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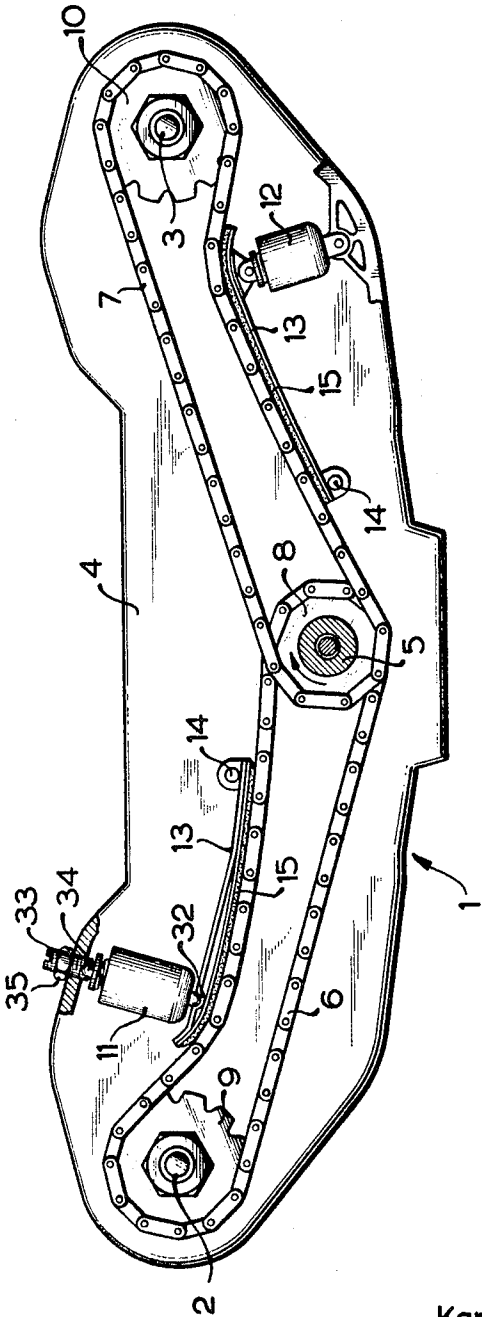
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AUTOMATIC HYDRAULIC DRIVING CHAIN TENSIONING DEVICE

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2 Sheets-Sheet 1

FIG. 1



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FIG. 2

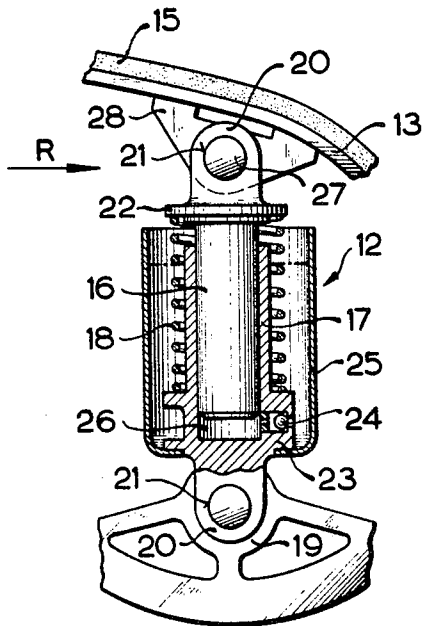


FIG. 3

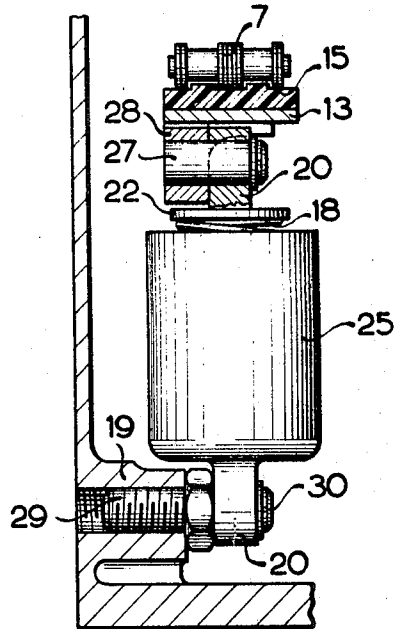
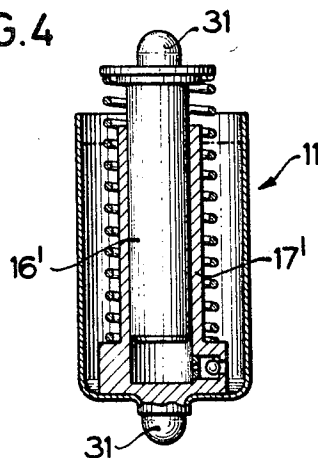


FIG. 4



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AUTOMATIC HYDRAULIC DRIVING CHAIN TENSIONING DEVICE

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5 Claims

ABSTRACT OF THE DISCLOSURE

An automatic hydraulic adjusting member for tensioning drive chains, particularly internal combustion engine camshaft drive chains, wherein a piston and cylinder are spring urged apart in the tensioning direction by a concentric spring and locked in outward adjusting positions by means of a check valve in the wall of the cylinder allowing fluid to enter the working chamber of the piston-cylinder from a concentrically arranged cup-shaped storage tank. The piston and cylinder are pivotally mounted between the engine housing and the chain glide member. The piston and cylinder each have annular collars for receiving therebetween the concentric spring, and one of which is secured to the tubular member forming the storage tank. The pivotal connections are preferably ball and socket joints.

Background of the invention

Hydraulic tension adjusting members are known for tensioning drive chains and the like. It is known to provide a piston slideably mounted within the engine housing under the action of a compression spring. The storage tank for the pressure fluid is also constructed as a part of the engine housing. This prior art construction presents considerable casting difficulties in the manufacture of the engine housing, which are increased when, for example, a number of chains are to be tensioned for engines having rows of cylinders. Also, if the tension spring is arranged within the working chamber of the piston-cylinder, the required length of the adjusting member is greatly increased, which is a considerable disadvantage. Another disadvantage is that the assembly and venting of the adjusting member is quite difficult to accomplish.

It has been proposed to form the adjusting member, storage tank and glide element contacting the drive chain or the like as a single assembly. The piston and glide element are rigidly connected together and the cylinder is rigidly connected to the crankcase so that the adjusting member is unable to align itself properly with the chain, or the like. This may result in jamming of the piston in the cylinder if there is a misalignment, because of canting. The above-mentioned devices cannot meet the high requirements of an internal combustion engine with respect to safe and prolonged operation.

Summary of the invention

In contrast to the above, it is an object of the present invention to provide an adjusting member having a short length, which is easily alignable with the drive chain and is connected between the drive chain or the like and the engine housing for easy replacement.

According to the present invention, the piston and cylinder are each provided with substantially identical connecting members for pivotal or universal connection between a stationary bearing in the engine housing and the glide member contacting the drive chain. The hydraulic fluid storage tank and compression spring concentrically

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surround the cylinder and piston. Thus, a compact adjusting member is provided that is simple in construction and requires only a short axial length for use with both the left and right drive chains of internal combustion engine camshafts having a plurality of rows of cylinders opposed with respect to each other. Preferably, the piston and the cylinder are provided with cylindrical collars between which the compression spring is mounted and on which the connecting members are secured. A further simplification of the construction is obtained when the cylinder collar is provided with a check valve and at the same time is secured to the tubular member forming the storage tank. Also, universal ball and socket joints may be provided for connecting the cylinder and piston between the guide element and the engine housing. An adjustment for the adjusting member may be provided outside of the engine housing.

Further objects, features and advantages of the present invention will become more clear from the following detailed description of the attached drawing.

Brief description of the drawing

FIGURE 1 is a side view of an internal combustion engine camshaft drive unit with the adjusting members of the present invention, wherein the engine is provided with oppositely arranged cylinder rows;

FIGURE 2 is a partial axial cross-sectional view through the adjusting member on the right side of FIGURE 1, on an enlarged scale;

FIGURE 3 is a partial cross-sectional view taken in the direction of arrow R in FIGURE 2; and

FIGURE 4 is a partial cross-sectional view of the adjusting member illustrated on the left side of FIGURE 1, on an enlarged scale.

Detailed description

As shown in FIGURE 1, the internal combustion engine 1 is provided with cylinder rows arranged oppositely with respect to each other and each having overhead camshafts 2 and 3, respectively, which are driven by the crankshaft 5 at the front end 4 of the engine. The drive chains 6 and 7 form a driving connection between the gears 8 on the crank shaft 5 and the gears 9 and 10 mounted on the camshafts 2 and 3, respectively. The chains 6 and 7 are automatically tensioned by means of the automatic hydraulic adjusting members 11 and 12, respectively, of the present invention that act upon the glide elements 13. Each of the glide elements or glide shoes 13 is pivotally mounted by means of a bolt 14 on the crank case or engine housing and is provided with a chain contacting noise dampening glide surface 15. It is understood that other types of glide shoes may be provided and the adjusting member may act upon belts, or other types of drive elements according to the broader aspects of the present invention.

As shown in FIGURE 2, the adjusting member 12 has a piston 16 slideably mounted within a cylinder 17 to be forced relatively apart by means of the concentric coil compression spring 18. The adjusting member 12 is mounted between the glide shoe 13 and an abutment 19 on the crankcase or engine housing. The piston 16 and the cylinder 17 are each provided with substantially identical tongues 20 having transverse bores 21 attached thereto in a single piece construction. The tongue 20 of the piston 16 is provided with an annular collar 22 providing one axial abutment surface for the pressure spring 18. The tongue 20 of the cylinder 17 is also provided with a cylindrical annular collar 23 for forming an abutment surface for the pressure spring 18. Also, the annular collar 23 contains a ball check valve 24, which controls the supply of pressure fluid from the storage tank 25 to the working chamber 26 of the piston-cylinder. The storage tank

25 is formed from a tubular member attached to the annular collar 23 in a cup-shaped manner and extends between the tongues 20 of the piston and cylinder. Therefore, the storage tank concentrically surrounds the pressure spring 18 and the pressure spring 18 concentrically surrounds the piston and cylinder.

For assembly of the adjusting member, the tongue 20 of either the piston or cylinder (the piston being shown) is connected to the bearing block 28 of the glide shoe 13 by means of a bolt 27. The remaining one of the tongues 20 (the tongue of the cylinder in FIGURE 2, for example) is connected to a stationary bearing block 17 formed in the engine housing by means of a transverse bolt 29. As shown in FIGURE 3, split rings or the like securing members are attached to the respective bolts and the adjusting member is ready for operation.

If a change in the length takes place, the pressure spring 18 pushes the piston 16 and cylinder 17 apart in the direction of tensioning the drive chain to thereby take up the slack in the drive chain. With this relative movement, a corresponding vacuum is produced within the working chamber 26 and the ball check valve 24 opens to allow flow of pressure fluid from the storage tank 25 into the working chamber 26. If a kickback of the chain occurs, the ball check valve 24 prevents a return flow of the pressure fluid from the working chamber 26 to the storage tank 25 so that the piston and cylinder are locked in their new adjusted position with respect to each other, although they may freely align themselves with the chain during any kicking or other lateral movement of the chain because of the pivotal connections.

As shown in FIGURE 4, the adjusting member 11 for the chain 6 of FIGURE 1 is of the same basic construction as the adjusting member 12 and differs therefrom only with respect to the connections for the piston 16 prime and cylinder 17 prime to the respective glide shoe and engine housing. The associated glide shoe 13 is provided with a ball cup bearing 32 as shown in FIGURE 1, and the engine housing bearing abutment 33 is similarly provided with an opposed ball cup bearing 34 for mounting there between the adjusting member 11. The bearing 34 is formed on a threaded bolt that adjustably and threadably extends through the crankcase or engine housing so that it may be adjusted from the outside and locked in place by means of the lock nut 35.

Although, for purposes of illustration, the adjusting member 11 has been shown for use on the left hand side of FIGURE 1 and the adjusting member 12 has been shown for use on the right hand side of FIGURE 1, it would be highly advantageous according to the present invention to construct both glide shoes identical so that they may be interchanged in their positions without modification. That is, with identical connection members, the adjusting members may be mounted in either position by relatively changing the piston or cylinder side with respect to the glide shoe and crank case side, respectively.

Also, according to the broader aspects of the present invention, it is contemplated that the adjusting members may be mounted horizontally, with the storage tank closed at each axial end and provided on the upper side with a vent and filling opening.

We claim:

1. An automatic hydraulic adjusting member for tensioning endless driving devices, such as chains and the like, comprising: a cylinder having an axis; a piston slidably received within said cylinder to constitute an expansible chamber; compression spring means concentrically surrounding said piston and cylinder for resiliently axially urging said piston and cylinder apart in the direction to increase the volume of said expansible chamber; a liquid storage tank concentrically surrounding said piston and cylinder; means providing fluid communication between said storage tank and said expansible chamber, including a check valve for allowing fluid flow from said storage

tank to said expansible chamber and preventing fluid flow from said expansible chamber to said storage tank for effectively hydraulically blocking relative movement between said piston and said cylinder in the direction to further compress said spring; said piston having connecting means on its outer end for drivingly connecting to one of the engine housing and driving device, said cylinder having connecting means on its outer end substantially identical to said first-mentioned connecting means for drivingly connecting said cylinder to the other of the engine housing and driving device; each of said connecting means including a tongue outwardly projecting from the corresponding one of the piston and cylinder; each of said piston and cylinder including a radially outwardly projecting annular collar at its outer end in axial abutment with said spring means; said cylinder collar containing therein said check valve and is annularly connected with storage tank; said storage tank including a tubular outer wall having an annularly inwardly projecting flange at one end attached to said cylinder collar; a bearing shoe for engaging said driving device on one side and having on its opposite side an outwardly opening cup-shaped bearing; an outwardly opening cup-shaped bearing for rigid attachment to the engine housing opposed with respect to said first cup-shaped bearing; each of said connecting means including an outwardly facing spherically shaped abutment engaging within a corresponding one of said cup-shaped bearings; said hydraulic adjusting member and driving device being contained within the engine housing; means for axially adjusting the cup-shaped bearing rigidly attached to said housing from outside of said housing.

2. The device of claim 1, wherein said adjusting means includes a threaded shaft extending through said housing having driving means at its outer end and the corresponding cup-shaped bearing at its inner end.

3. The device of claim 2, wherein said bearing shoe has one end pivotally mounted to said engine housing and its opposite end substantially perpendicular to said pivotal connection having its cup-shaped bearing therein.

4. The device of claim 3, wherein said storage tank consists of said tubular wall, the outer wall of said cylinder and tank annular flange to provide an annular filling opening at its upper end opposite from the end having said annular flange; said spring means being a helical spring concentrically mounted within said storage tank; said piston, piston spherical abutment and piston collar being integrally connected together as a single homogeneous piece; said cylinder, cylinder collar and cylinder spherical abutment being homogeneously connected together as a single element; said check valve consisting of a relatively large diameter bore terminating short of the outer surface of said cylinder collar and opening inwardly into said expansible chamber, a second relatively small diameter bore extending through the radially outer wall of said cylinder collar concentrically into said relatively large diameter bore, a retainer plate mounted within said relatively large diameter bore to form a check valve chamber with the walls of said relatively large diameter bore and having therein a fluid passage substantially smaller than the effective cross section of said relatively large diameter bore, and a ball within said check valve chamber for fluid tight sealing only with said relatively small diameter bore.

5. An automatic hydraulic adjusting member for tensioning endless driving devices, such as chains and the like, comprising: a cylinder having an axis; a piston slideably received within said cylinder to constitute an expansible chamber; compression spring means concentrically surrounding said piston and cylinder for resiliently axially urging said piston and cylinder apart in the direction to increase the volume of said expansible chamber; a liquid storage tank concentrically surrounding said piston and cylinder; means providing fluid communication between said storage tank and said expansible chamber, including a check valve for allowing fluid flow from said storage

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tank to said expansible chamber and preventing fluid flow from said expansible chamber to said storage tank for effectively hydraulically blocking relative movement between said piston and said cylinder in the direction to further compress said spring; said piston having connecting means on its outer end for drivingly connecting to one of the engine housing and driving device; said cylinder having connecting means on its outer end substantially identical to said first-mentioned connecting means for drivingly connecting said cylinder to the other of the engine housing and driving device; each of said connecting means including a tongue outwardly projecting from the corresponding one of the piston and cylinder; each of said piston and cylinder including a radially outwardly projecting annular collar at its outer end in axial abutment with said spring means; said cylinder collar containing therein said check valve and annularly connected with said storage tank; said storage tank including a tubular outer wall having an annularly inwardly projecting flange at one end attached to said cylinder collar; a bearing shoe for engaging said driving device on one side and having on its opposite side an outwardly opening cup-shaped bearing; an outwardly opening cup-shaped bearing for rigid attachment to the engine housing opposed with respect to said first cup-shaped bearing; each of said connecting means including an outwardly facing spherically shaped abutment engaging within a corresponding one of said cup-shaped bearings; said storage tank consists of said tubular wall, the outer wall of said cylinder and tank annular flange to provide an annular filling opening at its upper end opposite from the end having said annular flange; said spring means being a helical spring concentrically mounted within said storage tank; said piston, piston spherical abutment and piston collar being integrally connected together as a single homogeneous piece; said cylinder,

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der, cylinder collar and cylinder spherical abutment being homogeneously connected together as a single element; said check valve consisting of a relatively large diameter bore terminating short of the outer surface of said cylinder collar and opening inwardly into said expansible chamber, a second relatively small diameter bore extending through the radially outer wall of said cylinder collar concentrically into said relatively large diameter bore, a retainer plate mounted within said relatively large diameter bore to form a check valve chamber with the walls of said relatively large diameter bore and having therein a fluid passage substantially smaller than the effective cross section of said relatively large diameter bore, and a ball within said check valve chamber for fluid tight sealing only with said relatively small diameter bore; said means providing fluid communication further preventing any flow of fluid from said expansible chamber to said storage tank.

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