ABSTRACT
A cushion member having a bell-shaped outer configuration with an axial bore which is enlarged at the lower end. The cushion member is durable a higher compressive load as compared with a conventional cylindrical cushion member and has an increased fatigue life.

4 Claims, 4 Drawing Figures
RESONS CUSHION MEMBER

The present invention relates to a resilient cushion member. A resilient synthetic resin such as urethane rubber has widely been used for making a resilient cushion member since it is advantageous in that it can withstand repeated stresses to which the cushion member is subjected during its use. It is desirable to form a cushion member in such a shape that has a greater compressive strength and a greater durability with minimum amount of material. Hithertofore, a cushion member has been made in a cylindrical shape. However, this is not preferable in view of the above purpose.

Therefore, it is an object of the present invention to provide a cushion member which has a greater compressive strength and a greater durability with minimum amount of material.

Another object of the present invention is to provide the most suitable configuration of a cushion member for achieving the above object.

According to the present invention, a cushion member has a bell-shaped outer configuration with an axial bore which is gradually enlarged at the lower end.

The above and other objects and the features of the invention will become apparent from the following descriptions of a preferred embodiment taking reference to the accompanying drawings, in which:

FIG. 1 is a vertical sectional view of a conventional cushion member;

FIG. 2 is a vertical sectional view of a cushion member in accordance with the present invention;

FIG. 3 is also a vertical sectional view of another embodiment of the present invention; and,

FIG. 4 is a diagram showing load-deflection curves of the cushion members shown in FIGS. 1 and 3.

Referring to the drawings, particularly to FIG. 1 which shows a conventional cushion member generally designated by the reference numeral 1, the cushion member 1 is made of a suitable resilient material such as urethane moulded in a cylindrical form with an axial bore 2. According to the present invention, the cushion member 10 comprises, as shown in FIG. 2, a resilient body 11 having a bell-shaped outer configuration with an axial bore 12 which is enlarged at the bottom thereof as shown by the numeral 12a. Each corner of the resilient body may be rounded as shown in FIG. 2. According to the design of the present invention, a cushion member of 55 mm high and 60 mm in diameter may correspond to a conventional cushion member of 100 mm high and 60 mm in diameter. Usually, a conventional cushion member of 100 mm high and 60 mm in diameter may have inner diameter of 18 mm. In one example of the present invention shown in FIG. 2, a cushion member 10 of 55 mm high and 60 mm in maximum diameter may be 14 mm in inner diameter. The dimensions R₁ and R₂ in FIG. 2 may both be 60 mm having the elevation of center H₁ and H₂ of 15 mm and 30 mm respectively. When the cushion member of FIG. 1 having the aforementioned dimensions is compressed by 35 mm in the axial direction, it will be deformed as shown by dotted lines in FIG. 1. When the cushion member 10 shown in FIG. 2 is compressed in the axial direction by the same amount, it will be deformed as shown by dotted lines in FIG. 2.

Another embodiment of the present invention is shown in FIG. 3. In the embodiment, the outer configuration is slightly modified and an example of dimensions corresponding to the above-mentioned ones may be R₁ = 50 mm, R₂ = 60 mm, H₁ = 13 mm, H₂ = 30 mm, J₁ = 14 mm, OD = 60 mm, l₁ = 25 mm, l₂ = 10 mm, and l₃ = 20 mm. This cushion member is similar in other respects to that shown in FIG. 2. Therefore, corresponding parts are designated by the same reference numerals with the addition of primes.

Load deflection characteristics of the cushion members shown in FIGS. 1, 2 and 3 having the aforementioned dimension are shown in FIG. 3 by curves A, B and C, respectively.

Further, cushion members of the aforementioned dimensions were subjected to repeated axial deformation of 35 mm to find out their fatigue characteristics. In the cushion member of FIG. 1, a circumferential crack has appeared after 50,000 cycles of repeated deformations were applied, however, in the cushion member of FIG. 2, the permanent deformation did not exceed 5% even after 200,000 cycles of repeated deformations were applied. Thus, it has been proved that the cushion member of the present invention can be used almost permanently. The results of the test are shown in the following Table.

<table>
<thead>
<tr>
<th>Design</th>
<th>Deformation</th>
<th>Durable compressive force</th>
<th>Fatigue life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional one</td>
<td>35%</td>
<td>approx. 2,500 kg</td>
<td>50,000 cycles</td>
</tr>
<tr>
<td>(FIG. 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invention</td>
<td>64%</td>
<td>approx. 3,500 kg</td>
<td>200,000 cycles</td>
</tr>
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</table>

Further, the weight of the cushion member in accordance with the present invention is appreciably reduced as compared with the conventional cushion member. In fact, the conventional cushion member having the aforementioned dimensions, the weight is 330 gr, while the weight of the cushion member of the present invention is as small as 120 gr.

It is believed that the present invention can have a greater compressive deformation and a greater compressive strength due to the fact that, during the initial stage of deformation, the material of member is deformed into the central axial bore and thereafter can support load by being deformed as shown by the dotted lines in FIG. 2.

It should further be noted that the cushion member of the present invention can be easily and cheaply manufactured by moulding technique. Further, the shape of the present invention is very convenient to use. It should of course be noted that the cushion member of the present invention can be used in various known ways.

1 claim:

1. A cushion member consisting essentially of a bell-shaped outer configuration such that the cross-sectional width increases along the length thereof with an axial bore with a diameter which initially decreases briefly along its length, continues uniformly, then flares to an enlarged size at the opposite end.

2. A cushion member according to claim 1, wherein the cushion is composed of resilient material.

3. A cushion member according to claim 2, wherein deformation produces substantially complete contact between opposing surface areas of the bore.
4. A cushion member consisting essentially of an outer configuration such that it increases in cross-sectional width continuously from a point of origin along its length to a predetermined point and then decreases to its point of termination with an axial bore of initial uniform diameter which flares at a predetermined point along its length.