Sept. 7, 1943. J. P. GALLAGHER 2,328,878

DRAFT GEAR

Filed Aug. 19, 1940 2 Sheets-Sheet 1

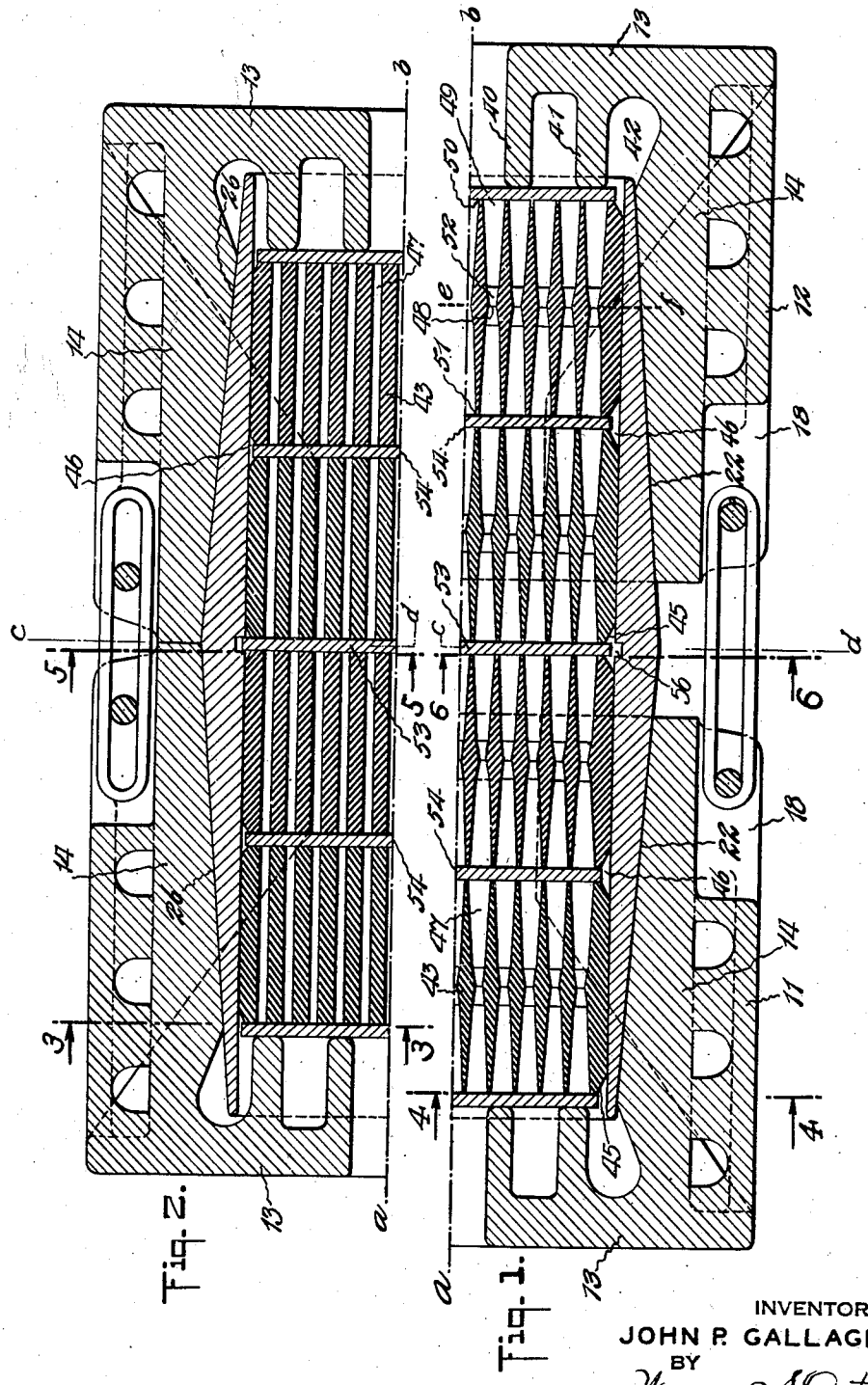


Fig. 2.

Fig. 1.

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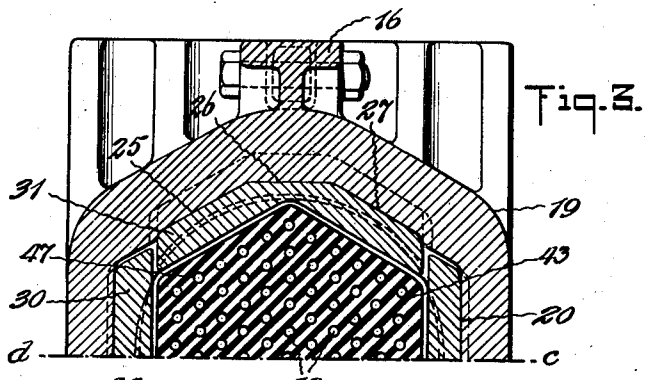


Fig. 3.

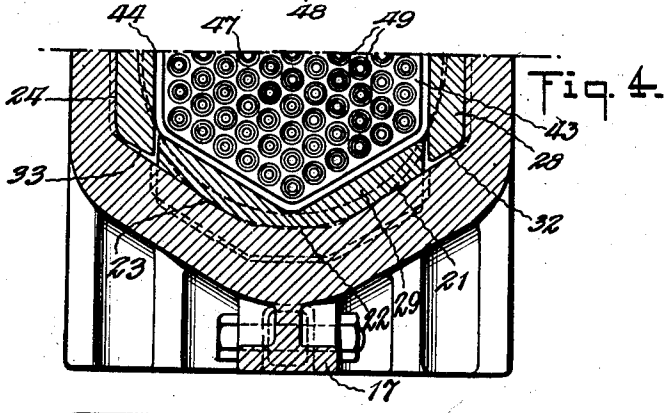


Fig. 4.

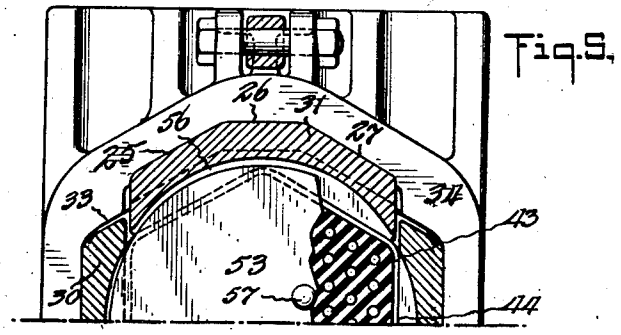


Fig. 5.

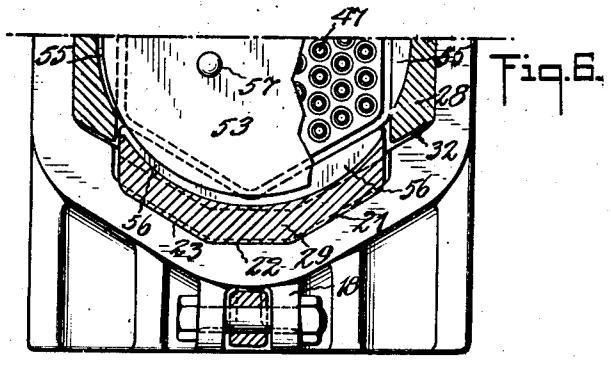


Fig. 6.

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2,328,878

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John P. Gallagher, Jersey City, N. J.

Application August 19, 1940, Serial No. 353,237

17 Claims. (Cl. 267—63)

This invention relates to a cushioning device of general application for use wherever it is desired to cushion the impact of loads. The present disclosure constitutes a development of the invention disclosed in my pending application, Serial No. 284,386, filed July 14, 1939, entitled "Cushioning device."

The primary object of the invention, as was one of the objects of the disclosure in said pending application, is to provide a simple, compact and effective form of cushioning device of the type outlined, which will provide for a continuous and efficient cushioning action when subjected to squeeze impacts of widely varying intensities and magnitudes to resist such impacts; which will provide for a uniform, continuous, easy and immediately operative return of the component parts of the device entirely back to their normal position when free from the squeeze impulses and, when functioning as a draft gear or similar form of cushioning device, to prevent the transmission therethrough of the short, oscillatory shocks, jars and similar irregular actions characterizing present forms of railroad vehicle coupling and draft mechanism.

Broadly, this invention is attained by providing an arrangement of pressure creating end squeeze elements, heads or followers, the relative approach of which is resisted by a hollow rubber block or, preferably, by a column of separate hollow rubber blocks, providing a cushioning resistance and in which each separate rubber block is disposed to operate in an additive relation by virtue of its resistance to distortion to restrain directly and in an axial direction the approach of the followers along their line of thrust.

Still another object of the invention is to provide a simple form of cushioning device of the type outlined which will provide for any desired degree of initial resistance to the loads to be cushioned and which will provide for an unusually rapid acceleration of the forces developed thereby in resistance to the advance of such loads whereby even loads of high magnitude may be stopped, dissipated, or, at least, materially reduced in magnitude within a short distance of travel of the movable elements forming the device.

Differently expressed, an object of the invention is to provide a cushioning device of high cushioning capacity but of small all-over volumetric capacity. In the case of a draft gear construction, a specific object of the present disclosure is to provide a draft gear featuring the use of rubber cushions of greater possible cushioning capacity than is now available and at the same time to confine its dimensions so that it can be contained in the size and shape of draft pockets now prescribed as standard.

More specifically defined with reference to its cushioning element, the invention relates to an improved form of hollow rubber block, or multiples thereof, capable of use in situations where the squeeze impacts thereon are widely variable and where it is required to act selectively in either direction along a line of thrust. The present disclosure features the use of a form of rubber block which will be immediately sensitive to refined, slight squeeze pressures thereon of relatively small magnitude and in resisting the same to absorb and smooth out short vibratory and oscillatory actions imposed thereon, and which will also be responsive to squeeze pressures and powerful thrusts thereon of extremely high magnitude and in resisting the same, to provide a cushioning device of extremely high cushioning capacity.

A particularly important object of the invention is to provide a form of rubber cushion which will have capacity to receive and absorb loads of widely variable force characteristics without loss of elasticity; which will immediately operate in a tendency to restore itself to its distended, initially set form as soon as the distorting force thereon has been removed; which will be substantially free at all times of internal stresses and which will therefore have a long life despite repeated actuation.

Broadly, this aspect of the invention is attained by providing for a peculiar distribution of the rubber in the block to avoid excessive internal strain or overstretching of the material in those portions which have the greatest difficulty in recovering their initial shape and condition. The block is so designed that the end portions which first receive the impacts or squeeze pressures shall present the least resistance thereto, or, differently expressed, shall present the most easily distortable masses of rubber and which block will progressively involve greater and greater masses or zones of rubber as the squeeze action progresses and therefore presents gradually increasing resistance to distortion until an interior zone or area, remote from both of said end portions, involves the maximum mass of rubber and thus a maximum degree of resistance to distortion, or, differently expressed, shall present a zone of least distortion and thus the zone subjected to the least deleterious effects of internal strain and stress.

The best distribution of rubber so far ascertained to attain these results is obtained by providing the block with one or more core holes of a double conical frustum form extending axially therethrough in parallel columns with their apices or small diametered circular ends in juxtaposition and having their large, circular ends at the pressure receiving faces of the block. It is preferred that these holes be circular in all cross sections perpendicular to their axes, as this form tends to resist internal collapsing of the walls outlining the holes when the block is subjected to a sudden forceful squeeze action.

The advantages of this structure were appreciated at the time of filing the copending application Serial No. 284,386 but the disclosure therein did not suggest the advisability of providing the block with a large number of such holes. In the illustrated form of the invention, there is disclosed a block which is provided with practically all the holes that could be contained in the block, and in this showing the holes are so arranged that the block will be formed almost solely of a large number of identical rubber columns integrally connected with each other to form the block and each of which columns have a maximum cross sectional area of material at a mid-height plane and progressively reducing in cross sectional area of material towards opposite ends.

While the device will function with a single block of the requisite column length, the present disclosure particularly features a column of separate and separated rubber blocks operating so that the resistance of the column considered as a whole is the aggregate of the resistances to distortion of the several separate blocks.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of device embodying the invention, and the invention also consists in certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a horizontal sectional view taken axially through a draft gear provided with rubber blocks forming a preferred embodiment of the invention; said draft gear shown in position completely assembled and ready to be installed in the draft gear pocket; with the parts in their normal distended position but with the cushioning elements distorted under an initial compression and showing one half of such a section; it being understood that the missing half is identical with that shown and symmetrical relative to the medial vertical plane indicated by the line *a*—*b*;

Fig. 2 is a similar view when the draft gear is installed in position showing the relation of the parts when the cushioning elements have been compressed to the limit of the intended cushioning capacity of the device and with the draft gear in its fully closed position;

Figs. 3, 4, 5 and 6 are each transverse sectional views taken respectively on the transverse planes indicated by the lines **3**—**3**, **4**—**4**, **5**—**5** and **6**—**6** of Figs. 1 and 2 with the mid-separating plate shown partly broken away in Figs. 5 and 6. In connection with these figures, it is to be understood that the draft gear is not only symmetrical relative to the horizontal plane *a*—*b* but its ends are also symmetrical relative to a medial transverse vertical plane taken on the line *c*—*d* of Figs. 1, 2.

The draft gear includes two metal heads or followers, a front follower **11** and a rear follower **12** of identical and thus reversible construction and disposed in looking-glass symmetry on opposite sides of the medial plane *c*—*d*. Each head includes a rugged end pressure transmitting cored wall **13** and a barrel-like projection **14**. The end wall **13** is conventionally braced from its hollow projection **14** by integral gussets. A pair of ribs **16** and **17**, T-shaped in cross section for the greater part of their lengths, extend from the wall **13** lengthwise along opposite sides of the projection **14**.

The inner periphery of each barrel projection **14** is provided with eight flat friction faces numbered clockwise as **20** to **27** inclusive in Figs. 3 and 4 and in Figs. 5 and 6, which faces are adapted to be engaged by two pairs of friction shoes, numbered clockwise as **28** to **31** inclusive in the same figures.

Located between the end followers and snugly fitting between the inner faces of the four shoes is a column of separate and separated rubber blocks **43**. In the illustrated embodiment of the invention, four of these blocks are used and shown in axial alignment but it is to be understood that the number of blocks used is dependent upon the requirements of each particular situation. As the blocks are of identical construction, the detailed description of any one will be sufficient for the others. Each block is, for practically the entire portion of its length, a six-sided prism with each of its side faces **44** flat or substantially so, and snugly fitting and at all times bearing on the face of the shoe which it is intended to engage.

However, opposite ends of the perimeter of each block, that is, the opposite end of each side face **44**, are bevelled inwardly as shown at **45** to provide clearance at **46** between the end edges of the blocks, the shoes and the separating plates to avoid possibility of the rubber fouling the juncture between the separating plates and the shoes. This construction takes the place of the split metal rings at the end corners of the rubber block disclosed in my co-pending application Serial No. 284,386. While the showing in Fig. 1 discloses the bevel **45** to be about 32°, it is understood that in this Fig. 1 the block has already been compressed somewhat from its normal configuration and that when non-compressed, the bevel **45** is longer than is illustrated in Fig. 1. The bevel is so proportioned that, even when the draft gear has closed as shown in Fig. 2, the clearance **46** is still maintained and in this way no rubber can creep edgewise into the joints.

It is a feature of this disclosure that the rubber blocks are provided with a plurality of core holes **47** extending axially therethrough in parallel relation and that these core holes are each of a double-frusto-conical form symmetrically arranged relative to a transverse mid-plane *e*—*f* (Fig. 1). The core holes are arranged with their minimum cross sectional area circular in outline as indicated at **48** (Fig. 3) in the mid-plane *e*—*f* and with their larger outer ends also circular in outline indicated at **49** (Fig. 4) at the pressure receiving ends **50**—**51** of each block. As thus far described, the core holes are of the form featured in the above identified application, Serial No. 284,386, and which discloses an arrangement of four such holes circumferentially spaced apart

and extending through a cylindrical block of rubber.

The present disclosure features an improvement over the prior structure in that a greater resiliency and longer life can be obtained from a rubber block of equal volume by reforming the configuration of the core holes and more particularly by reforming the rubber columns defining the material between the core holes. This is attained by a more extensive distribution of core holes than is suggested in the prior application and under some situations as in the illustrated case by providing as near as is practicable a maximum number of core holes in the block while being careful to leave some material at opposite ends about the large circles defining the ends of the core holes. In other words, it is preferable not to form the circles at the ends tangent to or nearly touching each other for in this case the resulting sharp edges at the ends of the component blocks forming the rubber columns would tend to disintegrate in use. The number of holes illustrated represents an extreme case featuring a large number of core holes but a lesser number will be found preferable in most cases.

It will be noted from the showing in Fig. 4 that the core holes are symmetrically arranged across the areas defining the ends **50—51** and are disposed in lines parallel to each other and to the adjacent side of the block and this same arrangement is suggested even when a relatively small number of holes is used. While this exact arrangement of the core holes is not necessary, it does provide a form of block which has proven highly satisfactory and provides for maximum elasticity without any noticeable fatigue in the rubber after repeated operations. It might be noted that the columns of solid rubber formed between any set of three adjacent core holes are somewhat triangular in cross section with three concaved sides and that these columns are integrally interconnected along their entire lengths to form a honey-comb structure of columns. In one form of the invention, each column of rubber is of less volume than the volume of the core holes which surround it but this is optional. Differently expressed, it is the intent of the disclosure to provide a cored rubber block in which the aggregate of the rubber displaced into the core holes is less than the aggregate volume of the core holes. In this way, the core holes are always open throughout their lengths in all operative positions of the blocks.

While the core holes have been described as being of frusto-conical form on opposite sides of the mid-plane *e—f*, this is only approximately so, and in the preferred form of the invention herein illustrated, the core holes converge towards their smaller ends a little more at a sharper angle than in the outer portion thus forming a relatively short innermost frusto-conical form of hole **52** at the inner ends of each half of the core holes as shown in Fig. 1.

As it is the intent of the disclosure to prevent any collapsing of the ring-like portion of the core hole wall defining the small circle at **48** when the block is subjected to its maximum intended squeeze action, the holes are designed to avoid the formation at **48** of any cylindrical form at any time prior to the maximum desired compression action. It has been found experimentally that forming the constriction portion at **48** more sharply inclined to the axis of the hole, that is, with the part **52** of shorter cone height than the cone height of the frusto-conical portion which defines the outer ends of the holes, defeats any possibility of the preforming of a cylinder shaped opening at the point **48** and thus avoids inward wall collapse before the final cylinder form has been attained as indicated in Fig. 2. Considering the part **52** on opposite sides of the area of least cross section, it progressively increases in cross sectional area from the plane *e—f* at a certain rate until the indicated line is reached and then the cross sectional area progressively increases at a less rate until the maximum areas at the end faces of each block are reached. The structure of the core holes when in the Fig. 1 condition may be considered by reference to a frustum of an imaginary cone, hereinafter referred to as a frustum of reference, whose larger base **49** is at either end **50—51** of the block and whose smaller base **48** is at the medial plane *e—f*. The opposite ends of the wall forming each half of each core hole **47** thus defines said larger and smaller bases. Every other part of said wall is exterior to said frustum of reference. This forms in each and every axial cross section, as in Fig. 1, opposing beams of resistance to any tendency of the walls to any premature or undesirable internal collapsing. It is theoretically possible to form each end of the core holes of a conical or, better, of a frusto-conical form but the double frusto-conical ends herein disclosed appear in practice to provide a better form of core holes and one least liable to an irregular collapse.

Each of the rubber blocks which make up the column is separated from its adjacent block and from the rings **40—41** which form the internal boss or plunger by means of rugged steel separating plates. These separating plates are of two forms, a single, combined separating and locking plate **53** located midlength of the column of blocks, and four hexagon shaped plates **54** located two on each side of the midplate between the end blocks and at opposite ends of the two end blocks.

The plate **53** is almost of circular form, is located between the two middle blocks **43** and intrudes at its shorter diametrically opposite edge portions into grooves **55** formed in the shoes **28—30** and at its longer diametrical edge portions into grooves **56** formed in the shoes **29—31**. In this way the shoes are held by the center plate **53** from relative axial movement while the device is in operation. The plate **53** is provided on one side with a pair of locating lugs **57** designed to engage in two of the core openings of the adjacent block to insure the proper rotative setting of this plate in position in the assembly.

In assembling the draft gear, the column of rubber blocks is arranged with the separating plates located in position as suggested in Fig. 1, it being understood, of course, that initially the rubber core assembly is of somewhat greater length than is shown in this figure and extends with its free height in opposite direction with its ends beyond opposite ends of the shoe assembly. The four shoes are grouped about the rubber core thus assembled with the shoes located to bring their slots **55** and **56** in registry with the edge of the mid-plate **53**. With the parts so assembled and temporarily held in position, the followers are slid endwise onto the assembly until they assume a position almost that shown in Fig. 1 but, of course, more separated axially.

In squeezing the rubber blocks, there is avoided in effect any outward distention or bellying of

the perimeter of the blocks and the rubber must distend and can only distend inwardly into the core holes 47 which, as above noted, are peculiarly designed for this purpose. As the rubber blocks are squeezed endwise from the Fig. 1 position, the rubber at the large ends of each core hole, that is, the rubber in the zones of least volume are first effected and moved inwardly, incidentally of course, diametrically contracting the initially large circles 48 which define the opposite ends of the core holes. As the squeeze continues progressively, more and more of the rubber outlining the core hole becomes involved, and more and more of the wall outlining the core hole moves inwardly until, when the draft gear is closed as shown in Fig. 2, these core holes reach their maximum degree of contraction and incidentally become at least approximately cylindrical in form throughout their entire length as shown in Fig. 2. In Fig. 2, the ends of the rubber columns are shown wider than in Fig. 1 and apparently are in engagement for their full area with the plates 53 and 54 and this showing is as accurate as the drawing can be made. However, tests have shown that the actual area of engagement of the rubber with the plates is the same as in Fig. 1 irrespective of the degree of squeeze of the blocks. The outer edges of the ends of the other column in Fig. 2 actually are spaced from the plates a slight distance and a distance too small to be shown on the drawings. It is to be assumed therefore in viewing Fig. 2 that the actual bearing engagement of the rubber on the plates is no more extensive than in Fig. 1 and that the apparent line of engagement should be considered as actually curved outwardly beyond the Fig. 1 area of engagement slightly away from its adjacent plate. This peculiar action of the rubber outlining the initially frusto-conical form and final cylindrical form of core holes is more particularly described and claimed in the copending application Serial No. 284,386.

While the disclosure herein illustrated features a construction of cored rubber blocks particularly designed for use in a railroad draft gear, bumper or equivalent powerfully acting shock absorber and force transmitter and features the use of a large number of core holes extending through each block to give an initially soft and progressively harder resistance to the impacts imposed thereon, it is understood that the number, size and relative disposition of the core holes best suited for use in any particular cushioning device is dependent upon the operating conditions to be met in any such device.

While this description features the use of core holes, preferably conical at least in part, other forms of frusto-shaped core holes might be used. It is suggested that such holes may be slightly elliptical in cross section simply provided the configuration will control the flow of rubber into the same as herein described. In any case, the block should never be permitted to exceed that degree of compression where the initially conical or equivalent form of hole assumes a cylindrical form of bore. In other words, it is vitally necessary to the successful operation of the device that the core holes never be permitted to close, nor even to start to close, beyond the finally permitted cylindrical form.

While this disclosure refers mostly to the shape of the core holes for convenience of description, it is not particularly the configuration of the core holes but the configuration of the resulting rubber columns which is important. The number and form of these columns will necessarily be dependent upon the working conditions in which the block is intended to operate.

It is also appreciated that the design of the rubber columns which constitute the major portion of the block is also influenced by the character of rubber used; a soft rubber with a low durometer being prescribed for long, soft resistance to light impacts and oscillatory movements; while a more dense character of rubber with a higher durometer is indicated for use where it is desired to present a rugged and more intense resistance to heavy and slowly delivered blows.

I claim:

1. In a cushioning device, a resilient unit comprising a block of rubber in the form of a hexagonal prism having a plurality of closely positioned holes extending axially therethrough, each hole being of a double frustoconical form with their larger ends at the two hexagonal ends of the block, the centers of said holes being parallel and spaced apart equidistantly to provide substantially equal distribution of the rubber about all of the holes except those adjacent the six sides of the block.

2. In a cushioning device, a resilient unit comprising a block of rubber in the form of a hexagonal prism having a plurality of closely positioned holes extending axially therethrough, each hole being at least in part of a double conical form with their larger ends at the two hexagonal ends of the block, the axes of said holes being spaced apart equidistantly, said holes being arranged symmetrically at each of the hexagonal ends and disposed in parallel lines with a line of holes paralleling each of the six side faces.

3. A cushioning device including a block of rubber having parallel pressure receiving faces at opposite ends thereof and with the material thereof disposed in symmetrical relation to an axis of thrust extending centrally through said faces, said block provided with a relatively large number, materially greater than four, equidistantly spaced apart core holes extending therethrough in parallel relation and each terminating at said faces, the aggregate area of material in the plane of either of said faces being less than the aggregate cross sectional area of material at every intermediate plane parallel to said faces, with the maximum amount of material in a plane spaced from both of said faces.

4. An axially symmetrical one-piece block formed solely of rubber for use as a cushion, composed for the most part of a plurality of integrally interconnected columns of material extending axially, said columns when the block is in a relatively uncompressed condition each having its maximum cross sectional area of material adjacent its midlength capable of at least some radial distortion and progressively decreasing therefrom in cross sectional area of material towards its opposite ends and said block when compressed axially from said condition changing the configuration of said columns to cause each of them to approach equally in cross sectional area of material in all planes perpendicular to the axis.

5. In a cushioning device, a resilient unit comprising a block of rubber having opposing pressure receiving faces and provided with a plurality of, closely positioned core holes extending

in parallel relation therethrough and terminating in circular holes at each of said faces, each of said holes being of a double frusto-conical form with their smaller ends abutting and thus providing the core holes with an hour-glass form, the circular holes at each end of the block distributed substantially uniformally over its associated face and forming substantially equal widths of material measured along the lines connecting the centers of each adjacent circular ends of substantially all of the core holes and said width of material so measured being a fractional part of the diameter of the circular hole ends whereby each hole except those at the outer periphery of the block will be surrounded by substantially equal masses of rubber.

6. A block of rubber axially symmetrical and provided with more than seven similar size core holes extending in parallel relation through the block and equidistantly spaced apart, each being at least in part initially outlined by a conical wall, groups of three off-centered adjacent core holes each coacting to form a rubber column substantially equilaterally triangular in cross section with each side formed by an adjacent part of the curved wall of one of the three core holes and of greater cross section of material at its midlength than at its opposite ends, said columns being integrally connected with similar columns formed by adjacent groups of units of three core holes.

7. A rubber block for use as a cushioning device provided with a plurality of similarly shaped core holes extending therethrough in parallel relation and each core hole being defined by a wall of conical form at least in part, said core holes each approaching a cylindrical form when the block is subjected in the direction of its height to a prescribed squeeze pressure, and said core holes being present in size and number sufficient to provide free spaces within the block having an aggregate volume greater than the amount of rubber displaced between the free height of the block and its height when under such prescribed compression thereby to prevent the core holes from entirely closing at any point throughout the length under all operating conditions.

8. A cushioning block or rubber provided at opposite ends with a pair of opposing pressure receiving faces and a plurality of openings extending through the block and terminating at said faces, opposite end portions of said block having a looking-glass symmetry relative to a transverse plane of reference parallel to both of said end faces, the openings on opposite sides of said transverse plane being of a compound conical form and the amount of material at said plane being maximum and the amount of cross sectioal area of material decreasing in cross sectional area of material from said plane towards both of said end faces.

9. In a cushioning device, a resilient unit comprising a block of rubber having opposing end faces and a plurality of pairs of opposing side faces symmetrical relative to the axis of the block, said block provided with a plurality of parallel holes extending axially therethrough, each hole being of a double frustoconical form and forming circular openings at each end, said circular end openings being arranged in lines forming concentric closed figures having the same number of sides as there are sides to the block, and the line of openings forming each side of the figure extending parallel to the adjacent side of the block.

10. A rubber block provided with a core hole extending therethrough and having a looking-glass symmetry on opposite sides of a plane extending transversely therethrough, the hole on each side of said plane being in the form of two axially aligned conical frustums of cones, the perimeter of the inner cone being more sharply inclined to the axis than the perimeter of the outer one and is of less length than the outer one.

11. A block composed solely of rubber for use in a cushioning device, said block being externally substantially in the form of a symmetrical prism and provided with a plurality of frusto-conical core holes open from end to end and extending axially therethrough with their maximum diameters at the end faces of the block.

12. A cushioning device including a plurality of all rubber blocks arranged in end to end relation to form a column, each block provided with a plurality of core roles circular in cross section in all operative positions of the device, extending axially in parallel relation therethrough open from end to end and forming air chambers, each core hole of each block having a greater cross sectional area of opening at its opposite ends than at any other cross-section and of minimum cross sectional area adjacent its midlength, plates separating each adjacent pair of blocks contacting the same and otherwise independent thereof and acting to close the adjacent ends of the core holes of each of its associated blocks.

13. In a cushioning device, a block of rubber provided at opposite ends with pressure receiving surfaces and said block being symmetrical relative to a central line of thrust through said surfaces, said block provided therein with a plurality of like core holes extending with their axis parallel to said line of thrust, opposite ends of each of said core holes being of frusto-conical form, the axes of said core holes being symmetrically arranged across the areas defining said end surfaces and located in lines some of which extend radially from said axis of thrust and some of which are in non-radial but in relative parallel relation and with more than two core holes in each line, any three adjacent core holes disposed with their axes at the apex of an equilateral triangle, and said core holes coacting to form therebetween solid rubber columns of substantially the same configuration and volume thereby to distribute the distortion action due to squeezing the block uniformly throughout each column.

14. In a cushioning device, a block of rubber provided at opposite ends with pressure receiving surfaces symmetrical relative to a center line of thrust, said block provided with a plurality of core holes extending therethrough with their axes parallel to said line of thrust, at least certain of said core holes having their open ends of greater cross sectional areas than their cross sectional area adjacent their midlengths, said core holes disposed to locate their open ends in equidistantly spaced apart arrangement across each of said end surfaces and the axes of certain of said core holes being arranged in radial lines intersecting said axes of thrust and there being at least two core holes in each radial line, and the axes of other of said core holes being disposed in non-radial and mutually intersecting lines, there being at least three core holes in each of said non-radial intersecting lines.

15. In a cushioning device, a block of rubber having opposing pressure receiving end faces and

of symmetric form relative to its axis and provided with a plurality of core holes extending therethrough in parallel relation and opening at opposite ends in the end faces of the block, said core holes being each circular in cross section and arranged with their ends distributed uniformly across each end face and each core hole being of a double frustum form, the centers of certain of the core holes disposed in six radial lines circumferentially spaced apart sixty degrees and passing through the axis, certain others of said centers being disposed in non-radial lines parallel to and equidistantly spaced from each of said radial lines and on opposite sides thereof and each line containing more than two core holes equidistantly spaced apart and offset from said axis.

16. A block of rubber provided with opposing pressure receiving faces and with an axially symmetrical cavity located therein, said cavity being of minimum cross sectional area adjacent its midlength, the portion of the core hole on one side of said minimum cross section progressively increasing therefrom in cross sectional area at one rate for a certain distance and therebeyond progressively increasing at a less rate to the maximum area at the adjacent end of the cavity.

17. A block of rubber provided with opposing pressure receiving faces and provided with an axially symmetrical hole extending therethrough, said hole being of conical section in all cross sections thereof, one end of the hole being of maximum cross section at its adjacent face and of least cross section adjacent the midlength of the hole, the perimeter of said maximum and minimum cross sections defining opposite ends of a frustum of reference and a wall having its opposite ends defining said maximum and minimum cross sections and all other parts of said wall being external to said frustum of reference.

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