March 1, 1966 J. T. SMITH ETAL 3,237,574

IMPACT ABSORBING APPARATUS

Filed Sept. 10, 1964 2 Sheets-Sheet 1

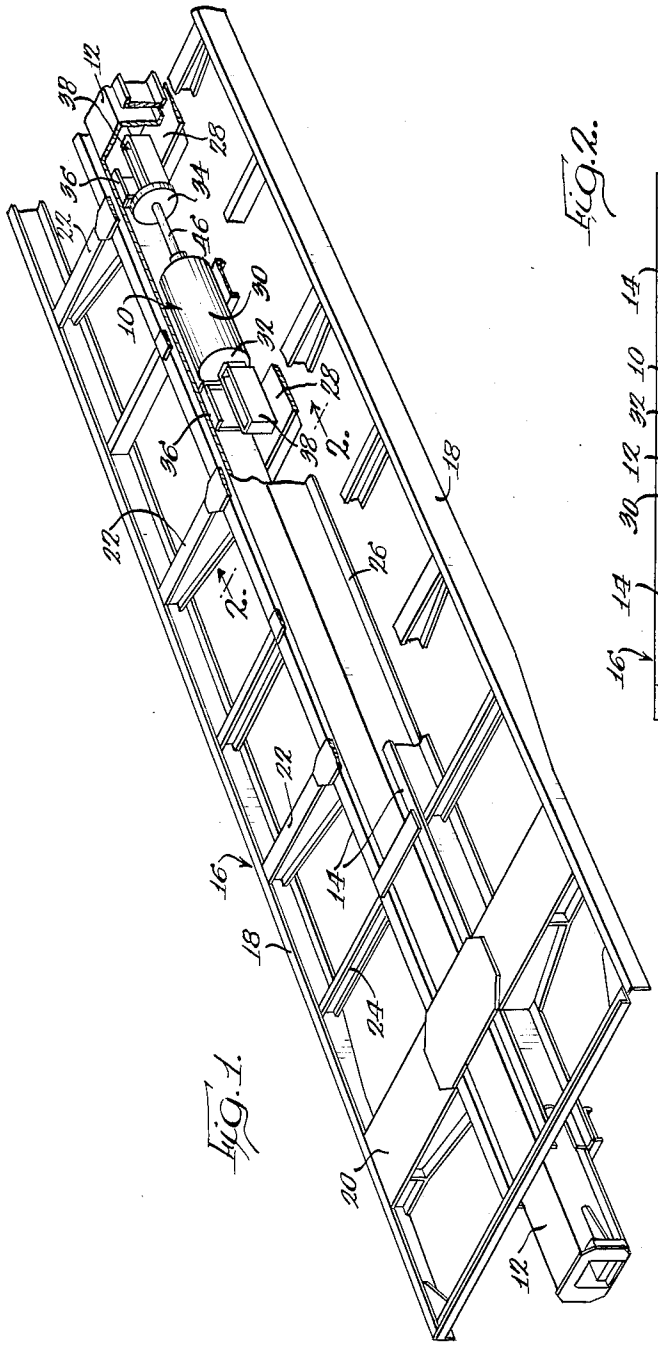

Fig. 1.

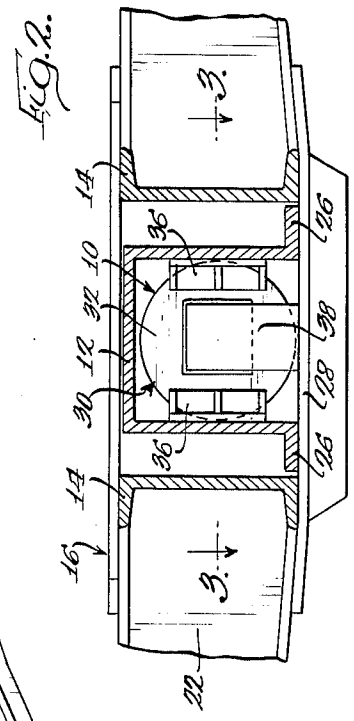

Fig. 2.

Inventors:
James T. Smith
Osvaldo Chierici
By
B. Gordon Aller
Atty

March 1, 1966 J. T. SMITH ETAL 3,237,574

IMPACT ABSORBING APPARATUS

Filed Sept. 10, 1964 2 Sheets-Sheet 2

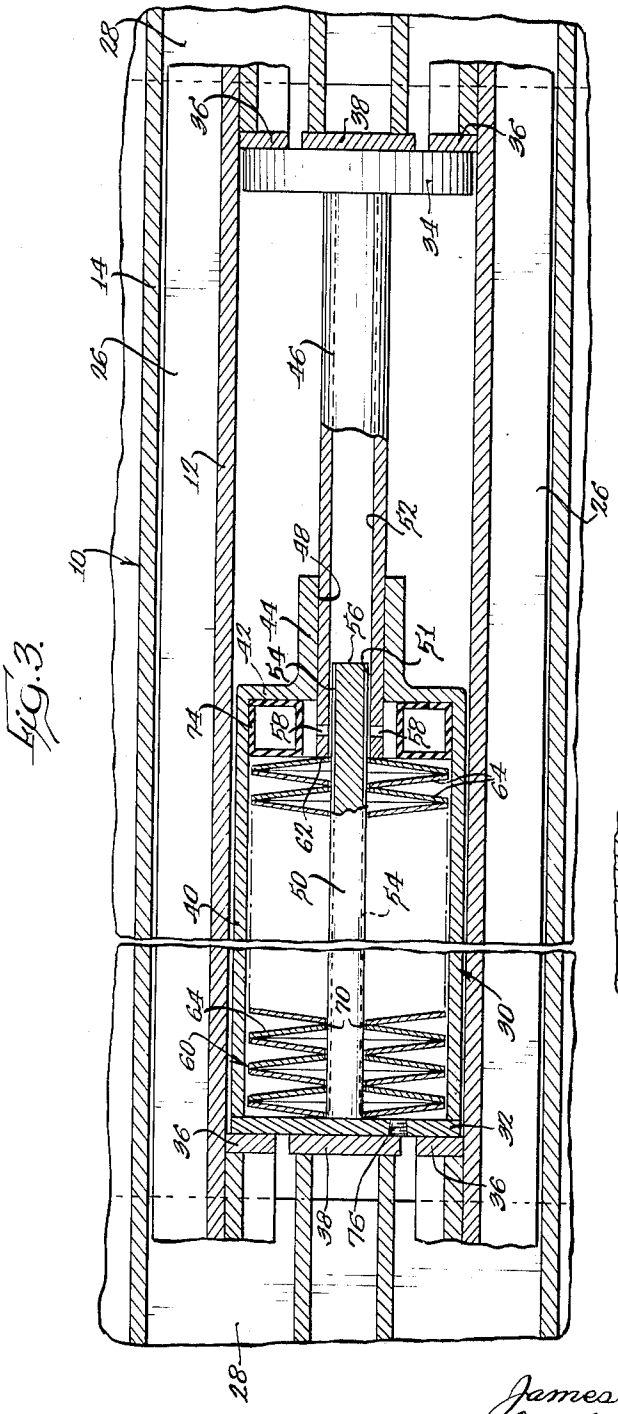

Fig. 3.

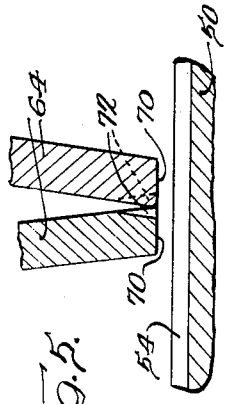

Fig. 5.

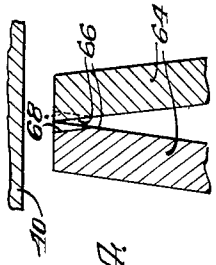

Fig. 4.

Inventors
James T. Smith
Osvaldo Chierici
By
B. Gordon Aller
Atty

United States Patent Office

3,237,574

Patented Mar. 1, 1966

3,237,574

IMPACT ABSORBING APPARATUS

James T. Smith, Wilmette, and Osvaldo Chierici, Elmhurst, Ill., assignors to Keystone Railway Equipment Company, Chicago, Ill., a corporation of Illinois

Filed Sept. 10, 1964, Ser. No. 395,391
3 Claims. (Cl. 105—454)

The present invention relates to an impact absorbing apparatus, and in particular to an improved impact absorbing apparatus for railway rolling stock.

Railway rolling stock, particularly freight cars, is subject to appreciable impacts in switch and classification yards where the trains are both broken up and made up. It is customary to attempt to limit the speed of the free rolling cars so that at the time of impact with another car the speed is not more than three or four miles per hour. However, this is not always possible and speeds as high as ten, twelve, or more miles per hour are known. Also coupling speeds of ten, twelve, or more miles per hour are not uncommon in making up the train or picking up cars from sidings, loading docks, and the like.

Tremendous thought, study, and research have been given to the problem of protecting the load or lading against damage from the impacts given to a fully or partially loaded freight car during coupling. The character of the lading itself usually dictates the best way it should be secured in a car. Some of the securing techniques provide for a controlled and limited movement of the load within the car to absorb the coupling or similar impact without damage to the load.

The draft gear connected to the coupler absorbs a part of the shock, but its effectiveness is limited by the severe limitation on the movement of the coupler relative to the remainder of the car. This movement is about two and three-quarter inches so as to minimize the amount of slack in a train that has to be taken up on starting and absorbed on stopping.

It has been proposed to interpose an impact absorbing cushion in the car between the draft gear and the lading which will permit the lading to move up to a certain distance on impact and thereafter be restored to its original or normal position. Alternatively, the impact absorbing cushion is interposed between the center sill for buff and draft and the underframe of the railway car. These cushions are of various designs and permit maximum movement from as little as eight inches up to as much as 40 inches. It is thought by some that the longer the cushion movement the greater the protection afforded to the lading. A principal difficulty with long cushion movement is the projection of the center sill for buff and draft beyond the end of the car a distance of 40 inches more than normal. This of course projects the coupler 40 inches greater beyond the end of the car than theretofore. When cars of this type are coupled into a train, particularly when coupled to each other, difficulties are encountered in sharp curves and it has been found necessary to prevent the routing of such cars over trackage which has such curves. This long projecting sill also makes coupling of these cars extremely difficult unless the coupling is done on straight track.

The present invention is concerned with improvements in impact absorbing cushions whereby whatever advantages exist in long movement may be retained with a cushion movement which is appreciably shorter.

It is therefore a principal object of the present invention to provide a hydraulic impact absorbing cushion between the draft gear and the lading in a freight car, having a movement less than half the maximum movement of long movement devices now available while retaining the load protecting advantages of such devices.

Another object is to provide a hydraulic impact absorbing cushion between the draft gear and the lading in a freight car, wherein the maximum lading movement is less than 20 inches.

Another object is to provide a hydraulic impact absorbing cushion incorporating a hydraulic reservoir within which is mounted a Belleville spring assembly arranged to be compressed under impact.

Another object is to provide a hydraulic impact absorbing cushion incorporating a hydraulic reservoir within which is mounted a Belleville spring assembly with the elements thereof having small flow restricting slits or slots at their contacting edges and arranged to be compressed under impact to express the hydraulic fluid from between the component parts of the spring assembly.

Other objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a fragmentary perspective view of the underframe of a railway car partly broken away to illustrate the mounting of the impact absorbing apparatus of the present invention;

FIG. 2 is a fragmentary transverse sectional view on an enlarged scale showing one end of the device taken along the line 2—2 of FIG. 1, looking in the direction of the arrows;

FIG. 3 is a plan medial sectional view on a further enlarged scale taken along the line 3—3 of FIG. 2, looking in the direction of the arrows;

FIG. 4 is a fragmentary detail sectional view on an enlarged scale showing the contacted outer edges of two Belleville spring elements; and

FIG. 5 is a fragmentary detail sectional view on an enlarged scale showing the contacted edges at the central openings of two Belleville spring elements.

Referring to FIG. 1 it can be seen that an impact absorbing device 10 is interposed between a slidable center sill 12 for buff and draft and an underframe center sill 14 within which it is mounted. Underframe 16 includes the conventional side sills 18, bolsters 20 (only one of which is shown), cross bearers 22 and other transverse bracing 24. The bolsters are mounted on conventional trucks which ride on the rails, and the underframe 16 supports the conventional box or other lading containing structure. Conventional couplers and draft gear (not shown) are carried by the slidable center sill 12 on the extreme ends thereof.

The slidable center sill 12 as seen in FIG. 2 has an inverted channel-shaped configuration with side flanges 26 which slide on cross plates 28 carried by the various transverse frame members.

The impact absorbing device 10 includes a reservoir 30 having a head 32 and a second head 34 which are urged apart in a manner to be described hereinafter. The heads 32 and 34 are normally held in engagement with stop lugs 36 carried on the slidable center sill 12 and with force transmitting stop members 38 carried on the underframe 16 of the car.

When there is relative movement between the slidable center sill 12 and the frame center sill 14 caused by an impact, one or other of the heads 32 and 34 is moved away from the lugs 36 while the other head is moved away from the underframe stop member 38. The normal position is that shown in FIGS. 1 and 3.

The reservoir 30 is formed with a cylindrical barrel 40 having a head 42 opposite the head 32 with the head 42 being formed with a cylindrical projection 44. The head 34 has secured thereto as by welding a cylinder forming tube 46 which extends from the head 34 toward the reservoir 30 and slidably projects thereinto through a bore 48 formed in the cylindrical projection 44 on the

reservoir barrel. The tube 46 has a sufficiently close fit with the bore 48 to prevent leakage of hydraulic fluid from the reservoir under the high pressures which are generated in the system.

The tube 46 telescopes over a rod 50 which is secured to the center of the head 32 of the reservoir by a suitable fastening such as welding, bolts or the like. The rod 50 does not have a tight fit with bore 52 of the tube 46 but has a slight clearance space 51 therearound of one-twelfth to one-sixteenth inch to meter the flow of fluid under high restriction from the bore 52 to the reservoir 30. The rod 50 also is provided with one or more slots 54 extending from its head end 56 substantially to the head 32 to increase the fluid flow capacity but not so much as to reduce the restricting effect. These slots are approximately one-eighth inch square, and the number of them used will determine the metering effect of the outflow of fluid from the tube 46 to the interior of the reservoir 30. The cylinder tube 46 is provided with ports 58 having substantially free flow characteristics which communicate each of the slots 54 and the space 51 with the interior of the reservoir. As shown in FIG. 3 the ports 58 are formed near the end of the tube which projects into the reservoir 30. It should be appreciated that the greater the distance the rod 50 is moved into the tube bore 52 the greater will be the restriction to the flow of fluid and thus there is an increase in the impact absorbing characteristics of the apparatus.

Enclosed within the reservoir 30 is a Belleville spring assembly 60 which acts with substantial force (6000 pounds, for example) between the inner face of the reservoir head 32 and end 62 of the cylinder tube 46 which projects into the reservoir. The Belleville spring assembly comprises a plurality of alternately facing dished spring annuli 64 made of spring steel which may be a quarter to five-sixteenths inch thick. The annuli are provided with central openings 70 to accommodate the rod 50. The annuli 64 are alternately arranged as shown in FIG. 3 so that their outer edges 66 contact as do the edges at the openings 70. As seen most clearly in FIG. 4, the annuli 64 are provided on their inner faces at their outer edges 66 with fluid metering slits 68 so that upon collapsing of the Belleville spring assembly fluid enclosed between the inner faces of the annuli 64 is expelled therefrom toward the inner face of the reservoir barrel 40. These slits 68 have flow restricting characteristics to increase the resistance and add to the absorption of the impact. If desired, the annuli adjacent their central openings 70 on their exterior faces may have similar flow restricting slits 72 for similar purposes. These slits also facilitate the proper distribution of the hydraulic fluid upon the restoration of the impact absorbing device 10 to normal position.

As the cylinder forming tube 46 is telescoped over the rod 50 upon impact, fluid is expelled from the bore 52 thereof into the reservoir 30 thereby tending to overfill it. In order to accommodate this ingress of fluid, the reservoir contains an air filled collapsible hollow ring 74 encircling but spaced from the tube 46 adjacent the bore 48. The ring 74 is preferably made of neoprene, oil resistant rubber or similar material, and it is collapsed or at least partially so by the pressure of the fluid in the reservoir 30 during impact absorption.

The system is charged with hydraulic fluid through appropriate charging fitting 76 in the reservoir head 32.

When the impact absorbing apparatus 10 is properly installed, the heads 32 and 34 at both ends thereof are abutted against the sliding center sill lugs 36 and the underframe force transmitting stops 38. When an impact is received from either end, the center sill 12 slides in the underframe center sill 14 pushing the contacted head at that end of the car from which the impact is received toward the opposite head thereby collapsing the impact absorbing apparatus 10. At the same time the moved head 32 or 34 moves away from the force transmitting member

38 and at the opposite end of the apparatus the center sill lugs 36 move away from the opposite head. During collapse of the apparatus the cylinder forming tube 46 slides into the reservoir 30 through the bore 48 and is telescoped over the rod 50. Fluid within the bore 52 of the tube is expelled therefrom through the retrictive passage 51 and the slots 54 and through the ports 58 into the interior of the reservoir, and the ring 74 is collapsed to the extent necessary.

The end of the tube 62 which is in contact with the rightmost annulus 64 of the Belleville spring assembly 60 pushes against the entire assembly, collapsing the assembly so that the fluid is expelled between the individual pairs of annuli 64 to the space therearound which measures a quarter of an inch or less from the inner wall of the reservoir barrel 40. The fluid is expelled from between facing annuli 64 of each pair through the flow restricting slits 68 at their outer edges 66 into the annular space around the assembly 60. These slits are of such character as to restrict the fluid flow thus increasing the absorbing characteristics of the assembly. When fully collapsed the Belleville spring assembly will have permitted the heads 32 and 34 to move relatively toward each other a distance of not more than twenty inches. This collapse will be against the force exerted by the Belleville spring assembly and the resistance to fluid flow by the restricting characteristics of the space 51 and slots 54 and of the slits 68 and 72. When the impact has been completely absorbed, the Belleville spring assembly expands to restore the heads to their normal position. In expanding, the spring assembly 60 draws in oil through the slits 68 and 72 and the openings 70 in the annuli 64, and fluid is expelled from the reservoir through the ports 58, the slots 54 and the annular space 51 to the bore 52.

From the foregoing description it will be apparent that the objectives claimed for this invention at the outset of this specification are fully attained.

While a preferred embodiment of the invention has been shown and described, it will be apparent that numerous modifications and variations thereof may be made therein without departing from the underlying principles of the invention. It is therefore desired, by the following claims, to include within the scope of the invention all such variations and modifications by which substantially the results of the invention may be obtained through the use of substantially the same or equivalent means.

What is claimed as new and desired to be secured by United States Letters Patent is:

1. In an impact absorbing appartus for interposition between the draft gear and the lading in a railway car of the type having a buff and draft center sill and a lading supporting frame mounted for movement relative to each other, the apparatus having a pair of heads normally abutted against lugs carried on the center sill and force transmitting stops carried on the lading supporting frame, the improvement comprising, a fluid reservoir mounting one of the heads, a cylinder forming tube mounting the other of the heads, said reservoir having an opening through which said tube projects into said reservoir, a rod secured to the first of the heads, extending through said reservoir, and movably projecting into said tube, said rod having at least one slot along its length from the end projecting into said tube substantially to the first head, a port in said tube communicating said slot with the interior of said reservoir, a Belleville spring assembly in said reservoir acting between the first head and the end of said tube projecting into said reservoir to urge the heads toward normal position, said Belleville spring assembly providing restrictive fluid flow metering means at the contacting edges of the elements thereof, and a compressible space compensating hollow ring in said reservoir.

2. In an impact absorbing apparatus for interposition between the draft gear and the lading in a railway car of the type having a buff and draft center sill and a lading supporting frame mounted for movement relative to

each other, the apparatus having a pair of heads normally abutted against lugs carried on the center sill and force transmitting stops carried on the lading supporting frame, the improvement comprising, a fluid reservoir mounting one of the heads, a cylinder forming tube mounting the other of the heads, said reservoir having an opening opposite the first head through which said tube projects into said reservoir, a rod secured to the first of the heads, extending through said reservoir, and movably projecting into said tube, said rod and said tube defining a fluid flow restricting passage connecting the bore of said tube with the interior of said reservoir, a Belleville spring assembly in said reservoir acting between the first head and the end of said tube projecting into said reservoir to urge said heads toward normal position, said spring assembly comprising a plurality of alternately faced dished spring annuli having fluid flow metering slits in their contacting edges, and a compressible space compensating hollow ring in said reservoir.

3. In an impact absorbing apparatus for interposition between the draft gear and the lading in a railway car of the type having a buff and draft center sill and a lading supporting frame mounted for movement relative to each other, the apparatus having a pair of heads normally abutted against lugs carried on the center sill and force transmitting stops carried on the lading supporting frame, the improvement comprising, a fluid reservoir mounting one of the heads, a cylinder forming tube mounting the other of the heads, said reservoir having a tubular guide projecting therefrom opposite the first of the heads so that said tube may be slidably received therethrough to project into said reservoir, a rod secured to the first of the

heads, extending through said reservoir, and movably projecting into said tube with a fluid flow restricting space therebetween, said rod having at least one slot along its length from the end projecting into said tube substantially to the first head, a port in said tube communicating said space and said slot with the interior of said reservoir, a Belleville spring assembly in said reservoir acting between the first head and the end of said tube projecting into said reservoir to urge the heads toward normal position, said spring assembly comprising a plurality of alternately faced dished spring annuli having fluid flow metering slits in their contacting edges, and a hollow ring in said reservoir encircling in spaced relationship said tube and compressible to compensate for displacement of fluid into said reservoir as said apparatus is collapsed upon impact.

References Cited by the Examiner

UNITED STATES PATENTS

2,905,458	9/1959	Mason	188—100
2,914,195	11/1959	Pawling	213—43
3,033,384	5/1962	Zanow et al.	213—43
3,070,363	12/1962	Ellis	188—100 X
3,111,201	11/1963	Bliven et al.	188—88
3,164,262	1/1965	Price et al.	213—8
3,175,699	3/1965	Price et al.	213—43
3,176,856	4/1965	Smith	213—43

ARTHUR L. LA POINT, *Primary Examiner.*

DRAYTON E. HOFFMAN, *Examiner.*