Dec. 8, 1953 L. S. WILBUR 2,661,943

RESILIENT CUSHIONING DEVICE

Filed Feb. 15, 1951

Fig. 1.

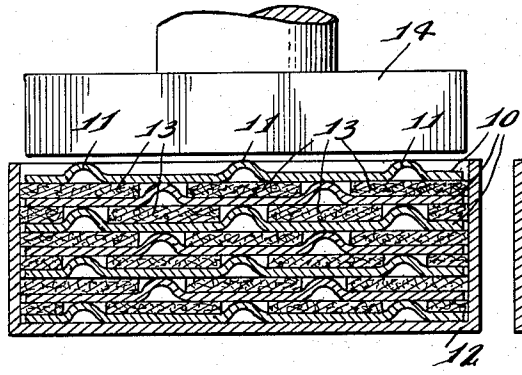


Fig. 3.

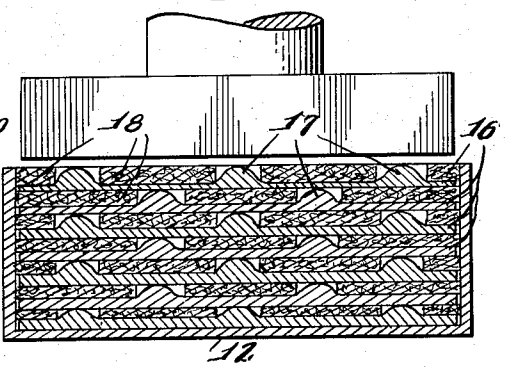


Fig. 2.

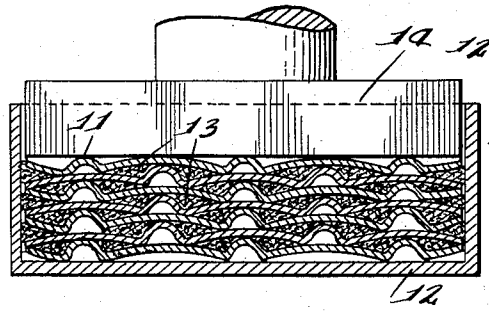


Fig. 4.

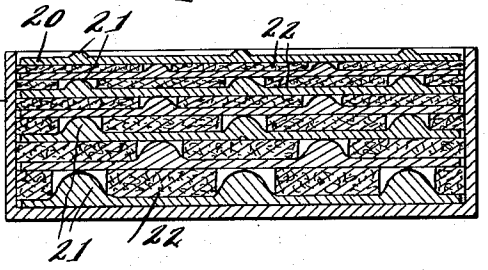


Fig. 5.

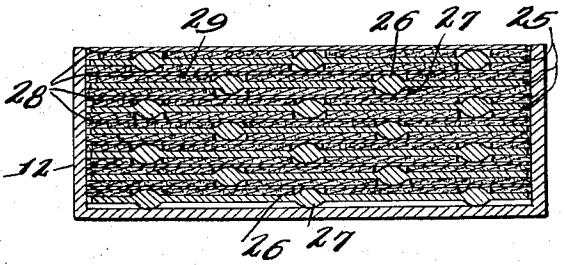
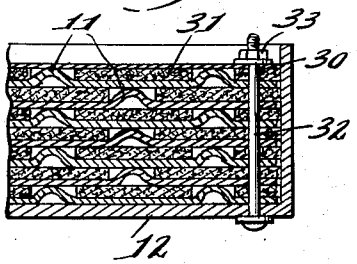


Fig. 6.



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2,661,943

RESILIENT CUSHIONING DEVICE

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Application February 15, 1951, Serial No. 211,099

5 Claims. (Cl. 267—2)

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This invention relates to improvements in resilient cushioning devices which have many and varied applications in industry. The present application is a continuation in part of my co-pending application, Serial No. 195,570, filed November 14, 1950.

In my said prior application I have shown a resilient cushioning device comprising a stack of resilient metal plates provided with means in the form of ribs or corrugations for spacing the plates in the stack.

The present invention is an improvement upon the cushioning device of my earlier application and resides fundamentally in the incorporation of resilient cushioning material in the spaces between the metal plates.

According to my present invention, the said spaces between the resilient metal plates are filled, or partially filled, with a resilient compressible material such as natural or synthetic rubber, or combinations of rubber and other materials, or natural or synthetic materials having the required properties of compressibility and resilience.

The filler material above referred to may be in the form of substantially solid blocks of such material or the said blocks may be of cellular construction in which the cells or pores may be of varying size so as to vary the compressibility of the block.

It is furthermore contemplated by the present invention that the said blocks or pads of resilient compressible material may be made of varying density so as to vary their compressibility and their resilience for varying load conditions.

In my present invention, then, I combine with the resistance of resilient metal plates the added resistance offered by masses of resilient compressible material, thus obtaining in the combined structure the resistance of both the plates and the filler material. It will be understood that it is within the contemplation of the present invention that the proportions of metal to filler material may be greatly varied so as to vary the part of the total resistance to load which may be offered either by the metal plates or the resilient filler material, or both.

The invention of the present application has many advantages over the structure of my above referred to co-pending application. Among such advantages may be mentioned (1) increasing the load capacity for a given volume; (2) prolonging the life of the structure; (3) providing for a wider range of adjustability for varying loads; (4) permitting the use of thinner metal plates; (5) eliminating noise; (6) providing for movement in many directions; and (7) sealing the structure against the elements.

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Where, in my present invention, I use rubber, whether natural or synthetic or combinations thereof, it is contemplated that the rubber filler material may be vulcanized to the metal plates, if desired, or the filler material may simply be loosely placed between the plates in the stack.

It is further pointed out that the blocks or pads of filler material may be of gradually increasing thickness from the top of the stack to the bottom, with the result that the device will hardly ever "bottom," there being always some compressibility left in the bottom layer, unless it be attempted to use the device to support a load beyond its intended range of activity.

Other objects and advantages of the invention will be more fully brought out as the description proceeds.

In the accompanying drawings, I have illustrated several practical embodiments of my invention but it is to be understood that the drawings are illustrative merely and that there is no intention to confine my invention to the details thereof. Once the basic idea of my invention is understood by those skilled in the art, it will be readily apparent how the invention may be embodied in other forms without departing from the spirit thereof or from its scope, as defined in the appended claims.

In the drawings,

Fig. 1 is a view in section of one embodiment of my invention showing the relative position of the parts before compression under load;

Fig. 2 is a view similar to Fig. 1 showing the device compressed;

Fig. 3 is a view similar to Fig. 1 showing a modification in which the spacing elements are in the form of solid ribs as distinguished from corrugations;

Fig. 4 is a view similar to Fig. 1 showing another modification in which the spacing elements are of gradually increasing height from top to bottom of the stack and the pads or blocks of filler material are of correspondingly gradually increasing thickness;

Fig. 5 is a view also similar to Fig. 1 showing a further modification of the invention; and

Fig. 6 is a fragmentary view similar to Fig. 1 showing a means for precompressing the stack of plates and fillers.

Referring now to the drawings, and particularly to Fig. 1, reference numeral 10 indicates a resilient metal plate, such as steel or the like, provided

with a plurality of corrugations 11 extending in parallelism across one face of the plate.

Fig. 1 shows a plurality of such plates 10 arranged in a stack with the corrugations 11 of the respective plates staggered with respect to each other. This arrangement is the same as that which is shown in my said co-pending application.

The stack of plates shown in Fig. 1 is confined within a container 12 which serves to keep the plates in proper assembled relation, although permitting some lateral play by reason of the clearance between the edges of the plates and the inside wall of said container. The container 12 also serves as a guide for the up and down movement of said plates when they are subjected to the compressive action of a load and the subsequent release thereof.

The outstanding novelty in the present application, as distinguished from my said co-pending application, is the provision of a plurality of blocks or pads 13 of resilient compressible material, which said blocks or pads are located in the spaces between the metal plates 10.

As heretofore stated, the said blocks or pads 13 may be made of natural rubber or synthetic rubber, or combinations of rubber and other materials, or suitable plastic compositions, so long as the material possesses the essential characteristics of compressibility and resilience.

In Fig. 1 the pads or blocks 13 do not entirely fill the spaces between the plates 10 but some clearance is provided adjacent the ribs or corrugations 11. This is so that when the pads or blocks 13 are compressed there may be sufficient space for the material to "flow."

For illustrative purposes, I have indicated in Fig. 1 by the reference character 14 any device that is intended to be supported upon my resilient cushioning device. The device indicated by the reference numeral 14 may be anything at all that needs to be resiliently supported. It may be an engine mounting, it may be a portion of a vehicle frame, it may be part of a railroad crossing, etc.

In Fig. 2, I have illustrated diagrammatically the compression of my resilient cushioning device as effected by movement of the diagrammatically illustrated element 14. It will be seen that the metal plates 10 are bent about the spacing elements or corrugations 11 and that the pads or blocks of resilient material 13 are also acted upon by the load so as to spread out or "flow" in the spaces between the plates.

The diagrammatic illustration in Fig. 2 may be said to represent a rather extreme condition which is to say that the relationship between the compressibility of the stack and the load to be supported thereon is such as virtually to compact the metal plates and the blocks of filler material into a substantially solid structure. However, even in this exaggerated form, there will still be sufficient resilience and compressibility left in my device to take even a heavier load.

As heretofore pointed out, the pads or blocks 13 of resilient compressible material may be so made as to vary the density thereof from the top of the stack to the bottom; that is to say, pads or blocks of relatively low density and therefore correspondingly high compressibility may be located at the top of the stack; the degree of density may then gradually vary until at the bottom of the stack will be located pads or blocks of great density and therefore correspondingly lower compressibility. In this way the device of my invention may be so arranged that the top of the stack will respond rather quickly and easily to the initial load impact and then as the load continues to move, gradually greater and greater resistance will be offered.

Upon release of the load, the device will work in exactly the opposite direction and thus the return of the load member 14 to its initial position will not be a sharp movement but a gradual one, as was the case when the load moved downwardly.

In order to secure varying density for the different layers of blocks or pads 13, I may make said blocks or pads of cellular material. This may be rubber or it may be many of the plastic materials available on the market today. Such plastic materials may be made with voids of different sizes so that the compressibility of the material is thereby varied, as desired.

Pursuing the explanation heretofore given, if plastic masses containing voids be used, it may be desirable to have the more compressible pads at the top of the stack and the less compressible pads at or near the bottom.

In Fig. 3, I have shown a modification of the invention in which my resilient cushioning device comprises a series of resilient metal plates 15, of steel or the like, which are provided with solid ribs or projections 17 which extend in substantial parallelism across one face thereof. In this form, also, the spaces between the plates 15 are filled, or partially filled, with blocks or pads of compressible resilient material 18, of the character heretofore described.

With respect to Fig. 3, it is pointed out that I have shown the plates 15 as of gradually increasing thickness from the top of the stack to the bottom. This is another way of securing gradually increasing resistance to compression from the top of the stack toward the bottom as explained in my previously mentioned co-pending application.

In Fig. 4, I show still another modification of the present invention. In this figure, I have shown the resilient metal plates 20 as provided with ribs or corrugations 21 which are of gradually increasing height from the top of the stack to the bottom. The result of this arrangement is that the spaces between adjacent plates become gradually greater in the downward direction and therefore the interposed fillers 22 are of gradually increasing thickness from the top of the stack to the bottom. This, again, is another way of securing a varying degree of resistance to load from the top of the stack to the bottom. In this modification, the filler pads or blocks 22 may also be made of gradually increasing density from the top of the stack to the bottom.

In Fig. 5, I show still another modification of the invention. In this figure, I show a series of resilient metal plates 25 having projections 26 and 27 extending from opposite faces of the plates, together with flat plates 28 interposed between adjacent pairs of plates 25. By this arrangement of projections on the plates, the bending movement of the plates under compression may be desirably restricted.

The said projections 26 and 27 may extend the same distance from their respective faces of the plates or they may be varied, as desired. For example, the projections 27 may extend from the bottom faces of the plates a greater distance than the projections 26 extend from the upper faces thereof. It is also within my contemplation that

the projections may vary in their extent from the top of the stack to the bottom. Thus, I provide in this embodiment considerable latitude for the building of a structure which will properly support and cushion loads of varying amount.

In the form of the invention shown in Fig. 5, it will be understood that the features heretofore described in connection with Figs. 1, 3 and 4 may also be incorporated, including the placing of filler blocks or pads **29** of compressible resilient material.

Fig. 6 is a fragmentary view of an arrangement such as that shown in Fig. 1. The corners of the metal plates **30** and filler pads or blocks **31** are provided with registering openings, through which passes a bolt **32**. A nut **33** is provided for the bolt and this may be turned down so as to place the stack of plates and filler pads under a predetermined initial compression. By this arrangement, a stack of plates and filler members may be assembled and by means of the bolts and nuts **32** and **33** the stack may be initially compressed to a desired degree. In this way, one may design the structure for a predetermined load and adjust the amount of precompression so that the stack will not yield until the load becomes greater than the precompression applied to the stack. This is, then, another way of varying the compressibility of the stack to suit the degree of load to which it is required to respond in actual practice.

While I have shown the metal plates of this embodiment of my invention to be provided with corrugations or ribs extending in substantial parallelism across one or both faces of the metal plates, I do not intend to limit myself to such construction. It will be clear that suitable spacing devices other than such ribs or corrugations may be provided. For example, the metal plates may be provided with a plurality of discrete protuberances arranged in a plurality of different patterns on one or both faces of the plate and the filler pads or blocks may be correspondingly shaped to conform to the spaces so produced.

It will be understood that the invention herein disclosed may be useful for all the purposes of the structure described in my previously mentioned prior application. Particularly, it is to be understood that the device itself, in any of the forms herein described, may be used as a unit to support resiliently any desired load and it may also be used somewhat as a shim to bolster up existing spring structures.

I claim as my invention:

1. A resilient cushioning device comprising a plurality of resilient plates stacked one upon another, said plates having a plurality of projections with flat portions between said projections, said plates being stacked with the projections on one plate in contact with the flat portions of an adjacent plate, and resilient compressible material in the spaces between the plates.

2. A resilient cushioning device comprising a plurality of resilient metal plates stacked one upon another, a plurality of protuberances on certain of said plates, others of said plates having flat portions in contact with said protuberances, thus providing spaces between the plates, and resilient compressible material in said spaces.

3. A resilient cushioning device comprising a plurality of resilient metal plates stacked one upon another, a plurality of protuberances on certain of said plates, others of said plates having flat portions in contact with said protuberances to provide spaces between said plates, whereby said flat portions will flex upon said protuberances when pressure is applied to the stack, and resilient compressible means in the spaces between said plates adapted to absorb a portion of the applied pressure.

4. A resilient cushioning device comprising a plurality of resilient metal plates stacked one upon another, a plurality of protuberances on certain of said plates, others of said plates having flat portions in contact with said protuberances, said protuberances being of gradually changing height from the top of the stack toward the bottom and thus providing spaces of gradually different height between the plates, and resilient compressible material in said spaces.

5. A resilient cushioning device comprising a plurality of resilient metal plates stacked one upon another, said plates being of gradually different thicknesses from the top of the stack toward the bottom, a plurality of protuberances on certain of said plates, others of said plates having flat portions in contact with said protuberances, thus providing spaces between the plates, and resilient compressible material substantially filling said spaces.

LAWRENCE S. WILBUR.

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