Oct. 20, 1942. L. G. SYMONS 2,299,661

FLEXIBLE SUPPORT FOR VIBRATED MEMBERS

Filed March 17, 1939 2 Sheets-Sheet 1

Fig. 1

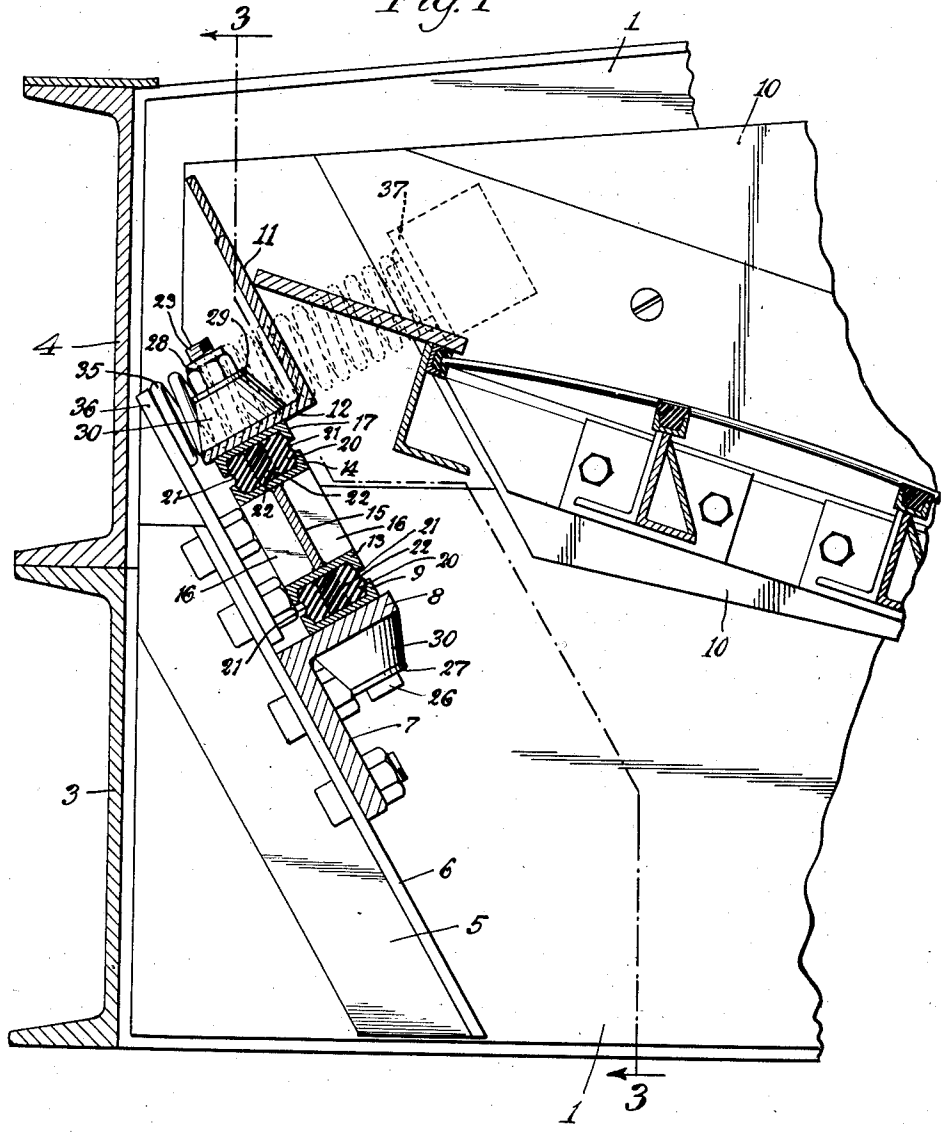
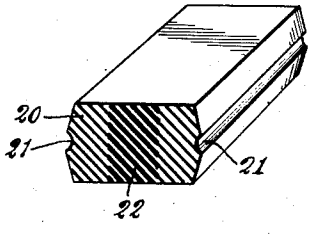


Fig. 2



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Fig. 3

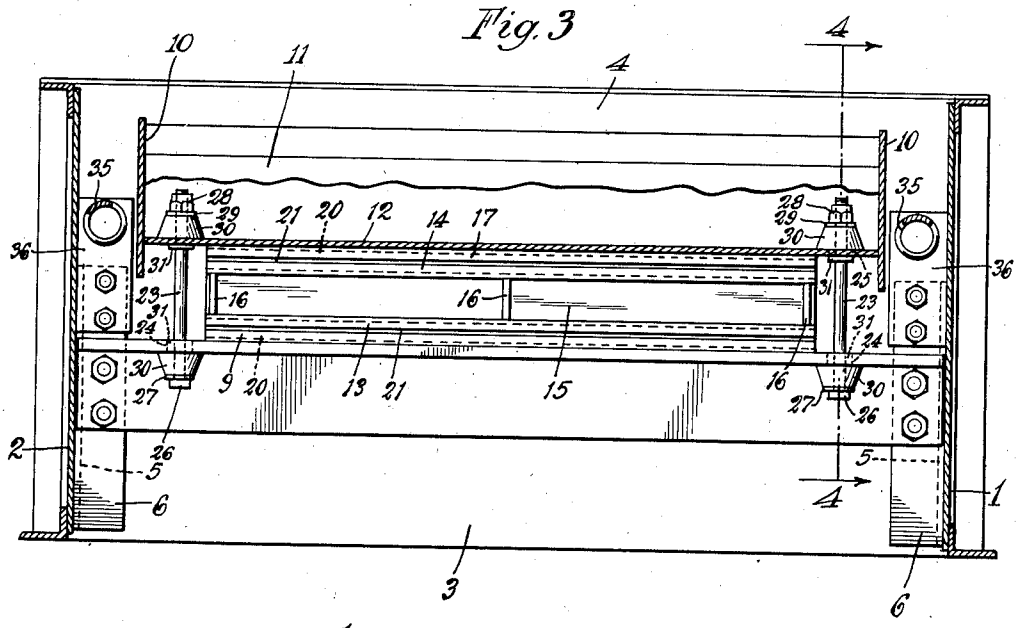
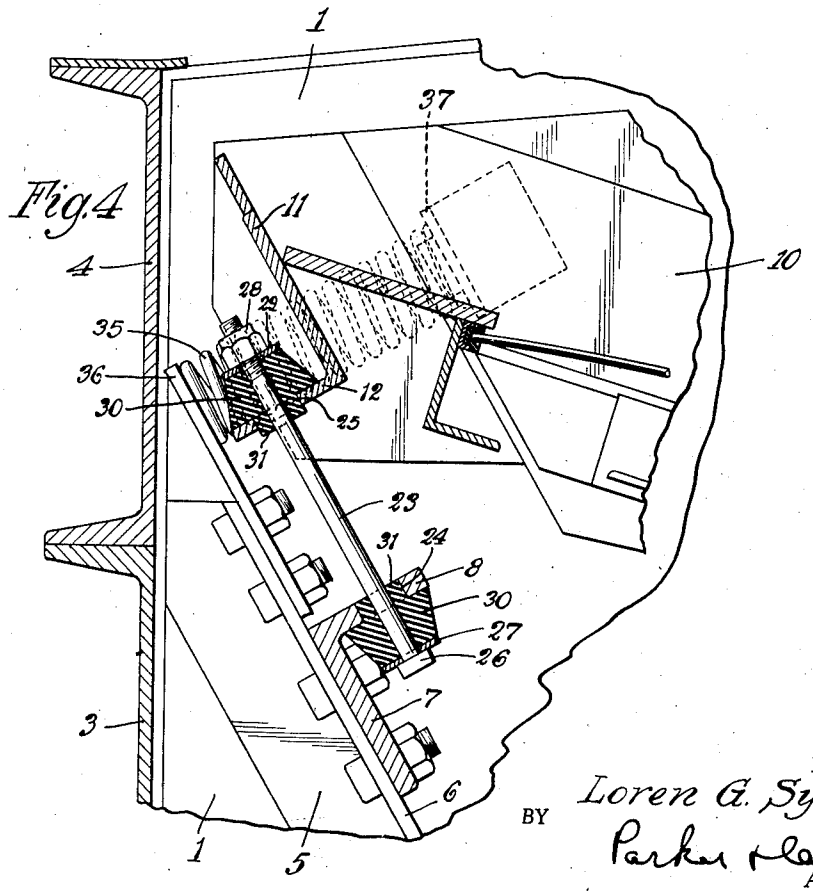


Fig. 4



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UNITED STATES PATENT OFFICE

2,299,661

FLEXIBLE SUPPORT FOR VIBRATED MEMBERS

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Application March 17, 1939, Serial No. 262,366

22 Claims. (Cl. 209—415)

My invention relates to an improvement in flexible supporting means for screens, conveyors and the like. One purpose is the provision of a supporting element adapted to permit vibration of a supported member.

Another purpose is the provision of such an element adapted to constrain a screen or conveyor or the like to substantially linear vibration.

Another purpose is the provision of a supporting member or element for screens, conveyors and the like which shall have a long life and maximum efficiency.

Other purposes will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings wherein:

Fig. 1 is a partial longitudinal vertical section through a screen embodying my invention;

Fig. 2 is a sectional view of a detail;

Fig. 3 is a section taken on the line 3—3 of Fig. 1 on a reduced scale; and

Fig. 4 is an enlarged section taken on the line 4—4 of Fig. 3.

Like parts are indicated by like characters throughout the specification and the drawings.

Referring to the drawings, I may employ a base frame including horizontally extending members, channels or the like 1, 2, which may be connected by any suitable cross members. I illustrate herein transversely extending cross members 3, 4. The details of the base structure are not of themselves important and do not form part of the present invention.

Angles 5 are located within the side frame members 1 and 2, each said angle having an outwardly extending flange 6. To this flange a horizontal, transversely extending angle 7 is secured, with its flange 8 which serves as a support for the channel 9. This channel 9 and the flange 8 extend most or all of the way across the interior of the frame.

10 generally indicates the supported frame, which in this instance is a screen frame, the details of which do not of themselves form part of the invention. At the end of the frame 10 is a transversely extending angle 11 with a flange 12 parallel with and upwardly spaced from the flange 8 on the base.

The purpose of the invention is to permit a linear movement or vibration of the frame 10 in relation to the base. Stated otherwise, the purpose is to permit a movement of the flange 12 in relation to the fixed flange 8, this movement being substantially linear and in a plane generally parallel with the plane of the flange 8. It will be understood, of course, that this vibration or movement, which is effectively linear, would constitute an arc if it were indefinitely prolonged. However, so far as the screening or conveying effect is concerned, the arcuate characteristic of this movement or vibration is so flat or slight as to be negligible.

Interposed between the opposed faces of the flanges 8 and 12 is a linkage which includes a lower, downwardly concave channel 13 and an upper, upwardly concave channel 14, a longitudinally extending connecting and supporting web 15, and spaced transversely extending webs or supports 16. The result is to provide a powerful compression member which will stand whatever compression is demanded by an ordinary screen or conveyor and which will be effective to support the weight of the screen or conveyor and of the material delivered to it or carried on its upper surface.

Positioned above the channel 14 is the inverted channel 17 which abuts against the flange 12. It will be observed that the channels 9, 13 and 14, 17 constitute substantially closed spaces, the opposed edges of the channels however being somewhat spaced apart. Within these closed spaces I position longitudinally extending pads or supports of flexible compressible material, such as rubber or the like, which in the present instance are continuous blocks or strips extending substantially from end to end of the channels. These strips have their upper and lower faces formed to conform accurately to the opposed faces of the channels which engage them.

I find it desirable, in order to increase the flexibility and compressibility of the blocks, as indicated at 20, to provide inwardly cut-away portions or channels 21 along the free surfaces of the blocks 20, between the opposed edges of their confining channel members. I also find it desirable, although not essential, to provide in each block 20 a central portion 22 of somewhat harder rubber than that which forms the rest of the block. The purpose is to prevent an unintendedly complete compression of the blocks 20 and to constrain them to a generally straight-line movement. The hardened portion of the rubber provides a necessary support against over-compression which, however, is obtained without inhibiting the free lateral flexure of the link structure as a whole.

In a broad sense, the solid or harder part of the rubber acts as a species of pivot upon which the opposed channels can rock. However, it

avoids the objection of the employment of a pivot including bearing surfaces since there is no movement of surface across surface and no lubricating problem. For instance, with extremely hard rubber cores, there is little if any distortion of the central portion of the block 20. However, the soft layers at each side of the hard core 22 primarily serve to position the hard portion 22 and flex and compress quite readily, thus permitting the hardened portion 22 to serve as a species of radius member.

In order to constrain the parts to the above described substantially linear pattern of movement, I provide the means for positively clamping the angle 12 downwardly against the angle 8 and for preventing any substantial movement of the angle 12 upwardly away from the angle 8. That is to say, there is very little rise or fall of the member 12 in relation to the member 8, a movement so slight as to be in practice negligible.

The particular means for holding the flange 12 down against the flange 8 in the construction herein shown includes a plurality of bolts 23. In this instance I illustrate a pair of such bolts, one located at and beyond each end of the link structure proper. Each bolt 23 is threaded through apertures 24, 25 in the flanges 8 and 12, respectively, these apertures being of sufficient size to permit a certain lateral movement of the bolt, which is necessary in order to prevent any cramping and also in order to prevent any metal to metal contact between any portion of the bolt and the surrounding edges of the said apertures 24 and 25. Each bolt is provided with a limiting abutment 26 at one end, which may be opposed to a washer 27 and a locking nut 28 at the opposite end opposed to a washer 29.

Interposed between the washer 29 and the upper surface of the flange 12, and also interposed between the washer 27 and the lower surface of the flange 8 are conic pads or members 30 which may be of rubber or any equivalent compressible, flexible material. These preferably include portions 31 which extend into the apertures 24 or 25, respectively, in order to prevent any metal to metal contact between the bolts 23 and the metal of the flanges 8 or 12. The compression may, of course, be adjusted by setting the locking nut 28. The rubber pads 30 permit the necessary flexure of the bolts 23 in relation to the channels 8 and 12 through which they pass.

Any suitable means may be employed for tending to return the platform or screen frame to a predetermined neutral position. I illustrate, for example, a coil spring 35, which may be compressed between an opposed fixed abutment 36 on the base and an abutment 37 on the screen frame itself. In the form of the device as herein shown, the link is inclined from the vertical. Therefore, in effect, the spring 35 is balanced or set to neutralize the gravital tendency of the screen frame to move the linkage above described in a counter-clockwise direction. It will be understood, however, that the linkage may be set at any desired angle, or may be perpendicular, and that any desired means may be employed to return it to neutral position. Under many circumstances no such return means are necessary.

It will be realized that whereas I have described and shown a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative and diagrammatic, rather than as limiting me to the specific structure or structures herein described and shown.

The use and operation of my invention are as follows:

I find it advantageous to employ a flexible connection for vibrated screens, conveyors or the like in which a metal to metal contact is avoided and in which the disadvantages of metallic supporting springs, with their tendency to break from fatigue is avoided. I prefer to employ blocks or bodies of flexible compressible material such as rubber. However, it often happens that in screening or conveying an amplitude of vibration is necessary which would cause an unduly great compression of the sides of a rubber block, if a single block of rubber or compressible, flexible material were employed.

I find it advantageous to obtain the advantages of a rubber block while preventing the heating or erosion which would take place if but a single block were employed. I therefore employ two members, of rubber or the like, as shown in Fig. 1, which are separated by the radius member or the spacing support 15, of sufficient length or depth to allow a wide amplitude of vibration to the screen or conveyor. The member 15 and the rubber blocks are proportioned to carry heavy loads and at the same time to limit the compression at the edges of the blocks to such a small amplitude that no heating or erosion of the rubber will result.

In actual practice, the employment of two separate blocks, as shown in Fig. 1, separated by the spacer 15, permits an amplitude of vibration many times that possible with the employment of a single block. In effect, a small angular displacement of the rubber block itself can be translated into a wide amplitude of vibration of the vibrated screen or conveyor by the use of the relatively deep intermediate supporting member 15. Increasing the length or depth of the inflexible member 15 increases the possible amplitude of vibration of the deck without increasing the compression at the edge of the rubber blocks, and at the same time maintains a support that is just as rigid as though the screen deck were supported on a single block the size of either one of the blocks shown.

It will be understood, of course, that whereas I have shown in Fig. 1 a single linkage at the end of the screen, a plurality of such connections may be employed along the length of the screen. Where linear vibration is desired for one end of the deck and orbital vibration for the other, a single unit may be employed at the end of the deck where linear vibration is desired, and any other appropriate supporting means may be employed for supporting the other end of the deck and for permitting non-linear or orbital vibration. On the other hand, if a linear vibration is desired from end to end of the deck, both ends of the deck may be supported upon units such as are shown in Fig. 1 and, with a long deck, any desired number of intermediate units may be employed along the length of the deck or screen.

It will also be understood that where I employ the term "linear" vibration, I wish it to be interpreted as of sufficient breadth to cover slightly arcuate vibration, as the actual form of vibration obtained with the linkage herein described is effectively linear, so far as its action on the particles is concerned, but is strictly speaking arcuate in that it is vibration about a center at or near

the channel 8 and in general alinement with the central web of the member 15.

In connection with the linkage structure above described, the employment of a hardened center 22 in each of the blocks, with soft rubber 21 at each side thereof, is advantageous as providing in effect an extension of the central web 15 to contact with the members 8 and 12, while still preventing the friction which would result from a bearing or a metal to metal contact.

I claim:

1. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including means for drawing said opposed abutment members together thereagainst.

2. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including means for drawing said opposed abutment members together thereagainst, and partially confining means for each said block, including opposed channel members on the abutment members and on the radius member, the opposed edges of said channel members being at all times spaced apart, whereby a lateral flexure of the blocks is permitted.

3. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including bolts passing through said abutment members, said abutment members being apertured to permit their passage, the size of the apertures being sufficient at all times to prevent direct contact between the bolts and the edges of the apertures, cushion means interposed between said bolts and the outer faces of said abutment members, and means for maintaining a predetermined compression against said cushion means.

4. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including bolts passing through said abutment members, said abutment members being apertured to permit their passage, the size of the apertures being sufficient at all times to prevent direct contact between the bolts and the edges of the apertures, cushion means interposed between said bolts and the outer faces of said abutment members, and means for maintaining a predetermined compression against said cushion means, said cushion means including portions extending into said apertures and directly interposed between the bolts and the edges of the apertures.

5. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including means for drawing said opposed abutment members together thereagainst, said blocks including relatively hard central portions located generally along the axis of thrust of said abutment members, and softer portions at each side thereof.

6. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including means for drawing said opposed abutment members together thereagainst, and additional means interposed between base and vibrated member, for urging said flexible support normally toward a predetermined neutral position when the vibrated member is at rest.

7. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius mem-

ber located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including means for drawing said opposed abutment members together thereagainst, and additional means interposed between base and vibrated member, for urging said flexible support normally toward a predetermined neutral position when the vibrated member is at rest, including spring means interposed between base and vibrated member.

8. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including compression members located beyond the ends of said compression receiving element.

9. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including compression members located beyond the ends of said compression receiving element, and lying in the plane of thrust defined by said blocks.

10. In a flexible support for screens and the like, a base and a deck supported thereon, a fixed abutment member on said base, an opposed abutment member on said deck, said abutment members extending transversely in relation to said deck, and being generally rectilinear in their extension, and a compression receiving element interposed between said abutment members, including a pair of blocks of flexible, compressible material, located one adjacent each said abutment member, and an intermediate radius member located between said blocks and spacing them apart, and means for applying compression to said compression receiving element, including means for drawing said opposed abutment members together thereagainst, said blocks each including a relatively hard central portion, located generally in the plane of said radius member and of the axis of thrust between said abutment members, and softer portions at each side thereof.

11. In a flexible support for vibrated members, a base and a vibrated member, and a supporting connection therebetween, including a plurality of elements of flexible, compressible material, and a generally rigid radius member therebetween, each said element having a central portion of relatively hard material alined with and in effect forming an extension of said radius member, and portions of softer material at each side thereof, and means aligned with said central portion of hard material for maintaining said elements of flexible, compressible material under continuous, substantially uniform, compression.

12. In combination, a screen, including a screen base, a deck mounted on said base, an abutment on said base, extending beneath and transversely of one end of said screen, an abutment on said deck extending transversely of said deck, and a flexible support interposed between said deck and said abutments, including a radius member and members of flexible compressible material inserted between opposed faces of said radius member and each of said abutments, and compression means adapted to exert compression between said abutments and against said radius member and members of flexible compressible material.

13. In combination, a base and a vibrated member, and means for imparting vibration to said member along a predetermined generally rectilinear axis, and a supporting connection between said member and said base, including a plurality of generally rectilinear elements of flexible compressible material extending transversely across the axis of vibration of said vibrated member, and located one adjacent the base and the other adjacent the vibrated member, and a generally rigid radius member therebetween, one edge of the radius member being opposed to one of said rectilinear elements and the other edge being opposed to the other rectilinear element, and means for maintaining said elements simultaneously under predetermined compression, along a plane of thrust generally coincident with the radius member.

14. In combination, a base and a vibrated member, and means for imparting vibration to said member along a predetermined generally rectilinear axis, and a supporting connection between said member and said base, including a plurality of generally rectilinear elements of flexible compressible material extending transversely across the axis of vibration of said vibrated member, and located one adjacent the base and the other adjacent the vibrated member, and a generally rigid radius member therebetween, one edge of the radius member being opposed to one of said rectilinear elements and the other edge being opposed to the other rectilinear element, and means for maintaining said elements simultaneously under predetermined compression, along a plane of thrust generally coincident with the radius member, including compression members extending between said base and vibrated member beyond the ends of said radius member.

15. In combination, a base and a vibrated member, and means for imparting vibration to said member along a predetermined generally rectilinear axis, and a supporting connection between said member and said base, including a plurality of generally rectilinear elements of flexible compressible material extending transversely across the axis of vibration of said vibrated member, one of said elements being upon the base and the other being upon the vibrated member, and a generally rigid radius member therebetween, said vibrated member being located at the upper end of said supporting connection and resting gravitally upon said supporting connection, and means for maintaining the effective length of said supporting connection substantially constant, said elements of flexible compressible material having generally parallel upper and lower exposed faces, said radius member and said base and vibrated member having open abutment faces opposed

respectively to the upper and lower faces of said elements of flexible compressible material.

16. In combination, a base, a vibrated member, a flexible support for said vibrated member, means for imparting vibration to said member along a predetermined generally rectilinear axis, and a supporting compression connection between the vibrated member and the base, including a body of flexible compressible material located adjacent and supported on the base, another body of flexible compressible material located adjacent the vibrated member, and a relatively rigid spacing radius member located between said bodies of flexible compressible material and of sufficient length to permit a substantial amplitude of vibration of the vibrated member in relation to the base, and along its axis of vibration, with a minimum distortion of said flexible compressible material, and means for holding said vibrated member against movement away from said base and for confining it to generally linear vibration in relation to said base along said generally rectilinear axis, the weight of said vibrated member being transmitted to the base directly through said bodies of flexible compressible material and the spacing radius member therebetween, the body of flexible compressible material supported on the base being fixed in relation to the base except for its deformation resulting from the flexing of the supporting compression connection as a whole, said bodies of flexible compressible material having generally parallel upper and lower exposed faces, said radius member and said base and vibrated member having open abutment faces opposed respectively to the upper and lower faces of said bodies of flexible compressible material.

17. In combination, a base, a vibrated member, a flexible support for said vibrated member, means for imparting vibration to said member along a predetermined generally rectilinear axis, and a supporting compression connection between the vibrated member and the base, including a body of flexible compressible material located adjacent and supported on the base, another body of flexible compressible material located adjacent the vibrated member, and a relatively rigid spacing radius member located between said bodies of flexible compressible material and of sufficient length to permit a substantial amplitude of vibration of the vibrated member in relation to the base, and along its axis of vibration, with a minimum distortion of said flexible compressible material, means for holding said vibrated member against movement away from said base and for confining it to generally linear vibration in relation to said base along said generally rectilinear axis, and means for maintaining said compression connection under substantially constant compression.

18. In combination, a base, a vibrated member, a flexible support for said vibrated member, means for imparting vibration to said member along a predetermined generally rectilinear axis, and a supporting compression connection between the vibrated member and the base, including a body of flexible compressible material located adjacent and mounted on the base, another body of flexible compressible material located adjacent the vibrated member, and a relatively rigid spacing radius member located therebetween, the weight of the vibrated member being supported upon the upper end of said compression connection and being transmitted to the base by the lower end of said compression connection through the intermediary of the body of flexible compressible material on the base, said bodies of flexible compressible material having generally parallel upper and lower exposed faces, said radius member and said base and vibrated member having open abutment faces opposed respectively to the upper and lower faces of said bodies of flexible compressible material, and means for confining the vibration of the vibrated member to generally rectilinear vibration along said generally rectilinear axis.

19. For use with flexible screen supports, including radius members and abutment members therefor, a rubber tilting compression block having generally parallel upper and lower faces, a relatively hard central fulcrum portion extending between said upper and lower faces and longitudinally and generally rectilinearly along said block, and relatively softer portions integral therewith and located at each side of said central hard fulcrum portion, and extending continuously along each side of the hard portion, the resistance to compression of said hard and softer portions being unequal, the relative widths and the relative resistances to compression of said hard and soft portions being such that said hard portion may function as a fulcrum member, whereby a member located against one side of said block may tilt along an axis parallel with said relatively hard central fulcrum portion.

20. A tilting member including a tilting compression block having the general characteristics of rubber as regards compression and flexibility, said compression block having generally parallel opposite faces and a relatively hard central fulcrum portion extending between said opposite faces and extending longitudinally and generally rectilinearly along said block, and relatively softer portions integral therewith and located at each side of said central hard fulcrum portion and extending continuously along each side of the hard portion, the resistance to compression of said hard and softer portions being unequal, the relative widths and the relative resistances to compression of said hard and soft portions being such that said hard portion may function as a fulcrum member, whereby a member located against one of said faces of said block may tilt along an axis parallel with said relatively hard central fulcrum portion, and opposed relatively tiltable members abutting said opposite faces of said block.

21. A tilting member including a tliting compression block having the general characteristics of rubber as regards compression and flexibility, said compression block having generally parallel opposite faces and a relatively hard central fulcrum portion extending between said opposite faces and extending longitudinally and generally rectilinearly along said block, and relatively softer portions integral therewith and located at each side of said central hard fulcrum portion and extending continuously along each side of the hard portion, the resistance to compression of said hard and softer portions being unequal, the relative widths and the relative resistances to compression of said hard and soft portions being such that said hard portion may function as a fulcrum member, whereby a member located against one of said faces of said block may tilt along an axis parallel with said relatively hard central fulcrum portion, and opposed relatively tiltable members abutting said opposite faces of said block, and means for maintaining said opposed relatively tiltable members compressed

against said opposite faces while permitting their relative tilting along an axis parallel with said relatively hard central fulcrum portion.

22. In combination, a screen including a screen base, a deck mounted on said base, means for vibrating said deck along a predetermined generally rectilinear axis, an upwardly open abutment fixed on said base and extending beneath and transversely of one end of the screen, a downwardly open abutment on said deck extending transversely of said deck, and a flexible support interposed between said abutments, including a radius member having opposed open abutment faces at top and bottom thereof, and members of flexible and compressible material enclosed between the open upper and lower faces of said radius member and the abutments on the deck and base, respectively, the thrust of said radius member being directly received by said lower member of flexible compressible material and the fixed abutment on the base which supports it, and means for constraining said deck to vibration along said generally rectilinear axis.

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