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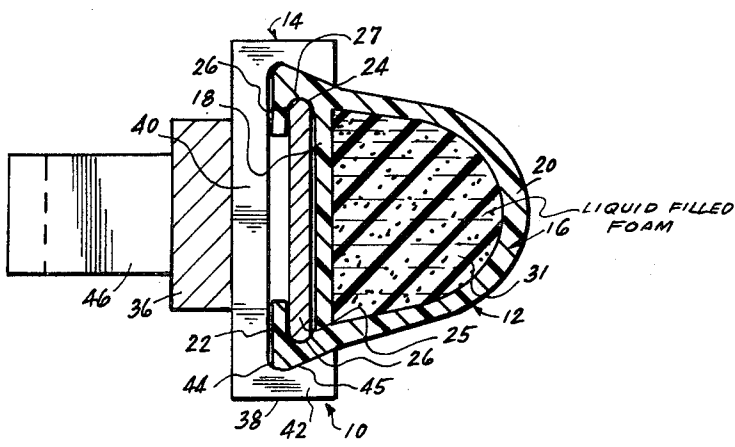
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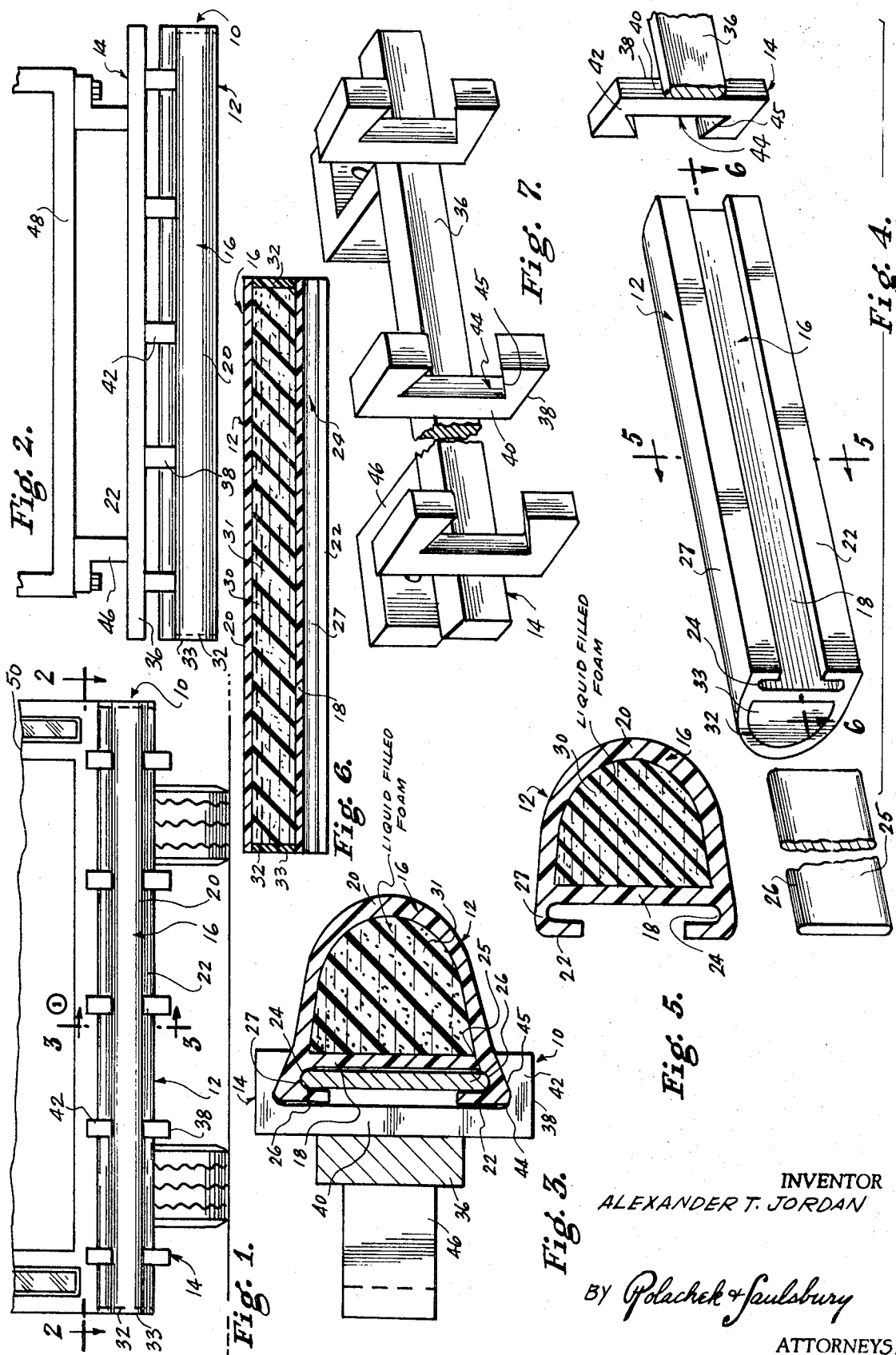
[54] RESILIENT SHOCK-ABSORBING BUMPER
11 Claims, 18 Drawing Figs.

[52] U.S. Cl..... 293/71,
180/82, 188/94, 256/1, 293/1, 293/60, 293/65,
293/88, 293/98, 293/99
[51] Int. Cl.....B60r 19/08,
B61f 19/04, F16d 57/00
[50] Field of Search..... 152/157;
188/94; 180/92, 82; 256/1; 293/1, 71, 71 (P), 60,
65, 88, 98, 99

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ABSTRACT: A shock-absorbing device comprising a bumper pad and dovetail mounting structure. The bumper pad includes a tubular casing made of nonporous, flexible plastic material with flanges on one side for removable attachment to a bracket. The other side of the pad is convex. The casing is filled with resilient, spongy, cellular foam material saturated with a liquid. Opposite ends of the casing are closed by breakable seals. The casing and foam filler flex yieldably when subjected to moderate impact, and on severe impact an end seal breaks to release liquid at a controlled rate. The bumper pad is attached to the mounting structure by a spreader plate engaged in the flanges of the casing. A plurality of bumper pads can be mounted vertically in spaced disposition in a single mounting bracket structure.





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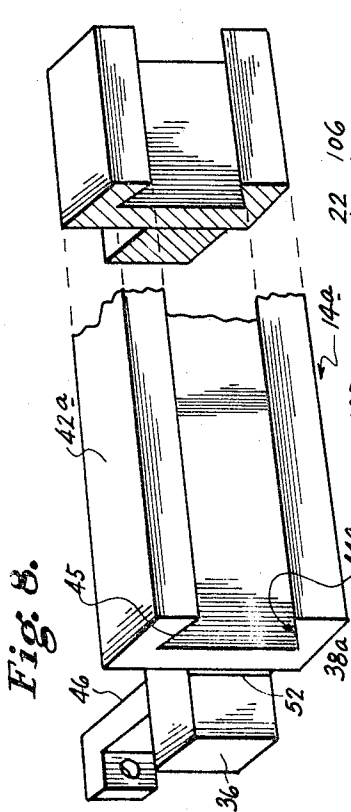


Fig. 8.

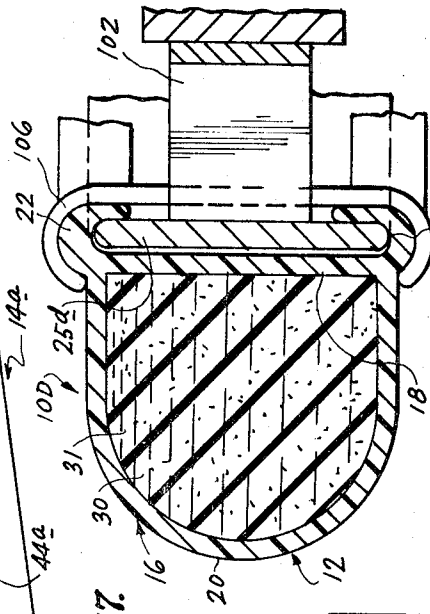


Fig. 17.

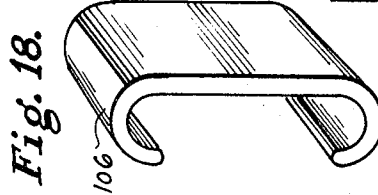


Fig. 18.

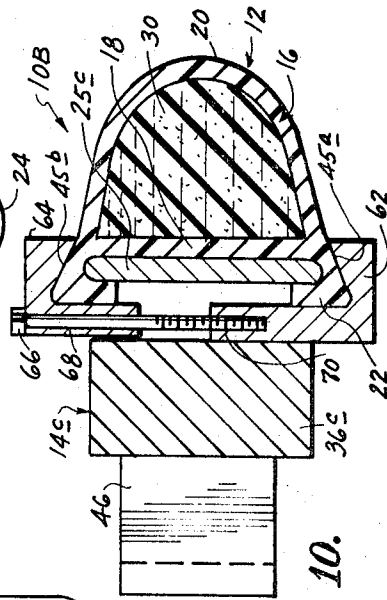


Fig. 10.

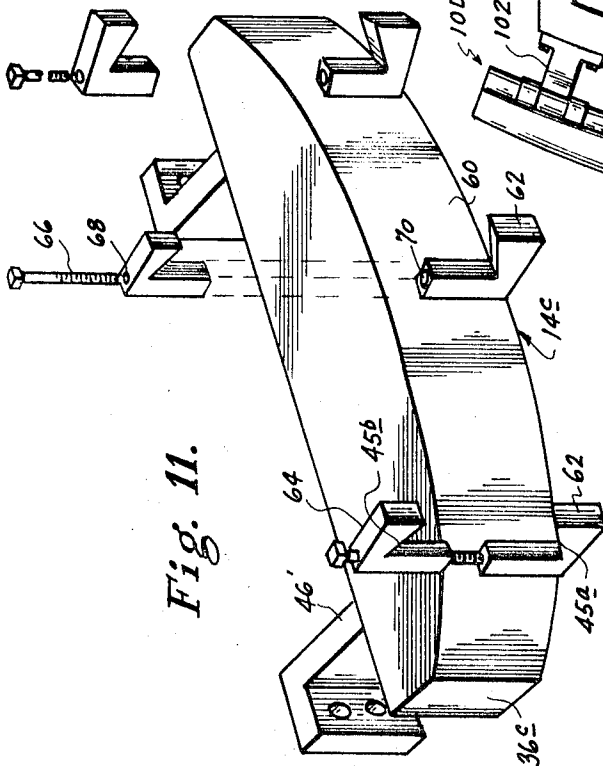


Fig. 11.

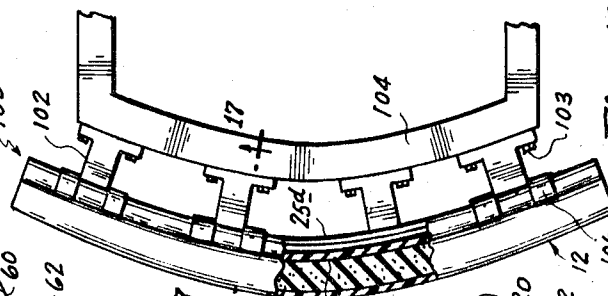


Fig. 16.

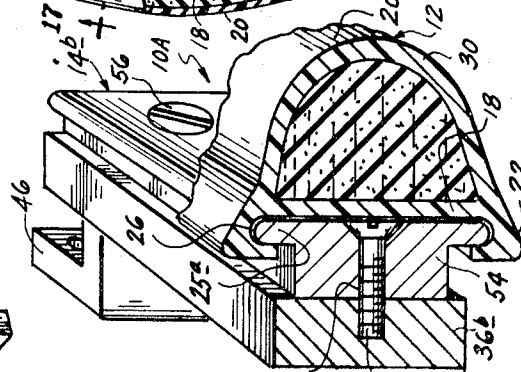


Fig. 9.

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Fig. 14.

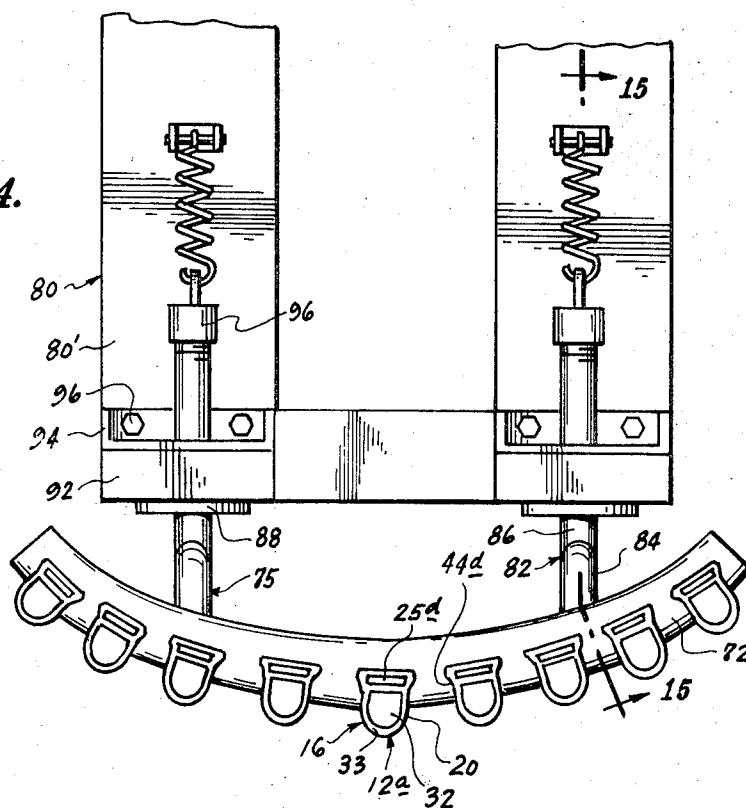
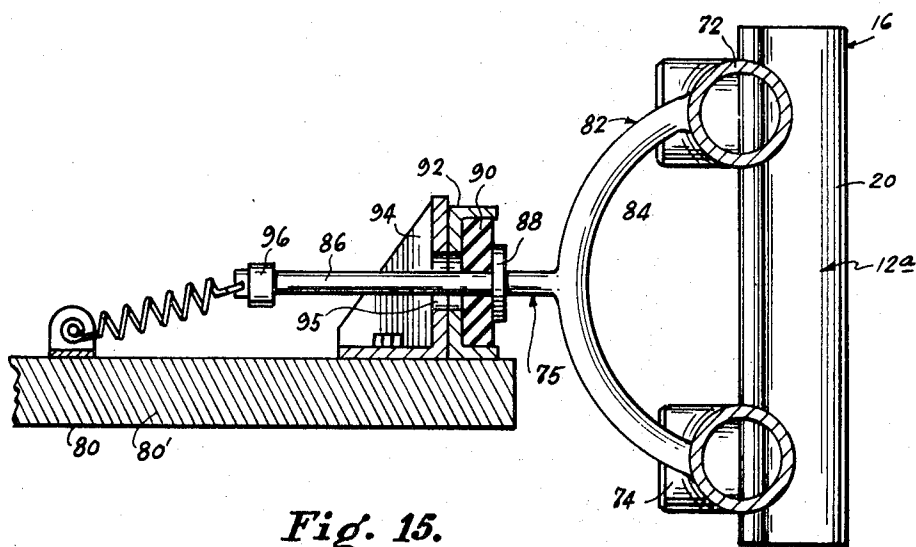


Fig. 15.

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RESILIENT SHOCK-ABSORBING BUMPER

The present invention is directed at overcoming difficulties and disadvantages of prior flexible bumpers of air- and liquid-filled types.

It has been proposed heretofore to make an automobile bumper of a pneumatic casing filled with air. U.S. Pat. No. 1,690,961 describes a typical bumper of this type. Such bumpers have not proven successful in practice because the air leaks out in time, rendering the bumpers ineffective when needed. Furthermore, the pneumatic bumpers do not dissipate energy, but store it, causing a rebound with harmful results.

It has also been proposed to make automobile bumpers of flexible casings filled with liquid. U.S. Pat. No. 3,284,122 describes a bumper typical of this construction. This bumper requires periodical refilling with fluid. When a severe impact is applied the pressure of the fluid ejects a series of stoppers causing the sudden release of the fluid. The bumper is rigidly attached to the frame of the automobile in conventional manner.

According to the present invention, a shock absorber device has a bumper pad made of a flexible nonporous outer casing packed with a resilient, spongy cellular plastic or rubber filling or body. The cellular body is saturated with water or other liquid of a degree of viscosity best suited to the purpose. The casing has a flat rear side and flexible intumed flanges which receive a spreader or wedging plate. The spreader plate serves a double purpose: to expand the flanges into flaring recesses formed in supporting bracket bars, and to provide rigidity to the bumper pad without preventing its lengthwise motion in relation to the supporting bracket bars. Opposite ends of the casing are closed by breakable seals.

In one arrangement of the invention, the shock absorber pad is mounted horizontally to extend the full width of an automobile at either end thereof. In another arrangement, a plurality of shock absorber pads are mounted vertically and are supported by horizontal bracket bars which can be attached to the frame of the automobile either rigidly or through the intermediary of a flexibly attached subframe. The shock absorber pads can be mounted by adjustable clamps, individual brackets, or by long bracket bars to an automotive vehicle.

Various objects, features and advantages of the invention will become apparent upon reading the following specification together with the accompanying drawing forming a part thereof.

Referring to the drawing:

FIG. 1 is a front elevational view of a first shock absorber assembly embodying the invention and shown mounted at one end of an automobile.

FIG. 2 is a horizontal plan view of the first shock absorber assembly taken on line 2-2 of FIG. 1.

FIG. 3 is an enlarged vertical sectional view taken on line 3-3 of FIG. 2.

FIG. 4 is an exploded rear perspective view of parts of the shock absorber assembly of FIGS. 1 and 2.

FIG. 5 is an enlarged vertical sectional view taken on line 5-5 of FIG. 4.

FIG. 6 is a horizontal sectional view taken on line 6-6 of FIG. 4.

FIG. 7 is a front perspective view on an enlarged scale of a mounting bracket structure employed in the assembly of FIGS. 1 and 2, parts being broken away.

FIG. 8 is a perspective view of a second mounting bracket structure.

FIG. 9 is a fragmentary perspective view partially in vertical section showing a second shock absorber assembly including a third mounting bracket structure.

FIG. 10 is a sectional view similar to FIG. 3, showing a third shock absorber assembly employing a fourth mounting bracket structure.

FIG. 11 is a perspective view partially exploded in form showing the mounting bracket structure employed in the assembly of FIG. 10.

FIG. 12 is a perspective view of a fourth shock absorber assembly.

FIG. 13 is an enlarged fragmentary sectional view taken on line 13-13 of FIG. 12.

FIG. 14 is a horizontal plan view of the shock absorber assembly shown in FIG. 12.

FIG. 15 is a vertical sectional view taken on line 15-15 of FIG. 14.

FIG. 16 is a top view of a fifth shock absorber assembly with a portion broken away.

FIG. 17 is an enlarged vertical sectional view taken on line 17-17 of FIG. 16.

FIG. 18 is a perspective view of one of the engaging and disengaging clips of the form of the invention shown in FIG. 16.

Referring first to FIGS. 1, 2 and 3, there is shown a shock absorber assembly 10 including a bumper pad 12 and mounting bracket structure 14. The bumper pad has an elongated tubular casing made of nonporous plastic such as a vinyl or other polymer. The casing 16 has a flat rear wall 18 and a convex front wall 20 integral with the rear wall. A pair of opposing flanges 22 which are L-shaped in cross section extend the full length of the rear of the casing at opposite edges of wall 18 shown in each of FIGS. 1-6. These flanges define channels or grooves 24 which receive a long wedging or spreading plate 25. The plate 25 has beveled or rounded edges 26 and when inserted into the grooves 24 spreads the flanges 22 outwardly. This is best shown in FIGS. 3 and 5. In FIG. 5, the flanges are shown unstressed with wall portions 27 perpendicular to backwall 18, while in FIG. 3, the wall portions 27 are spread outwardly angularly to wall 18 at the beveled edges of the spreading plate 25. The shape of the flanges shown is only by way of example and numerous other configurations can be used, such as dovetailed flanges, slots running the length of the casing and other shapes designed to facilitate its attachment. Flanges can also be dispensed with and the flexible casing attached to the parts to be protected by means of a suitable adhesive.

Inside the tubular casing 16 is a filling or body 30 of resilient, porous cellular rubber or plastic spongy foam material. This material forms a one-piece body of open cell material to define interstices which take up a considerable quantity of liquid. The casing is made of very tough strong flexible material so as not to rupture even under very severe mechanical impact. The body 30 is soft and flexible and yields when subjected to impact. The porous body 30 is saturated with a liquid 31 of any desired viscosity. It can be water, oil or other suitable liquid or gel. If a very high viscosity, semifluid substance is used, the form filling may be dispensed with. Semifluid substances with some air bubbles may be used to achieve a degree of compressibility. In some applications the foam alone may be used without liquid.

Opposite ends 33 of the tubular casing 16 are closed by thermally fusing or cementing plastic films to form breakable seals 32. The seals may be graduated according to strength, so as to provide shock-absorbing capabilities suited to various applications. When the shock absorber is subjected to an impact in any direction the porous body will yield elastically at the point of impact and the liquid will flow away from that point to provide a gradual cushioning of the impact. If a severe shock is applied such as in an automobile collision, the porous body will yield elastically while the liquid flows to the opposite ends of the casing until pressure builds up enough to break either or both seals 32 when the liquid will be released while the elastic body 30 continues to yield under the impulse of the applied force.

The mounting bracket structure 14 shown in FIGS. 1-3 and 4-7 includes a long flat bar or plate 36 to which is welded a plurality of flat brackets 38. Each bracket is of generally rectangular U-shape with a straight back 40 and two forwardly extending legs 42. The legs are inwardly dovetailed to define a dovetail recess 44 which receives the flanges 22 of pad 12. As indicated in FIGS. 3 and 4, the bumper pad 12 can slide freely longitudinally through the recesses 44 of the brackets 38 then the spreader plate 25 can be pushed into channels 24 between the flanges 22. This spreads the flanges 22 forcing them out-

wardly against the inner slanted edges 45 of legs 42 as shown in FIG. 3. The spreader plate can be hammered into place to lock the bumper pad securely to the brackets. It can also be hammered out to remove the bumper pad for replacement with another if necessary. The support bar or plate 36 is provided with apertured L-shaped rear brackets 46 which can be secured by bolts 47 to one end of the frame 48 of an automotive vehicle 50.

A particular advantage of the assembly 10 is the manner in which the bumper pad accommodates to the intensity of force applied in a gradually yielding manner with wide distribution of the force to effectively protect the vehicle 50. If the impact is severe enough to break open either or both seals 32, the casing can be refilled with displaced liquid and the ends of the casing can be resealed. The tough casing will not break even under an impact violent enough to demolish the vehicle, but it should somehow become cut or damaged, the entire bumper pad is expendable and can be replaced by another at low cost.

FIG. 8 shows another mounting bracket structure 14a which can be used to mount bumper pad 12. Parts corresponding to those of bracket structure 14 are identically numbered. Instead of individual brackets 38, there is provided a single long channel bracket 38a which is secured by welding 52 to back bar or plate 36. Alternatively, the channel bracket and bar 36 can be made as an integral unit. The channel bracket has two long forwardly extending walls 42a with slanted inner sides 45a defining a dovetailed recess 44a extending the full length of the channel bracket. This structure 14a is somewhat more expensive to fabricate than bracket structure 14 but it has the advantage of greater strength and more uniform support for bumper pad 12. The spreader plate 25 will spread apart the flanges 22 of the bumper pad in channel bracket 38a in the same manner as illustrated in FIG. 3.

In FIG. 9, the shock absorber assembly 10A has another mounting structure 14b in which spreader plate 25a is a rather T-shaped in cross section with a rear plate portion 54 extending rearwardly of the flanges 22 and engaged by bolts 56 with support plate 36b. The bolts seat in threaded holes 57. The bolts extend through countersunk holes 59 in the spreader plate 25a. Rear brackets 46 of which only one is shown enable the assembly to be mounted to the frame of a vehicle. The mounting structure 14b will serve for a light-duty installation since the outwardly spread flanges 22 are not compressed against parts of mounting brackets or a channel bracket as in mounting structures 14 and 14a.

FIGS. 10 and 11 show mounting structure 14c of another shock absorber assembly 10B. Support bar 36c may have a flat or curved front face 60. Welded to the face 60 at spaced points are L-shaped flat bracket sections 62. Cooperating L-shaped bracket sections 64 can be adjustably engaged with sections 62 by bolts 66 which extend through bores 68 in sections 64 and screw into threaded holes 70 in sections 62. The inner slanted faces 45b and 45b' of sections 62, 64 contact the outer sides of flanges 22 when they are spread apart by spreader plate 25c of the bumper pad 12. Other parts of the assembly corresponding to assembly 10 are identically numbered. Assembly 10B has the advantage of being adjustable to different widths of bumper pad 12. Also it makes it possible to remove the bumper pad and to replace it with another by unscrewing bolts 66 which is easier than hammering or drawing wedge plate 25c longitudinally out of the bumper pad.

FIGS. 12-15 show another shock absorber assembly 10C in which a plurality of bumper pads 12a are constructed like bumper pad 12 except that pads 12a are smaller in size. Each pad 12a has a tubular flexible nonporous casing 16a and porous resilient filling 30 saturated with liquid 31. The ends 33 of the casing are closed by breakable seals 32 all as described in connection with assembly 10. The bumper pads 12a are vertically disposed with flanges 22 engaged in aligned dovetailed recesses 44d of two horizontal mounting bracket bars 72 and 74. Spreader plates 25d are inserted between the flanges 22 in recesses 44d. As in bumper pad 12, each

spreader plate is disposed behind the backwall 18 of the casing. The spreader plate is hammered into place to spread the flanges 22 apart. Top and bottom ends of the vertical spreader plates extend above top bar 72 and below bottom bar 74 as clearly shown in FIGS. 12 and 15.

An auxiliary frame structure 75 is provided for mounting the assembly 10C to frame 80 of a vehicle. The auxiliary frame structure includes a pair of yokes 82 whose arms 84 joint the two bars 72, 74 and hold them in spaced parallel relationship one above the other. Extending rearwardly from each yoke is a common shaft 86 on which is an annular flange 88. Shaft 86 extends through a circular shock-absorbing resilient pad 90 held in a cup ring 92 secured to channel bracket 94 which is held on frame 80 by bolts 96. Shaft 86 extends through opening 95 in bracket 94. Flange 88 bears against pad 90. At the rear end of shaft 86 is a fitting 96. A coil spring 98 is connected between fitting 96 and bracket 99 on frame bar 80'. The coil springs 98 serve as counterweights to stabilize the shock absorber assembly. The bumper pads 12a take up the initial impact of an applied mechanical shock. Pads 90 serve as auxiliary resilient supports. They permit the assembly to move slightly up, down or laterally in yielding to obliquely directed mechanical shocks and then the pads 90 restore the assembly to their initial undeflected position. Assembly 10C has the advantage that any one bumper pad can be replaced without disturbing any other.

The bars 72 and 74 are shown axially curved but they can be made straight if desired. Instead of being round tubes, bars 72, 74 can be made rectangular in cross section or of any other geometrical shape. They may also be solid instead of tubular in structure.

In FIGS. 16 and 17, there is shown another shock absorber assembly 10D which includes a curved spreader plate 25d supported by spaced brackets 102 secured by bolts 103 on frame 104 of a vehicle. Shock absorber pad 12 which is the same as described in connection with FIGS. 1-6 is supported by plate 25d. The flanges 22 of pad 12 engage around the edges of plate 25d. Pairs of C-shaped spring clips 106, best shown in FIG. 18, snap over the expanded flanges 22 of the pad 12 at opposite sides of brackets 102 as shown in FIGS. 16 and 17. Assembly 10D has the advantage that it is very quickly mountable on and demountable from plate 25d by engaging and disengaging clips 106.

All the shock absorber assemblies described employ quickly mountable and quickly detachable bumper pads which are expendable and which can be replaced if necessary. The bumper pads can be mounted interchangeably in various mounting structures and brackets as described. Each has advantages of its own depending on the desired strength of the shock absorber desired and other requirements of the installation. It will be well at this point to summarize some important features of the present invention. It will be understood, particularly by reference to FIGS. 12-16 that protection against damage to a vehicle is afforded in a succession of stages. In the first stage, the resilient bumper pads absorb the impact. If the impact is excessive they yieldably rupture. In the second stage, the spreader plates absorb the impact. If the impact is excessive they yieldably bend. In the third stage, resilient, elastic mountings of the support bars yield to the impact. In the fourth stage, the mounting bars for the bumper pads and their supporting yokes yieldably bend to excess impact. By this arrangement the vehicle is effectively protected against damage.

It should be noted that the mounting of the bumper pads requires no screws, wires, clips or other auxiliary devices. The pads can easily be inserted in the recesses in the mounting bars and removed therefrom by sliding them longitudinally. The spreader plates are similarly removable. Thus if any pad or plate is damaged, it can be replaced without disturbing any other assembly of pad and spreader plate.

The shock absorbers have been described in connection with their use as bumpers at the rear or front ends of an automotive vehicle. However, it will be readily apparent to

those skilled in the art that they can be used in many installations other than automobiles, where an effective economical shock absorber is desired.

While I have shown and described what I believe to be the best embodiments of my invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A shock absorber device for a vehicle or the like, comprising a bumper-mounting structure supportable by the vehicle, said mounting structure having mounting means defining at least one dovetail recess, said recess having a flat inner wall and a pair of opposed lateral walls slanting forwardly from the inner wall to define a forward opening into said recess; a bumper pad comprising an elongated, flexible body removably insertable longitudinally into said recess through one end thereof, said body having a convex front wall to extend forwardly through said opening for receiving the force of an applied impact, a rear wall integral with said front wall, and a pair of intumed flexible flanges integral with and extending along said rear wall at opposite edges thereof; a rigid spreader plate removably insertable longitudinally between said flanges to abut said rear wall and to spread said flanges inside the recess to fit them tightly against the slanted lateral walls and inside wall of the recess, so that the bumper pad is held therein only by friction and compressive force, whereby the bumper pad provides a first stage of impact absorption, whereby the spreader plate provides a second successive stage of impact absorption, and whereby said mounting structure provides a third successive stages of impact absorption.

2. A shock absorber device as defined in claim 1, wherein said bumper mounting structure includes resilient support means for said mounting means, said resilient support means providing said third stage of impact absorption, and said mounting means providing a fourth successive stage of impact absorption.

3. A shock absorber device as defined in claim 2, wherein said mounting means comprises a pair of parallel bars coupled to said resilient support means.

4. A shock absorber device as defined in claim 3, wherein said mounting means further comprises yokes having arms joined to the bars respectively, each yoke having a shaft extending rearwardly from the bars and engaged with said resilient support means.

5. A shock absorber device as defined in claim 3, wherein said recess is formed in said bars, so that the bumper pad and spreader plate are supported directly by said bars.

6. A shock absorber device as defined in claim 1, wherein

said mounting means further defines a plurality of like dovetail recesses for supporting other bumper pads, each recess having a flat other inner wall to define a forward other opening into the recess; a plurality of other bumper pads, each other bumper pad comprising an elongated flexible other body removably insertable longitudinally into one of the other recesses to extend forwardly through said other opening, said other body having a convex front other wall, a rear other wall integral with the front other wall, and a pair of other intumed flexible flanges extending along said rear other wall at opposite edges thereof; and a plurality of other rigid spreader plates respectively removably insertable longitudinally between said other flanges to abut said rear other wall within one of said other recesses to spread said other flanges inside the other recess to fit tightly against the respective slanted lateral walls and inside wall thereof to hold a bumper pad therein only by compressive force, whereby any one of the bumper pads and any one of the spreader plates can be replaced by sliding it longitudinally out of a recess in which it is engaged.

7. A shock absorber device as defined in claim 6, wherein said recesses are disposed longitudinally parallel to each other so that a plurality bumper pads can be supported in spaced parallel relationship to each other.

8. A shock absorber device as defined in claim 6, wherein said mounting means comprises a pair of parallel support bars, said recesses being formed in said bars, so that a plurality of bumper pads can be supported in spaced parallel relationship to each other by said bars.

9. A shock absorber device as defined in claim 6, wherein said bumper-mounting structure includes resilient support means for said mounting means, said resilient support means providing said third stage of impact absorption, and said mounting means providing a fourth successive stage of impact absorption.

10. A shock absorber device as defined in claim 9, wherein said mounting means comprises a pair of parallel bars coupled to said resilient support means; and yokes having arms joined to the bars respectively, each yoke having a shaft extending rearwardly from the bars and engaged with said resilient support means.

11. A shock absorber device as defined in claim 10, wherein said mounting structure further comprises brackets mounting to said vehicle cup rings carried by the brackets; said resilient support means comprising apertured resilient pads in the cup rings, the shafts of the yokes extending through the resilient pads; flanges on the yokes abutting the resilient pads; and coil springs connecting ends of the shafts with said vehicle to serve as counterweights while the resilient pads serve as supports for the yokes, bars, bumper pads and spreader plates.

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