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(54) **Variable event timing mechanism**

Variable Ventilsteuerungseinrichtung

Distribution variable

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US-A- 5 787 849
US-A- 5 979 381

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Description

Field of the invention

[0001] The present invention to relates to a mechanism for enabling the duration of a valve event in an internal combustion engine to be varied.

Background of the invention

[0002] In an internal combustion engine having cam operated intake and exhaust valves, the duration of a valve event (the proportion of an engine cycle measured in crankshaft angle during which the valve remains open) is determined by the cam profile. Conventionally, internal combustion engines have cams with fixed profiles and the duration of the valve events cannot therefore be modified to suit the engine operating conditions. The valve event durations could not be optimised for performance over the entire load/speed operating range of the engine and instead the fixed cam profiles were selected to provide an acceptable compromise over the engine operating range.

[0003] Proposals have in the past been put forward to allow event duration to be varied during engine operation and these can be regarded as falling into two categories. In the first category of variable event timing (VET) mechanisms, the geometry of the cams is variable but the cams always rotate at half crankshaft speed. Such mechanisms tend to be complex and expensive. In the second category, to which the mechanisms of the present invention belong, the cams have fixed profile but their phase is cyclically varied as the engine turns so that during each engine cycle the phase is advanced and retarded relative to the crankshaft. In other words, a variable amplitude oscillation is superimposed on the rotation of the cams so as to vary event duration dynamically.

Object of the invention

[0004] In its various aspects, the present invention seeks to provide a variable event timing mechanism that is compact, reliable and capable of being fitted to existing engines without the need for major alterations to the engine block or cylinder head.

Summary of the invention

[0005] According to a first aspect of the invention, there is provided a mechanism for enabling the duration of a valve event in an internal combustion engine to be varied, comprising a drive shaft rotatable in synchronism with the engine crankshaft, a cam sleeve (12) concentrically mounted for rotation about the drive shaft (10) and carrying a cam for opening and closing an engine valve and a drive member (14) coupled to the drive shaft (10) and to the cam sleeve (12), wherein the drive member is mounted for rotation about an axis parallel to that of the drive shaft and the axis of the drive member is variably offset from the drive shaft axis, the extent of the offset serving to vary the phase of the cam sleeve relative to the drive shaft cyclically thereby superimposing a variable amplitude oscillation on the steady rotation of the cam sleeve by the drive shaft to vary the valve event duration, characterised in that the means for coupling the drive member for rotation with the drive shaft includes a pin slidable in and out of a radial bore in the drive shaft and the end of the pin projecting from the drive shaft is pivotably mounted on the drive member.

[0006] Preferably, the drive member may be coupled to the cam sleeve by way of a doubly articulated link that is pivotably secured at one end to the drive member and at the other end to the cam sleeve.

[0007] The drive member may conveniently be connected to a cylindrical ring surrounding the drive shaft and journalled in a block that is mounted for sliding movement towards and away from the surface of the engine to which the pillow blocks supporting the drive shaft bearings are secured.

[0008] The ability to adjust the event timing by movement of blocks that are mounted on the same surface as the drive shaft bearing pillow blocks once again makes for a compact arrangement and avoids the need for extensive modification to the engine block or cylinder head.

[0009] As an alternative to providing an intermediate drive member that can be moved to an eccentric position in relation to the cams, it is possible to provide a mechanism in which he drive shaft can itself be moved to an eccentric position in relation to the cams.

[0010] Thus, according to a second aspect of the invention, there is provided a mechanism for enabling the duration of a valve event in an internal combustion engine to be varied, comprising a drive shaft rotatable in synchronism with the engine crankshaft, a rotatably mounted cam sleeve surrounding the drive shaft with clearance and carrying a cam for opening and closing an engine valve, means for coupling the cam sleeve for rotation with the drive shaft, and means for moving the cam sleeve and the drive shaft relative to one another between concentric and eccentric positions, the extent of the offset between the axes of rotation of the cam sleeve and the drive shaft serving to vary the phase of the cam sleeve relative to the drive shaft cyclically thereby superimposing a variable amplitude oscillation on the steady rotation of the cam sleeve by the drive shaft to vary the valve event duration, characterised in that the means for coupling the cam sleeve for rotation with the drive shaft includes a pin slidable in and out of a radial bore in the drive shaft and the end of the pin projecting from the drive shaft is pivotably mounted on the cam sleeve.

[0011] In all the embodiments, the radial pin is slidably received in the drive shaft, and moves in and out of its bore to accommodate the eccentric motion of the drive member or cam sleeve relative to the drive shaft, making it possible to pivot the projecting end of the pin on the drive member or cam sleeve.

[0012] In prior art mechanisms that superimpose an oscillation on a cam to vary the valve event duration, as exemplified by US 5,979,381 and EP 0801213, drive is taken from the crankshaft driven drive shaft by means of a radial pin that is permanently fixed to the drive shaft. However a sliding connection is then required somewhere else along the path through which torque is transmitted to the cams from the drive shaft. Hence, in US 5,979,381 a sliding connection is provided between the radial pin and an eccentric drive member, while EP 0801213 uses a sliding connection between an eccentric drive member and a cam sleeve. Such sliding connections are difficult to lubricate, complicate assembly and add to manufacturing cost.

Brief description of the drawings

[0013] The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective assembled view of a mechanism of the invention,
Figure 2 is an exploded view of the same mechanism,
Figure 3 is a section through a cylinder head fitted with the mechanism of Figures 1 and 2, taken in a plane normal to the drive shaft of the mechanism,
Figure 4 is a diagram of valve lift versus crankshaft angle for an engine having a mechanism of the invention fitted to both the intake and exhaust valves, and
Figures 5 to 7 are exploded views similar to the view of Figure 2 showing three further alternative embodiments of the invention.

Detailed description of the preferred embodiments

[0014] Referring to Figures 1 and 2, a VET mechanism of a first embodiment of the invention comprises a drive shaft 10 that is driven in the normal manner from the engine crankshaft. The illustrated mechanism serves to vary event duration and phase in a fixed relationship to one another (as shown in the valve lift diagram of Figure 4) but should it additionally be required to vary the phase of the valve events independently of any change in event duration, then it is possible to incorporate a known phase change mechanism in the pulley driving the drive shaft 10.

[0015] The VET mechanism comprises a cam sleeve 12 that is fitted over the drive shaft 10 and can rotate freely relative to it. Drive is transmitted from the drive shaft 10 to the cam sleeve 12 by a crescent shaped drive member 14. At its axial end, the drive member 14 is formed integrally with a ring 16 that is journalled in a block 18. The ring 16 surrounds the drive shaft 10 with clearance and can be moved by sliding the block 18 up and down from a position where it is concentric with the drive shaft 10 to eccentric positions.

[0016] Each end of the crescent of the drive member 14 is bifurcated and receives a pivot pin between its jaws. One of the ends 14a is pivotably connected by a pin 28 to a lollipop-shaped element 20 having a stem which is slidably received in a radial bore 22 in the drive shaft 10. The opposite end 14b of the drive member 14 is connected by way of a link 23 to the cam sleeve 12. The link 23 is doubly articulated, being pivotable about a first pin 24 relative to the drive member 14 and about a second pin 26 relative to the cam sleeve 12. Circlips 30 and 32 received in grooves 34 and 36 on the drive shaft 10 serve to retain the cam sleeve 12 and its drive member 14 axially on the drive shaft 10.

[0017] When the ring 16 of the drive member 14 is positioned by the block 18 to be concentric with the drive shaft 10, then the cam sleeve 12, the drive shaft 10 and the drive member 14 all rotate in unison without moving relative to one another. This will produce the events represented by the curves 102 and 112 in Figure 4 (depending on whether the cam acts on an intake or an exhaust valve). The shape of these curves 102 and 112 is determined by the profile of the cam on the cam sleeve 12.

[0018] By moving the block 18 either up or down from this position, the ring 16 will be forced to rotate about an axis that is vertically offset from the axis of the drive shaft 10. As a result, as the drive member 14 rotates, the distance of the driven end 14a from the centre of the drive shaft centre will vary cyclically during each revolution. Hence the lollipop-shaped element 20 will move in and out of the bore 22 in synchronism with the rotation of the drive shaft 10 causing a rotational oscillation of the drive member 14 around the drive shaft.

[0019] The opposite end 14b of the drive member 14 connects to the cam sleeve 12 via the doubly articulated link 23 which moves during each revolution to compensate for the drive member 14 and cam sleeve 12 having different centres of rotation. This motion causes a further rotational oscillation of the cam sleeve 12 relative to the drive member 14 which superimposes upon the oscillation of the drive member 14 around the drive shaft 10 such that the phase of the cam sleeve is varied cyclically as the drive shaft rotates. This will result in the curves 100 and 114 at the extreme of adjustment of the block 18 in one direction and in the curves 104 and 110 at the extreme of adjustment in the opposite direction. Of course, it is possible to set the block 18 to any position between these extremes to give continuous control of the duration of the valve events.

[0020] It will be seen from Figure 4 that by suitable selection of the geometry of the mechanism, it is possible to ensure that the opening and closing times of the valves are substantially unaltered and that only the duration of events is modified. In Figure 4, the lines 106 and 108 indicate the position of the piston crown as a function of crankshaft angle to demonstrate that collision between the piston and valves is avoided at all times.

[0021] The various blocks 18 for the different valves

must all be movable in synchronism with one another and this can be achieved by mounting each block 18 on pins 40 that extend vertically from the cylinder head, i.e. from the face of the cylinder head on which the pillow blocks supporting the drive shaft bearings are mounted. Eccentrics 50 received in the bores 42 in the blocks 18 can be rotated in unison to raise and lower all the blocks 18 simultaneously by the same amount.

[0022] The mounting of the blocks 18 on guide pins 40 in the cylinder head is also advantageous in that is permits lubrication of the various bearing surfaces of the block 18. To this end, as shown in Figure 3, one of the guide pins 40 may be formed with a bore 42 that communicates with an oil gallery 44 in the cylinder head. Further bores 46 in the block 18 connected to the bore 42 serve to guide the oil to the bearing surface of the ring 16, to the eccentric 50 and to the outer surfaces of the guide pins 40.

[0023] In the embodiment of Figures 1 to 3, the drive shaft 10 and the cam sleeve 12 are always concentric and they are coupled to one another by an intermediate drive member 14 that can be moved to an eccentric position. By contrast, in the embodiments of Figures 5 to 7, the intermediate drive member is omitted and instead the drive shaft 110 can be moved to an eccentric position relative to the cam sleeve 112. In other respects, all the embodiments operate in any analogous manner to one another. The embodiments of Figures 5 to 7 also have in common with the embodiment of Figures 1 to 3, the fact that the coupling between the drive shaft 110 and the cam sleeve includes a pin slidably received in a radial bore in the drive shaft 110 and the fact that all the coupling forces acts in the same plane normal to the axis of rotation of the mechanism. The bearing blocks that support the drive shaft may furthermore be constructed in a similar manner to the blocks 18.

[0024] In the embodiment of Figure 5, a pin 220 is slidably received in a radial bore 122 in the drive shaft 110 the pin 220 having a tangentially extending arm 223. A single pivot pin 224 connects the arm 223 to the cam sleeve 112. The slidable pin 220 reciprocates radially within the bore 122 as the mechanism rotates.

[0025] In the embodiment of Figure 6, the slidable pin 320 has a cylindrical head 324 of which the axis lies parallel to the axis of rotation of the mechanism. The head 324 is received in a block 326 that is a force fit in a bore 328 in the cam sleeve 112. Once again in this embodiment, the pin 320 needs to move in the bore 122 to take up the eccentricity.

[0026] Lastly, in the embodiment of Figure 7, the pin 420 again has a part cylindrical head 424 but this is received in a cap 426 that is retained in a cut-out 432 in the cam sleeve 112 by a clamping band 430. The head 424 of the pin 420 cannot move radially in relation to the cam sleeve 112 and the pin 420 must once again reciprocate within the bore 122 in the drive shaft 110.

Claims

1. A mechanism for enabling the duration of a valve event in an internal combustion engine to be varied, comprising a drive shaft (10) rotatable in synchronism with the engine crankshaft, a cam sleeve (12) concentrically mounted for rotation about the drive shaft (10) and carrying a cam for opening and closing an engine valve and a drive member (14) coupled to the drive shaft (10) and to the cam sleeve (12), wherein the drive member (14) is mounted for rotation about an axis parallel to that of the drive shaft (10) and the axis of the drive member (14) is variably offset from the drive shaft axis (10), the extent of the offset serving to vary the phase of the cam sleeve (12) relative to the drive shaft (10) cyclically thereby superimposing a variable amplitude oscillation on the steady rotation of the cam sleeve (12) by the drive shaft (10) to vary the valve event duration, **characterised in that** the means for coupling the drive member for rotation with the drive shaft includes a pin (20) slidable in and out of a radial bore (22) in the drive shaft (10) and the end of the pin (20) projecting from the drive shaft (10) is pivotably mounted on the drive member (14).

2. A mechanism as claimed in claim 1, wherein the drive member (14) is coupled to the cam sleeve (12) by way of a doubly articulated link (23) that is pivotably secured at one end to the drive member (14) and at the other end to the cam sleeve (12).

3. A mechanism as claimed in claim 1 or 2, wherein the drive member (14) is connected to a cylindrical ring (16) surrounding the drive shaft (10) and journalled in a block (18) that is mounted for sliding movement towards and away from the surface of the engine to which are secured the pillow blocks supporting bearings of the drive shaft (10).

4. A mechanism as claimed in claim 3, wherein the block (18) within which the cylindrical ring (16) is journalled is mounted on guide pins (40) of which at least one has a bore (42) that communicates with an oil gallery (44) of the engine, the block (18) being formed with further bores (46) for connecting the bore (42) in the guide pin (40) to bearing surfaces of the block (18).

5. A mechanism for enabling the duration of a valve event in an internal combustion engine to be varied, comprising a drive shaft (110) rotatable in synchronism with the engine crankshaft, a rotatably mounted cam sleeve (112) surrounding the drive shaft (110) with clearance and carrying a cam for opening and closing an engine valve, means for coupling the cam sleeve for rotation with the drive shaft, and means for moving the cam sleeve (112) and the drive shaft

(110) relative to one another between concentric and eccentric positions, the extent of the offset between the axes of rotation of the cam sleeve and the drive shaft serving to vary the phase of the cam sleeve relative to the drive shaft cyclically thereby superimposing a variable amplitude oscillation on the steady rotation of the cam sleeve (112) by the drive shaft (110) to vary the valve event duration, **characterised in that** the means for coupling the cam sleeve (112) for rotation with the drive shaft (110) includes a pin (220,320,420) slidable in and out of a radial bore (122) in the drive shaft (110) and the end of the pin (122) projecting from the drive shaft (110) is pivotably mounted on the cam sleeve (112).

6. A mechanism as claimed in claim 5, wherein the pin (220) is formed with a rigid tangentially extending arm (223), the end of which is connected by way of a pivot pin (224) to the cam sleeve (112).

7. A mechanism as claimed in claim 5, wherein the pin (320) has a cylindrical head (324) of which the axis lies parallel to the axis of rotation of the mechanism, the head (324) being received in a block (326) that is a force fit in a bore (328) in the cam sleeve (112).

8. A mechanism as claimed in claim 5, wherein the pin (420) has a part cylindrical head (424) is received in a cap (426) that is retained in a cut-out (432) in the cam sleeve (112) by a clamping band (430).

9. A mechanism as claimed in any preceding claim, wherein the coupling elements connecting the drive member to the drive shaft and the cam sleeve, respectively, intersect a common plane normal to the axis of rotation of the drive shaft.

Patentansprüche

1. Mechanismus zur Variierbarmachung der Dauer eines Ventilansteuerungsereignisses in einer Brennkraftmaschine mit einer synchron mit der Motorkurbelwelle drehbaren Antriebswelle (10), einer Nokkenhülse (12), welche konzentrisch um die Antriebswelle (10) drehbar angebracht ist und einen Nocken zum Öffnen und Schließen eines Motorventils trägt, und mit einem mit der Antriebswelle (10) und der Nockenhülse (12) gekoppelten Mitnehmerglied (14), worin das Mitnehmerglied (14) zur Drehung um eine parallel zur Achse der Antriebswelle (10) verlaufende Achse montiert ist, und worin die Achse des Mitnehmergliedes (14) der Achse der Antriebswelle (10) gegenüber einen variierbaren Versatz aufweist, wobei der Grad des Versatzes dazu dient, die Phase der Nockenhülse (12) gegenüber der Antriebswelle (10) zyklisch zu verstellen, so daß der konstanten Drehung der Nockenhülse (12) durch die Antriebswelle (10) eine Schwingung mit variabler Amplitude überlagert wird, so daß die Dauer des Ventilansteuerungsereignisses variiert wird,
dadurch gekennzeichnet, daß die Mittel zur Ankoppelung des Mitnehmergliedes zur Drehung mit der Antriebswelle (10) einen Stift (20) beinhalten, der gleitend in eine Radialbohrung (22) in der Antriebswelle (10) hinein- und aus dieser herausbeweglich ist, und daß das aus der Antriebswelle (10) herausragende Ende des Stiftes (20) schwenkbar an dem Mitnehmerglied (14) angelenkt ist.

2. Mechanismus nach Anspruch 1, worin das Mitnehmerglied (14) über ein doppelt gelenkiges Verbindungsglied (23) mit der Nockenhülse (12) gekoppelt ist, das mit einem Ende schwenkbar am Mitnehmerglied (14) und mit dem anderen Ende an der Nokkenhülse (12) befestigt ist.

3. Mechanismus nach Anspruch 1 oder 2, worin das Mitnehmerglied (14) mit einem zylindrischen Ring (16) verbunden ist, welcher die Antriebswelle (10) umgibt und drehbar in einem Block (18) gelagert ist, der so montiert ist, daß er eine Gleitbewegung in Richtung auf eine Oberfläche des Motors, auf welcher die die Lager der Antriebswelle (10) tragenden Lagerböcke befestigt sind, und von dieser Oberfläche hinweg ausführen kann.

4. Mechanismus nach Anspruch 3, worin der Block (18), in dem der zylindrische Ring (16) drehbar gelagert ist, auf Führungsstiften (40) gelagert ist, wovon wenigstens einer eine Bohrung (42) aufweist, die mit einem Ölverteilerkanal (44) des Motors kommuniziert, wobei der Block (18) mit weiteren Bohrungen (46) zur Verbindung der Bohrung (42) im Führungsstift (40) mit Lagerflächen des Blockes (18) ausgebildet ist.

5. Mechanismus zur Varüerbarmachung der Dauer eines Ventilansteuerungsereignisses in einer Brennkraftmaschine mit einer synchron mit der Motorkurbelwelle drehbaren Antriebswelle (110), einer drehbar montierten Nockenhülse (112), welche die Antriebswelle (110) mit Spiel umgibt und einen Nocken zum Öffnen und Schließen eines Motorventils trägt, Mitteln zur Koppelung der Nockenhülse zur Drehung mit der Antriebswelle, und mit Mitteln zur Bewegung der Nockenhülse (112) und der Antriebswelle (110) relativ zueinander zwischen einer konzentrischen und exzentrischen Lagen, wobei der Grad des Versatzes zwischen den Drehachsen der Nokkenhülse und der Antriebswelle dazu dient, die Phase der Nokkenhülse gegenüber der Antriebswelle zyklisch zu verstellen, so daß der konstanten Drehung der Nokkenhülse (112) durch die Antriebswelle (110) eine Schwingung mit variabler Amplitude überlagert wird, so daß die Dauer des Ventilansteuerungsereignis-

ses variiert wird,
dadurch gekennzeichnet, daß die Mittel zur Koppelung der Nockenhülse (112) zur Drehung mit der Antriebswelle (110) einen Stift (220, 320, 420) beinhaltet, der gleitend in eine Radialbohrung (122) in der Antriebswelle (110) hinein- und aus dieser herausbeweglich ist, und daß das aus der Antriebswelle (110) herausragende Ende des Stiftes (122) schwenkbar an der Nockenhülse (112) angelenkt ist.

6. Mechanismus nach Anspruch 5, worin der Stift (220) mit einem starren, radial abstehenden Arm (223) ausgebildet ist, dessen Ende über einen Gelenkstift (224) mit der Nockenhülse (112) verbunden ist.

7. Mechanismus nach Anspruch 5, worin der Stift (320) einen zylindrischen Kopf (324) hat, dessen Achse parallel zur Drehachse des Mechanismus liegt, wobei der Kopf (324) in einem Block (326) gelagert ist, der mit Preßpassung in eine Bohrung (328) in der Nockenhülse (112) eingesetzt ist.

8. Mechanismus nach Anspruch 5, worin der Stift (420) einen teilzylindrischen Kopf (432) hat, der in einer Kappe (426) aufgenommen wird, welche durch eine Spannschelle (430) in einer Aussparung (432) in der Nockenhülse (112) gehalten wird.

9. Mechanismus nach einem beliebigen der vorangehenden Ansprüche, worin die das Mitnehmerglied mit der Antriebswelle und der Nockenwelle verbindenden Kupplungsglieder jeweils eine gemeinsame, senkrecht zur Drehachse der Antriebswelle verlaufende Ebene schneiden.

Revendications

1. Mécanisme destiné à permettre à la durée d'un événement de soupape dans un moteur à combustion interne d'être modifiée, comprenant un arbre d'entraînement (10) pouvant tourner en synchronisme avec le vilebrequin du moteur, un manchon de came (12) monté de façon concentrique pour une rotation autour de l'arbre d'entraînement (10) et supportant une came destinée à ouvrir et fermer une soupape de moteur, et un élément d'entraînement (14) couplé à l'arbre d'entraînement (10) et au manchon de came (12), dans lequel l'élément d'entraînement (14) est monté pour une rotation autour d'un axe parallèle à celui de l'arbre d'entraînement (10) et l'axe de l'élément d'entraînement (14) est décalé de façon variable par rapport à l'axe de l'arbre d'entraînement (10), l'étendue du décalage servant à faire varier la phase du manchon de came (12) par rapport à l'arbre d'entraînement (10) de façon cyclique, en superposant de cette manière une oscillation à amplitude variable à la rotation continue du manchon de came (12) par l'arbre d'entraînement (10) pour faire varier la durée d'événement de soupape, **caractérisé en ce que** le moyen destiné à coupler l'élément d'entraînement pour une rotation avec l'arbre d'entraînement comprend une broche (20) pouvant coulisser pour entrer et sortir d'un alésage radial (22) dans l'arbre d'entraînement (10), et l'extrémité de la broche (20) dépassant de l'arbre d'entraînement (10) est montée de façon à pouvoir pivoter sur l'élément d'entraînement (14).

2. Mécanisme selon la revendication 1, dans lequel l'élément d'entraînement (14) est couplé au manchon de came (12) par l'intermédiaire d'un élément de liaison à double articulation (23) qui est fixé de façon à pouvoir pivoter à une extrémité à l'élément d'entraînement (14) et à l'autre extrémité au manchon de came (12).

3. Mécanisme selon la revendication 1 ou 2, dans lequel l'élément d'entraînement (14) est relié à une bague cylindrique (16) entourant l'arbre d'entraînement (10) et tourillonnée dans un bloc (18) qui est installé pour un mouvement coulissant vers et à l'écart de la surface du moteur, à laquelle sont fixées les chaises paliers supportant les paliers de l'arbre d'entraînement (10).

4. Mécanisme selon la revendication 3, dans lequel le bloc (18) à l'intérieur duquel la bague cylindrique (16) est tourillonnée, est monté sur des broches de guidage (40) dont au moins une comporte un alésage (42) qui communique avec un passage d'huile (44) du moteur, le bloc (18) étant formé d'autres alésages (46) destinés à relier l'alésage (42) dans la broche de guidage (40) à des surfaces de support du bloc (18).

5. Mécanisme destiné à permettre à la durée d'un événement de soupape dans un moteur à combustion interne d'être modifiée, comprenant un arbre d'entraînement (110) pouvant tourner en synchronisme avec le vilebrequin du moteur, un manchon de came installé de façon à pouvoir tourner (112) entourant l'arbre d'entraînement (110) avec du jeu et supportant une came destinée à ouvrir et fermer une soupape de moteur, un moyen destiné à coupler le manchon de came pour une rotation avec l'arbre d'entraînement, et un moyen destiné à déplacer le manchon de came (112) et l'arbre d'entraînement (110) l'un par rapport à l'autre entre des positions concentrique et excentrique, l'étendue du décalage entre les axes de rotation du manchon de came et de l'arbre d'entraînement servant à faire varier la phase du manchon de came par rapport à l'arbre d'entraînement de façon cyclique, en superposant de cette manière une oscillation à amplitude variable à la rotation continue du manchon de came (112) grâce à l'arbre

d'entraînement (110) pour faire varier la durée d'événement de soupape, **caractérisé en ce que** le moyen destiné à coupler le manchon de came (112) pour une rotation avec l'arbre d'entraînement (110) comprend une broche (220, 320, 420) pouvant glisser pour entrer et sortir d'un alésage radial (122) dans l'arbre d'entraînement (110) et l'extrémité de la broche (122) dépassant de l'arbre d'entraînement (110) est montée de façon à pouvoir pivoter sur le manchon de came (112).

6. Mécanisme selon la revendication 5, dans lequel la broche (220) est dotée d'un bras rigide s'étendant tangentiellement (223), dont l'extrémité est reliée au moyen d'un pivot (224) au manchon de came (112).

7. Mécanisme selon la revendication 5, dans lequel la broche (320) comporte une tête cylindrique (324) dont l'axe se situe parallèlement à l'axe de rotation du mécanisme, la tête (324) étant reçue dans un bloc (326) qui s'ajuste serrée dans un alésage (328) dans le manchon de came (112).

8. Mécanisme selon la revendication 5, dans lequel la broche (420) présente une tête en partie cylindrique (424) qui est reçue dans un couvercle (426) qui est maintenu dans une partie découpée (432) dans le manchon de came (112) par un collier de serrage (430).

9. Mécanisme selon l'une quelconque des revendications précédentes, dans lequel les éléments d'accouplement reliant l'élément d'entraînement à l'arbre d'entraînement et le manchon de came, respectivement, coupent un plan en commun normal à l'axe de rotation de l'arbre d'entraînement.

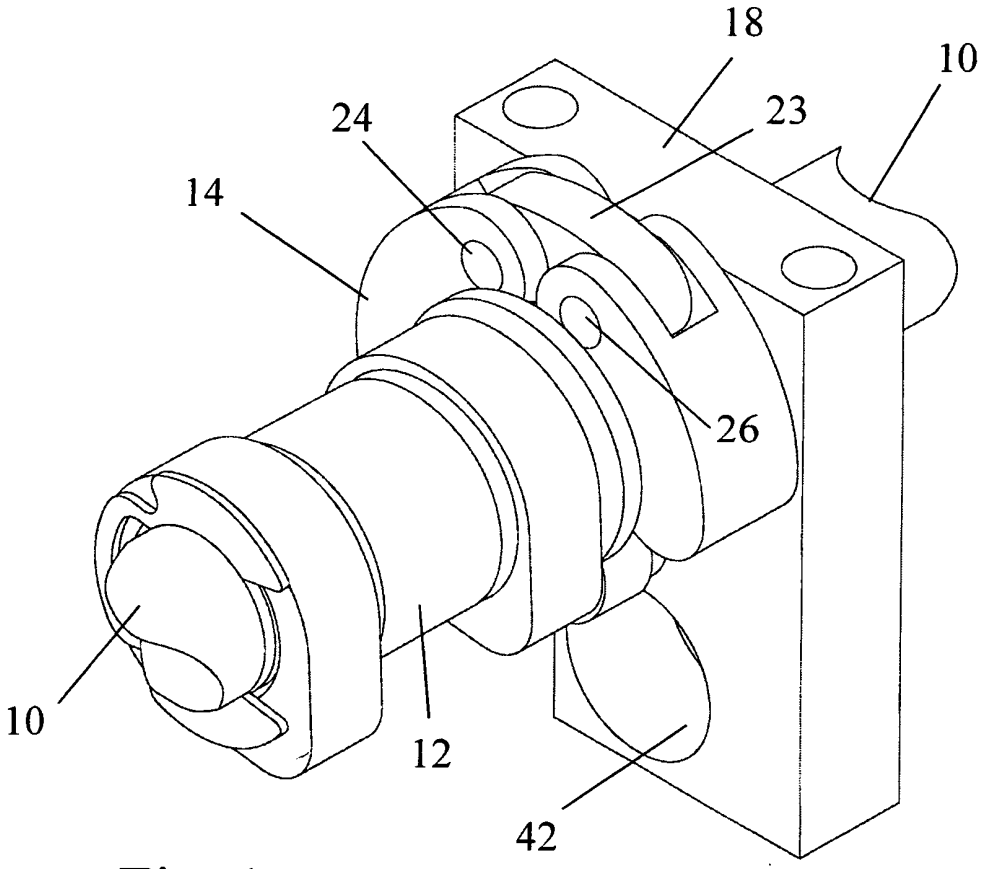

18
10
24
23
14
26
10
12
42

Fig. 1

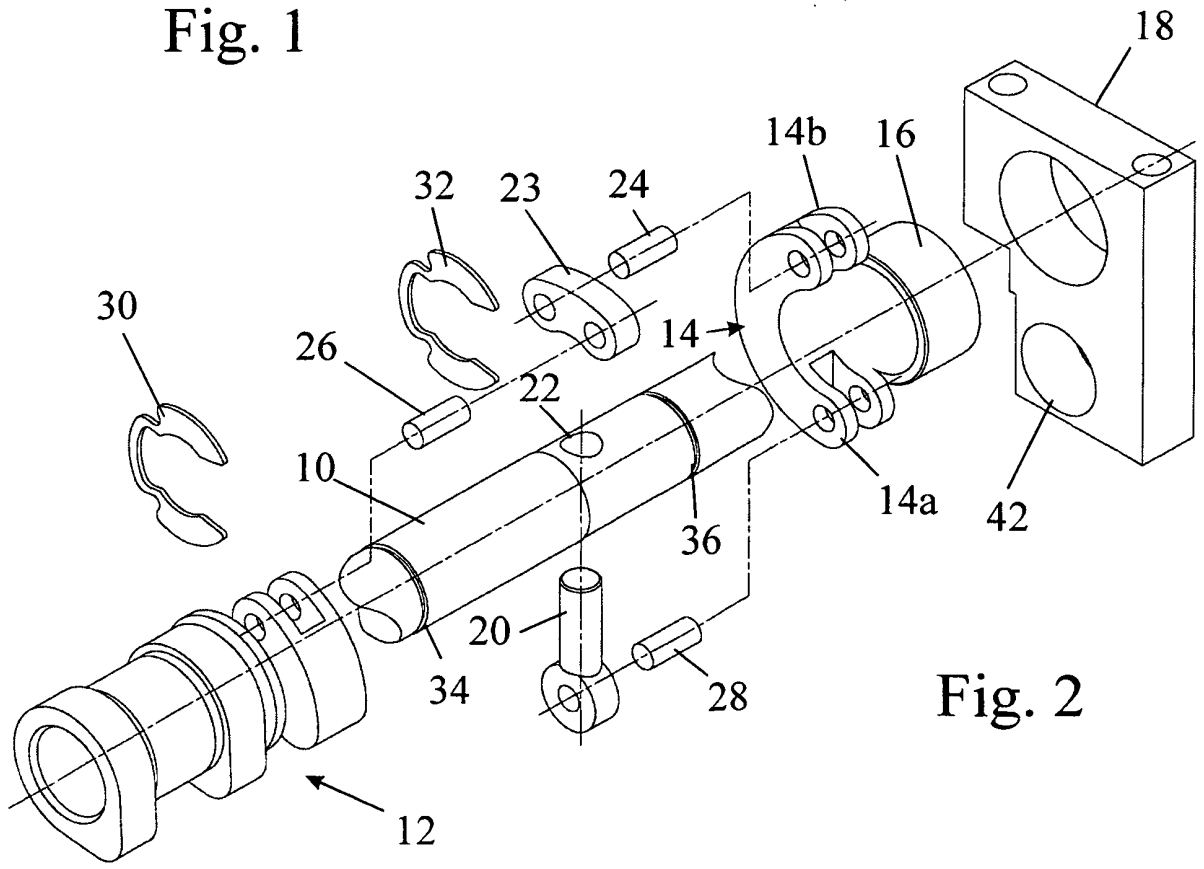
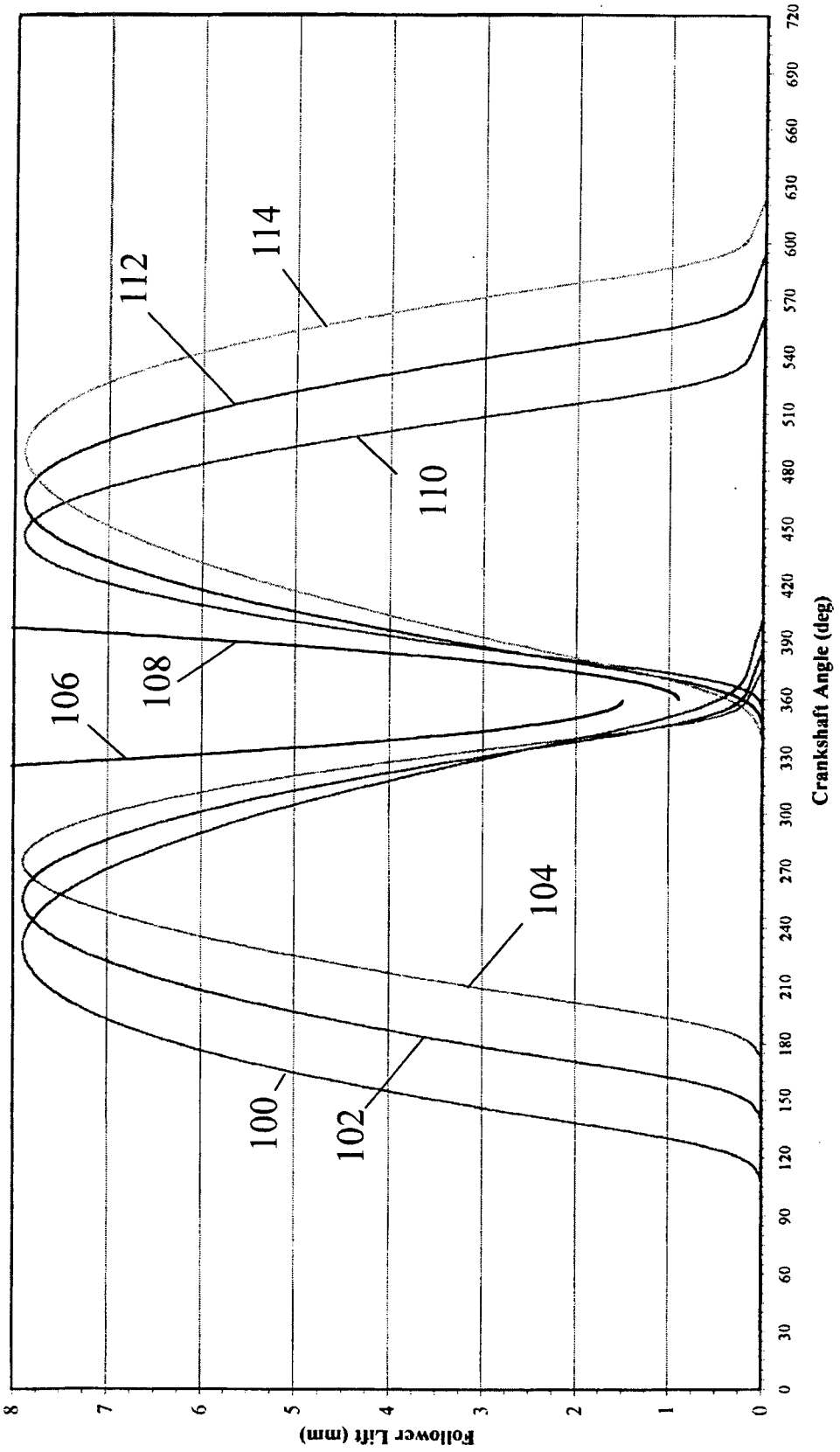

18
14b
16
32
23
24
30
26
14
22
10
14a
42
36
20
34
28
12

Fig. 2

Fig. 4


Follower Lift (mm)
Crankshaft Angle (deg)
0
1
2
3
4
5
6
7
8
0
30
60
90
120
150
180
210
240
270
300
330
360
390
420
450
480
510
540
570
600
630
660
690
720
100
102
104
106
108
110
112
114

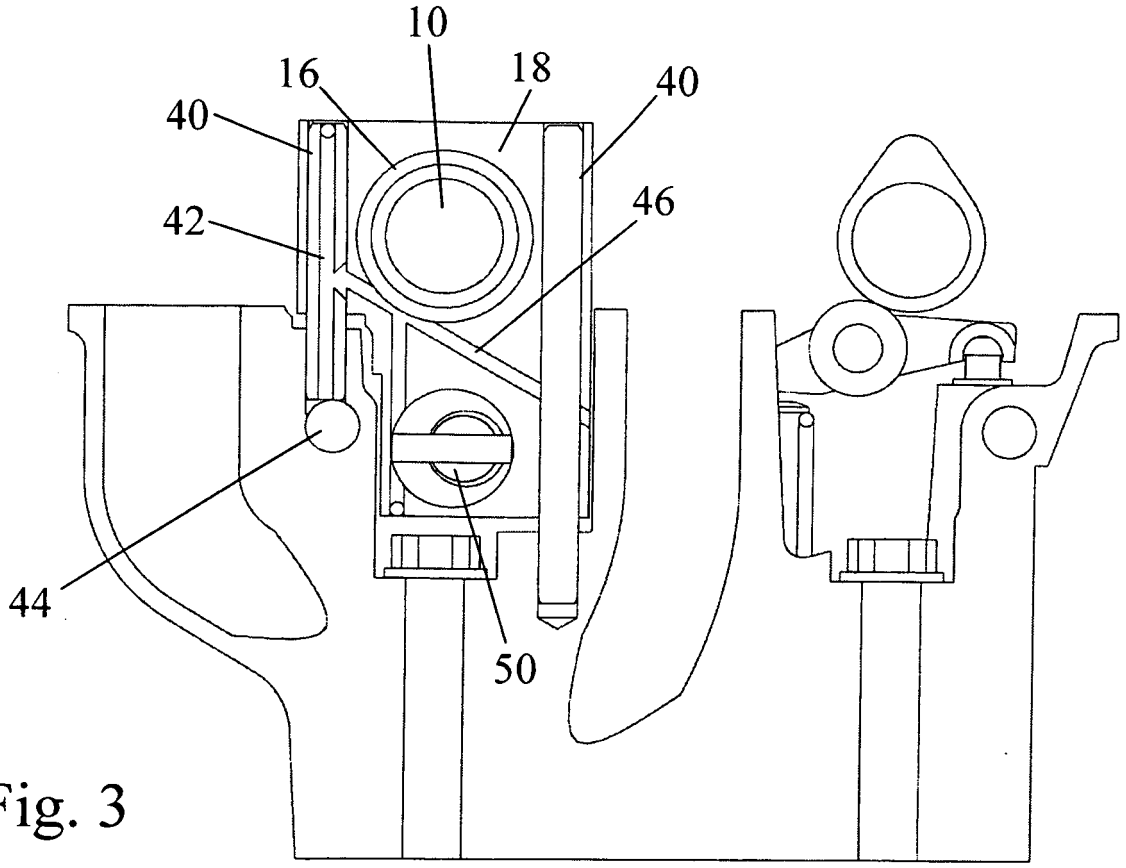


Fig. 3

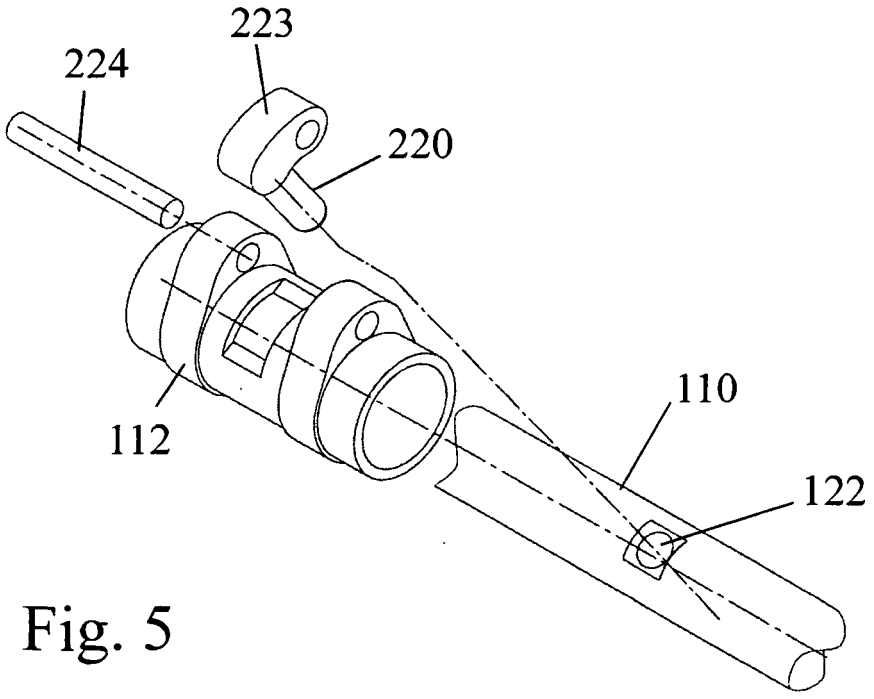


Fig. 5

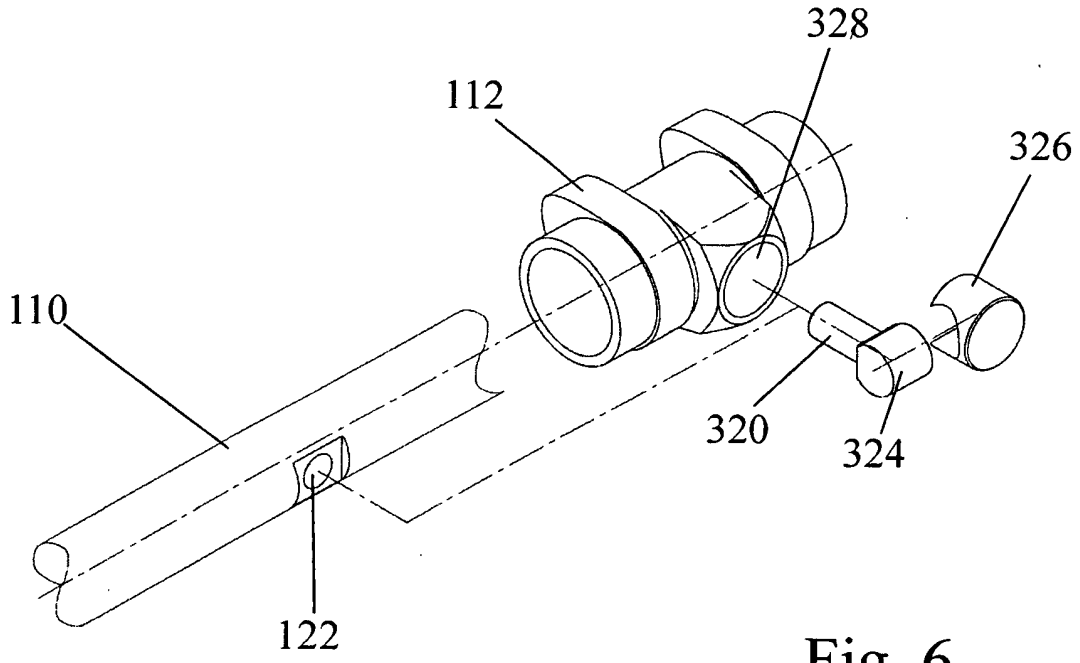


Fig. 6

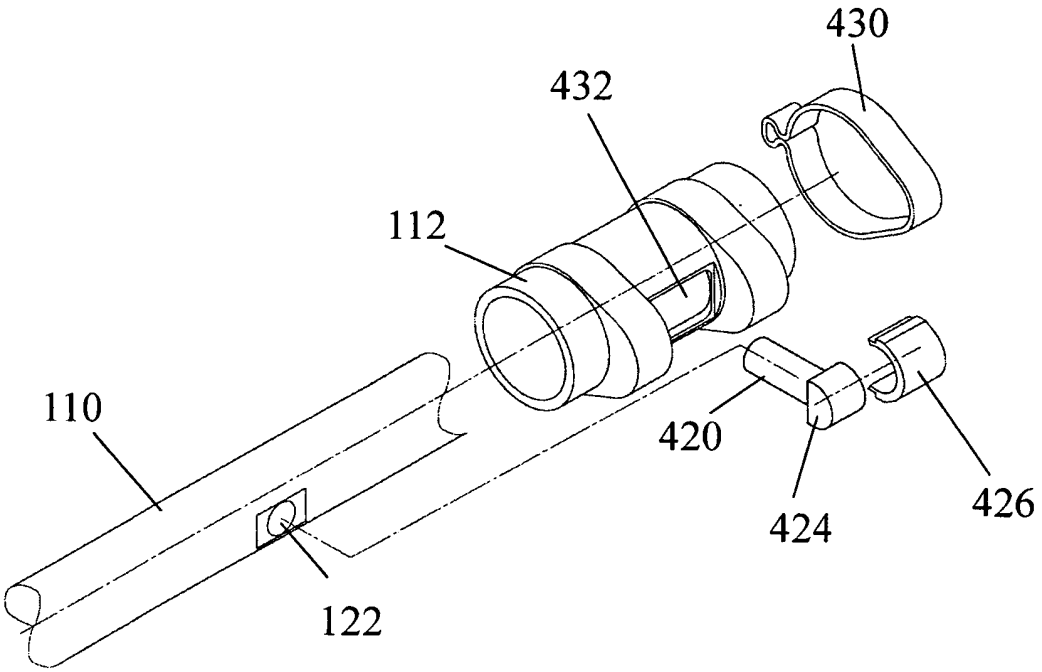


Fig. 7