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[54] **LIQUID SHOCK ABSORBING BUFFER**
14 Claims, 2 Drawing Figs.

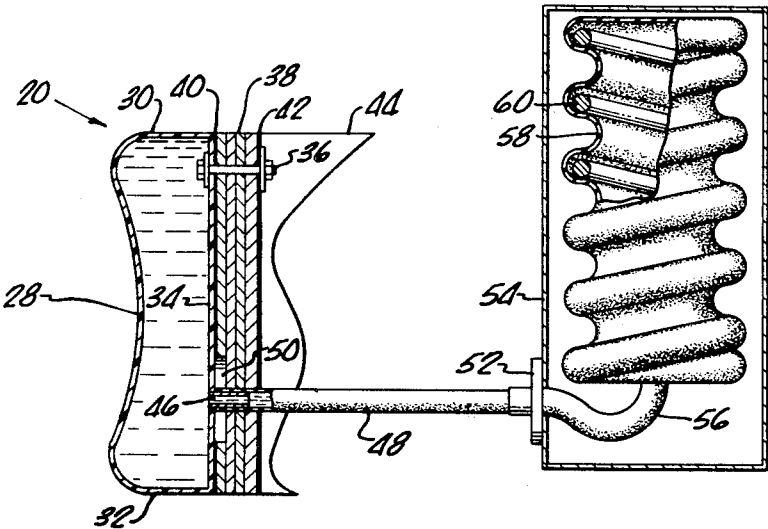
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B61f 19/04, B61q 11/12

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52F, 60, 67, 71, 71P, 84, 85, 86; 267/116, 122,
139

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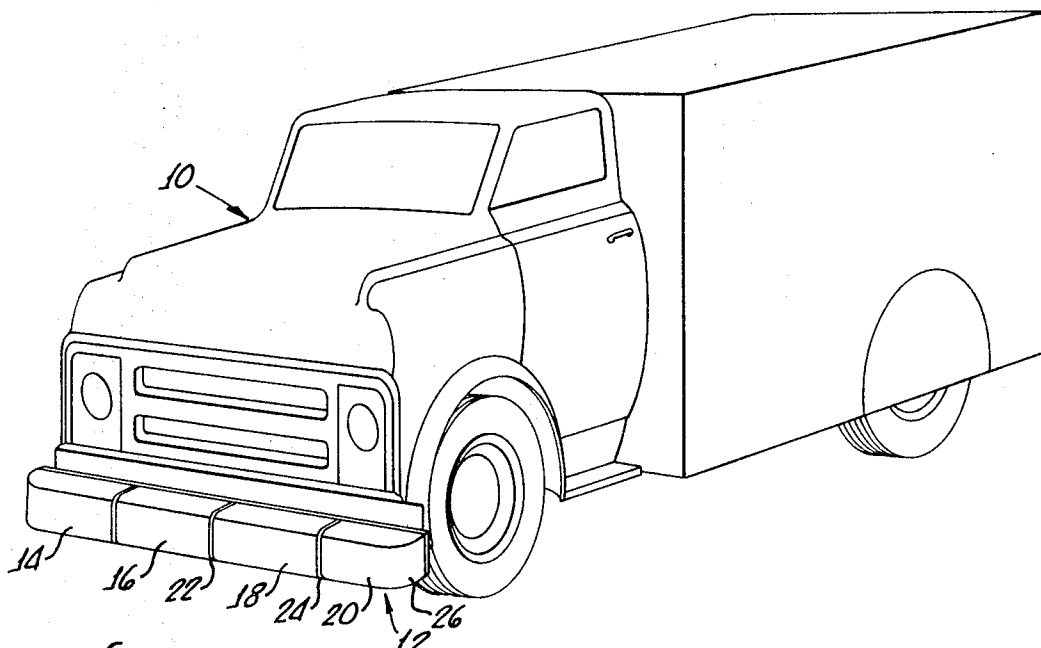


FIG. 1.

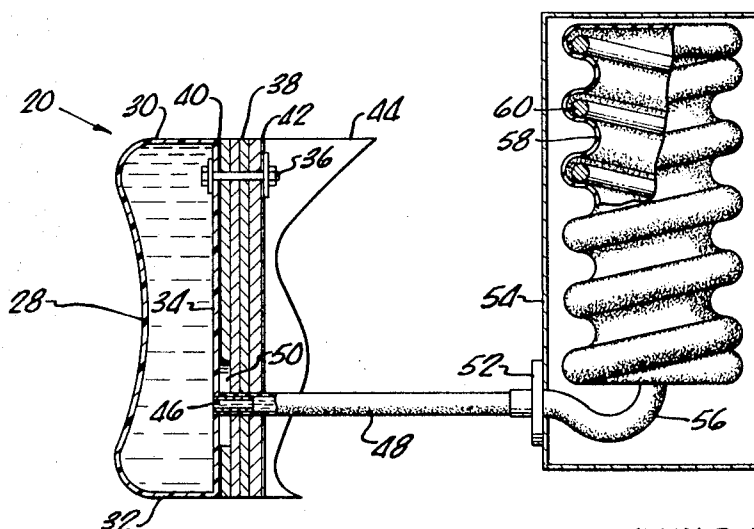


FIG. 2.

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LIQUID SHOCK ABSORBING BUFFER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to vehicle shock absorbing devices and, more particularly, to shock absorbing buffer members for use in addition to or in lieu of bumpers on cars, trucks, buses, etc.

2. Description of the Prior Art

A great variety of kinetic energy absorbing devices for vehicles have been described in the prior art. They may be categorized generally as being of the piston type, compression type or, more recently, the viscous flow-displacement type. Only the latter type has attained any technical or commercial importance. In addition, certain devices may include facets of more than one of the aforementioned types. For example, Peterson, U.S. Pat. No. 3,097,725, has described a combination resilient and dashpot type of absorber. Resilient absorbers are quite unsatisfactory because, instead of dissipating the energy, the kinetic energy is merely stored and reexerted, sometimes with even greater damage than that resulting from the initial impact. A number of such devices have been described. For example, Corydon II, U.S. Pat. Nos. 2,731,289 and 2,731,290, has recently described embodiments of this type of device. An earlier embodiment was described by Van Gelver, U.S. Pat. No. 1,402,324. An example of the piston type of device is described by Druihet, U.S. Pat. No. 2,555,436, and a combination resilient-piston type of device is described by Ventura, U.S. Pat. No. 1,702,675. In theory, the piston type of device, if properly designed so as not to store impact energies, should be satisfactory but, in practice, these devices do not work well, perhaps because impact forces are not properly transmitted to the piston.

In any event, the type of device which has been found to be satisfactory and the only device, to our knowledge, which has ever attained any degree of technical or commercial success is the type described by Rich in U.S. Pat. No. 3,284,122. Devices of this type have attained substantial commercial and technical importance in the transportation field and, for most purposes, are eminently satisfactory. Indeed, for general application, it is expected that the devices described by Rich in the aforementioned patent may be more satisfactory and universally applicable than the devices of the invention to be described hereinafter. However, certain problems have been encountered using the aforementioned Rich Soft Cushion "Water" Bumper.

The principal problem which has been encountered relates to the use of the Rich Bumper on trucks which customarily back up against loading docks. The bumpers are extremely useful in absorbing the shock otherwise associated with the contact of the truck with the loading dock. As those in the trucking industry are aware, severe damage often results either to the truck or to the loading dock and sometimes to both the truck and the loading dock. It is, therefore, highly desirable to provide some type of energy dissipating device on the truck or on the dock. The Rich device is completely satisfactory in the sense that it quite effectively absorbs the impact energy but in so doing, large quantities of water (or other liquid) are spewed out of the bumper onto the dock and adjacent work areas. This is, obviously, more desirable than damaging the dock but it does create an unsightly and inconvenient condition which may also present safety hazards if men are working in the vicinity and could slip on the wet surface. It is a principal object of this invention to eliminate the problems associated with the expulsion of water from the buffer member without substantially decreasing the energy absorbing and dissipating advantages of devices of this type.

SUMMARY

The principal object of this invention is accomplished by providing an improved shock absorbing buffer combination which includes a tubular body member comprised of a resilient material of sufficient rigidity normally to retain a

predetermined shape and being of sufficient strength to resist rupture upon impact connected by a conduit means to an easily expandible reservoir unit which has a position of minimum containment and which can expand to a position of greater containment wherein the conduit means, body member, and reservoir unit are relatively so constructed and adapted that impact against the body member forces the liquid through the conduit at a rate commensurate with the severity of impact such that the impact energy is absorbed and dissipated by the displacement of the liquid by viscous flow through the conduit with negligible storage of energy in the reservoir unit.

An additional object of the invention is the provision of a novel reservoir unit in combination with a conduit and resilient normally liquid filled body member.

An improved combination of body member, conduit, and insignificantly energy storing resilient reservoir unit constitutes an additional object of the invention.

Still an additional object of the invention is the provision of a combination which includes a rigid backing member of particular construction in combination with a shape retaining resilient body member.

A still more specific object of the invention is to provide a shock absorbing buffer which comprises a plurality of normally liquid filled tubular body members secured to a backing member in association with a plurality of conduits and reservoir units.

The specific embodiment described herein constitutes a nominating object of the invention.

Other additional and more specific objects of the invention will be apparent from the specification which follows and from the drawing to which reference is now made.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a truck illustrating the disposition of the buffer combination and shock absorbing buffer of this invention secured thereto.

FIG. 2 is a side cross-sectional view showing, schematically, the components and interconnections of components which comprise the shock absorbing buffer combination of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As illustrated in FIG. 1, this invention is intended for use with vehicles, such as truck 10 to which the improved shock absorbing buffer 12 is connected. In FIG. 1, the buffer is shown on the front of the vehicle. It is understood, however, that the buffer may be used wither on the front or the rear of the vehicle and, for application to trucks, the invention finds its greatest applicability and utility when connected to the rear of the vehicle, rather than to the front, since the truck usually backs against a loading dock.

The improved shock absorbing buffer comprises a plurality of buffer combinations shown at 14, 16, 18, and 20. Each of these combinations includes a body member having end walls which may be substantially perpendicular to the axis of the body members, as indicated at 22 and 24, or may be curved and only partially angled with respect to the axis of the body members as indicated at 26. Normally, the body members are essentially coaxial but may be curved, depending upon the type of vehicle and the particular application involved.

Each of the body members, in addition to the end portions, includes a front wall portion 28, top and bottom portions 30 and 32, and a rear wall portion 34. The rear wall portion is preferably connected by means of adhesive and/or by a bolt fastener 36 to a backing member 38. The backing member may be made of plastic, steel, or other material, but is preferably comprised of a plurality of wood layers laminated together in overlying relation with the wood grain running in different directions, such as plywood, with a layer of resin-bonded fiberglass on each face, as indicated at 40 and 42. Generally, polyester resins readily available from commercial sources are used to bond the fiberglass to the respective faces

of the plywood core of the backing member. This combination gives greater strength and resiliency to the backing member than is available using corresponding weights of metal or other material.

The backing member may be secured by bolts, screws, or any conventional fastening means to the vehicle frame, indicated generally at 44, either directly or indirectly. The type of connection used normally between a steel bumper and the frame may be used; however, it is usually desirable to connect the backing member by a more rigid support directly to the frame.

Unlike the Rich buffer, no openings are provided in the top of the body member. Instead, an opening 46 to a conduit 48, which is connected by a fitting 50 to the body member wall 34 is provided. Fluid conduit means 48 has a diameter different from the diameter of orifice 46, which allows expansion of the fluid flowing from the body member to the reservoir, resulting in a pressure drop and greater absorption and dissipation of impact energy. The other end of the conduit 48 is connected by a fitting 52 to the wall of a housing 54 and extends, as indicated at 56, into the housing 54 where it is connected to a readily expandable reservoir unit.

The reservoir unit comprises a flexible easily resilient container such as sack 58 and means for compressing the retainer to a position of minimum containment such as spring 60. Spring 60 is shown, in FIG. 2, inside the container 58 but an equivalent construction to obtain like operation could be provided using a spring on the outside of the container. The container 50 is shown in the position of maximum containment and, in the normal position of minimum containment, would be collapsed to approximately one-fourth the size shown in FIG. 2. The relative thicknesses and dimensions of the walls and diameters of the container and the spring are shown for illustration purposes rather than for design purposes.

The body member 20, for example, is tubular in configuration and is comprised of a resilient material of sufficient rigidity normally to retain a predetermined shape and is of sufficient strength to reduce rupture on impact. Generally, this tubular member, except for the orifices, is of the type described in the aforementioned Rich patent and may be comprised of any suitable material. Properly plasticized polyvinyl chloride has been found the most satisfactory, however.

The reservoir unit is constructed and composed so as to have a position of minimum containment and a position of maximum containment and is so adapted as to normally retain the position of minimum containment and to expand to a position of greater containment upon the flow of liquid under pressure thereinto. The materials are so selected and the components are so dimensioned, however, that essentially no energy is stored in the resilient expansion of the container beyond that minimally necessary to return the water (or other liquid) to the body member when the latter is in its normal predetermined shape.

The fluid conduit means 48 and the openings thereto, in association with the body member and reservoir, is so constructed and adapted that impact against the body member serves to force the liquid through the conduit means into the reservoir unit. The conduit means is so constructed that escape of the liquid from the body member into the reservoir unit is permitted only commensurately with the severity of impact and consequent deformation of the body member. By this means, the impact energy is absorbed by displacement of the liquid from the body member to the reservoir by viscous flow through the conduit means. Since the reservoir is so constructed that resilient energy stored by expansion thereof is very minor, this stored energy is insignificant relative to the energy which is dissipated by the viscous flow and the displacement of the liquid upon impact.

If desired, a plurality of such reservoir units and conduits may be connected to and associated with each of the body members. It is not necessary, however, that the capacity of the reservoir units or the sum capacity of all associated reservoir units equal the capacity of the body member since it is unlike-

ly that in any given situation all of the liquid would be expelled from the body member at one time. Generally, it is sufficient that the reservoir have a capacity equivalent to from 50 to 80 percent of the body member capacity.

It has been found that adequate energy absorption and dissipation can be obtained using a plurality of body members for the buffer construction rather than a single body member as described in the aforementioned Rich patent. The use of a plurality of such body members connected by bolts, such as shown in FIG. 2, is in every essential respect fully equivalent to the Rich bumper. The distinguishing characteristic of the present invention lies primarily in the combination of conduit means and nonenergy storing reservoir means in association with such a body member.

Using conventional engineering values, the resilient force exerted by spring 60 in combination with any resiliency of the container 58 is so adjusted that only an insignificant part of the impact energy is stored. Generally, less than 10 percent and preferably less than 1 percent of maximum absorbable impact energy is capable of being stored in the reservoir. Maximum expected impact energy is determined from the weight of the vehicle and expectant speeds. The maximum energy which can be dissipated is largely a function of the size of the body member and the rate of dissipation is a function of the size of the conduit means. Conduits from about 1/2 inch diameter to as great as 2 inch diameters may be used but a diameter of about 3/4 to 1 1/4 inches is preferred for the conduit.

It will be understood that the foregoing embodiment is non-limiting and that variations therefrom may be made without departing from the spirit and scope of the invention as defined in the following claims.

We claim:

1. The improved shock absorbing buffer combination which comprises:

a tubular body member having at least one orifice therein and comprised of a resilient material of sufficient rigidity normally to retain a predetermined shape and being of sufficient strength to resist rupture upon impact and normally filled with liquid;

at least one easily expandable reservoir unit having a position of minimum containment and being so adapted and constructed to retain the position of minimum containment and to expand to a position of greater containment upon the flow of liquid under pressure thereinto from said body member;

fluid conduit means interconnecting the body member orifice and the reservoir unit, said fluid conduit means having a diameter different from the diameter of said orifice to permit absorption and dissipation of impact energy commensurate with the severity of impact against said body member upon flow of the liquid from said body member to said reservoir;

said fluid conduit means, body member and reservoir unit being relatively so constructed and attached that impact against said body member serves to force said liquid through said conduit means into said reservoir unit; and said reservoir being so constructed that resilient energy stored by expansion thereof is sufficient only to force the liquid back into said body member after impact and is insignificant relative to the energy dissipated by viscous flow and displacement of the liquid.

2. The buffer combination of claim 1 which comprises: a plurality of such reservoir units interconnected by such conduit means with said body member.

3. The buffer combination of claim 1 in combination with at least one additional such buffer combination, said buffer combinations being secured to a backing member on a vehicle.

4. The buffer combination of claim 1 further comprising: a substantially rigid backing member constructed and adapted for being secured to a vehicle; means securing the body member to the backing member; and means for securing the reservoir unit to the vehicle.

5. The buffer combination of claim 4 further comprising:

at least one additional buffer combination with the body member thereof being secured to the backing member and including means for securing the reservoir unit thereof to the vehicle.

6. The combination of claim 5 wherein the backing member comprises:

a plurality of layers of wood glued together with the wood grain of the respective layers running in different directions relative to each other; and

a resin bonded fiberglass layer on each side of the layered wood construction for preventing splintering and increasing the resilience and strength of the backing member.

7. The combination of claim 1 wherein the reservoir unit comprises:

a flexible expansible container in communication with said conduit means; and

means for resiliently compressing said container to said position of minimum containment, said resilient compressing means exerting an insignificant force compared with expected impact forces and storing an insignificant energy compared with the energy dissipated in displacement and viscous flow of the liquid.

8. The combination of claim 7 wherein the resilient compressing means is a spring.

9. The combination of claim 8 wherein the spring is inside the expansible container.

10 The combination of claim 7 further comprising: a substantially closed rigid housing for the expansible container.

11. In combination, an improved shock absorbing buffer which comprises:

a substantially rigid backing member constructed and adapted to be secured to the front or back of a vehicle;

at least one normally liquid filled tubular body member having at least one orifice therein secured to the backing member, said body member being comprised of a resilient material of sufficient rigidity normally to retain a predetermined shape and being of sufficient strength to resist rupture upon impact and normally filled with liquid;

at least one easily expansible reservoir unit having a position of minimum containment and being so adapted and con-

structed so as normally to retain the position of minimum containment and to expand to a position of greater containment upon the flow of liquid under pressure thereinto from said body member;

fluid conduit means interconnecting the body member orifice and the reservoir unit, said fluid conduit means having a diameter different from the diameter of said orifice to permit absorption and dissipation of impact energy commensurate with the severity of impact against said body member upon flow of the liquid from said body member to said reservoir;

said fluid conduit means, body member and reservoir unit being relatively so constructed and attached that impact against said body member serves to force said liquid through said conduit conduit means into said reservoir unit; and

said reservoir being so constructed that resilient energy stored by expansion thereof is sufficient only to force the liquid back into said body member after impact and is insignificant relative to the energy dissipated by viscous flow and displacement of the liquid.

12. The buffer of claim 11 wherein the reservoir unit comprises:

a flexible expansible container in communication with said conduit means; and

means for resiliently compressing said container to said position of minimum containment, said resilient compressing means exerting an insignificant force compared with expected impact forces and storing an insignificant energy compared with the energy dissipated in displacement and viscous flow of the liquid.

13. The buffer of claim 11 wherein the reservoir unit is so composed and constructed that less than about 10 percent of the maximum energy capable of dissipation is stores in said reservoir unit.

14. The buffer of claim 11 wherein the reservoir unit is so composed and constructed that less than about 1 percent of the maximum energy capable of dissipation is stressed in said reservoir unit.

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