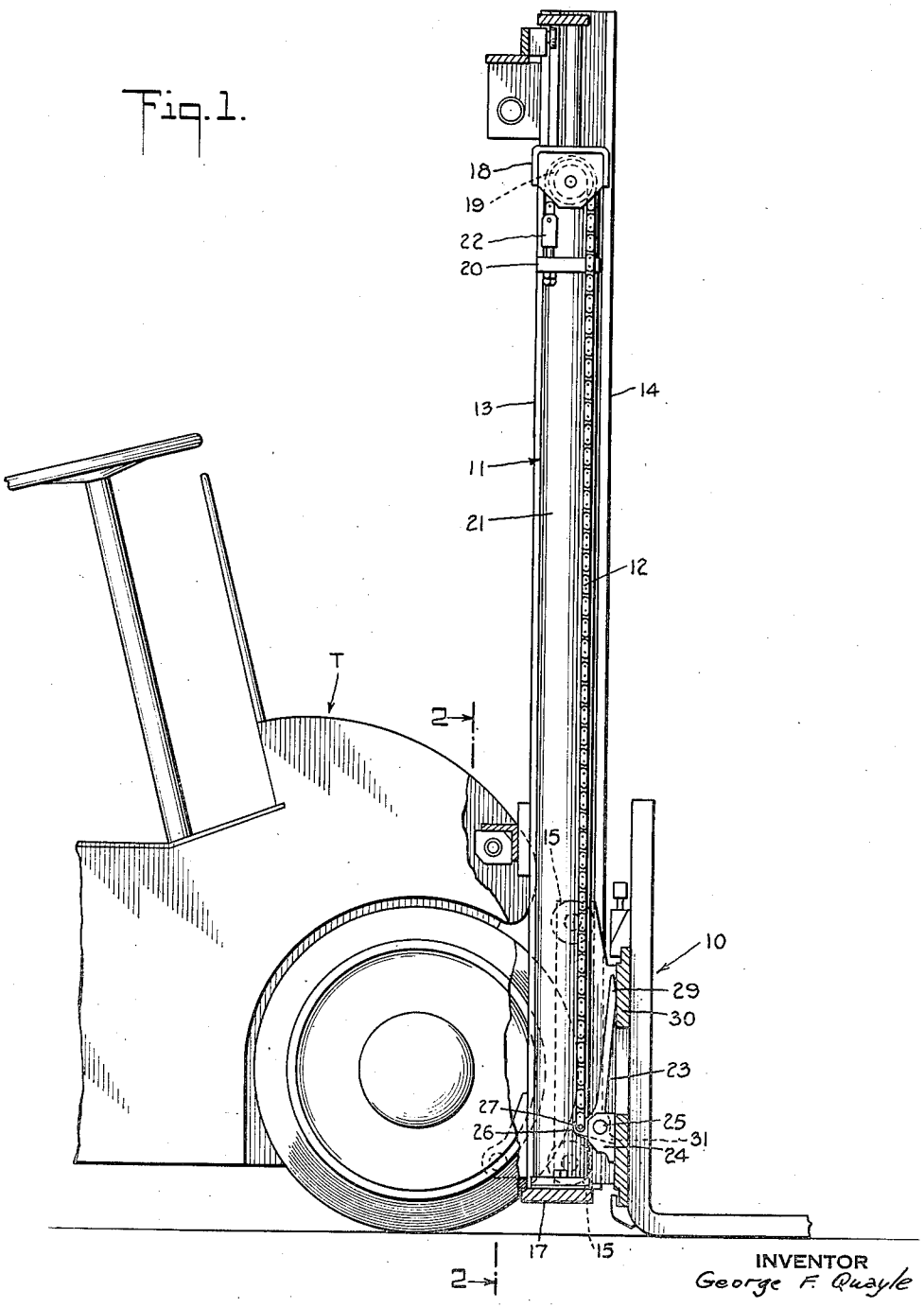
April 2, 1957 G. F. QUAYLE 2,787,338

CHAIN SECURING MEANS FOR A LIFT TRUCK

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Fig. 1.



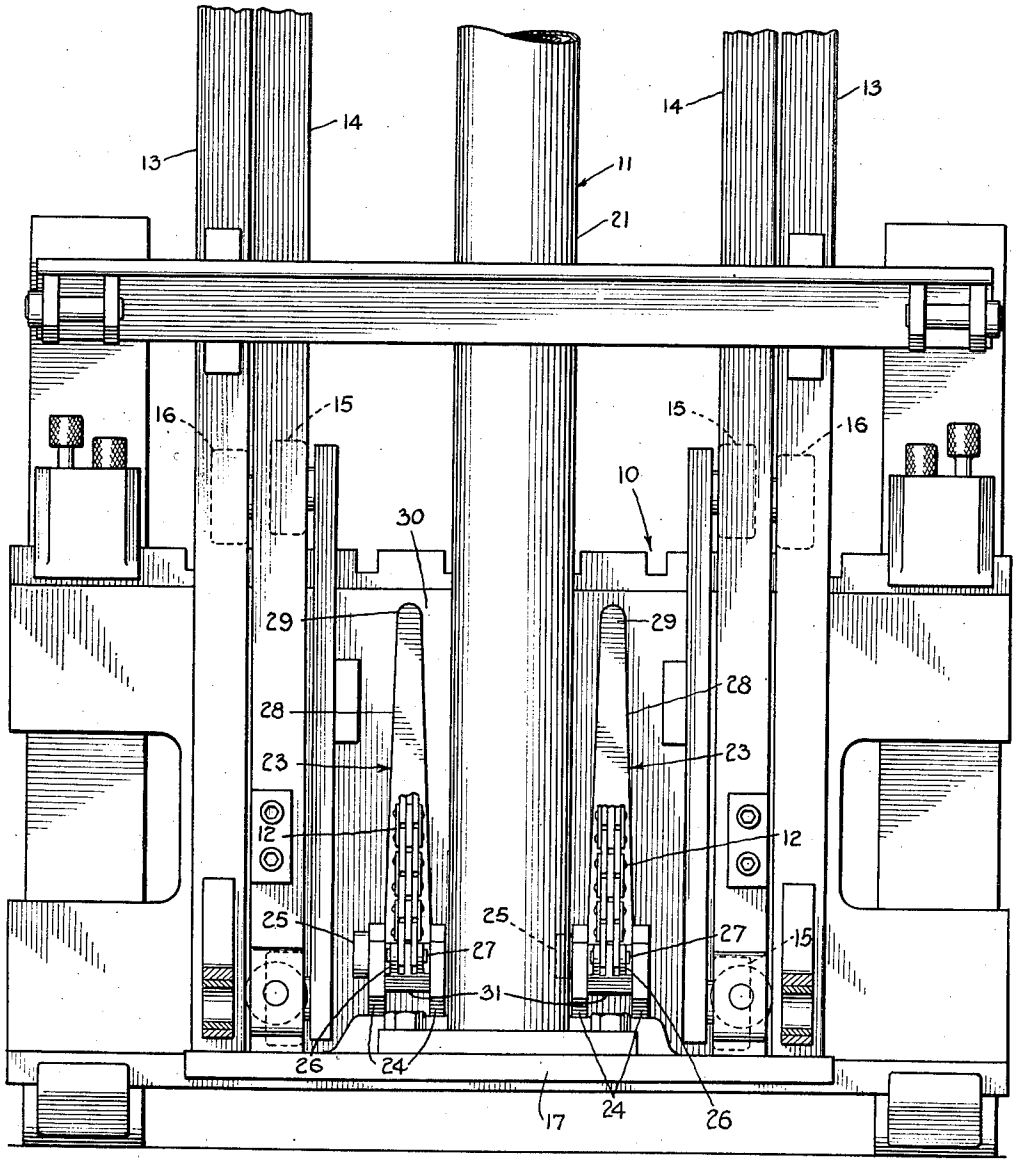
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CHAIN SECURING MEANS FOR A LIFT TRUCK

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Fig. 2.



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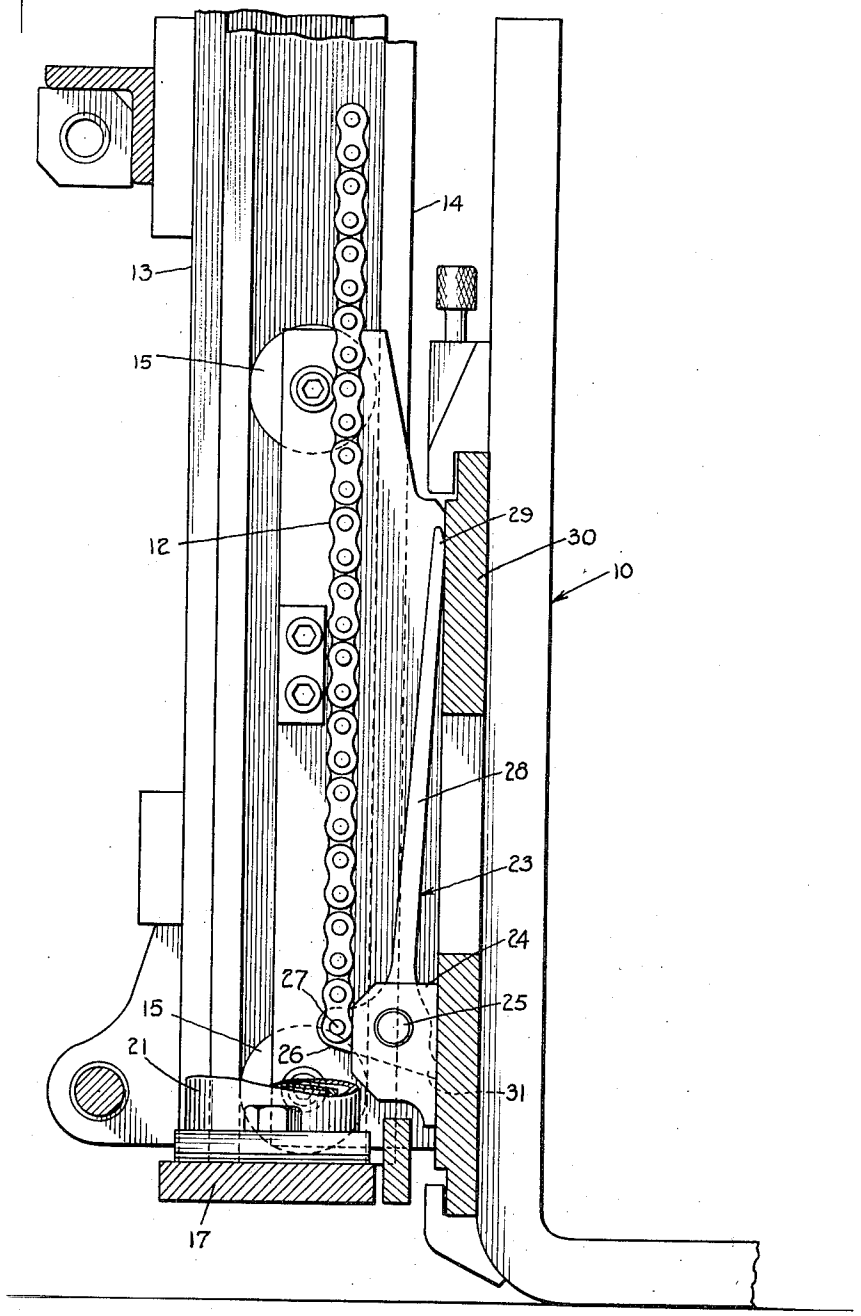
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CHAIN SECURING MEANS FOR A LIFT TRUCK

Filed Sept. 1, 1953

3 Sheets-Sheet 3

Fig. 3.



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2,787,338

CHAIN SECURING MEANS FOR A LIFT TRUCK

George F. Quayle, Philadelphia, Pa., assignor to The Yale & Towne Manufacturing Company, Stamford, Conn., a corporation of Connecticut

Application September 1, 1953, Serial No. 377,886

7 Claims. (Cl. 187—9)

This invention relates to industrial lift trucks of that class in which a lifting mechanism exerts a pull through flexible members or chains to lift a load carriage. More particularly, my invention relates to novel means whereby I secure the flexible members in a truck of this class relatively to the load carriage.

Those skilled in the art will understand that the flexible members and lifting mechanism in this type of truck are sometimes subjected to unusual strains incidental to the operation of the load carriage. Thus, the carriage may be subjected to a vertical impact, and in the prior art, this impact is transmitted to the flexible members and through these members to the lifting mechanism. Particularly when the lifting mechanism is a hydraulic ram, a sudden closing of the valve that controls the ram fluid during descent of the carriage will cause a shock to be transmitted between the carriage and ram through the flexible members. This shock is detrimental to parts of the truck, and is extremely severe when a heavy load is on the carriage.

Further, one flexible member or chain may accept a greater part of the load than another to cause unequal stresses in the flexible members and lifting mechanism. As one instance in which this occurs in the prior art, the flexible members may be of slightly different lengths as a result of wear, so that the longest member fails to take its full share of the load. Also, the load carriage in some trucks may tend to apply a greater part of the load to one flexible member through a tendency of the carriage to cock in a transverse direction when supporting a load that is not symmetrical relatively to the carriage.

The unequal loading of the flexible members and the shocks transmitted through these members have presented a considerable problem to the industry, and numerous solutions have been suggested. I believe the extremely novel means of my invention herein to be disclosed forms a considerable contribution to the art.

As an important feature of my invention, I apply the pull of the flexible members to the load carriage of the truck through yielding stops on the carriage. By yielding of these stops, the pull applied to the carriage through the flexible members is distributed between these members, and thereby the flexible members do not transmit unequal stresses to the lifting mechanism. Moreover, the stops absorb shocks when the carriage or flexible members are subjected to sudden impact.

I am aware that coil springs have been proposed for cushioning the lifting action of chains or cables relatively to a load member. However, it is not feasible to utilize coil springs for this purpose in a lift truck, because these springs by yielding will effect an objectionable amount of lost motion betweeen the load carriage and flexible members. This is due to the characteristic yielding of a coil spring with a movement that is substantially proportional to the load applied to the spring. In addition, the heavy loads handled would require springs of tremendous size.

It is a particular feature of my invention that the yielding stops allow relatively little lost motion between the load carriage and flexible members, while enabling the flexible members to accept heavy loads on the carriage with relatively little shock. I form each stop as an attachment member, and this attachment member secures one of the flexible members for movement relatively to the carriage. On the attachment member is yielding means opposing movement of the flexible member, with the yielding means so formed that by yielding it enables the attachment member to accept, at a gradually increasing rate, forces that are applied between the carriage and flexible member.

As a further feature of my invention, I utilize in the yielding attachment members a novel construction that is compact in a lateral sense. Those skilled in the art will understand that a coil spring, because of the size of spring that would be necessary to function under the extremely heavy load handled by a lift truck, can not be readily mounted in the limited space at the back of the load carriage. In addition, a coil spring requires mounting means to make possible its functioning. My novel yielding attachment members, because of their compact construction, are very well adapted for mounting in the limited space provided, and eliminate all need for particular mounting means to obtain spring action.

As a more detailed feature of my invention, I mount each attachment member on the carriage merely through a pivot, with an elongated yielding portion formed integrally on the member and contacting a part of the carriage at a considerable distance from the pivot, to oppose movement of the member on the pivot.

I have thus outlined rather broadly the more important features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention. It is important, therefore, that the claims be regarded as including such equivalent constructions as do not depart from the spirit and scope of my invention, in order to prevent the appropriation of my invention by those skilled in the art.

Referring now to the drawings:

Fig. 1 is a side view showing my novel flexible chain securing means embodied in a lift truck.

Fig. 2 is a view taken on the line **2—2** in Fig. 1.

Fig. 3 is a detail view similar to a part of Fig. 1.

To illustrate my invention, I show in the drawings a lift truck T having a load carriage **10**, and a hydraulic ram **11** acting through a pair of chains **12** to lift the carriage **10**. Actually, the load carriage **10** is mounted for vertical movement on the truck T through primary uprights **13** and secondary uprights **14**, with rollers **15** guiding the carriage **10** relatively to the secondary uprights **14**, and rollers **16** guiding these uprights relatively to the primary uprights **13**. The details of the mounting for the carriage **10** are not important to an understanding of my invention, however, and it is merely necessary to know that the load carriage is guided relatively to the truck for lifting movement.

The hydraulic lifting ram **11** is mounted relatively to the primary uprights **13** through a lower cross member **17** on these uprights, and the ram has a cross head **18** adapted to be extended upwardly by fluid pressure in the ram. At opposed sides of the ram **11**, the cross head **18** carries a pair of wheels **19** over which the lifting

chains 12 are reeved. The chains 12 are fixed at one end to a bracket 20 on the ram cylinder 21 through adjustable anchors 22, so that in effect the chains 12 are anchored to the primary uprights 13. The chains 12 extend downwardly from the wheels 19 to opposed sides of the load carriage 10, and the crosshead 18 when extended by the ram 11 exerts a pull through the chains 12 to lift the carriage 10.

In essence, the construction I have thus far described is conventional. I shall now describe the exceedingly novel means whereby I secure the lifting chains to the load carriage.

At the lower end of each lifting chain 12, I provide a novel attachment member, indicated generally by the numeral 23 and best seen in Figs. 2 and 3. The attachment members 23 are pivoted to the load carriage 10, and I show for this purpose a transverse pivot pin 25 mounting each member 23 on the carriage through a pair of brackets 24. An arm portion 26 on each member 23 extends rearwardly from the pivot pin 25, and the chain 12 is attached to this arm portion 26 through a pin 27. The pull of the lifting chains 12, therefore, tends to rotate the attachment members 23 on their pivots 25.

I form integrally on each member 23 an elongated yielding portion or arm 28 extending upwardly away from the pivot 25. The upper end 29 of the arm 28 is in contact with the rear face of a part 30 on the load carriage 10 at a point a considerable distance from the pivot 25. The yielding arm 28 thereby opposes rotation of the attachment member 23 on its pivot 25, but the member 23 nevertheless can rotate through yielding of the arm 28 in response to the pull of its chain 12, with the chain and carriage 10 then moving vertically relatively to one another.

The arm portions 26 on the members 23 are quite short relatively to the yielding arms 28, and thereby the members 23 occupy but little space upon the truck. In this arrangement, furthermore, the movement of the arm portions 26 contributes very little lost motion between the carriage 10 and chains 12 despite a considerable yielding movement of the arms 28. Through the action of these arms 28 when a pull is exerted through the chains 12, I apply the pull of the chains to the carriage 10 at a gradually increasing rate. Stated in other words, the yielding arms 28 oppose movement of the chains 12 relatively to the carriage 10 with a resistance that increases at a higher rate as the load is applied to the attachment members.

The particular yielding action of the arms 28 is extremely effective to enable the attachment members 23 to absorb vertical shocks between the load carriage 10 and the chains 12, and I thereby protect the lifting ram 11 against shocks incidental to the operation of the carriage. Some tendency for the carriage 10 to bounce may occur when the shock is very severe, and to hold the attachment members 23 with their arms 28 against the part 30 when this bouncing action occurs, I form on the members 23 lugs 31 adapted to contact a lower portion of the carriage.

Because the attachment members 23 secure the lifting chains 12 separately to the load carriage 10, the carriage can, of course, move independently relatively to each chain. Therefore, in those circumstances in which one chain tends to accept more than its share of the load, the attachment member for this chain will yield to reduce somewhat the load on the chain, thereby increasing the load on the other chain by a corresponding amount. By distributing the load between the lifting chains 12 in this way, I eliminate strains tending to occur in the lifting mechanism when chains are not exactly the same length, or when the carriage 10 has a tendency to cock in a transverse direction.

I believe that the operation and advantages of my novel flexible chain securing means will now be clearly understood, and that the very considerable value of my invention will be fully appreciated by those skilled in the art.

I now claim:

1. In a lift truck of the class described, a load member mounted for vertical movement on the truck, a flexible lifting member for said load member, means exerting a pull through said flexible lifting member to lift the load member, an attachment member pivoted to the load member, means attaching one end of the flexible lifting member in a position relatively to the pivot of said attachment member whereby pull on said flexible lifting member tends to rotate said attachment member on its pivot, an integral yielding portion of said attachment member opposing the pivotal movement thereof relatively to the load member, and said portion being formed to yield upon the application of stress to said attachment member by said flexible lifting member.

2. In a lift truck of the class described, a load member mounted for movement on the truck, a lifting means, a pair of flexible lifting members through which the lifting means exerts a pull at each side of the load member to lift the load member, attachment members pivoted to the load member, means securing each flexible lifting member to an attachment member at a point adjacent its pivotal mounting for moving said attachment member relatively to the load member in response to the pull of said flexible member, a yielding portion integral with each attachment member so related to the pivotal mounting of said attachment member as to contact a part on the load member to oppose the movement of each attachment member relatively to the load member.

3. In a lift truck of the class described, a load member mounted for vertical movement on the truck, a flexible lifting member for said load member, means exerting a pull through said flexible lifting member to lift the load member, an attachment member, means mounting said attachment member on the load member for movement relatively thereto, means attaching one end of the flexible lifting member to said attachment member whereby pull on said flexible lifting member tends to move said attachment member on its mounting means, an integral portion of said attachment member opposing said movement thereof relatively to the load member, and said portion being formed to yield upon the application of stress to said attachment member by said flexible lifting member.

4. In a lift truck of the class described, a load member mounted for movement on the truck, a lifting means, a pair of flexible lifting members through which the lifting means exerts a pull at each side of the load member to lift the load member, a pair of attachment members, means mounting each attachment member on the load member for movement relatively thereto, means securing each flexible lifting member to an attachment member for moving said attachment member relatively to the load member in response to the pull of said flexible member, a yielding portion integral with each attachment member opposing said movement of the attachment member on its mounting relatively to the load member, and each yielding portion formed to accept at a gradually increasing rate the forces applied thereto through the attachment member.

5. In a lift truck of the class described, a load member mounted for movement on the truck, a lifting means, a pair of flexible lifting members through which the lifting means exerts a pull at each side of the load member to lift the load member, said flexible lifting members when unequally loaded tending to effect unequal stresses in said lifting means, an attachment member through which each flexible lifting member is attached to the load member, means mounting each attachment member on the load member for movement relatively to the load member in response to the pull of its flexible member, a yielding portion integral with each attachment member contacting a part on the load member to oppose said movement of each attachment member relatively to the load member,

and said attachment members acting through yielding of their yielding portions to distribute between the flexible lifting members the load applied to said lifting members.

6. In a lift truck of the class described, a pair of uprights, a load carriage mounted for vertical movement on said uprights, a pair of flexible lifting members for said carriage with one flexible lifting member secured to each side of the carriage, a hydraulic ram exerting a pull through said flexible lifting members to lift the carriage on the uprights, an attachment member to which each lifting member is attached, means mounting each attachment member on the load carriage for movement relatively to the carriage in response to the pull of its flexible lifting member, a yielding portion integral with each attachment member contacting a part on the load carriage to oppose said movement of each attachment member relatively to the carriage, and said attachment members moving slightly through the yielding of said yielding portions when the flexible lifting members are stressed in lifting the load carriage.

7. In a lift truck of the class described, a load member mounted for movement on the truck, a lifting means, a

pair of flexible lifting members through which the lifting means exert a pull at each side of the load member to lift the load member, a pair of attachment members each in the form substantially of a lever having a thin yielding integral end portion, means securing one end of each flexible member to one of said attachment members, and means pivoting each attachment member near one end thereof on the load member for pivotal movement relatively to the load member in response to the pull of its flexible member and with its integral yielding portion contacting a part on the load member to oppose said pivotal movement of each attachment member relatively to the load member.

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