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F2V
F2H

(54) Screw action securing device for spring-biased damping valve

(57) A simple screw action securing device for an adjusting nut 9 of a damping valve 5 is obtained in that the clamping connection between the adjusting nut 9 and a corresponding bolt thread 7 is formed by a thread pair which possesses slightly differing pitches. The difference in pitch is so dimensioned that, for a given number of thread turns of the adjusting nut, only a clamping action at the screw connection is achieved.

Fig. 2

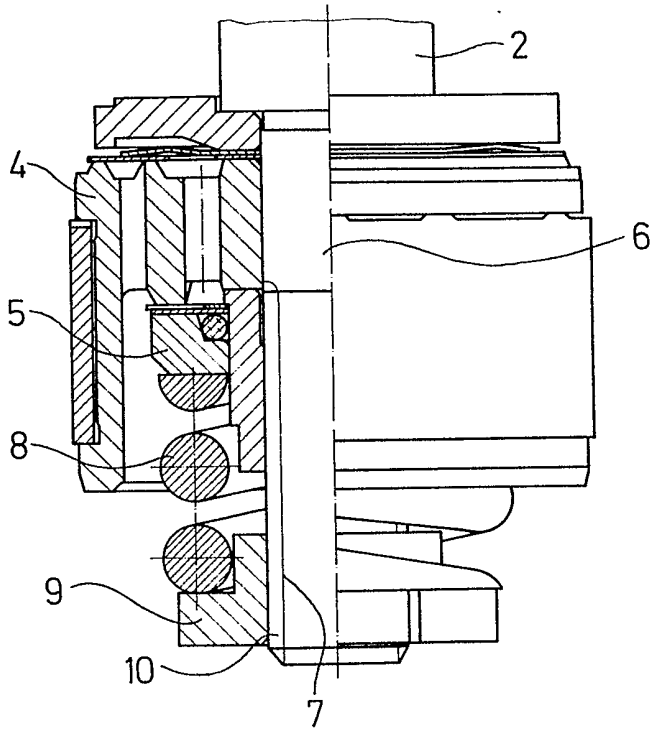

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Fig.1

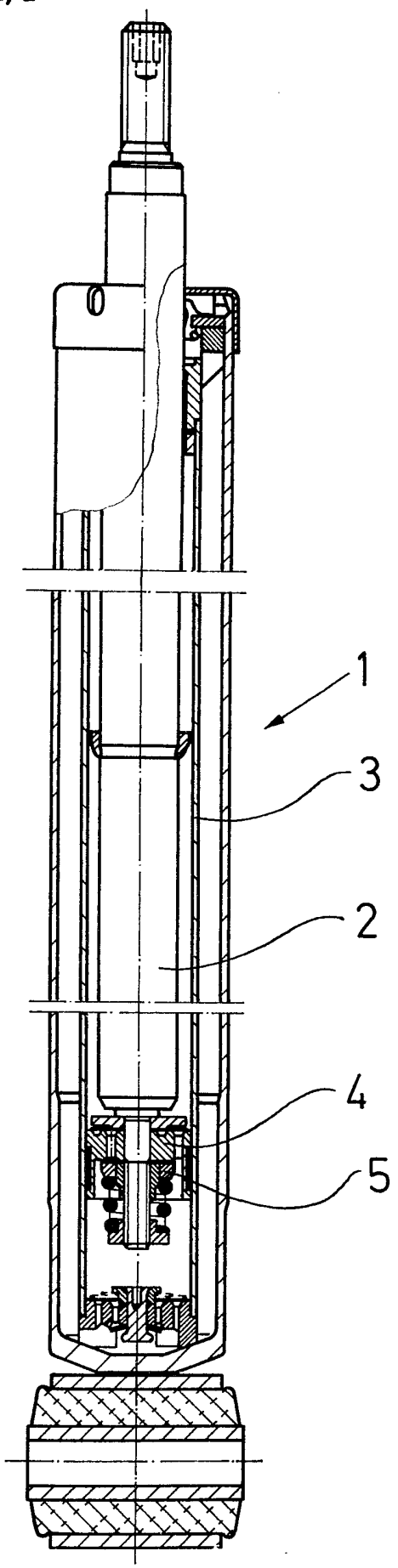

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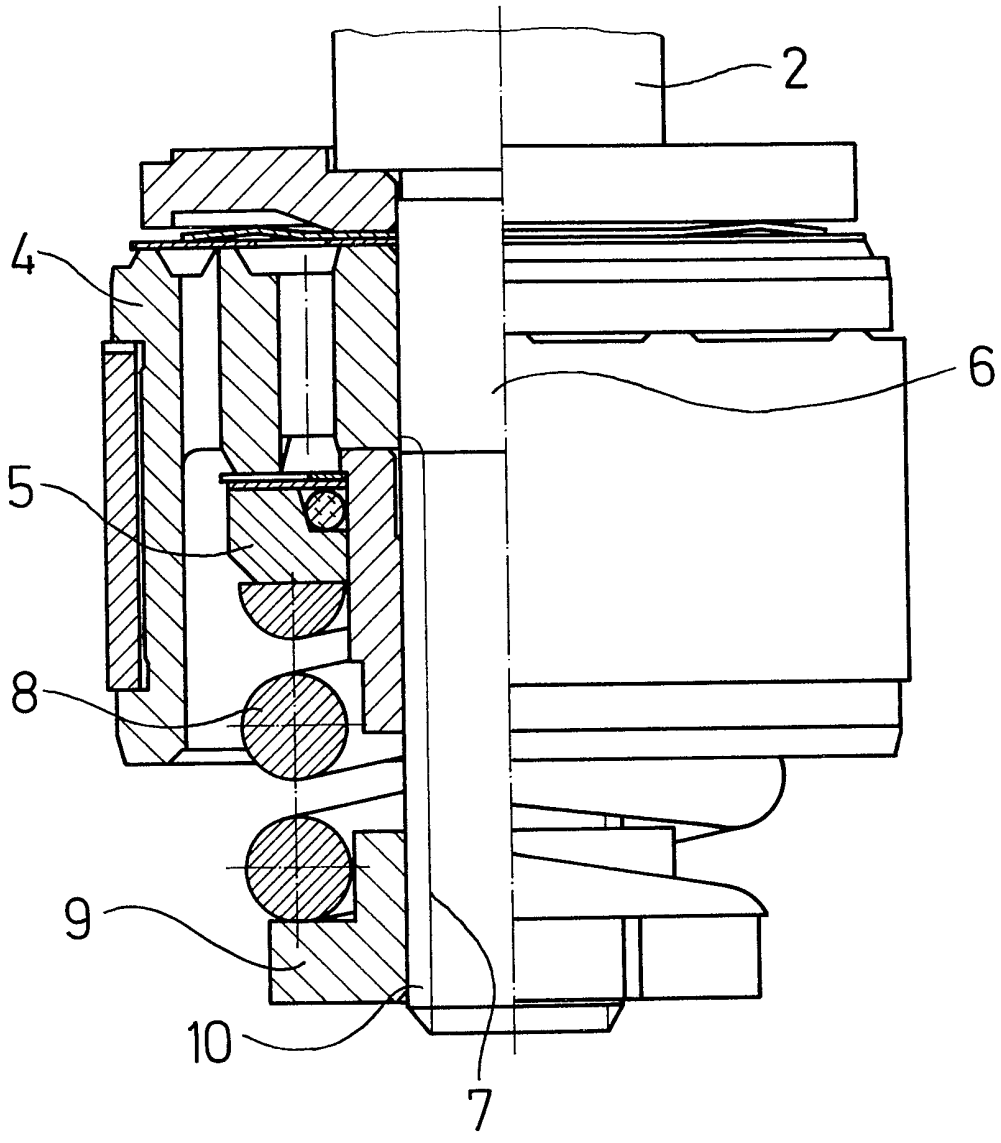
Fig. 2



SPECIFICATION

Screw action securing device for vibration dampers and spring struts

This invention relates to a screw action securing device for vibration dampers and spring struts for automobiles, especially securing device for an adjusting nut of a damping valve according to the introductory portion of Claim 1.

A clamping connection of this type between the nut and the corresponding bolt thread is known from the VDI- Nachrichten No. 43 (VDI News No. 43) of 28 October 1983. A flank form differing from the standard thread is proposed here, which maintains the prestressing force even under alternating load. In the periodical MASCHINENMARKT 1984, on page 12, a similar bolt connection with newly developed nuts is described. Here again the flanks of the internal thread are kinked on the tension side, so that the thread crests of the bolt are clamped under loading. The clamping security is, in these screwed connections, dependent upon the axial loading, i.e. with heavier axial loading a more definite diffing in of the bolt thread into the kinked flanks of the nut thread takes place, with accompanying risk of the formation of chips.

It is moreover known in practice to deform outgoing thread turns of the nut on one side into a cup shape and to achieve a clamping effect by the pressed-in, last thread turn. This type of deformation of the last thread turn is subject to very wide variations in manufacturing, so that on the one hand a cup is present in the nut but no deformation of the thread turns takes place, and on the other hand a slightly too large deformation of the thread turns results in breaking off of the deformed thread crests and therefore a kind of chip formation takes place. It is moreover disadvantageous that the deformed, outgoing thread turns, under repeated loosening and tightening up of the nut, lose their clamping force by reshaping, so that security especially in the case of an adjusting nut of a vibration damping valve is no longer reliably guaranteed.

The task of the present invention is to create a screw action securing device for vibration dampers and spring struts, especially a securing device for an adjusting nut of a damping valve, which will assure high functional reliability even after repeated loosening and tightening of the nut, without seizing up or the formation of chips. Moreover an easy, problem-free assembly must be assured.

This task is achieved according to the present invention in that the clamping connection is formed by a pair of threads possessing slightly differing pitches, the difference in pitch being so designed that, with a predetermined number of turns of the nut, only a clamping action at the screwed connection results. By this clamping connection assurance is provided that even after repeated loosening or tightening of the nut a releasing moment is still present, which reliably prevents an independent loosening of the nut. By the relatively large bearing surface between the bolt thread and the nut thread, chip formation and so-called seizing in the thread are prevented. Assembly also is easy and without problems, because the nut can be easily screwed onto the bolt for about three quarters of the nut thread length and no positional fixing is necessary when fitting the nut onto the bolt thread. Dimensional and functional checking of this clamping connection is also extremely simple to carry out, because the checking of the nut thread can be carried out in a simple manner with the test pin. Furthermore, by the differing pitch between nut thread and bolt thread, it is possible in a simple manner to optimize the release moment at the screwed connection for the particular application.

An advantageous form of embodiment is obtained according to the present invention in that the nut possesses four to five thread turns, while the difference in pitch between the nut thread and the bolt thread is approximately 0.05 mm for a thread pitch of the standard thread of 1 mm.

The invention is explained in more detail below with reference to the example of embodiment thereof illustrated in the drawings. The figures show:

Figure 1 a vibration damper in longitudinal section;

Figure 2 the piston of the vibration damper according to Figure 1 with adjustable tension damping valve to enlarged scale.

The two-tube vibration damper 1 shown in Figure 1 possesses a piston rod 2, which carries a damping piston 4 and is thereby axially guided in a cylinder and divides the internal space of the cylinder into two working chambers. The damping piston 4 possesses, amongst other things, an adjustable tension damping valve 5 which, as shown in Figure 2, is formed by a valve plate.

The enlarged view of the damping piston of Figure 2 shows the connection of the piston 4 with the piston rod 2 by means of a screw bushing, on which the tension damping valve 5 is axially movably guided. The continuation of the piston rod 2 formed as a bolt 6 is furnished with a bolt thread 7, which is provided both for the screw bushing which fixes the piston and also for an adjusting nut 9. A valve spring 8, acting upon the tension damping valve 5, bears against the adjusting nut 9, the nut thread 10 cooperating with the bolt thread 7. In the form of embodiment shown, the abutment for the valve spring 8 is formed integrally with the adjusting nut 9, but it could equally well be provided as a separate component, which would bear at the spring side against the end face of the adjusting nut 9.

For securing the adjusting nut 9 on the bolt 6, the thread pair between the bolt thread 7 and adjusting nut 9 possesses slightly differing pitches. This difference in pitch between the bolt thread 7 and nut thread 10 is so dimensioned that, for a given number of thread turns of the nut thread 10, a clamping action results between the bolt thread 7 and the nut thread 10. For adjusting the required damping action of the tension damping valve 5, the valve spring 8 is modified in its prestress by tightening or loosening the adjusting nut 9. It is

not of importance whether, for the clamping action, the nut thread 10 or the bolt thread 7 differs slightly from the thread pitch of the standard thread. It can be readily imagined that, for example, the fixing bushing for the piston 4 may also be screwed in this manner onto the bolt 6.

A very advantageous securing of the adjusting nut 9 on the bolt 6 is obtained by the nut possessing four to five thread turns and the difference in pitch between the nut thread 10 and the bolt thread 7 being approximately 0.05 mm for a thread pitch of the standard thread of 1 mm.

The above described securing of the adjusting nut 9 on the bolt 6 for the tension damping valve 5 of a piston valve for the pulling stroke may readily be used also for a compression damping valve disposed in the bottom valve plate of a two-tube vibration damper.

In the principal claim it is stated that, for a predetermined number of threads of the adjusting nut, only a clamping action at the screwed connection is to be obtained. This statement should be explained more fully:

The bolt thread 7 has a specific pitch. The nut thread 10 also has a specific pitch, the pitch of the nut thread 9 being different from the pitch of the bolt thread 7. Between a bolt thread and a nut thread there normally exists a certain axial play. This axial play is, for equal pitches of the bolt thread and nut thread, theoretically independent of the number of turns of the nut thread that are in engagement with the bolt thread. If, however, the pitch of the nut thread is different from the pitch of the bolt thread, then this play will be progressively eliminated the greater the number of turns of the nut thread that are screwed onto the bolt thread. According to the present invention a sufficient number of turns of the nut thread shall now be screwed onto the bolt thread for the play existing between the nut thread and bolt thread to be completely eliminated and, furthermore, for an elastic clamping action to occur between the nut thread and the bolt thread, i.e. and elastic deformation of the thread turns of the nut thread and bolt thread in mutual engagement. A plastic deformation should be avoided. This state of affairs is shown in the claim by the expression "only a clamping action at the screwed connection". It is assumed that the nut thread 10 is fully screwed onto the bolt thread 9. On this supposition, the difference in pitch between the two threads, the number of thread turns of the nut thread and any play defined by the flank form and flank spacing of the two threads must be so adapted to one another that, after complete screwing of the nut thread onto the bolt thread, the play is eliminated and an elastic clamping takes place. The elastic clamping should extend as near as possible to the plastic deformation range, without reaching the latter. The nearer the elastic clamping approaches to the plastic deformation range, the greater is the torque which is necessary in order to rotate the adjusting nut relative to the bolt.

The greater the number of thread turns of the nut thread 10, the smaller must the difference in pitch between the nut thread and the bolt thread be for the elastic clamping range not to be exceeded.

CLAIMS

1. Screw action securing device for vibration dampers and spring struts for automobiles, especially securing device for an adjusting nut of a damping valve, wherein the adjusting nut constitutes an abutment for a valve spring cooperating with a damping valve, by which the spring prestress of the valve spring is infinitely adjustable and a clamping connection between the adjusting nut and a corresponding bolt thread is present, characterised in that the clamping connection is formed by a thread pair (bolt thread 7, nut thread 10), which possesses slightly differing pitches, the difference in pitch being so dimensioned that, for a given number of thread turns of the adjusting nut (9), only a clamping action at the screwed connection (bolt thread 7, nut thread 10) is obtained.

2. Screw action securing device according to Claim 1, characterized in that the adjusting nut (9) possesses four to five thread turns, while the difference in pitch between the nut thread (10) and the bolt thread (7) is approximately 0.05 mm for a thread pitch of the standard thread of 1 mm.

3. Screw action securing device for vibration dampers and spring struts for automobiles as claimed in Claim 1, substantially as described herein with reference to and as illustrated by the example shown in the accompanying drawings.

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