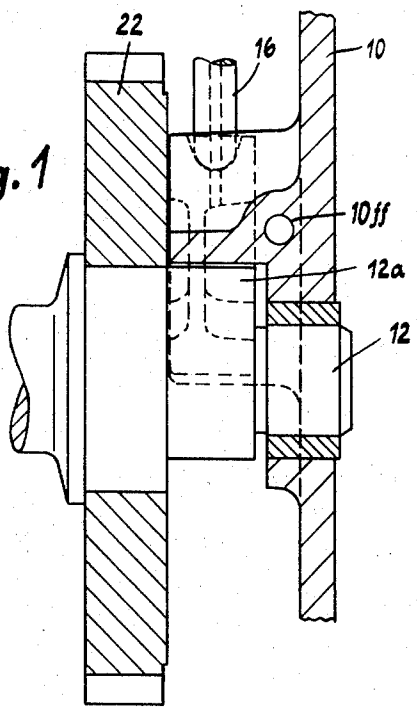


Fig. 1



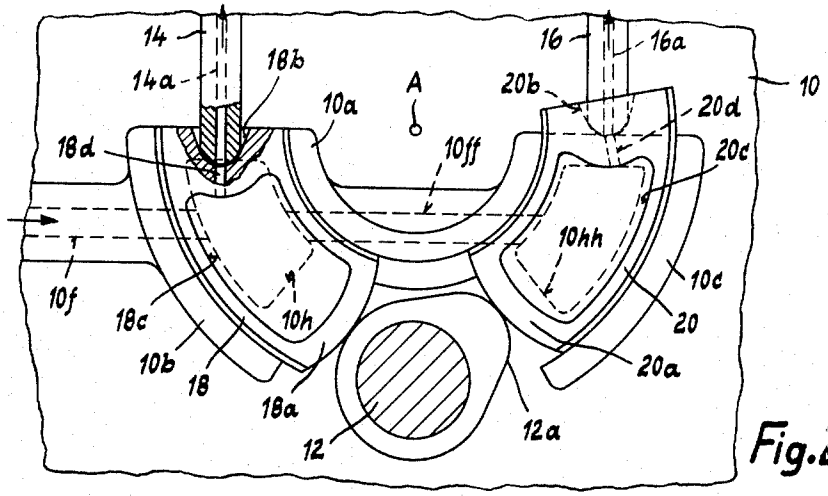


Fig.2

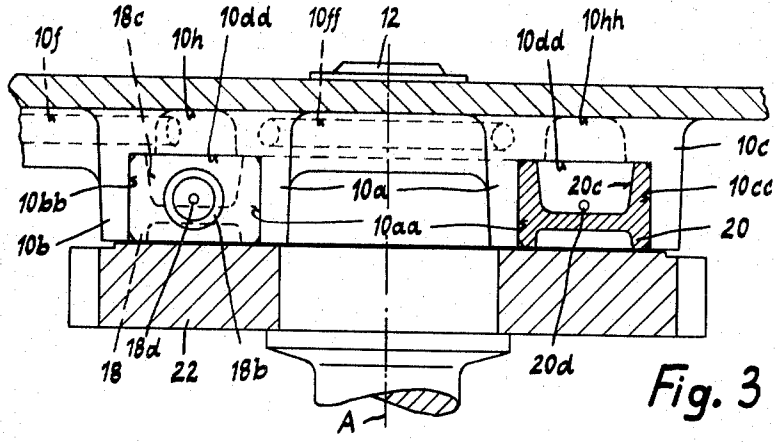


Fig. 3

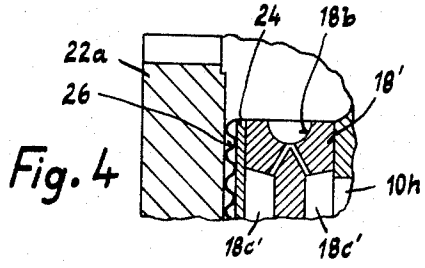


Fig. 4

VALVE OPERATING GEAR IN INTERNAL COMBUSTION ENGINES

FIELD OF THE INVENTION

This invention relates to an arrangement, in internal combustion engines, for transmitting the driving motion from an operating camshaft through intermediate transmission members to valve-operating push rods.

BACKGROUND OF THE INVENTION

In known driving gear of this general character and purpose, multi-arm pivotal levers are mostly used as the transmission members, these levers being fixedly mounted and one arm thereof being driven from the cam and a second arm providing a support for the push rod. Pivotal levers and their journal pins are, however, expensive component parts, the assembly of which makes demands on space and also involves drawbacks as regards finishing. Where the mountings of the pivotal levers are separated, two journal pins, relatively widely spaced, are required, whilst in the case of a common journal pin one of the pivotal levers must be of forked formation, all of which is unfavorable to machining and makes considerable demands on space.

When, further, the pivotal levers form a part of the oil feed system to the push rods and subsequently to the rocker arms of the valves, very narrow and long ducts have to be machined in these pivotal levers, thus involving a complicated and expensive fabrication. Subsequently, moreover, the ducts which run right through have to be finished at one end with closure plugs, which of course is very uneconomic.

SUMMARY OF THE INVENTION

It is an object of the present invention to avoid the disadvantages of known arrangements of this kind and provide an improved uncomplicated driving transmission system which is capable of being implemented in economic fashion as regards manufacture and assembly, even in mass production. This object is generally met in accordance with the invention by the fact that the engine casing is provided with segmental flanges, the guide surfaces of which define a guideway, preferably annular, extending at right angles to the axis of the camshaft, in which guideway are disposed intermediate transmission members, which are in the form of segmental elements, and which are provided with corresponding outer guide surfaces, the elements being mounted in such a way that one end thereof bears against the operating cam and the other end is provided with a seat for the associated push rod. It is of advantage to provide the inner guideway in the segmental flanges and the segmental elements with a rectangular cross section.

In the preferred embodiment of the invention the inner guideway is open at one side to cater for simple insertion of the segmental elements, the guiding of the segmental elements in the axial direction of the shaft being provided by removable cover member means covering the open side and providing a guiding surface for the arcuate intermediate members in the axial direction, which cover member means may comprise a gear mounted on the camshaft closely adjacent the annular guideway, and may have a cover plate interposed between the gear and the annular guideway, and biased toward the guideway by spring means between the gear and the cover plate.

A further advantageous embodiment of the invention is obtained in constructions of the type in which each push rod is provided with at least one oil duct for the lubricating system or for compensating valve play, if hollow oil reservoirs, which open against one another, are provided within a guide face of the segmental flange and within the adjacent guide face of the corresponding segmental element, the oil reservoir in the segmental flange being in communication with an oil feed duct, and the oil reservoir of the segmental element being in communication with the oil duct in the push rod.

It is possible in specific instances, despite the oil transmission, to use two like segmental elements inserted in the inner guideway. This further rationalizes the finishing, mounting and assembly of the arrangement.

Further an arrangement of a kind known per se may be incorporated in each segmental element for automatic hydraulic compensation of valve play, which further implements the arrangement.

DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

FIG. **1** is a longitudinal section through the arrangement of the segmental elements which are incorporated in the drive transmission,

FIG. **2** is a side view corresponding to FIG. **1**,

FIG. **3** is a plan of the assembly seen in FIG. **2**, with parts in section, and

FIG. **4** is a longitudinal section through a modified detail.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. **1** the engine casing of an internal combustion engine of known construction is designated **10.** Mounted in this casing **10** is a camshaft **12** equipped with a driving cam **12***a*. This cam, through the agency of intermediate transmission members, moves two push rods **14, 16** alternately up and down, these push rods in turn operating the admission and exhaust valves through rocker arms. The arrangement of the rocker arms and valves in the internal combustion engine is per se known and is therefore not here illustrated in any detail. The transmission members are, however, specially constructed and arranged in the manner described below.

Casing **10** has projecting segmental flanges **10***a*; **10***b*, **10***c* with annular inner guide surfaces **10***aa*, **10***bb*, **10***cc*, **10***dd* which form an open-sided annular guideway of rectangular cross section disposed in a plane at right angles to the axis of shaft **12.** Disposed in this guideway are two segmental elements **18, 20** which are of corresponding rectangular cross section, with their outer surfaces conforming to the guideway. Each segmental element has a rounded end **18***a* and **20***a*, respectively, bearing against cam **12***a*, and a spherical seat **18***b* and **20***b* respectively, which receives the associated push rod **14, 16.** When the assembly is in operation the segmental elements **18, 20** perform an annular reciprocation in the annular guideway about a rotary axis A of the guideway, parallel to the axis of shaft **12,** under the action of cam **12***a* and the valve springs (not shown). The push rods **14, 16** are moved alternately up and

down by these means, and the valves are opened and closed in the requisite cycle.

During assembly the finished segmental elements are only mounted loosely in the guideway. The function of preventing them from falling out of the guideway may, for example, be performed by a toothed wheel **22** on shaft **12** adjacent the segmental elements **18, 20** (see FIG. 3). Alternatively, the open side or end of the guideway can be closed by the application of a cover plate **24** after the segmental elements have been installed (see FIG. **4**), this plate either being rigidly connected to the casing **10** or as shown by FIG. **4** — having pressure applied thereto from the adjacent toothed wheel **22***a* through the intermediary of an undulating spring **26** against the end of the segmental flanges **10***a*, **10***b*, **10***c*.

The segmental elements **18, 20** may further constitute a part of an oil feed system used for lubricating purposes or as a hydraulic means for compensating valve play. For this purpose a cavity, **18***c* and **20***c*, respectively, is provided in each of the segmental elements **18, 20** to constitute an oil reservoir which faces an associated cavity, **10***h* and **10***hh*, respectively, in casing **10**, which also constitute oil reservoirs. Reservoir **10***h* communicates through a duct **10***f* with an oil feed pump (not shown), whilst reservoir **10***hh* is connected through duct **10***ff* with oil reservoir **10***h*. Exit ducts, **18***d* and **20***d*, respectively, are machined in segmental elements **18** and **20** to connect the oil reservoirs **18***c* or **20***c* with the spherical seats **18***b* and **20***b*. The oil from the fixed reservoir **10***h* then passes into the oil reservoir **18***c* in the segmental element **18** and hence through duct **18***d* to the oil conduit **14***a* in push rod **18**. The oil passes from this conduit to the appropriate point of use. In a similar way oil passes from reservoir **10***hh* to conduit **16***a* in push rod **16**.

Because of the unilateral positioning of oil reservoirs **18***c* and **20***c* the segmental elements **18, 20** of FIGS. **1** to **3** are not interchangeable, because these reservoirs cannot be applied against the toothed wheel **22** because this would cause oil leakage. If, however, a coverplate **24** is used as indicated in FIG. **4**, and the segmental elements are tightly sealed in this direction, the cavity **18***c'* (FIG. **4**) can be used as an oil collector both at the left and also at the righthand side of the segmental element **18'**, and thus two like segmental elements can be inserted in the inner guideway. In cases where there is no passage of oil over or through the segmental elements, and consequently no cavities have to be provided in the plane parallel surfaces thereof to serve as oil collectors, like segmental elements could of course by used for both the lefthand and for the righthand push rod.

An inner guideway can be machined with sufficient accuracy in flanges precast on the casing by a simple turning operation. The segmental elements themselves can also be produced in an economic fashion by, for example, making rings of appropriate thickness and of a sectional shape providing the cavities, in a pressing or casting operation from steel or the like, then machine plane the side faces of these rings to the required exact thickness, finish machining the inner and outer diameters of the rings, and finally dividing these rings into segmental pieces which then only have to be provided with rounded ends and the spherical seats.

Three to five segmental elements can in this way be made from a single ring. Finally it is pointed out that the types of construction described represent only a few of the possible embodiments of the invention. Other and different constructional forms can be used, for example, the oil feed may be conducted individually to the oil reservoirs in the segmental elements. The arrangement can be still further improved by incorporation of a hydraulic play compensating device in each segmental element.

I claim:

1. In an internal combustion engine having an engine casing, a camshaft rotatable in said casing, and valve-operating push rods movably mounted in said casing, the improvement comprising: means forming a guideway carried by said casing at right angles to the axis of said camshaft, said guideway being of smooth annular curvature as viewed axially of said camshaft, and at least one arcuate intermediate transmission member slidably disposed in said annular guideway for reciprocating along said annular guideway and transmitting driving motion from the camshaft to one of said push rods, said intermediate transmission member having one end thereof bearing against a driving cam on the camshaft and the other end thereof having a seat receiving the end of said one push rod, said annular guideway being open at its outermost side relative to said casing to permit insertion and removal of said arcuate intermediate members axially of said camshaft, and removable cover member means covering said open side and providing a guiding surface for said arcuate intermediate members in said axial direction, said cover member means comprising a gear mounted on said camshaft closely adjacent said annular guideway.

2. In an internal combustion engine having an engine casing, a camshaft rotatable in said casing, and valve operating push rods movably mounted in said casing, the improvement comprising: means forming a guideway carried by said casing at right angles to the axis of said camshaft, said guideway being of smooth annular curvature as viewed axially of said camshaft, at least one arcuate intermediate transmission member slidably disposed in said annular guideway for reciprocating along said annular guideway and transmitting driving motion from the cam shaft to one of said push rods, said intermediate transmission member having one end thereof bearing against a driving cam on the camshaft and the other end thereof having a seat receiving the end of said one push rod, mutually confronting and communicating oil reservoirs located, respectively, in a guide surface of said annular guideway carried by said casing and within the opposed surface of said reciprocating arcuate intermediate transmission member, said reservoirs being in continual communication in each operating position of said transmission member, an oil feed duct opening into said guideway oil reservoir, means communicating said oil reservoir in said member with the seat for said push rod, and an oil duct extending through said push rod.

3. In an internal combustion engine having an engine casing, a camshaft rotatable in said casing, and valve-operating push rods movably mounted in said casing, the improvement comprising: means forming a guideway carried by said casing at right angles to the axis of said camshaft, said guideway being of smooth annular curvature as viewed axially of said camshaft, and at least one arcuate intermediate transmission member slidably disposed in said annular guideway for reciprocating along said annular guideway and transmitting

driving motion from the camshaft to one of said push rods, said intermediate transmission member having one end thereof bearing against a driving cam on the camshaft and the other end thereof having a seat receiving the end of said one push rod, said annular guideway being open at its outermost side relative to said casing to permit insertion and removal of said arcuate intermediate members axially of said camshaft, and removable cover member means covering said open side and providing a guiding surface for said arcuate intermediate members in said axial direction, said cover member means comprising a cover plate adjacent said guideway and interposed between said guideway and a gear mounted on said camshaft, and spring means between said gear and said cover plate biasing said cover plate toward said guideway.

* * * * *