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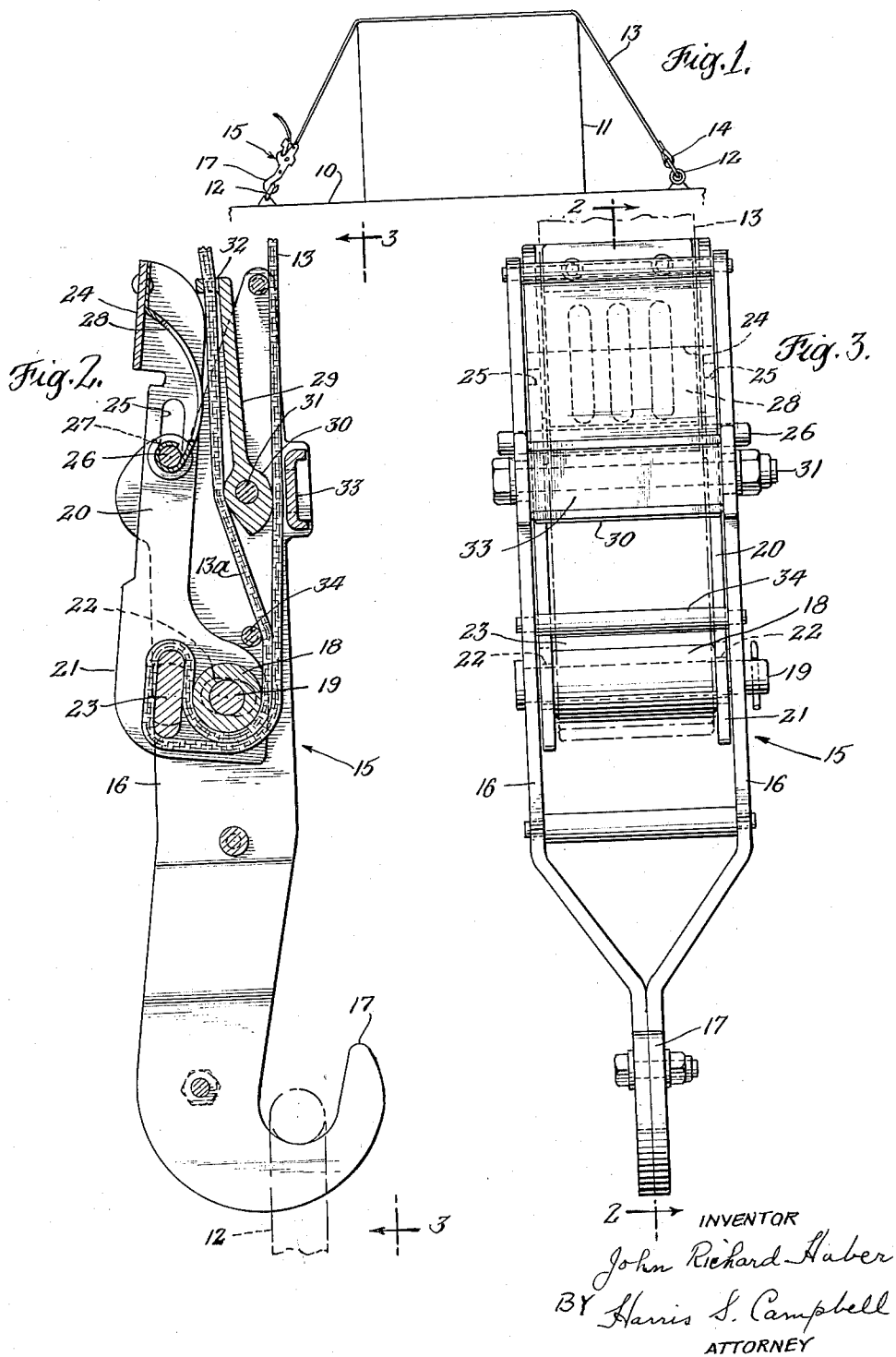
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STRAP TENSIONING DEVICE

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2 Sheets-Sheet 1



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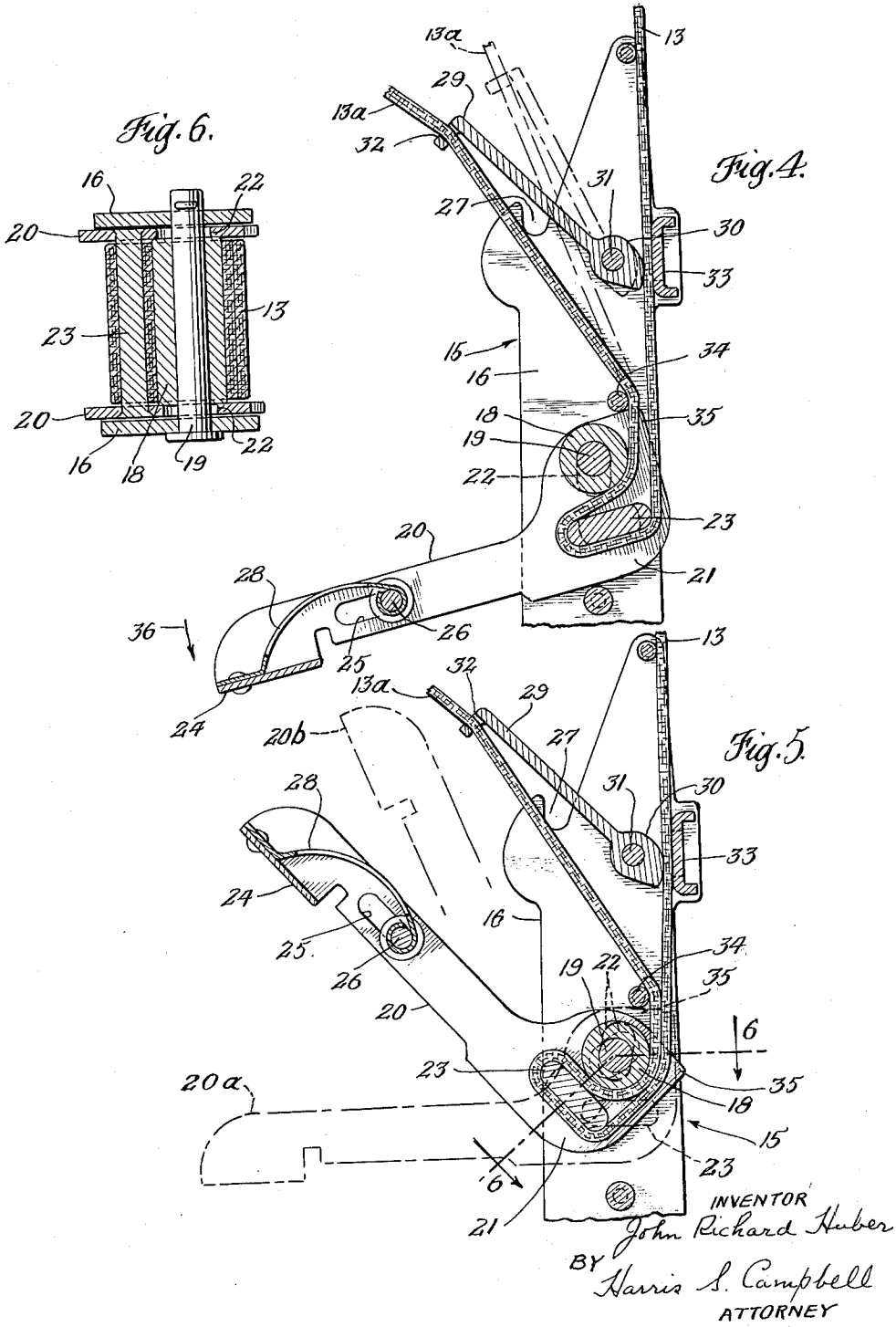
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## STRAP TENSIONING DEVICE

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This invention relates to strap adjusting devices and is particularly concerned with devices of this nature in which tensioning mechanism is incorporated.

Strap adjusting devices of the type with which the present invention is concerned are often used for securing cargo in position and initial tensioning of the straps is particularly useful under these circumstances to securely retain the cargo in the loaded position. Inasmuch as the strap material is often nylon or similar stretchable webbing a considerable takeup is needed to apply the desired initial tension. With a section of strap several feet long the elongation will be several inches under a tension of say three hundred pounds. Strap devices previously used have incorporated a load transfer mechanism which includes a toggling movement designed to provide a slight initial takeup. Also previous devices for adjusting the length of strap tension members have incorporated cams with a uni-directional action to permit pulling through the strap to a certain point and then providing a clamping force by means of the cam which holds the strap at its adjusted position. With this latter type of engagement the maximum tension which can be attained in the adjusted strap is that which can be applied directly by hand when the strap is pulled through the device to adjusted position. With the toggling type of device the toggle is capable of inducing tension in the strap but where the stretch is appreciable the amount of takeup is so small that it can produce a tension only slightly greater than that which can be applied by hand.

It is the primary object of the present invention to provide a strap adjusting and tensioning device which provides both a toggling mechanism and a cam clamping mechanism in proper related fashion so that the toggling mechanism can be operated repeatedly to produce the desired shortening or takeup effect while the cam device may be used to provide a holding action to retain the takeup between successive movements of the toggling mechanism. By these repeated toggling movements any amount of stretch can be overcome and the full effectiveness of the toggle may be developed so as to provide a strap tension several times the value that can be applied directly by hand.

In strap adjusting mechanism of this general nature the toggling mechanism may be latched in the toggled position and is designed to transfer to the frame of the device the full load to be carried by the strap. This toggling portion of the mechanism is arranged to engage the strap in a manner which does not damage the strap under maximum load carrying conditions. On the other hand the camming action type of strap holding mechanism normally will damage the strap if it is called upon to transfer the full load of which the strap is capable. The initial tension desired to be applied to the strap is usually only a fraction of the ultimate strength capacity of the load transfer device. Thus during the adjusting of the tension it is desired to hold only the initial tension load by means of the camming device after which the load is picked up by the main holding mechanism. It is an important object of the invention therefore to provide the cam adjusting portion of the mechanism so that after initial adjustment has been made and the toggling device has been closed to the latched position for holding the full capacity the cam mechanism is retained in a position where it is ineffective for load transfer. In this way the camming

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mechanism cannot carry the high working loads of the device and thus damage to the strap is prevented.

In order to operate the device to obtain the initial tensioning it is desired to control the cam by the angle at which the unloaded end of the strap is held relative to the frame of the load transfer device. It is an object of the present invention to provide a construction for the cam element which permits it to engage the strap where it emerges from the device thus allowing the operator to control the takeup movement.

A further object of the invention is the provision of cam structure for retention of the strap to permit repeated takeup of small increments of the strap which is compatible with the general construction of existing strap clamping and load transfer devices.

How the foregoing and other objects and advantages of the present invention are accomplished will be clear from the following description of the drawings in which—

FIGURE 1 is a view showing the application of a strap device according to the present invention in holding down cargo during transport.

FIGURE 2 is a sectional view of the load transfer device to an enlarged scale taken generally in the direction of arrows 2-2, FIGURE 3, showing the parts in closed, load carrying position.

FIGURE 3 is a view of the device taken in the direction of arrows 3-3, FIGURE 2.

FIGURE 4 is a view of a portion of the device shown in FIGURE 2 but with the parts in full open position of adjustment.

FIGURE 5 is a view similar to FIGURE 4 but showing the handle in a different position of adjustment.

FIGURE 6 is a sectional view taken in the direction of arrows 6-6, FIGURE 5.

Referring to the figures, FIGURE 1 illustrates a typical application for the securing device of the present invention. The floor of the transporting vehicle is illustrated at 10 supporting a piece of cargo 11. Tie down rings 12 are attached to the vehicle structure and the strap 13 may be provided with a suitable anchor fitting 14 at one end. The strip 13 is attached to an adjusting and tensioning device 15 which, in the form illustrated, is provided with a load transfer fitting in the form of a hook.

The construction of the strap adjusting and tensioning device and the manner of operation will be clearly seen by reference to FIGURES 2 to 6. FIGURES 2 and 3 show the device with the strap and mechanism in the locked or load carrying position. The frame of the device 15 is shown as a pair of spaced plates 16, the spacing being suitable to accommodate the width of a strap and the adjusting mechanism. Near one end of the frame members 16 there is an anchor fitting in the form of hook 17. The load is transferred from the strap 13 to the frame 16 through the medium of strap engaging structure which may be moved to accommodate the adjustment of the strap to the proper length prior to anchoring the strap in the load transfer position. This strap load transfer structure includes a beam member 18 which is supported in the frame 16 by a pin 19. Pin 19 also forms the pivotal support for a handle member 20 which incorporates two side plate members spaced to fit inside the frame plates 16 and to accommodate the strap 13. The pivoted end 21 of the handle 20 is enlarged and incorporates slots 22 which engage the pivot 19. Another strap engaging beam 23 is attached to the handle end 21 in a position such that movement permitted by the slot 22 allows the beam 23 to move toward or away from the beam 18 according to the forces supplied by the strap and the handle operation.

The handle 20 is formed with a transverse element 24 at its outer end. A slot 25 in each side of the handle

accommodates a latch member 26 which projects through the slots 25 in position to engage the notches 27 formed in the side frame members 16. A spring 28 reacts between the handle and the latch member 26 to urge the latch 26 toward one end of the slots to engage the notch 27. As will be evident the latch member 26 may be released against the spring force to disengage the notch 27 and permit the handle 20 to be moved for release or adjusting purposes.

Additional mechanism to assist in the tensioning of the strap is provided and this includes a cam member 29 having a cam portion 30 which is supported between the frame plates 16 by means of a pivot pin 31. At the outer end of the extended arm portion of the cam member 29 provision is made for engaging the strap such as by a slot 32. The cam portion 30 of the cam member is shaped so that when the cam member 29 is moved about its pivot 31 the cam portion will engage the strap 13 more intimately. To provide a clamping action a transverse beam 33 is mounted in the frame plates 16 adjacent the cam portion 30 and thus forms a pressure surface to accomplish the clamping produced by the cam.

As shown in FIGURE 2 in the load carrying latched position of the device the loaded portion of the strap 13 enters the device from one end and passes between the pressure surface 33 and the cam portion 30, then extends around the beam 18 and over the outside of the beam 23. The strap end passes between the beam 23 and the beam 18 and around the beam 18 underneath the loaded portion of the strap. The unloaded end 13a of the strap then passes outwardly to emerge from the device at the end of the frame at which the loaded end entered. In proceeding from the anchoring beams 18 and 23 the unloaded end 13a passes the frame spacer 34 which actually serves as a functional stop in a manner which will be described later. The unloaded portion 13a of the strap then extends past the cam member 29 on the side opposite the loaded portion 13 of the strap and passes through the slot 32. This arrangement positions the cam member 29 between the loaded and unloaded portions of the strap.

The manner in which the mechanism operates to adjust, tension and hold the load will be clear by reference to FIGURES 4 and 5. In FIGURE 4 the handle 20 is shown in position for removing the slack from the strap and adjusting it to proper length for the condition under which it is being used. In the extreme open position of the handle the corner 35 engages the stop 34 and by applying slight pressure on the handle in the direction of arrow 36 movement is permitted by the slots 22 to space the beam 23 away from the beam 18. Thus with the strap threaded through as shown and with the cam mechanism in the released position as shown by dotted outline the slack may be pulled freely through by a slight tension applied by hand to the unloaded end 13a of the strap. Since no appreciable load is in the strap it will move freely over the beam 23 while held in the position shown in FIGURE 4.

When the slack has been removed and the tension retained by hand the handle 20 may then be moved to the position shown by the dotted outline 20a in FIGURE 5. In this position the toe 35 has backed away from the stop 34 sufficiently to let the handle 20 move on the slots 22 so that the beam 23 shifts toward the beam 18 and causes direct pressure to be applied to the strap 13 where it passes between the two beams 23 and 18. At this position the clamping action between the beams will hold an appreciable load on the loaded portion of strap 13. The handle movement may then be continued in the closing direction and the lengthening or toggling action which occurs around the beams by virtue of this movement of the handle stretches the loaded portion 13 of the strap and induces initial tension. When the handle reaches the end of its stroke at say position 20b, FIGURE 5, the cam member 29 is moved to clamped posi-

tion by pulling at an angle on the strap end 13a as shown in full line position of the cam member. This holds the tensioned strap in position at the surface 33 and allows the handle to be moved back to the position shown in FIGURE 4 while preventing the tension which was obtained from being lost. By retaining the hand tightness on the strap end 13a the shortened requirement in the untoggled position FIGURE 4 permits the length difference to be pulled through and with the strap again hand tight between the clamping surface 33 and the unloaded end 13a the handle is again toggled from position 20, FIGURE 4, to 20b, FIGURE 5.

The portion of the stroke between position 20a and 20b may be made with the cam relaxed from the surface 33 so that the toggling action again induces further tightening in the strap 13. The relaxation of the cam during this portion of the stroke is accomplished by moving the end 13a of the strap to place the cam in the dotted position of FIGURE 4.

Repeated motion of the handle and manipulation of the end 13a of the strap to maintain the slight tension and change the direction to apply and release the clamping action at the desired positions in the movement of the handle 20 permits incremental tightening action in the loaded end 13 of the strap. The maximum tension is determined by amount of the load applied to the end of the handle. With the particular mechanism illustrated a tension in the loaded strap 13 may be developed approximately 6 times the applied load at the handle. Thus for a handle load of 50 pounds a tension may be applied in the strap of 300 pounds by sequential movements of the handle 20 while the end of strap 13a is manipulated to properly relate the operation of the holding cam device 33. When the desired tension has been applied the handle 20 is then moved all the way to the position shown in FIGURE 2 where the latch 26 engages in the frame notch 27 to retain the handle in closed position. In this position the cam member 29 lies approximately parallel to the handle and the cam action is in released position so that the loaded strap 13 is held by the beam structure 18 and 23 which is designed to hold the strap without damage even at loads approaching the ultimate strength of the strap.

The portion of the mechanism illustrated for retaining and transferring the load from the strap to the frame is essentially the same as that shown in U.S. Patent 2,852,827. However other strap holding mechanism of a generally similar nature could be used in combination with the camming device to provide tensioning and holding mechanism of the type involved.

From the foregoing it will be evident that I have provided an improved type of strap tensioning and anchoring device of the type which permits initial tensioning to an extent greater than can be attained by direct hand tensioning. The strap holding mechanism of the toggling type wherein some takeup of the strap is attained during the handle closing movement combined with a holding clamp which is controllable in a fashion to phase its action with the handle motion provides a simple mechanism for accomplishing the improved tensioning results. This mechanism has the advantage that it can handle any amount of takeup since the takeup is merely fed through to the unloaded end of the system. Therefore it is not limited by the capacity of a wind-up reel or the like such as would be the case with roll-up mechanism. The operation of the holding cam is simply and effectively accomplished by engaging the unloaded end of the strap in the structure of the cam member to control its operation merely by shifting the direction of hand applied tension at the strap. The particular relationship of the cam member to the handle member assures that the cam is retained in a position where it is protected and cannot transmit load from the loaded end of the strap to the frame when the device is latched in load carrying position. Thus damage to the strap from this cause is avoided. With this

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improved combination the basic structure of previously developed strap adjusting mechanism may be used to provide an improved device with increased tensioning capabilities.

I claim:

1. A strap adjusting and tensioning device having a frame, an anchor fitting located at one end of said frame, strap adjusting and load transfer mechanism attached to said frame, said mechanism including a handle, a pivot attaching said handle to said frame, a strap engaging beam mounted on said pivot and extending transversely with respect to said frame, a second strap engaging beam attached to said handle in offset relation to said first strap engaging beam, said handle being movable to a position closely adjacent said frame, a latch member interengaging said handle and said frame when the handle is in latched position, a strap clamping device movably mounted on said frame in a position offset from the pivotal mounting of said handle, and a strap including a first portion extending into said frame at the end opposite said anchor fitting and engaging both of said beams, said strap also including a second portion extending from said beams outwardly through the end of said frame at which said first strap portion extends into said frame, said clamping device being located between said strap portions, said clamping device incorporating a cam engageable with said first strap portion and an extension arm engageable with said second strap portion.

2. A strap adjusting and tensioning device according to claim 1 in which said clamping device is retained in non-clamping position when said handle is in latched position.

3. A strap adjusting and tensioning device having a frame, an anchor fitting located near one end of said frame, strap adjusting and load transfer structure attached to said frame, a handle pivotally mounted on said frame, a plurality of transverse beams over which the strap may be wrapped for load transfer purposes, one of said beams being attached to said handle for movement therewith, a strap member engaging said device, said strap member having a load carrying portion entering said frame from the end opposite said anchor fitting, then passing around said beams, an unloaded strap portion extending back adjacent said loaded portion, said handle being swingable

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about its pivotal mounting from a generally upright position with respect to said frame to a latched position where said handle is adjacent and parallel to said frame in a position overlying said portions of the strap located within said frame, a cam device pivoted in said frame and lying below said handle and between the loaded and unloaded portions of said strap, and a transverse frame member forming a pressure surface adjacent said cam device, said load carrying portion of said strap passing between said cam device and said pressure surface, said cam device including a cam portion and an extension arm, said extension arm having engaging means for connecting to said unloaded portion of the strap to provide controlling means for operating the cam device.

4. A strap adjusting and tensioning device having a frame, an anchor fitting located at one end of said frame, strap adjusting and load transfer mechanism attached to said frame, said mechanism including a handle pivotally mounted on said frame, a strap attachable to said device, structure comprising a plurality of beams around which said strap passes to provide the load transfer means between said strap and said frame, one of said beams being movably mounted relative to said handle to provide for relative movement of said beams from strap adjusting to strap loaded position, said strap having loaded and unloaded portions located to extend from said frame at the end opposite said anchor fitting, a controllable strap clamping device attached to said frame and positioned for clamping engagement with the loaded strap portion at a location between the position of said beams and the end of the frame from which said strap extends, said clamping device being positioned between said strap portions and including means engageable with said unloaded strap portion to provide for control movement of the clamping device.

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