

Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The invention pertains to the field of variable camshaft timing systems. More particularly, the invention pertains to variable camshaft timing system in which the housing and the driving element are made of different materials.

DESCRIPTION OF RELATED ART

[0002] Generally in variable cam timing systems (VCT) phasers, the driving element and the housing are manufactured as one steel metal piece.

[0003] Some alternatives to creating sprockets and other engine parts of more than one piece, though not for VCT phasers is shown in US 6,283,076, which discloses a method of forming a compliant sprocket by forming the metal hub and rim portions and injection molding an elastomeric material, rubber, into the gap between the hub and the rim. Heat is applied, causing the rubber to vulcanize in place resulting in a one-piece compliant sprocket.

[0004] US 5,722,295 discloses an injection molded crankshaft gear which is made by placing sintered iron insert ring and forming the outside portion and teeth portion of the gear by injection molding a resin and then heat treating the molding so that certain properties are present.

[0005] US 5,333,668 discloses a process for coating the surface of a ferrous insert with a thin layer of metallic bonding material enabling the coated insert to be united with molten aluminum where the molten aluminum is poured onto the coated insert. In another embodiment, the aluminum or ferrous liner insert is preheated and placed in the engine and molten aluminum is poured into the mold to surround the outer surface of the liner.

[0006] JP 11200819 discloses a camshaft of an over head cam (OHC) engine that drives an intake and exhaust valve that is formed of a synthetic resin and is integrally formed by injection molding with a metal sprocket.

[0007] Another solution is JP06225505, which discloses aluminum injected into slot holes and ring shapes in the rotor core of an induction motor.

[0008] JP 2000297614 discloses a gear and a housing that are integrally provided on an intake camshaft, such that the gear and the housing may rotate. A vane rotor housed in a chamber between the gear and the housing is fastened to the end portion of the intake camshaft to rotate integrally therewith. The housing and the rotor are made of aluminum-type metals. A thin metal sheet of steel is interposed between the vane rotor and the housing.

SUMMARY OF THE INVENTION

[0009] A variable cam timing phaser for an internal combustion engine having at least one camshaft comprising a housing, a rotor, and a driving element. The housing is has an outer circumference for accepting drive force, a circular notched groove, and is made of a first material. The notched groove may be axially centered between the leading and trailing edges of the housing or adjacent to either of the leading or trailing edges of the housing. The rotor connects to a camshaft coaxially located within the housing. The driving element is made of a second material and is coaxially located around the outer circumference of the housing. The first material is aluminum or magnesium and the second material is steel. The driving element may be a gear or a sprocket. The driving element may be axially centered on the housing.

BRIEF DESCRIPTION OF THE DRAWING

[0010]

Fig. 1 shows a schematic of a first embodiment of the present invention.

Fig. 2 shows a schematic of a second embodiment of the present invention.

Fig. 3 shows a schematic of a third embodiment of the present invention.

Fig. 4 shows a schematic of a fourth embodiment of the present invention.

Fig. 5 shows a schematic of a cross-section of Figure 4.

Fig. 6 shows a schematic of a cross-section of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0011] Figure 1 shows a variable cam timing phaser in which the housing 104 is made of a first material and contains a circumferential notched groove or inset 114. The notched groove 114 is axially centered on the outer circumference of the housing 104 between the leading and trailing edges of the housing 104. The notched groove 114 receives driving element 108. The driving element 108 is made of a second material. The driving element 108 is used to accept drive and may be a gear if a timing gear is used or a sprocket if a timing chain or timing belt is used.

[0012] The housing 104 surrounds the rotor 102, which provides a connection, in this case a mounting flange 110 to a camshaft 120 coaxially located within the housing 104. The rotor 102 is shown schematically and

no details should be implied, including the shape of the spool 112 and the location of the spool.

[0013] The first material is preferably aluminum, magnesium, another lightweight material, or plastic. The second material is preferably steel. The rotor 102 may also be made of the same first material as the housing 104. Cover plates 106 are present on either side of the housing 104.

[0014] Figure 6 shows a cross-section of Figure 1 and the relationship of the housing 104 relative to the rotor 102 to form the chamber 118 for receiving the vane 116 of rotor. Figure 6 also shows examples of an interlocking feature 122, 124. The interlocking feature 122, 124 may be any radial feature that facilitates radial, axial, and rotational retention. The interlocking feature 122, 124 may extend from the driving element 108 into the housing 104 as shown by 122 or from the housing 104 to the driving element 108 as shown by 124. The shape of the interlocking feature 122, 124 is not limited to those shown in Figure 6. The interlocking feature 122, 124 may be continuously present around the circumference of the housing 104 or may be spaced around the circumference of the housing 104 with one or more interlocking features 122, 124 present. The interlocking features 122, 124 shown in Figure 6 may be present in any of the embodiments of the present invention.

[0015] Figure 2 shows a second embodiment in which the housing 204 is made of a first material and contains a circumferential notched groove or inset 214. The notched groove 214 is adjacent to either the leading end or the trailing edge of the housing 204. The notched groove 214 receives driving element 208. The driving element 208 is made of a second material. The driving element 208 is used to accept drive and may be a gear if a timing gear is used or a sprocket if a timing chain or timing belt is used.

[0016] The housing 204 surrounds the rotor 202 which provides a connection, in this case a mounting flange 210, to a camshaft 220 coaxially located within the housing 204. The rotor 202 is shown schematically and no details should be implied, including the shape of the spool 212 and the location of the spool.

[0017] The first material is preferably aluminum, magnesium, another lightweight material, or plastic. The second material is preferably steel. The rotor 202 may also be made of the same first material as the housing 204. Cover plates 206 are present on either side of the housing 204.

[0018] Figure 3 shows another embodiment of the present invention in which the driving element 308 is centrally located around the circumference of the housing 304 between the leading and trailing edges of the housing. The housing 304 is made of a first material and the driving element 308 is made of a second material. The driving element 308 is used to accept drive and may be a gear if a timing gear is used or a sprocket if a timing chain or timing belt is used.

[0019] The housing 304 surrounds the rotor 302,

which provides a connection, in this case a mounting flange 310, to a camshaft 320 coaxially located within the housing 304. The rotor 302 is shown schematically and no details should be implied, including the shape of the spool 312 and the location of the spool.

[0020] The first material is preferably aluminum, magnesium, another lightweight material, or plastic. The second material is preferably steel. The rotor 302 may also be made of the same material as the housing 304.

[0021] Figure 4 shows a fourth embodiment in which the housing 404 is made of a first material and contains a circumferential notched groove or inset 414. The notched groove 414 is along the entire outer circumference width of the housing 404 extending between the leading and the trailing edges of the housing 404. The notched groove 414 receives the driving element 408. The driving element 408 is made of a second material. The driving element 408 is used to accept drive and may be a gear if a timing gear is used or a sprocket if a timing chain or timing belt is used.

[0022] The housing 404 surrounds the rotor 402, which provides a connection, in this case a mounting flange 410, to a camshaft 420 coaxially located within the housing 404. The rotor 402 is shown schematically and no details should be implied, including the shape of the spool 412 and the location of the spool.

[0023] The first material is preferably aluminum, magnesium, another lightweight material, or plastic. The second material is preferably steel. The rotor 402 may also be made of the same first material as the housing 404. Cover plates 406 are present on either side of the housing 404.

[0024] Figure 5 shows a cross-section of Figure 4 and the relationship of the housing 404 relative to the rotor 402 to form the chamber 418 for receiving the vane 416 of the rotor 402.

[0025] Accordingly, it is to be understood that the embodiments of the invention herein described are merely illustrative of the application of the principles of the invention. Reference herein to details of the illustrated embodiments is not intended to limit the scope of the claims, which themselves recite those features regarded as essential to the invention.

Claims

1. A variable cam timing phaser for an internal combustion engine having at least one camshaft comprising:

a housing of a first material having an outer circumference for accepting drive force;

a rotor for connection to a camshaft coaxially located within the housing; and

a drive element of a second material coaxially

located around the outer circumference of the housing.

2. The phaser of claim 1, wherein the rotor is made of the first material. 5
3. The phaser of claim 1 or 2, wherein the first material is aluminum or magnesium.
4. The phaser of claim 1, 2 or 3, wherein the second material is steel. 10
5. The phaser of any one of claims 1 to 4, wherein the driving element is a sprocket. 15
6. The phaser of any one of claims 1 to 4, wherein the driving element is a gear.
7. The phaser of any one of claims 1 to 6, further comprising a first cover plate and a second cover plate. 20
8. The phaser of any one of claims 1 to 7, wherein the driving element is axially centered on the housing.
9. The phaser of any one of claims 1 to 8, wherein the housing has a circular notched groove. 25
10. The phaser of claim 9, wherein the driving element is inset in the notched groove. 30
11. The phaser of claim 9 or 10, wherein the notched groove is axially centered between a leading and a trailing edge of the housing.
12. The phaser of claim 9 or 10, wherein the notched groove is adjacent to either the leading edge of the housing or the trailing edge of the housing. 35

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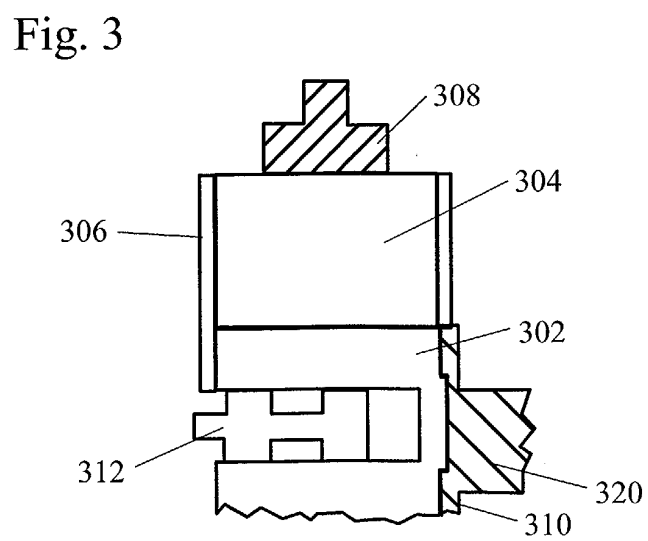
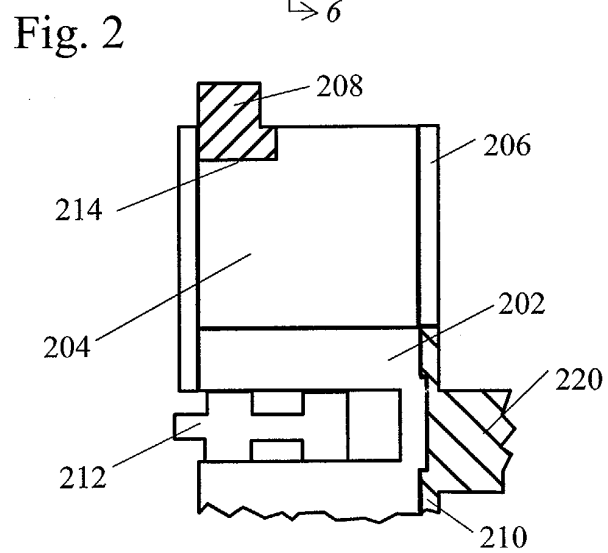
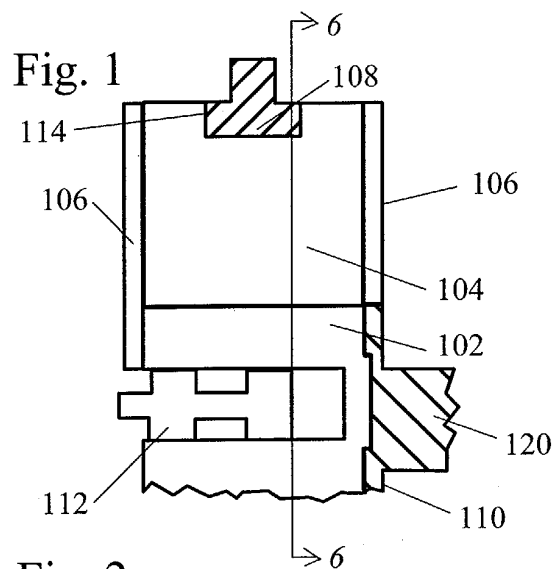


Fig. 4

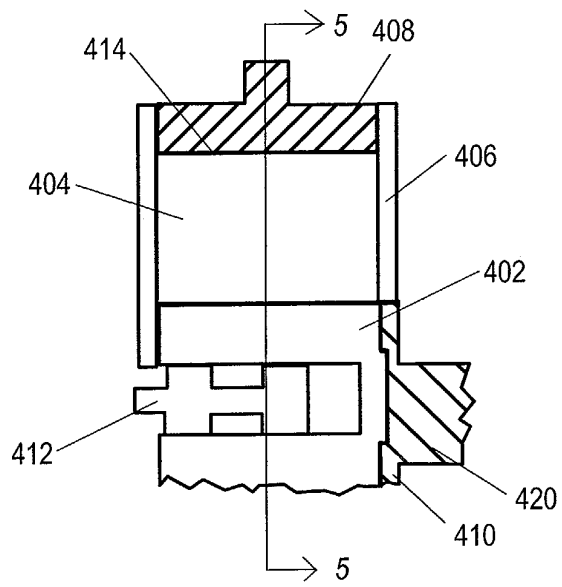


Fig. 5

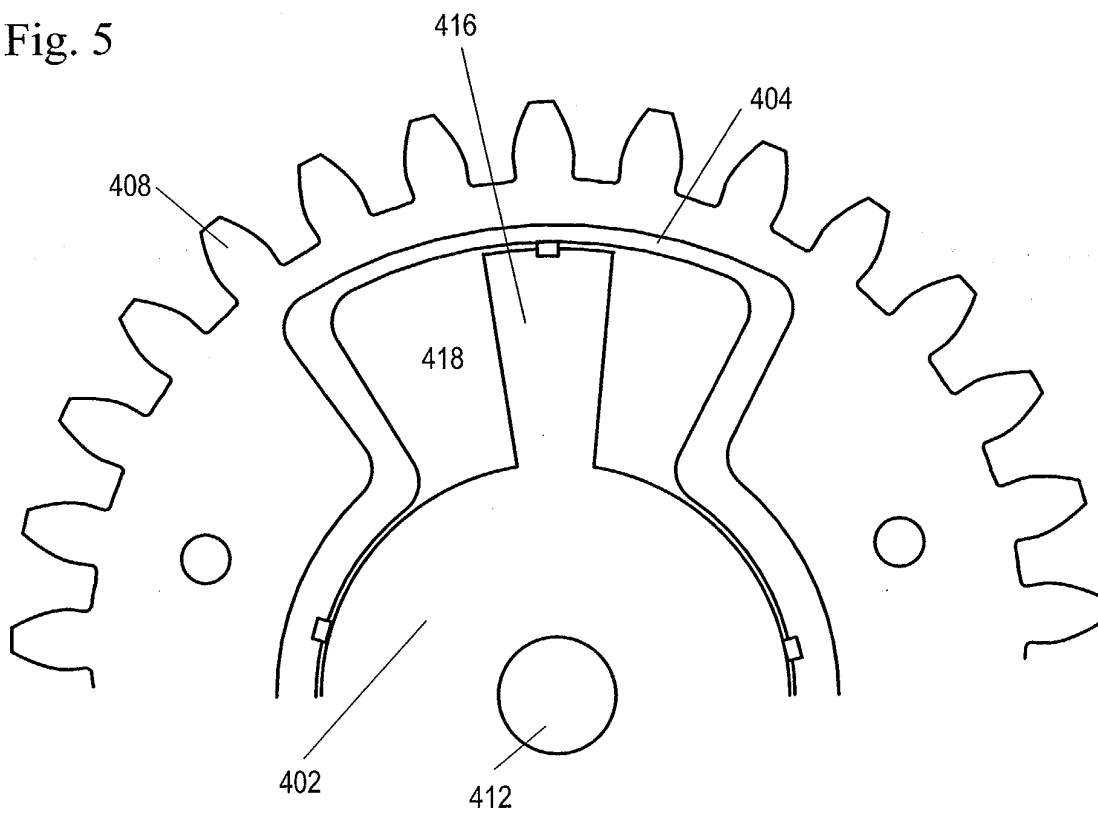


Fig. 6

