PATENT SPECIFICATION (11) 1 572 985

1 572 985

(21) Application No. 2306/78 (22) Filed 20 Jan. 1978

(31) Convention Application No. 2 702 483 (32) Filed 21 Jan. 1977 in

(33) Fed. Rep. of Germany (DE)

(44) Complete Specification published 13 Aug. 1980

(51) INT. CL.[3] F16F 1/44

(52) Index at acceptance F2S 704 CF

(54) IMPROVEMENTS IN OR RELATING TO DAMPING STOP ARRANGEMENTS

(71) We, SIEMENS AKTIENGESELLSCHAFT, a German Company, of Berlin and Munich, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to damping stop arrangements.

In numerous technical applications it is necessary to intercept a moving mass with a low noise and low shock or to limit movement of a reciprocating member. In precision engineering, damping stops consisting of elastic material are used for this purpose. In practice, damping elements often consist of elastomer, in particular the material known under the registered trade mark "Viton", R.T.M., which is a copolymer of vinylidene fluoride and hexafluoropropylene (DIN 47020 = ISO/R 1629—1971). This material exhibits good damping under shock load and shock noise. However, elastomers have the disadvantage that if a movable mass has a long period of dwell against the stop, detachment of the mass is thereafter obstructed by adhesion to the surface. The adhesive effect is dependent upon temperature, the strength of the preceding shock and the force with which the mass strikes at the stop. In precision engineering, (for example in a teleprinter or a printer for a data processing installation operating at high switching speeds) even delay times of about 10 msec are impermissibly long. Furthermore, known damping elements, after a long period of operation and under fluctuating ambient temperature, undergo impermissible wear, and plastic deformation also tends to occur. In the case of a stop having a decelerating effect, considerable variations in coefficient of friction also often occur and this gives rise to a very variable deceleration and rebound behaviour. The effects of some lubricants on known damping elements can further intensify these disadvantageous influences by causing chemical changes in the surface of such an element.

In known damping stops, in various applications the adhesive effect is counteracted by means of applying increased restoring forces to the moving mass. Furthermore, in order to avoid the above mentioned disadvantages, the operating time and the operating temperature range are restricted. Automatic rotation of the damping stop following a suitable transit time is also used. Restriction of lubrication has also led to some improvement.

An object of the invention is to provide an improved damping stop.

According to the invention, there is provided a damping stop arrangement comprising: a pivotably mounted member; a damping stop provided on said member so as to be movable with said member between two positions; and a stop surface arrangement to intercept said damping stop for temporary contact therewith when the member is at one of said positions, wherein the damping stop has a shock and/or noise absorbing body of an elastomer on an external surface of which is disposed a metal layer supported solely via the underlying elastomer, in a position such that said temporary contact is between said stop surface and said metal layer, the mean thickness of which is small in comparison with the dimension of said body perpendicular to said layer whereby said body can absorb mechanical energy of said lever during said temporary contact.

Preferably, said dimension is at least five times the thickness of said layer.

In one embodiment, the surface of the metal layer is corrugated.

Preferably, said body is cylindrical, and

said layer is formed by a metal sleeve round said body.

In a further embodiment, on its periphery a hollow cylindrical body is provided with a groove and said layer is constituted by a spiral spring disposed in said groove, the wire diameter of the spring being small in comparison with the wall thickness of the cylindrical body.

Preferably, the wall thickness of the body is at least five times the diameter of the spring wire.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawing, in which:

Figure 1 illustrates an arrangement of a moving mass and a damping stop;

Figure 2 illustrates a damping stop in accordance with the invention;

Figure 3 illustrates a further damping stop in accordance with the invention; and

Figure 4 illustrates a yet further damping stop in accordance with the invention.

Figure 1 shows an arrangement of a moving mass and a damping stop. The moving mass is a metal lever 1 which is pivotable about an axis. A drive system for moving the lever is not shown in Figure 1. The drive system can be a mechanical, hydraulic or magnetic drive system. The lever 1 is pivotable in the two arrow directions *r* and *l*. The pivoting range is limited by two stops 3 and 4 as parallelepipeds or cylindrical bodies of elastomer and to coat each of these with a metal layer on its contact surface. The metal lever 1 would then directly strike against the damping stops which serve to limit its movement.

Figure 1 illustrates an embodiment in which a damping element 5 is either fixedly mounted or rotably mounted on an axis 6 on lever 1. Thus only one damping element 5 is required. When the lever is deflected in the two pivoting directions, it abuts the stops 3 and 4 which serve only to limit the movement, and perform no damping function.

Figure 2 is an enlarged cross-sectional view of the damping stop 5 of Figure 1. The damping stop 5 consists of a cylindrical body 7 of an elastomer which is provided with a bore 8. Body 7 can either be firmly screwed in position or rotatable about an axis. The major part of the periphery is surrounded by a metal sleeve 9. The wall thickness *a* of the metal sleeve is considerably less than the wall thickness A of cylindrical body 7. The metal sleeve is either pushed, pressed or glued onto the body 7. When movement of lever 1 is limited, the metal surface of the damping stop 5 abuts against the lateral counter stops 3 and 4 (Figure 1).

Figure 3 illustrates a further embodiment of the damping stop shown in Figure 2 intended to be mounted on a lever as in the arrangement of Figure 1. The difference consists in that the surface of the metal layer 10 is not flat, but is corrugated or grooved. These corrugations or grooves reduce the chance that an adhesive effect will occur by contact with the surface of the damping stop, in particular when oils, fats or other liquids are applied thereto.

Figure 4 illustrates a particularly useful embodiment of damping stop intended to be mounted on a lever as in the arrangement of Figure 1. The cylindrical body 7 with its bore 8 is provided at its periphery with a wide groove 11 which is bounded at the two end sides by flanges 12 and 13 respectively. A spiral spring 14 is disposed in the groove 11. The turns of the spiral spring are arranged closely adjacent to one another. The diameter *d* of the spring wire is considerably smaller than the wall thickness D of the body 7. The wire diameter is to amount to about 1/5 or less of the wall thickness D of the body 7. The known good noise absorbing and damping properties of elastomers are retained. The design of the damping stop illustrated in Figure 4 is particularly advantageous because it can be produced relatively cheaply. The spiral spring can be produced very cheaply in large numbers. Fixing of the spring 14 on the elastomer body in the groove 11 is particularly simple since the spring is merely pushed over one of the two flanges 12 or 13. The two flanges serve to prevent a lateral displacement. This produces a particularly simple component. The damping stop illustrated in Figure 4 can also be used as a counter stop, for example in place of the stops 3 and 4 in Figure 1. For this purpose each damping stop is secured by its bore 8 to a wall, transversely to the direction of movement of the lever 1, or is arranged to be rotatable. The lever 1 is then intercepted by the surface of the spiral spring. On account of the elastic spring, the arrangement in Figure 4 exhibits excellent shock elasticity. In place of the spiral spring, a metal sleeve can be inserted into the groove 11. This can be affected, for example, by injecting or casting the elastomer body into the metal sleeve. Thus even in the case of a long period of dwell, the supported mass does not adhere to the surface of the damping stop. Even with high surface pressure, little flattening occurs on the damping stop contact surface as the shape is maintained by means of the metal layer. Very little wear occurs. Direct contact between the elastomer and a moving mass is avoided. There is no additional adhesive influence by chemically or physically changed surface of the elastomer due

to lubricants or temperature fluctuations. Variations in coefficient of friction are considerably reduced. The properties regarding noise absorbing and shock-damping are retained in full.

WHAT WE CLAIM IS:—

1. A damping stop arrangement comprising; a pivotably mounted member; a damping stop provided on said member so as to be movable with said member between two positions; and a stop surface arranged to intercept said damping stop for temporary contact therewith when the member is at one of said positions, wherein the damping stop has a shock and/or noise absorbing body of an elastomer on an external surface of which is disposed a metal layer supported solely via the underlying elastomer, in a position such that said temporary contact is between said stop surface and said metal layer, the mean thickness of which is small in comparison with the dimension of said body perpendicular to said layer whereby said body can absorb mechanical energy of said lever during said temporary contact.

2. An arrangement according to claim 1 wherein said dimension is at least five times the thickness of said layer.

3. An arrangement as claimed in claim 1 or 2 wherein the surface of the metal layer is corrugated.

4. An arrangement as claimed in any one of claims 1 to 3 wherein the body is cylindrical, and said layer is formed by a metal sleeve round said body.

5. An arrangement as claimed in claim 4, wherein on its periphery the body is provided with a groove and said layer is constituted by a spiral spring disposed in said groove, the wire diameter of the spring being small in comparison with the wall thickness of the cylindrical body.

6. An arrangement as claimed in claim 5 wherein the wall thickness of the body is at least five times the diameter of the spring wire.

7. A damping stop arrangement substantially as hereinbefore described with reference to Figures 1 and 2, Figures 1 and 3 or Figures 1 and 4 of the accompanying drawing.

For the Applicants,
G. F. REDFERN & CO.,
Marlborough Lodge
14 Farncombe Road
Worthing, West Sussex
BN11 2BT.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1980.
Published at the Patent Office, 25 Southampton Buildings. London. WC2A 1AY. from which copies may be obtained.

1572985 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig. 1

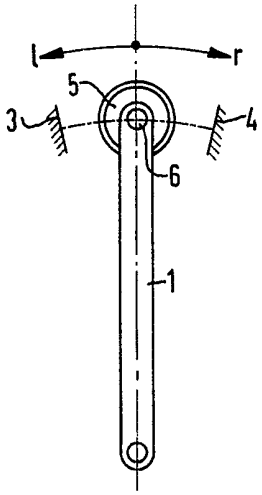

Fig. 2

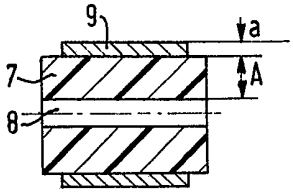

Fig. 3

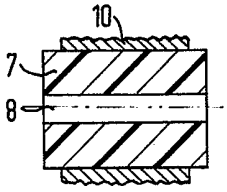

Fig. 4