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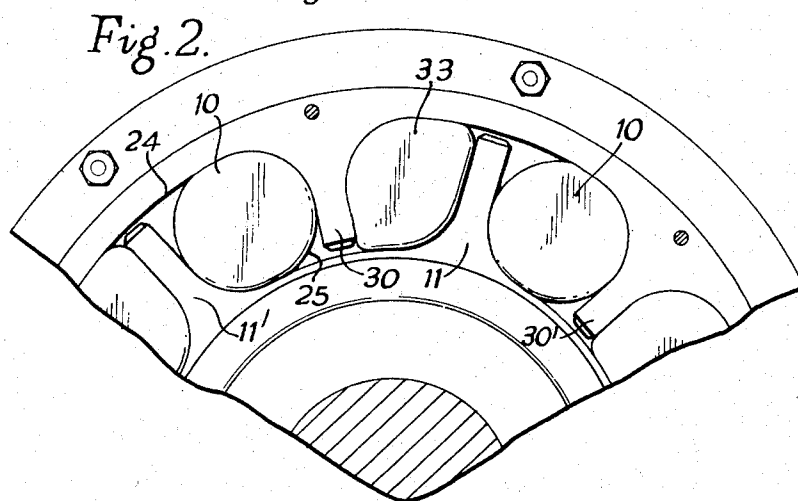
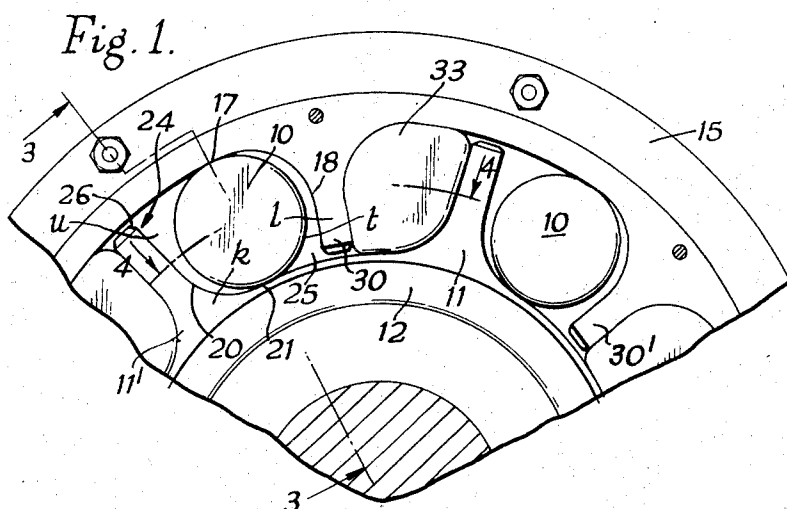
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FLEXIBLE COUPLINGS, DAMPERS, GEARWHEELS AND LIKE DEVICES

Filed Dec. 5, 1956

2 Sheets-Sheet 1



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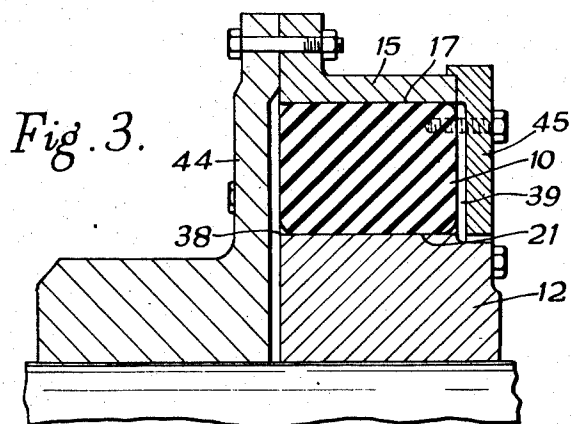
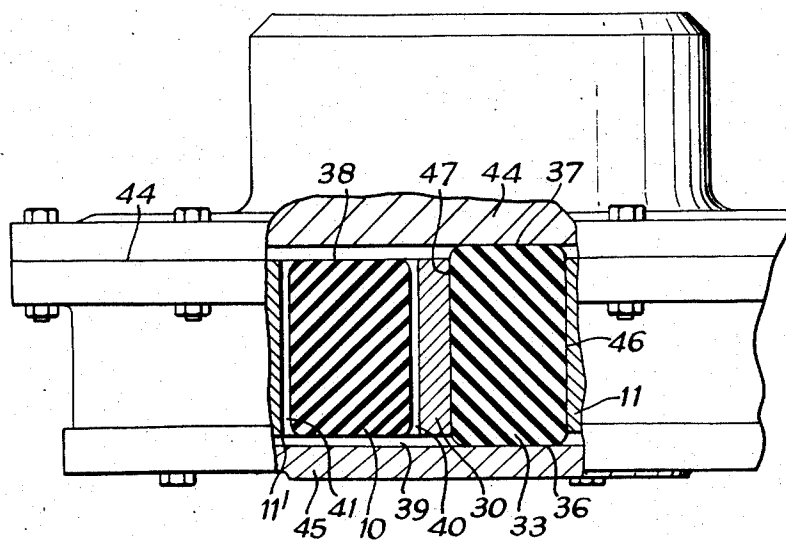


Fig. 4.



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FLEXIBLE COUPLINGS, DAMPERS, GEARWHEELS AND LIKE DEVICES

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3 Claims. (Cl. 64-14)

This invention relates to flexible couplings, dampers, gearwheels, and like devices comprising two co-axial members, two sets of blades which extend radially and axially of said members and which blades are connected alternately in the circumferential direction to one and the other of said co-axial members, and an outer drum surrounding the blades so as to form cells which contain blocks of rubber or synthetic rubber-like material so that each block engages adjacent blades carried by the said members respectively.

The main object of the present invention is to enable the blocks to deform with a rolling action engaging with the cell walls and disengaging therefrom, and to provide a greater degree of deformation of the blocks and therefore a lower coupling stiffness for a given cell volume. A further object is to facilitate varying of the torsional deflection or coupling stiffness.

According to the invention the block in axial view and the roots of the blades are of correspondingly shaped curvature at two opposite parts of the block, one having an arc of contact of more than 90° , the other of less than 90° around the block, leaving two oppositely disposed parts, extending over similar angles, out of contact with the cell but movable into engagement with the cell under increasing load by an approximately rolling engagement.

Preferably the blocks are of circular cross-section and have a radius in the free condition equal to or slightly greater than that of the root of the blade and approximately half the radial height of the cell.

The invention will now be further described with reference to the accompanying diagrammatic drawings wherein:

Figure 1 is a sectional view of part of a flexible coupling made in accordance with the invention;

Figure 2 is a similar sectional view showing somewhat larger blocks; and

Figures 3 and 4 are sectional views on the lines 3-3 and 4-4 on Figure 1.

In the drawings a cylindrical roller 10 is shown the free diameter of which is about equal to the radial dimension of the cell formed by a blade 11 on an inner member 12 and the adjacent blade 30' on the outer member 15. The outer member blade has a circular portion 17 to 18 and the inner member blade has a circular portion 20 to 21 which have a radius equal to half the radial height of the cell, the radius of the roller 10, in the free condition, being equal to or greater than that of the blade root. Each blade then continues as a free end having walls parallel to each other and it will be seen that the radiused portion of an outer member blade is slightly greater than an angle of 90° and that of the inner member blade slightly smaller than an angle of 90° . This arrangement leaves two spaces 24, 25 in each cell offset at 180° from each other into which the rollers can be forced when under load. The rubber roller as it deforms has an approximately rolling contact with the parallel walls of the blades and the adjacent wall of the outer

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member. It unrolls from these surfaces as the load is reduced. The rollers may completely fill the axial dimensions of the cell. The length of the curves 20 to 21 of the blades on the inner member are about equal to the length of the parallel parts (such as 20 to 26) e. g. 80 to 120% of such parts. The length of the curves 17 to 18 of the blades on the outer member 15 are greater than the parallel parts of said blades, e. g. 110 to 155% of the length of such parts.

The left-hand side of Figure 1 shows a roller which in the free condition has a diameter equal to the radial height of the cavity, that is a radius equal to that of the blades, which in the no load or assembled condition have a pitch of 30° , secondly, this figure shows, between blades 11 and 30, a roller subjected to maximum deformation which corresponds to a torsional deflection of 4° , this in one sense of rotation being a leading or driving roller or cavity, the pitch between the blades being $30^\circ - 4^\circ = 26^\circ$ and the trailing cavity formed by blades 30 and 11' showing the roller half way between the adjacent blades which are at a pitch of $30 + 4 = 34^\circ$, the roller making tangential contact only with the peripheries of the inner and outer members.

Figure 2 shows, on the right-hand side, a roller 10 which in the free condition has a radius slightly greater than that of the root of the blade or half the radial height of the cavity and, therefore, upon insertion undergoes deformation, the pitch of the blades in the unloaded condition being also 30° . The driving roller 33 is shown under maximum deformation, the angle between the blades 11' and 30 being $30 - 2 = 28^\circ$. Trailing rollers 10 are shown under a slightly compressed condition, the angle between blades 11', 30 and 11, 30' being $30 + 2 = 32^\circ$.

It will be seen that whether it is inserted with or without pre-compression, depending upon its diameter being equal to or slightly larger than the radial height of the cavity or cell, the roller makes full contact with the large fillet at the root of the blades and spaces are left for deformation under torque load only at 24 and 25 and/or 38 and 39 (see Figure 3), space 24 (see Figure 2) between the periphery of the outer members and the parallel portion or tip of the blade of the inner member being larger than the space 25, there being no rubbing action at any point during deformation but only rolling action between roller and cavity surfaces. The degree of torsional deflection and coupling stiffness can be varied by the simple expedient of varying the roller diameter for a given number of pairs of rollers, roller hardness and pitch circle diameter of the rollers.

In Figures 3 and 4, a driving flange 44 is shown to which the outer member 15 is bolted. A cover 45 is bolted to the other side of member 15. The parts 44, 45 close the ends of the cells. The trailing blocks normally have a clearance 38, 39, from the parts 44, 45, and in some cases also a clearance 40, 41 from the blades 11, 30, 11', but make contact under load as at 36, 37 and 46, 47.

The coupling of the present invention has a greater torque capacity due to the blades being able to withstand greater bending loads.

As there is no rubbing action but rolling action only between the roller and cavity surfaces it is possible to use unmachined cavities for many applications.

Due to the considerable reduction in blade bending stress, forged or cast steel components need not be used exclusively but material of lower ductility, such as high grade cast iron, may be used with advantage.

I claim:

1. A flexible vibration damping apparatus comprising two approximately co-axial members, two sets of blades which extend radially and axially of said members and

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which blades are connected alternately in the circumferential direction to one and the other of said co-axial members, an outer drum surrounding the blades so as to form cells, blocks of elastic material in said cells, each block and the roots of the blades being of correspondingly shaped curvature at two opposite parts of the block, one of said parts of the block having an arc of contact of more than 90°, the other of less than 90° around the block, leaving two oppositely disposed parts, extending over similar or smaller angles, out of contact with the cell but movable into engagement with the cell under increasing load by an approximately rolling engagement, said blades each having parallel sides at its free end whereby spaces are provided when the blocks are unloaded which spaces are substantially filled by the blocks when these are deformed under load.

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2. Apparatus as claimed in claim 1 wherein the blocks are of circular cross-section and have a radius in the free condition equal to or slightly greater than that of the root of the blade and approximately half the radial height of the cell.

3. Apparatus as claimed in claim 1 wherein the length of the curvature of the roots of the blades on the inner member is 80 to 120% of the parallel parts of said blades and the length of the curvature of the roots of the blades on the outer member being greater than the parallel parts of these blades.

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