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Nash

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[54] **ARCUATELY OSCILLATING DAMPER**

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[52] **U.S. Cl.** ..... **188/306;** 74/18.1; 277/212 F

[51] **Int. Cl.** **F16d 57/02**

[58] **Field of Search** ..... 188/290, 306; 74/18.1; 277/212 R, 212 F

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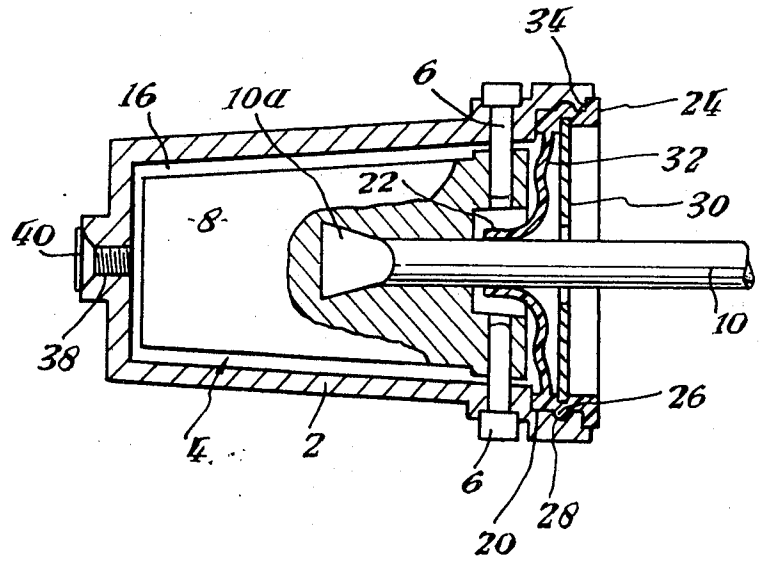
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[57] **ABSTRACT**

A damper has a vane member pivotally displaceable in a fluid filled chamber and both the member and the chamber have tapering forms that reduce in cross-sectional area with increasing distance from the pivot axis whereby the vane member and the chamber body can both be formed as simple castings or mouldings and the number of separate parts in the damper be reduced. At its larger cross-section end the chamber is closed by a flexible seal also engaging the vane member and yieldable to compensate for thermal expansion of the chamber fluid.

10 Claims, 2 Drawing Figures



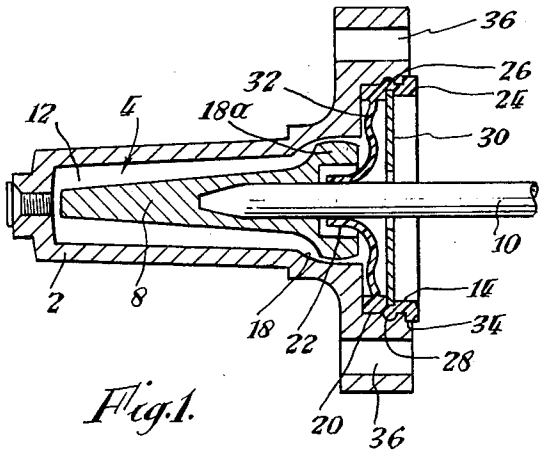

36
26
24
32
18a
12
4
30
10
2
8
14
18
22
34
28
20
36

Fig. 1.

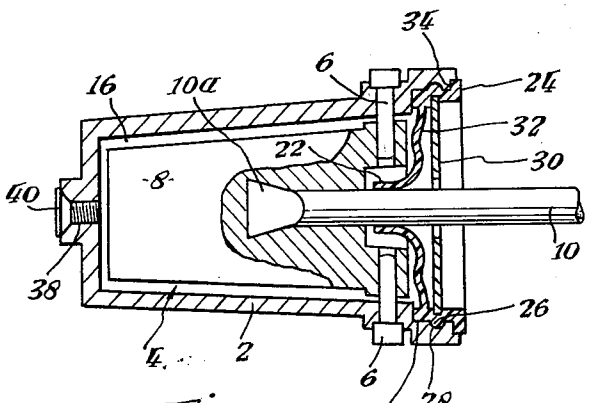

34
6
24
16
10a
32
22
30
8
40
10
38
26
4
2
6
28
20

Fig. 2.

ARCUATELY OSCILLATING DAMPER

This invention relates to fluid dampers and is concerned in particular with dampers that have mutually pivoting parts.

Fluid dampers have many applications to different kinematic systems where they are often required to smooth out fluctuations of movement and transient disturbances. Their use is limited, however, by cost factors in some instances and the present invention is concerned with providing a fluid damper that is capable of being produced relatively economically.

According to the invention, there is provided a damper comprising a body providing a chamber within which a vane member extends, said member being pivotally mounted on the body, the chamber being of tapered form such that its cross-sectional area reduces with increasing distance from the pivot axis of the vane member. By the provision of such an arrangement, it is possible to form the chamber as a unitary member, e.g., by moulding or die-casting, an internal mould or die part then forming the interior of the body and being withdrawable, by virtue of the tapered form of the chamber, through said pivot axis region of the body. The vane member may similarly be of tapered form so as to be capable also of production by a moulding or casting process.

Preferably, the vane member comprises a mounting element extending externally of the body away from said axis and a flexible seal extends between the body and the vane member to close that region of the body from which the mounting element projects. It is possible to arrange that said seal engages the vane member at a portion of its length in the region of said pivot axis in order to reduce the deflection of the seal that occurs with movement of the vane member.

Moreover, the seal may be provided with a peripheral region engaging the body and so formed that the area contained within said region is substantially greater than the cross-sectional area of the chamber to the opposite side of the pivot axis. This then can allow for flexure of the seal to vary the enclosed volume significantly, e.g., to accommodate thermal expansion of the damping fluid, without undue deformation of the seal.

One embodiment of the invention will be more particularly described by way of example with reference to the accompanying drawing wherein:

FIGS. 1 and 2 are side and plan axial sections of a damper according to the invention.

Referring to the drawing, the damper comprises a body 2 within which there is a vane member 4 pivotally mounted on pins 6 and comprising a vane element 8 to which is rigidly secured a generally cylindrical operating rod 10 of the member. The vane element lies in a chamber 12 formed within the body and closed by a flexible sealing diaphragm 14, of a synthetic elastomer such as neoprene, that engages the body 2 and the rod 10.

The chamber 12 is tapered so that its cross-section reduces with increasing distance from that end at which are the pivot pins 6. The vane element 8 is similarly but more sharply tapered, so that there is clearance between it and the body inner wall for pivoting movements of about 5° to either side of a central position. The transverse cross-sectional shape of the vane element 8 and the chamber in planes transverse to the sectional planes of the figures is substantially rectangular,

whereby at all angular positions of the vane member there is a similar small clearance (about 0.010 inches), indicated at 16, between the chamber wall and the vane element side and smaller end edges.

At the region of the pivot pins 6, where the height of the chamber is increased by curved wall portions 18, the clearance between the body and the vane element is much reduced by shoulders 18*a* on the vane element. By using a damping fluid, e.g., a silicone fluid, of suitable viscosity, this will substantially trap the fluid present in the main, tapered region of the chamber when there is relative pivoting movement between the chamber and the vane element. At the same time, by avoiding direct contact between the vane element and the body portions 18, a source of possibly substantial rubbing friction is avoided.

At the end region 20 beyond the pivot pins 6, the body internal cross-section becomes circular. The diaphragm 12 thus has circular mating faces for both its inner and outer peripheries. At its inner region, a sleeve-like end portion 22 of the diaphragm extends inwardly into the sealed space and engages the rod 10 in the region of the pivot axis defined by the pins 6 so that there will be relatively little diaphragm movement with displacement of the vane member. This fact, together with the widening of the region 18 of the body to allow a relatively large diaphragm to be used, has the result that the flexing of the diaphragm with movement of the vane member will offer very little resistance to that movement.

At its outer periphery, the diaphragm has an axially extended lip 24 and a sealing rib 26 on the outer face of the lip engages sealingly with an undercut 28 in the inner wall of the end region 20. Acting partly to retain the rib and undercut in sealing engagement is a metallic washer 30 that bears on the inner face of the lip. The washer also functions as a support for intermediate corrugated portion 32 of the diaphragm to prevent undue deformation of this should there by any large transient rise in local fluid pressure, although there is sufficient normal clearance between the washer and the diaphragm to allow thermal expansion of the fluid to be accommodated without hindrance.

The end of the lip 24 of the diaphragm fits into a stop 34 in the end of the body and stands slightly proud of the end face of the body. When the body is clamped onto a support surface (not shown) by bolts through lugs 36, the end of the diaphragm lip will be compressed to act as a seal against that support surface.

A feature of the illustrated construction is the relative economy with which it can be constructed. Thus, the tapered form of the dashpot body is so arranged that virtually no machining is required if the body is produced as a metal die-casting or a plastics moulding, since the internal core then utilised can determine most of the closely dimensioned surfaces. It is in fact possible to form all the significant features of the body thus, with the exception of the undercut 28 and the holes for the hardened steel pins 6 that are subsequently pressed into the body. Even filling hole 38 for the dashpot fluid can be cast or moulded without any subsequent machining if a self-tapping screw 40 or a fusible plug is used to close the hole. The vane member can be formed in a casting or moulding operation also, for which purpose the rod 10 is keyed to the vane element 8 by its flattened end 10*a* to be integrally incorporated

with it, and it is then required only to make the clearance holes required for the pins **6.**

The assembly of the diaphragm in practice is simply achieved, since its location is easily accessible from outside, by first mounting the washer **30** on the diaphragm and then pressing this sub-assembly into place on the already assembled body and vane member.

While a construction of the form illustrated will allow only a relatively limited pivoting movement of the vane member in the body, it will be appreciated that this movement can be made greater than that actually shown. However, a movement of 5° to either side of a neutral position is found to be sufficient the particular purpose for which the illustrated example has been constructed, namely for a self-levelling arrangement for the suspension of a road vehicle. Details of a preferred self-levelling arrangement incorporating the dashpot described above are to be found in my copending patent application filed simultaneously herewith.

What I claim and desire to secure by Letters Patent is:

1. A damper comprising, in combination, a body, a chamber within the body, a vane member extending within the chamber from one end thereof and a pivot connection being provided between the body and the vane member in the region of said end of the chamber and defining a pivot axis projecting transversely to the direction of extension of said vane member for constraining relative movement between the vane member and the body to oscillation about said axis, the chamber being of tapered form such that its cross-sectional area reduces with increasing distance from said pivot connection, and a flexible seal additionally being provided between the vane member and the body forming an enclosing boundary for the chamber in the region of said pivot connection.

2. A damper according to claim **1** wherein an element of said vane member within the chamber, by the movement of which element relative to the chamber a damping force is generated, is also of tapered form such that its cross-sectional area reduces with increasing distance from said pivot connection.

3. A damper according to claim **1** wherein the flexible seal engages the vane member in the region of said pivot connection.

4. A damper according to claim **1** wherein a peripheral region of the seal engages the body, a sealing face surrounding the vane member being provided on the body for said engagement, said sealing face being disposed on the one side of the pivot connection and on the opposite side of said connection the chamber having said reducing cross-section, the sealing face enclosing an area substantially greater than the maximum cross-section of the tapered form of the chamber on said opposite side of the pivot connection.

5. A damper according to claim **1** wherein an end step is provided on the body in a region of engagement with the flexible seal, a peripheral portion of the seal at said region extending away from the pivot connection and beyond said end step, and mounting means being provided on the body in the region of said end step whereby attachment of the damper to a surface by said mounting means compresses said peripheral portion of the seal into sealing engagement with said surface.

6. A damper according to claim **1** wherein a peripherally outer rim of the flexible seal has a radially outer surface seating against the body, a radially inwardly directed surface being provided on said rim and a rigid member bearing on said surface to urge the rim into sealing engagement with the body.

7. A damper according to claim **6** wherein said rigid member is disposed on the opposite side of the pivot connection to that on which the chamber has said reducing cross-section and provides a boundary limiting outwards deflection of the seal.

8. A damper according to claim **1** further comprising a filling aperture in the body and extending axially of the tapered form of the chamber.

9. A damper comprising, in combination, a body, a tapered chamber within the body, a vane member comprising a vane element and a mounting element, the vane element extending within the chamber from one end thereof and having a width similar to that of adjacent side regions of the chamber whereby there is a small clearance between the vane element and said chamber side regions, a pivot connection being provided between the body and the vane member defining a fixed predetermined pivot axis projecting in the direction of said vane width for relative oscillatory movement between the vane member and body, the vane member mounting element extending externally of the body away from said pivot connection, respective portions of the body and the vane member adjacent said pivot connection being disposed close to each other to obstruct a flow of damping fluid in the chamber past said portions, a flexible seal being disposed between the body and the vane member outwardly of said body and vane member portions to close an end of the chamber at that region of the body from which the mounting element extends, said seal engaging the vane member adjacent said pivot axis and being deformable by said relative oscillatory movement between the body and the vane member.

10. A damper comprising, in combination, a body, a chamber within the body, a vane member comprising a vane element and a mounting element, the vane element extending within the chamber from one end thereof and a pivot connection being provided between the body and the vane member in the region of said end defining a fixed, predetermined pivot axis substantially in the plane of the vane element and projecting transversely to the direction of extension of the vane element for relative oscillatory movement between the body and the vane member, the chamber being of tapered form such that its cross-sectional area reduces with increasing distance from said pivot connection, the vane member mounting element projecting externally from the body away from said pivot connection and a flexible seal extending between the body and the vane member to close said one end of the chamber, a sealing face surrounding the vane member being provided on the body to engage said seal and said sealing face enclosing an area substantially greater than the maximum cross-section of the tapered form of the chamber transverse to the direction of extension of the vane element.

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