Jan. 29, 1957 A. RODER 2,779,321

CAMSHAFT DRIVE FOR HIGH SPEED INTERNAL COMBUSTION ENGINES

Filed Nov. 20, 1952 3 Sheets-Sheet 1

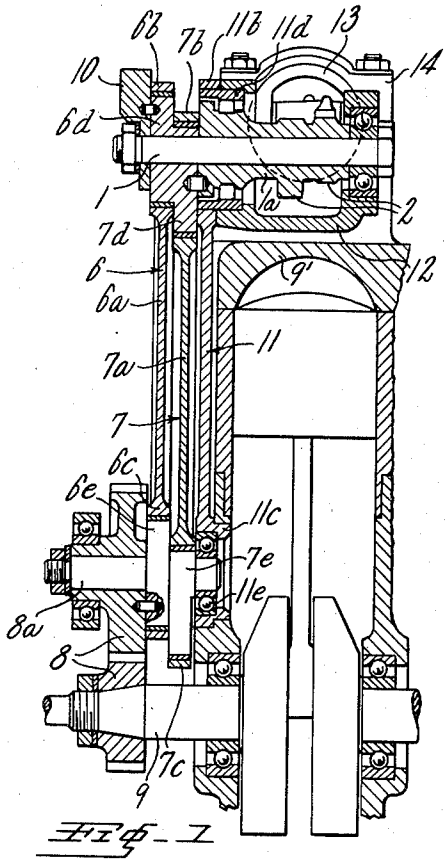


Fig. 1

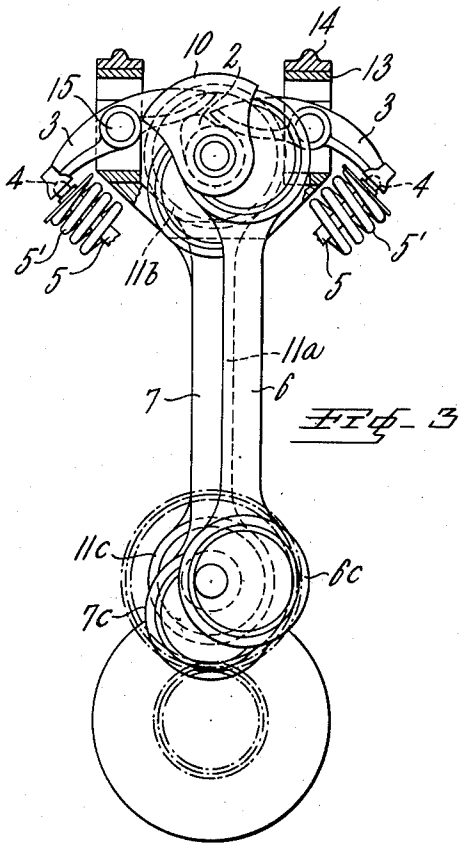


Fig. 3

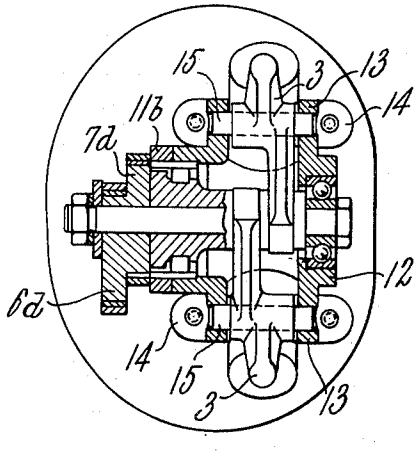


Fig. 2

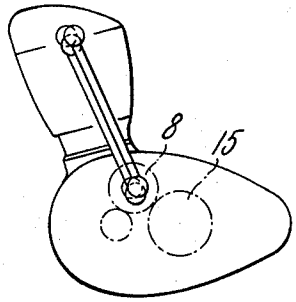


Fig. 4

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CAMSHAFT DRIVE FOR HIGH SPEED INTERNAL COMBUSTION ENGINES

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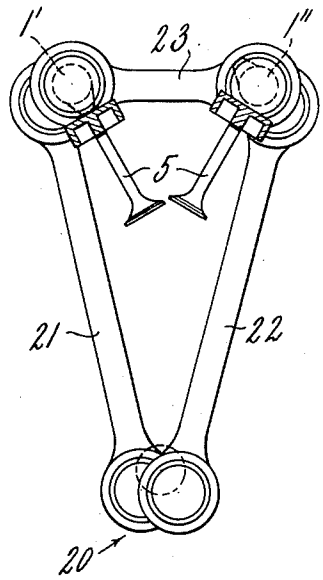


Fig. 6

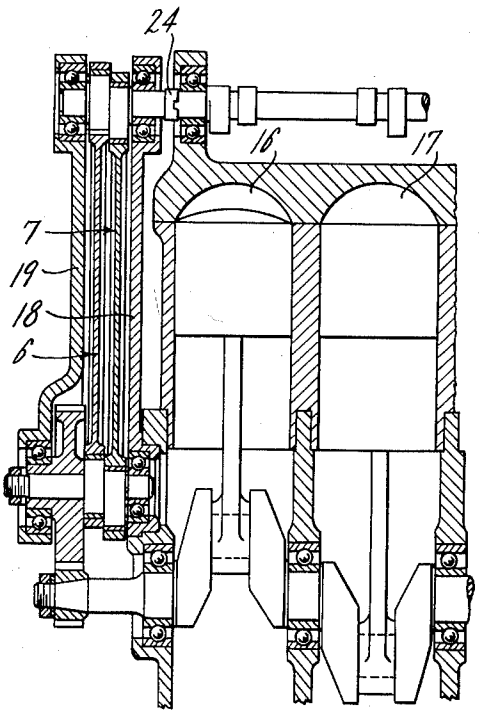


Fig. 5

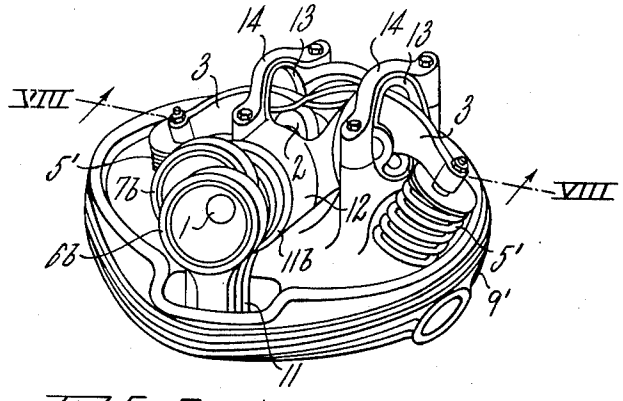


Fig. 7

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CAMSHAFT DRIVE FOR HIGH SPEED INTERNAL COMBUSTION ENGINES

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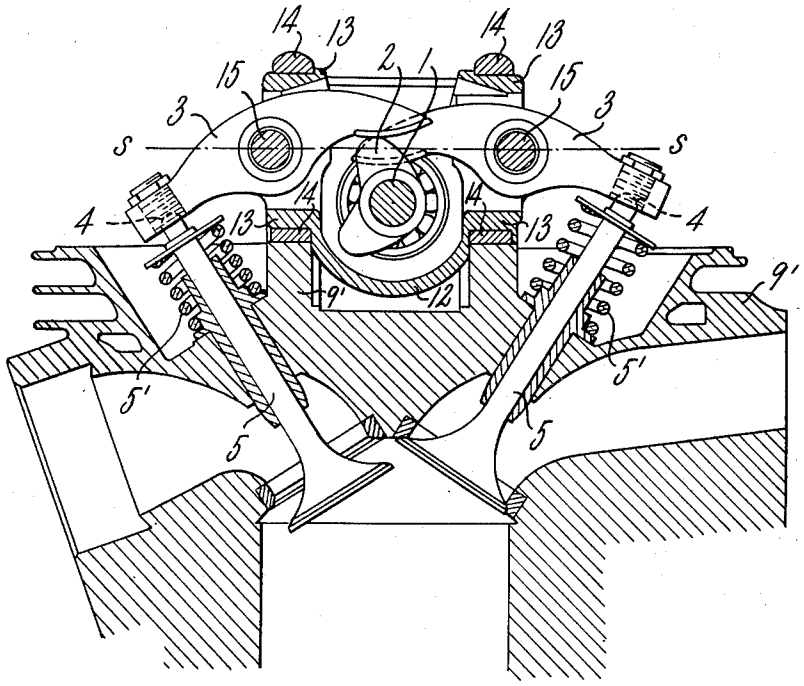


Fig. 8

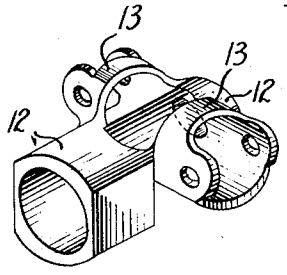


Fig. 9

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2,779,321

CAMSHAFT DRIVE FOR HIGH SPEED INTERNAL COMBUSTION ENGINES

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Application November 20, 1952, Serial No. 321,670

Claims priority, application Germany November 29, 1951

3 Claims. (Cl. 123—90)

This invention relates to a camshaft drive for high speed internal combustion engines. The main object of the invention is to provide means affording a drive for the internal combustion engine of vehicles to run and operate as quietly and smoothly as possible.

In contradistinction to the known toothed gear drives, chain drives or bevel gear drives used in antomotive vehicles, the present invention preferably uses a construction in the form of a crank gear, whose operation is characterized by quietness, dependability and economy.

As regards slow running vertical marine engines and the like, it has already been proposed to construct the camshaft drive in the manner of a crank gear. These suggestions, however, have proved to be practically of no importance, especially as this old idea did not work at all in high speed internal combustion engines of the type used in connection with motor cars.

Another object of the invention is to provide means rendering the possibility of employing a crank gear drive as a camshaft drive in the motor car industry, carefully conducted tests proving surprisingly the arrangement of a balanced and silenced crank drive to be of great advantage.

A further very important object of the invention is to provide means conducive to unusual reduction of frictional conditions, so that unwanted jamming etc. is absolutely avoided.

In this connection it is most important to take into account expansions and contractions caused by temperature changes which occur while the internal combustion engine is in operation.

According to the invention it is proposed to incorporate in the internal combustion engine distance bodies (in the form of distance rods or the like) which practically prevent the said expansions and contractions from being transferred to the crank gear arrangement.

Another object of the invention is the provision of means permitting mounting of the camshaft in a floating manner (e. g. by a casing pivotally connected to the cylinder head) so that the expansions and contractions of the cylinder or internal combustion engine are also carried out by the camshaft and the casing, whereby no jamming or other interfering phenomena can occur.

It is a further object of the invention to provide means enabling the tilting arms or levers to be mounted within said casing above referred to, so that play for the working of the valves is afforded.

A still further object of the invention is the provision of means contributing to an arrangement by which an ordinary transmission (chain drive, toothed gear drive or the like in the form of a reduction gear) is suitably inserted between the driving shaft of the engine and the crank gear arrangement, the slight noise that may thereby occur being substantially insignificant.

Furthermore, this invention enables the change speed gear of the internal combustion engine also to be driven from the aforesaid reduction gear, which is particularly required in the motorcycle industry.

If for instance, two opposite camshafts running parallel to each other are associated with an internal combustion engine, it is advisable, according to the invention, to drive these two camshafts from an eccentric device over the crank gear and, furthermore, to provide a rod connection between the two opposite shafts, so as to overcome the dead center position. This arrangement has also the advantage that fewer crank gear elements are used than would be needed with a separate drive for each camshaft.

Further details of the invention are hereinafter described in connection with two embodiments thereof, as illustrated, by way of example, in the accompanying diagrammatic drawings, wherein:

Fig. 1 is a partly sectional view of the camshaft drive of a single-cylinder engine;

Fig. 2 is a partly sectional plan view of the drive according to Fig. 1;

Fig. 3 is a schematic side elevational view of said drive;

Fig. 4 is a diagrammatic representation of an engine embodying features of the invention, indicating also the change speed gear drive, as applied to motorcycles;

Fig. 5 is a partly sectional view of a slightly differently constructed camshaft drive for a multi-cylinder internal combustion engine;

Fig. 6 is a diagrammatic side elevational view of a modified camshaft drive for two camshafts;

Fig. 7 is an isometric view of the casing as mounted on the cylinder head of the internal combustion engine according to Fig. 1, the camshaft being shown without a balancing weight;

Fig. 8 is a sectional view taken along the line VIII—VIII in Fig. 7; and

Fig. 9 is a perspective view of the rocker arm bearing, referred to in the specification.

In the embodiment of the invention shown in Figs. 1–3 and also in Figs. 7 and 8, **1—1*a*** is the camshaft, and **2** are the cams. The cams are from time to time in contact with the tilting levers or rocker arms **3**, as is well known, the levers acting on the valve-spindles **5** surrounded by biasing valve springs **5'** over ball and socket joints **4**.

The crank drives **6** and **7** serve to drive the camshaft, two crank drives being preferably provided so as to overcome the dead center position.

As may be seen from Figs. 1 and 3 in particular, the connector rod portion of the crank drive **6** comprises an intermediate or central link or rod member **6*a***, an upper circular loop or strap **6*b*** and a lower circular loop or strap **6*c***, while the connector rod portion of the crank drive **7** comprises an intermediate or central link or rod member **7*a*** as well as upper and lower circular loops or straps **7*b*** and **7*c***.

The straps **6*b*** and **7*b*** with the aid of suitable bearing means embrace respective circular parts **6*d*** and **7*d*** of a double eccentric member fixed to the camshaft **1—1*a***, and the straps **6*c*** and **7*c*** with the aid of other bearing means embrace respective circular parts **6*e*** and **7*e*** of another double eccentric member. The latter and, consequently, all the crank drives are driven through a reduced toothed gear drive **8** which, in turn, is controlled by the driving shaft **9** of the internal combustion engine.

In order to get a quiet and smooth running of the engine it is proposed according to the invention to balance the crank drives. Fig. 1 shows the balancing weight **10**. In addition thereto, one wheel of the toothed gear drive **8** is shaped accordingly to simulate a further balancing weight.

In order to get a quiet and smooth running of the crank drive system, as free as possible of friction, it is moreover necessary to exclude any jamming and stresses. This can be attained by the choice of the material for

the crank drives, that is to say, the crank drives and especially the connector rod or motor transmission portions thereof are preferably made of the same material or of materials having the same coefficient of heat-expansion.

Another means consists in arranging the cams in relation to the crank drive in such a way, that the connecting rod of the crank drive is tensionally stressed each time during the working stroke.

Finally, a further means of avoiding any jamming etc. consists in the arrangement of a distance body or a distance rod **11** for which use is also made of a material which has the same coefficient of heat expansion, as the material used for the connecting rods of the crank drives **6** and **7**.

Referring especially to Figs. 1, 3 and 7, the distance rod **11** comprises a central or intermediate rod portion **11***a*, an upper circular loop or strap **11***b* and a lower circular loop or strap **11***c*. The strap **11***b* with the aid of a suitable bearing **11***d* embraces a portion of the cam-bearing section of the camshaft **1**—**1***a* closely adjacent the part **7***d* of the upper double eccentric member, and the strap **11***c* with the aid of a bearing **11***e* embraces a portion of the shaft **8***a* on which the output gear of the gear drive **8** as well as the lower double eccentric member **6***e*, **7***e* are mounted.

Fixed to and projecting upwardly from the top of the cylinder head **9'** are two bearing blocks **14** having circular central openings in which two hollow journals **13** are rotatably supported, respectively. The casing **12** is fixedly connected to the journals **13** and thus is effectively pivoted to the cylinder head about the common axis S—S (see Fig. 8) of the openings in the bearing blocks **14**. The valve-actuating rocker arms **3** are supported in the casing **12** by means of pins or axles **15** pivotally carried by the journals **13**, the rocker arms extending through the central openings in the hollow journals (see Fig. 9).

As will be well understood, the junction between the strap **11***b* of the distance rod **11** and the cam-bearing section **1***a* of the camshaft provides a second pivot location for said camshaft. If, for example, the distance rod were considered to be a rigid, inexpansible or inextensible body, then expansion and upward movement of the cylinder head **9'** (as seen in Figs. 1 and 7) due to temperature increases in the engine would tilt the camshaft about the pivot location afforded by the distance rod **11**. However, due to the close proximity of the junction between the camshaft and the member **6***d*—**7***d* of the crank drives to this pivot location, the displacement of the left-hand end of the camshaft would be much smaller than the concurrent displacement of the right-hand end of the camshaft but would still be within the preset extent of play of the crank drives.

In actual practice, of course, the distance rod **11** expands together with the cylinder head **9'** and thus tends to compensate for the expansions of the latter so as to maintain the camshaft in a substantially untilted condition. The double pivot or floating support of the casing **12** nevertheless still permits such tilting of the camshaft if the expansion of the cylinder head differs to any extent whatsoever from the expansion of the distance rod **11** and crank drives **6** and **7**.

The important feature of the embodiment of the invention shown in Fig. 4 is that the usual toothed gear drive **8** acts at the same time also on the transmission or driving wheel **15** of the change speed gear of a motor-cycle or the like.

In the example shown in Fig. 5, the internal combustion engine has several cylinders **16** and **17** (it may have even more) and the crank drive **6**, **7** extends within two distance members **18** and **19**. The operation of this embodiment of the invention is, however, the same as that of the embodiment of Fig. 1.

Fig. 6 shows a crank drive which is intended for two camshafts **1'** and **1''** lying opposite each other. In this case, crank drives **21** and **22** lead from an eccentric arrangement **20** to each camshaft and a rod **23** connects the two camshafts with each other through eccentrics, thereby assisting in overcoming the dead center position.

In the case of multi-cylinder internal combustion engines of the kind described, it is advisable to provide between the crank drive arrangement and the camshaft a coupling **24**, which allows for a displacement of the camshaft axially of itself.

Various changes and modifications may be made without departing from the spirit and scope of the present invention and it is intended that such obvious changes and modifications be embraced by the annexed claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. A camshaft drive with crank drive means for use in a high speed valved combustion engine having a drive shaft; comprising gear drive means operatively connecting said drive shaft with said crank drive means, respective mass-balancing means on said cam-shaft and on said gear drive means to ensure smooth running of the drive, cam actuated means for opening and closing the valves of said engine, and camshaft supporting means pivotally disposed on top of said engine and provided with openings, said cam actuated means being provided with extension means passing through said openings of said supporting means, whereby said cam-shaft and said cam actuated means will follow changes due to manufacturing inaccuracies and also caused by heat expansion and contraction when said engine is in operation.

2. In a camshaft drive with crank drive means for use in a high speed valve-operated engine having a drive shaft and gear drive means operatively connecting said drive shaft with a camshaft having cam means and forming part of said crank drive means; cam actuated means for operating the valves of said engine, and camshaft supporting means pivotally disposed on top of said engine and provided with openings, said cam actuated means being provided with extension means passing through said openings of said supporting means and constructed for contact with said cam means, whereby said camshaft and said cam actuated means will follow changes due to manufacturing inaccuracies and also caused by expansion and contraction when said engine is in operation.

3. A camshaft drive according to claim 1, including means for operatively connecting said gear drive means with the transmission of an automotive vehicle carrying said engine.

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