June 28, 1966 L. P. CROSET 3,257,825

FLEXIBLE COUPLINGS

Filed March 6, 1964

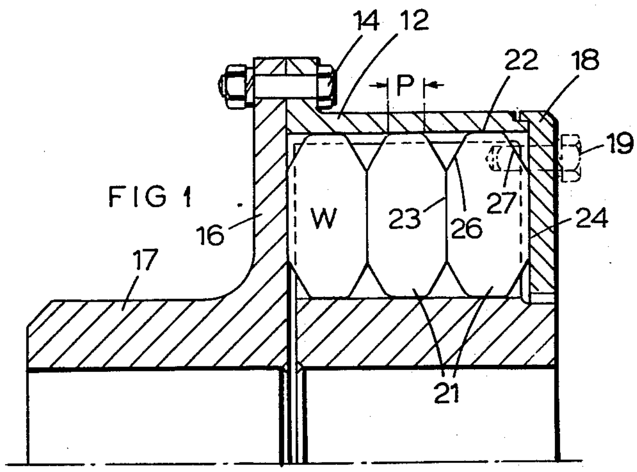
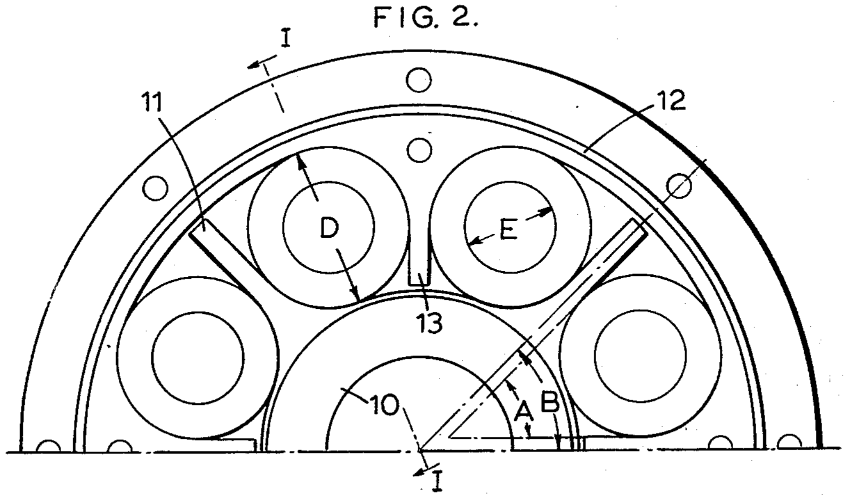



FIG 1

FIG. 2.

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## FLEXIBLE COUPLINGS


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4 Claims. (Cl. 64—14)


This invention relates to flexible vibration damping apparatus comprising two coaxial members, two sets of blades which extend radially and axially of the apparatus, which blades are connected alternately to said coaxial members so as to form cells, and blocks of elastic material in said cells. Examples of such apparatus are decribed in the specifications of my British patents Nos. 641,425 and 802,400.

The main object of the present invention is to provide a degree of deformation of the blocks under load much greater (e.g. 100% greater) than heretofore and a correspondingly lower coupling stiffness.

A further object is to increase the sensitiveness of the coupling, particularly at light load by reducing the contact area between the blocks and the cell or cavity end walls.

A still further object in this type of coupling, in which the blocks operate in pairs, one driving, one trailing, for any direction of rotation, is to base the coupling characteristics, namely stiffness and torsional deflection, not by a haphazard choice of the number of cells, but by the calculation of the desired number of cells which determines the angle of torsional deflection as a function of the cell angle for any specific mass-elastic system, the size or diameter of the blocks and the number of blocks per cell being determined by the desired coupling capacity.

According to the invention, a flexible vibration damping apparatus comprises two coaxial members, two sets of blades which extend radially and axially of the apparatus and which blades are connected alternately to said coaxial members so as to form cells, a plurality of solid circular blocks of elastic material in each cell, the blocks having circular flat end surfaces parallel to each other of smaller diameter than that of the blocks, an outer circular peripheral surface of smaller width than that of the blocks, and inclined outer annular surfaces from the end faces of the peripheral surface.

The term "solid" is intended to mean that the blocks are free from any major holes or cavities, e.g. no bolts, pins or the like pass through the blocks and in fact the blocks should even be as free as possible from smaller cavities although in practice it may be impossible to avoid occasional minor cavities altogether.

For blocks having a diameter D, the width may be 0.45 to 0.55 D, and the blocks may have an end surface diameter of 0.5 to 0.6 D (preferably 0.45 to 0.55) and a width of peripheral surface 0.2 to 0.3 D.

The size of blocks is preferably such as to fit the cells without pre-compression or such as to require up to 3.0 percent (preferably not more than 1.5 percent) pre-compression in both diameter and width.

Each cell may contain 2 to 6 blocks.

The roots of the blades may have a radius equal to half the radial height of the cells and the remainder of the blades may have their sides parallel to each other.

The cone-shape block offers the following advantages:

(a) Softer effect than cylindrical blocks;

(b) Area of contact with cell end-walls is less than 50% of that of cylindrical blocks used hitherto;

(c) Lesser volume of rubber and simple mould shape.

A constructional form of the invention is illustrated by way of example in the accompanying drawing.

FIGURE 1 is a half sectional view on a radial plane

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I—I of a coupling made in accordance with the invention; and

FIGURE 2 is a half end view thereof with the end plate removed.

The two coaxial members consist of an inner member **10** carrying blades **11** surrounded by an outer member **12** carrying blades **13**. The outer member **12** is bolted by bolts **14** to a driving flange **16** on a driving sleeve **17**. Each blade on one member is located normally midway between two blades on the other member to form cells. A shows the cell angle and B shows the centre of blade angle, both angles being identical.

Each cell contains three solid rubber blocks and the cells and closed by an end plate **18** bolted by bolts **19** to the member **12**. Each block has an outer peripheral surface **22** two circular end surfaces **23, 24** and two frusto-conical surfaces **26, 27** connecting the surface **22** to the end surfaces **23, 24**. For a block diameter D the width W of the block is 0.5 D, the diameter E of end face 0.55 D, and the width P of the peripheral surface 0.25 D. The end surfaces contact each other and/or the flange **16** or plate **18**. The roots of the blades are curved to a radius equal to half the radial height of the cells.

The number of cells may vary for example between 6 and 16 and it will be realised that in a coupling having 6 cavities only the cavity angle will be 60° and in a coupling with 16 cavities 22.5° so that for a given maximum compressive strain of say 25% the appropriate torsional deflection angles obtained would be 15° and 5.6°, respectively.

The preferred number of blocks in each cell is 2, 3, 4 or 5 but it is also possible to make a coupling with only 1 block or if desired 6 blocks per cavity.

The blocks whether "driving" or "trailing" at all times make contact with the parts **16, 18** with a pre-compression of the order of 1 to 1.5% to ensure that the blocks are maintained in their true plane of rotation at all times and cannot possibly twist in the cavities. In other words, only the block end-faces contact the cell end walls, both under no-load and under full-load conditions, in order to reduce the friction between the driving blocks and the cavity walls. Whilst under maximum torque load the driving block end-faces become slightly elliptical, the conical flanks **26, 27** remain out of contact with the cavity walls at all times and an increase in the block deformation of the order of 100% is thereby obtained compared with the cylindrical blocks.

The blades may if desired by slightly tapered.

The use of "tapered" instead of "parallel" blades makes the cell volume a little larger, obtaining thereby an increased torsional flexibility of the coupling and incidentally effecting a reduction in weight. The increase in torsional flexibility is of the order of 5%.

I claim:

1. A flexible vibration damping apparatus comprising two coaxial members, two sets of blades which extend radially and axially of the apparatus and which blades are connected alternately to said coaxial members so as to form cells, a plurality of solid circular blocks of elastic material in each cell, the blocks having circular flat end surfaces parallel to each other of smaller diameter than that of the blocks, an outer circular peripheral surface of smaller width than that of the blocks, and inclined outer annular surfaces from the end faces to the peripheral surface, said blocks having a diameter D, each of said blocks having a width 0.45 to 0.55 D, an end surface diameter 0.5 to 0.6 D and a width of peripheral surface 0.2 to 0.3 D.

2. A flexible vibration damping apparatus comprising two coaxial members, two sets of blades which extend radially and axially of the apparatus and which blades are connected alternately to said coaxial members so as

to form 6 to 16 cells at least two and not more than six solid circular blocks of elastic material in each cell, the blocks having circular flat end surfaces parallel to each other of smaller diameter than that of the blocks, an outer circular peripheral surface of smaller width than that of the blocks, and inclined outer annular surfaces from the end faces to the peripheral surface, said blocks having a diameter D, each of said blocks having a width of 0.45 to 0.55 D, an end surface diameter of 0.5 to 0.6 D, and a width of peripheral surface 0.2 to 0.3 D.

**3.** A damping apparatus as claimed in claim **1** wherein the blocks fit in the cells without pre-compression or with a pre-compression not exceeding 3.0 percent in diameter and width.

**4.** A damping apparatus as claimed in claim **1** wherein the roots of the blades have a radius equal to half the radial height of the cells and the remainder of the blades have their sides parallel to each other.




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