Jan. 6, 1959 F. L. DAVIS 2,867,406

HEAVY DUTY CARGO TIE-DOWN

Filed March 14, 1955 3 Sheets-Sheet 1

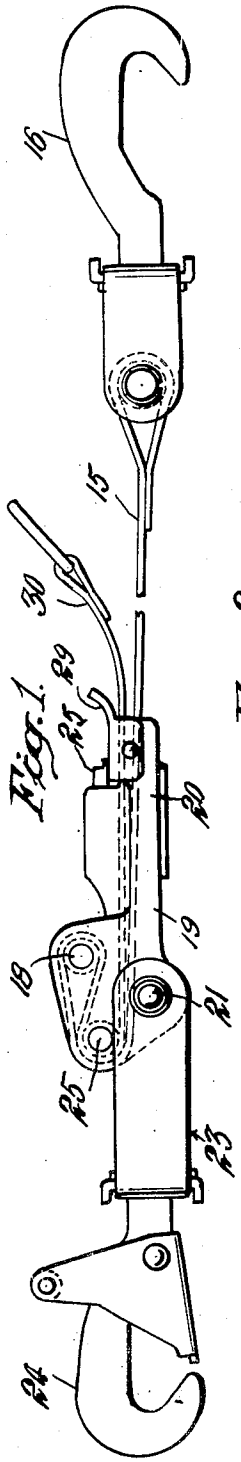



Fig. 1.

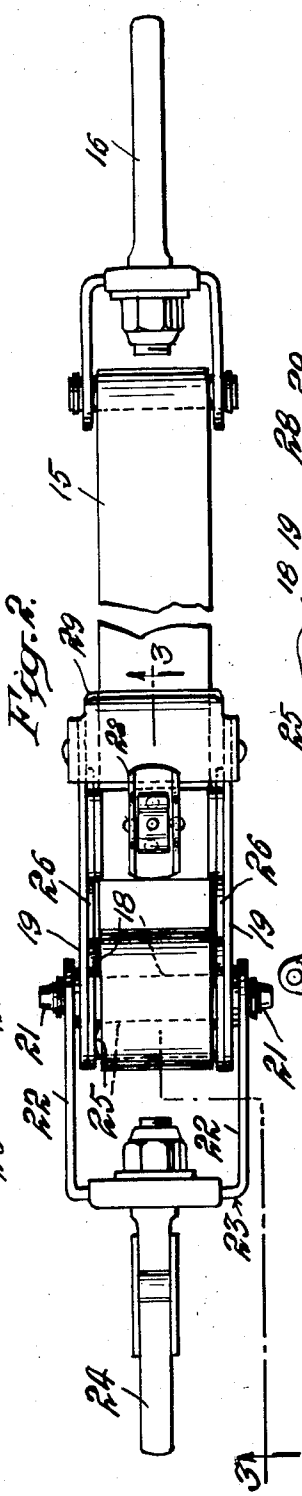



Fig. 2.

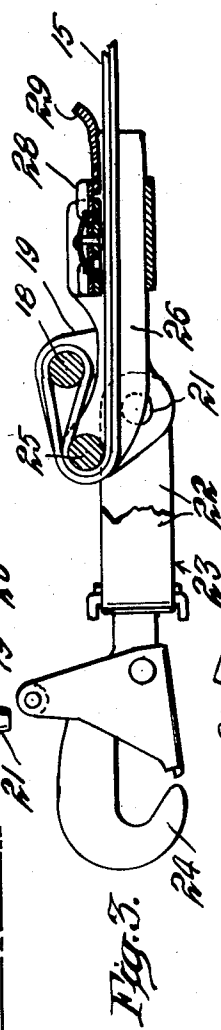



Fig. 3.

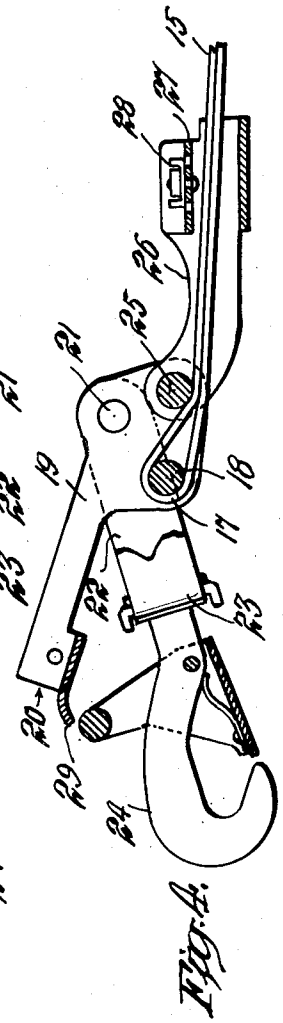



Fig. 4.

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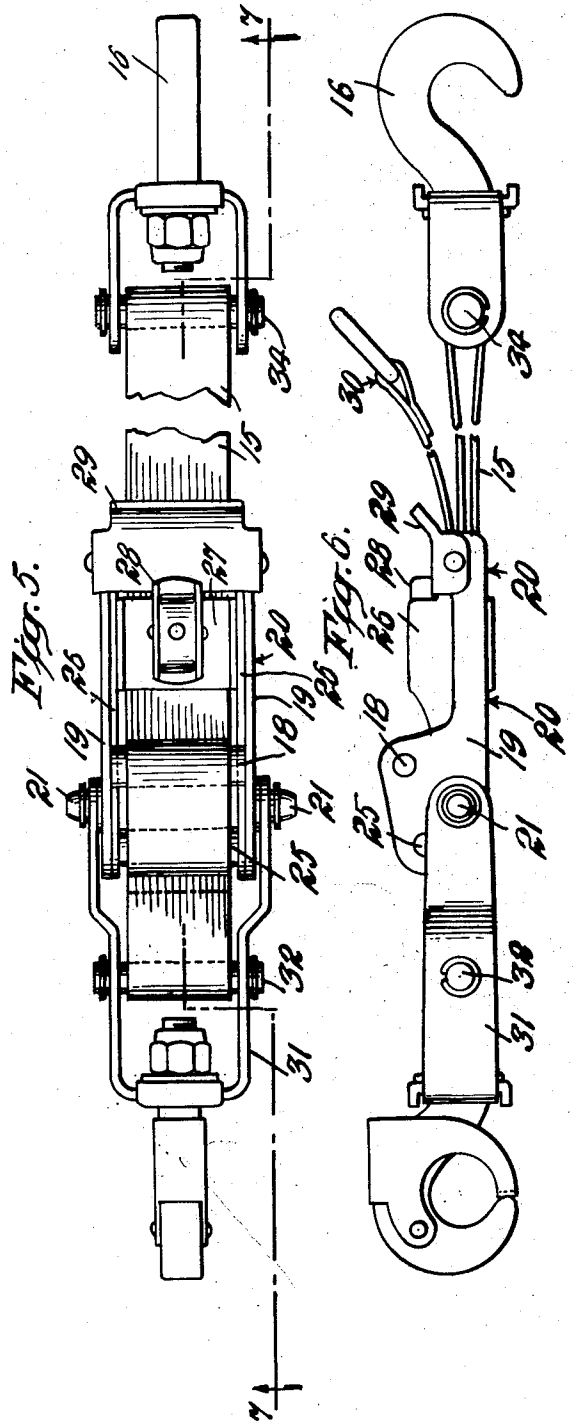


Fig. 5.



Fig. 6.

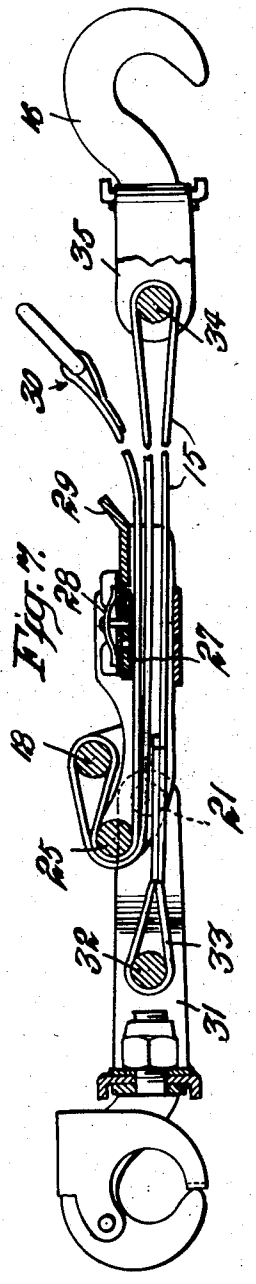


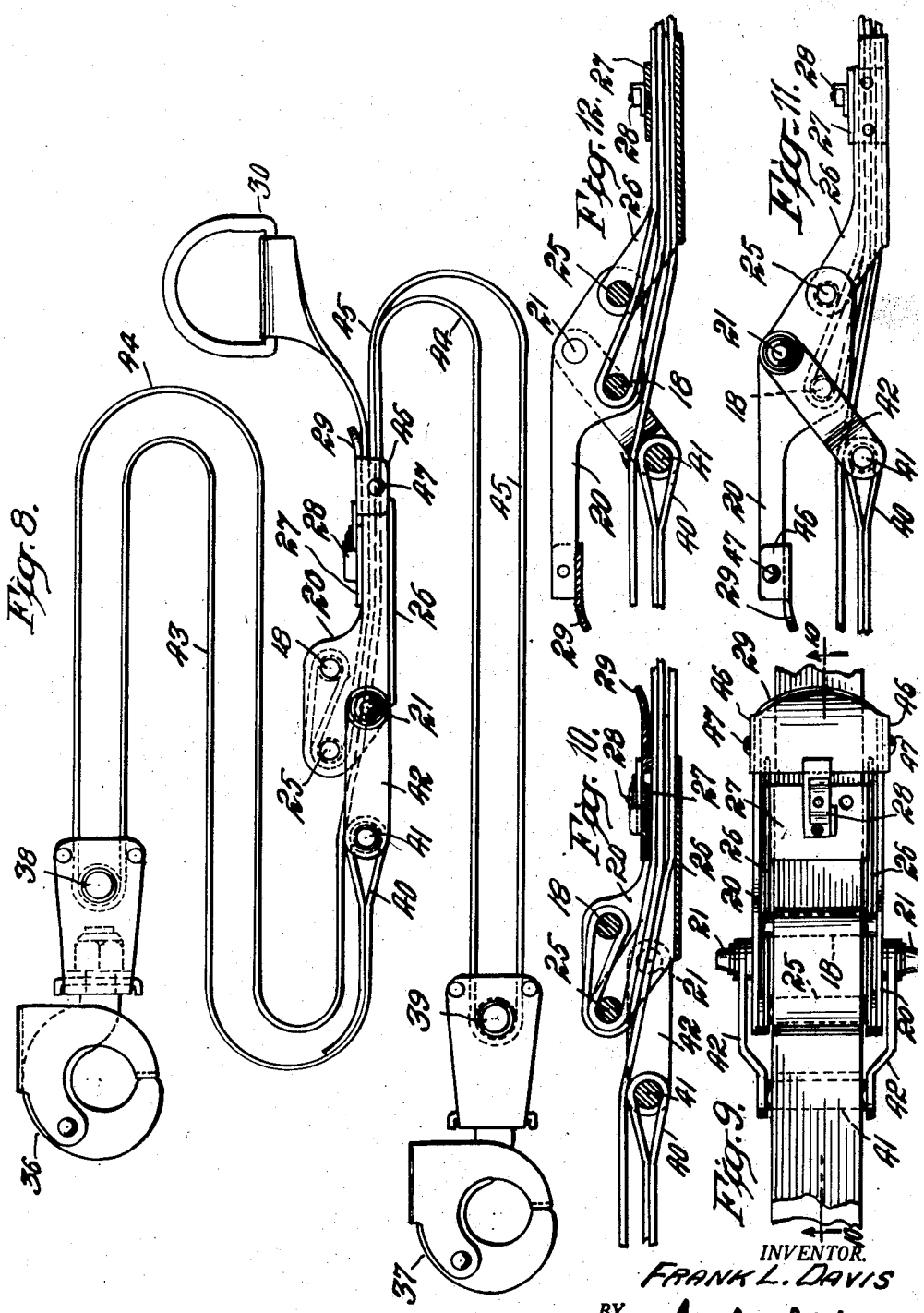
Fig. 7.

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HEAVY DUTY CARGO TIE-DOWN

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2,867,406

# HEAVY DUTY CARGO TIE-DOWN

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8 Claims. (Cl. 248—361)

The invention herein disclosed relates to tie-down equipment, and important objects of the invention are to provide satisfactory tie-down for heavy cargo.

Particularly it is a purpose of the invention to provide strong and durable but lightweight construction which can be readily applied, freely and easily adjusted to engage the load and take up slack and then with slight effort, be tensioned and preloaded in firm, secure holding condition.

Special objects of the invention are to provide simple construction consisting of but few parts and which can be readily assembled and in some instances, be modified to suit different requirements, particularly in respect to desirable power multiplying effects.

Other desirable objects and the novel features through which the purposes of the invention are attained are set forth and will appear in the course of the following specification.

The drawings accompanying and forming part of the specification illustrate several possible embodiments of the invention, but it will appear that structure may be further modified and changed, all within the true intent and broad scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawings is a broken side elevation of one of the tie-downs in closed, tensioned, holding relation;

Fig. 2 is a broken plan view of the same showing in particular the rotary turn-button form of lock for the tensioning lever;

Figs. 3 and 4 are broken sectional views on substantially the plane of line 3—3 of Fig. 2, showing the tensioning lever first in closed, locked relation and then in the unlocked, fully open position;

Fig. 5 is a broken plan view illustrating a modification in which the strap is doubled to operate with power amplifying pulley effect;

Figs. 6 and 7 are broken side elevation and broken longitudinal sectional views of the same, the latter taken on substantially the plane of line 7—7 of Fig. 5;

Fig. 8 is a side elevation illustrating another modification with power further amplified by double pulley effect;

Fig. 9 is a broken plan view of the buckle construction shown in Fig. 8;

Fig. 10 is a broken longitudinal sectional view on substantially the plane of line 10—10 of Fig. 9;

Fig. 11 is an enlarged broken side elevation of the same with the tensioning lever in open position;

Fig. 12 is a broken sectional view of the parts in this same relation.

In the first embodiment of the invention illustrated in Figs. 1 to 4, the strap which may be of webbing, is designated 15 and is shown equipped with a swivel hook 16 for engagement with a stationary anchorage such as an eyebolt, beam, stanchion or the like.

This strap is extended in a loop 17 about a pin 18 carried by the parallel side portions 19 of a yoke-shaped lever 20 pivoted at 21 between the parallel sides 22 of a terminal yoke 23, the latter equipped with swivel hook 24 for engagement with an opposite anchorage or support.



The pin 18 carrying the loop of strap is offset from the pivotal support 21 of the lever and said lever further carries a second pin 25 offset in generally triangular relation from the other pin 18 and the pivot center 21, as indicated in Fig. 4.

Pivotally supported on the cross-pin 25 is a retainer shown as having parallel side portions 26 pivotally engaged on pin 25 and carrying at the free end a loop or box 27 through which the two runs of the looped strap are guided.

This strap guide 27 is shown as carrying on the top of it a turn-button 28 which, when the lever is lowered over the same as in Figs. 1, 2 and 3, may be rotated to engage over the handle portion 29 at the end of the lever.

Fig. 4 shows the lever released from the retainer and swung upwardly to substantially fully open condition, releasing the loop of strap 17 to ride freely over the innermost cross-pin 18. In this relation the strap may be freely adjusted in both directions to take up or to let out slack. Then, as it is swung right-handedly in Fig. 4, the second or outer cross-pin 25 will be brought to bear against the upper layer to snub and hold the strap the more firmly as the lever travels about center 21 to the final position shown in Fig. 3. There the second or outer pin 25 will have passed over the dead-center position in respect to pivot 21 and automatically lock as a toggle. As a precautionary measure the lever may then be locked in place by turn-button 28, thus to fully secure the strap in pretensioned, preloaded condition.

The free or takeup end of the strap is shown as equipped with a suitable pull handle 30.

The advantage of block and tackle for exerting greater power may be obtained by elongating the terminal hook yoke or shackle 23 of Fig. 1, as shown in Fig. 7, as a longer shackle 31 and by providing it with a cross-pin 32 and attaching the end of the strap to this cross-pin, as indicated at 33, the strap being extended around pin 34 of the other hook shackle 35 as a pulley and thence being looped about cross-pins 18 and 25 on the tensioning lever, as before.

With this construction the strap will operate about the cross-pin 34 of hook 16 with leverage multiplying pulley effect.

When the lever is in open position like that shown in Fig. 4, the strap may be easily shifted back and forth to release it or to tighten it over the load, and the pulley action disclosed in Fig. 7 enables one person to apply sufficient power to fully grip and hold any ordinary load.

This block and tackle and leverage advantage reacts to hold the load all the more securely when the lever is operated as a toggle to tighten and secure the strap.

Figs. 8 to 12 show how the pulley effect and leverage advantage may be doubled by running the strap over pulley rolls or pins at both tie-down ends of the strap. This adjustment assembly may be shifted in either direction in the intermediate portion of strap between the end hooks to locate it at the most advantageous position for use.

In this instance the strap is run over pulley rolls or pins at both terminal hook ends and the takeup and tensioning device is suspended on the doubled strap between the terminal ends.

To accomplish this the opposed terminal hooks or fastenings 36, 37 are equipped with pulley rolls or pins 38, 39 and the end of the strap at 40 is caught to a cross-pin 41 on the yoke 42 which carries the fulcrum 21 for the toggle lever 20, the strap being extended continuously from such end fastening in one run 43 about the pulley roll 38 of one hook and thence in a return run 44 to and about the pulley roll 39 of the other hook, from whence

it returns in a run 45 about the outer and inner pins 25, 18 of the lever.

Figs. 11 and 12 show how, with the lever opened up, the strap may be freely pulled back and forth to adjust it and preliminarily tighten it to the load, and Figs. 9 and 10 show how, with the lever swung over and closed down on the retainer, the strap will be tightened under the toggle action of the lever and then be firmly secured in that relation.

The construction in all cases is relatively simple, consisting of but few durable parts which are light in weight and amply strong.

The device can be quickly applied to and adjusted to any load and then after first tensioning, be fully tightened and locked down on the load. If slack develops, as by shifting load, this may be taken up at any time by pull on the free end at 30 without unlocking or releasing the gear, a particularly important feature under rough weather conditions.

If desirous, one or more riders may be applied to the intermediate length of strap.

While rigid cross-pins may be provided at 18, 25, on the toggle lever, it is contemplated that these or the other cross-pins may be equipped with rolls, or that in place of pulley rolls such as at 38, 39, Fig. 8, regular fixed cross-pins may be employed, these and other possible changes being matters of choice and requirements under given circumstances.

The handle portion 29 of the toggle lever is illustrated as having side flanges 46 carrying finger buttons or knobs 47 to facilitate easy handling.

The construction is small in size for results accomplished and may be produced from available materials at reasonably low cost.

In the use of the invention either one of the end hooks may be attached to an anchorage and then with the toggle lever open, the strap be lengthened or shortened to connect the other hook. Then, after a preliminary tensioning and tightening of the strap over the load, the toggle lever may be swung over and closed down to take up any final bit of slack and firmly grip the strap over the load. If at any subsequent time any slack results, this may be taken up as required without unlocking the unit or releasing the load.

In the double pulley form of the invention, Fig. 8, after connection of the end hooks with anchorages the strap may be manipulated to shift the takeup unit back and forth toward one or the other of the end hooks, or be left in the intermediate length of the strap, according to best advantages as to accessibility, ease of operation or matters of available space and the like.

The invention is readily made up in the several forms such as illustrated, suited to heavy duty hold-down purposes and in different power ratios, according to demand, enabling a load to be properly secured and tied down by one man. The retainer for securing the toggle lever, while free to accommodate itself to the direction of pull on the strap, is directly pivoted to the lever and so always retains proper relation for locking the lever in the strap securing position.

While fabric web or webbing may generally be preferred, it is contemplated that flat wire cable or other forms of tie-down strap may be employed. The toggle or takeup lever may be combined, as shown, with one of the end swivel hooks or be mounted as a separate unit on the intermediate stretch of web between the two end hooks, and by use of a different number of sheaves or pulleys and correspondingly different reeving the power available for hold-down and takeup purposes may be varied as required.

What is claimed is:

1. Takeup and tensioning device for cargo holding strap, comprising a fulcrum carrying fitting having parallel spaced sides, a toggle lever having spaced sides fulcrumed to said spaced sides of the fulcrum carrying fitting, inner and outer cross-pins carried by said spaced sides of the lever in substantially triangular relation to the fulcrum center, a retainer having spaced sides pivoted on the outer cross-pin and having a strap encircling guide loop at the free end of the same and a strap looped about the inner pin and extending in doubled relation over said outer pin and through said guide loop and said toggle lever having pivotal movement about said fulcrum center sufficient to carry both pins past dead-center relation with said fulcrum center.

2. Takeup and tensioning device for cargo holding strap, comprising a fulcrum carrying fitting having parallel spaced sides, a toggle lever having spaced sides fulcrumed to said spaced sides of the fulcrum carrying fitting, inner and outer cross-pins carried by said spaced sides of the lever in substantially triangular relation to the fulcrum center, a retainer having spaced sides pivoted on the outer cross-pin and having a strap encircling guide loop at the free end of the same and a strap looped about the inner pin and extending in double relation over said outer pin and through said guide loop and said toggle lever having pivotal movement about said fulcrum center sufficient to carry both pins past dead-center relation with said fulcrum center, and said lever having a handle extension arranged to override said guide loop in the holding position of the lever and means on said guide loop releasably engageable with said handle extension for locking said toggle lever in the holding position.

3. Takeup and tensioning device for cargo holding strap, comprising a fulcrum carrying fitting having parallel spaced sides, a toggle lever having spaced sides fulcrumed to said spaced sides of the fulcrum carrying fitting, inner and outer cross-pins carried by said spaced sides of the lever in substantially triangular relation to the fulcrum center, a retainer having spaced sides pivoted on the outer cross-pin and having a strap encircling guide loop at the free end of the same and a strap looped about the inner pin and extending in double relation over said outer pin and through said guide loop and said toggle lever having pivotal movement about said fulcrum center sufficient to carry both pins past dead-center relation with said fulcrum center, said toggle lever having a handle extension arranged to stand at the end of said guide loop and a turn-button on said guide loop positioned to engage said handle extension.

4. Heavy duty cargo gear comprising a buckle frame having spaced parallel sides, a toggle lever having spaced parallel sides fulcrumed to said spaced sides of the frame, inner and outer transverse cross pins carried by said spaced sides of said lever located substantially equal distances from the fulcrum and spaced apart from each other, the outer pin located substantially at the end of the toggle lever and the inner pin spaced inwardly of the lever away from said outer pin, a strap looped about the inner cross pin and having both runs of the loop extending from said inner cross pin about the outer side of the outer cross pin and arranged with the load carrying run at the outside and holding the inner run against said outer pin, said toggle lever having movement about the fulcrum from a release position with both pins at one side of the fulcrum center where both runs of the strap are substantially straight and free to be pulled in either direction, to a position with both pins at the opposite side of the fulcrum center and with both pins past the dead center position of the toggle lever in respect to the fulcrum and in which position the load tensioning pull on said outer run of the strap holds the inner run wrapped about the outer cross pin with the load tension on the outer run holding the toggle lever in the over-center toggle position and in which relation slackening of the load tension on the outer run will permit the inner run to be pulled about the outer inner cross pins to take up slack without throwing the toggle lever back to the release position first described.

5. The invention according to claim 4 in which the

buckle frame has a transverse anchor pin spaced inwardly of the frame away from the fulcrum and in which the end of the load carrying run of the strap is connected to said anchor pin and an end fitting is provided having a cross pin about which the load carrying run is looped and extends therefrom to the outer cross pin of the toggle lever.

6. The invention according to claim 4 with end fittings at opposite sides of the buckle, said end fittings having transverse pulley forming pins and in which the strap is anchored at one end to the buckle frame and extends in loops about said pulley forming pins of the end fittings.

7. The invention according to claim 4 in which a retainer for the toggle lever is pivoted on the outer cross pin and has a portion engaged about the strap to hold the pivoted retainer in position for securing the lever.

8. Cargo tie-down gear comprising two end fittings constructed for connection with stationary anchorages, said end fittings having pulley forming elements, a web looped about said pulley forming elements and thereby adapted to be shifted longitudinally in opposite directions between said end fittings, a web securing and take up unit shiftable with said web and comprising a buckle frame having parallel spaced sides, a cross pin carried by said parallel spaced sides, one end of the web being connected to said cross pin, a take up lever having parallel spaced sides pivotally fulcrumed to said parallel spaced sides of the frame, cross pins carried by said spaced sides of the lever and spaced in substantially triangular relation in respect to the fulcrum pivot of said lever and said web extending from said cross pin of the buckle



frame about the pulley forming element of one end fitting, between the parallel spaced sides of the take up lever, thence about the pulley forming member of the other end fitting, back between the spaced sides of the lever, about one cross pin on the lever, thence about the other cross pin on the lever and back about said first-mentioned lever cross pin and thence between the parallel sides of the lever and out over the other two layers of web as a free end portion which can be pulled or released for shifting the web and the take up unit to different positions between the end fittings and said take up lever having a swinging movement about the fulcrum pivot to carry the two cross pins thereon to opposite sides of the fulcrum pivot whereby in one position to release the web extended thereabout and in the other position to hold the web and whereby after pulling on the free end of the web to take up slack in the selected position where the take up unit has been located, the lever can be thrown to the opposite position to secure the doubled web in cargo holding relation.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 163,195 | Hester | May 11, 1875 |
| 533,547 | Moore | Feb. 5, 1895 |
| 762,857 | Anderson | June 15, 1904 |
| 1,204,919 | Wightman | Nov. 14, 1916 |
| 2,304,911 | Harpold | Dec. 15, 1942 |
| 2,679,670 | Griswold | June 1, 1954 |
| 2,710,436 | Davis | June 14, 1955 |