

[54] **HEAVY DUTY WINCH FOR CARGO TIE-DOWN**

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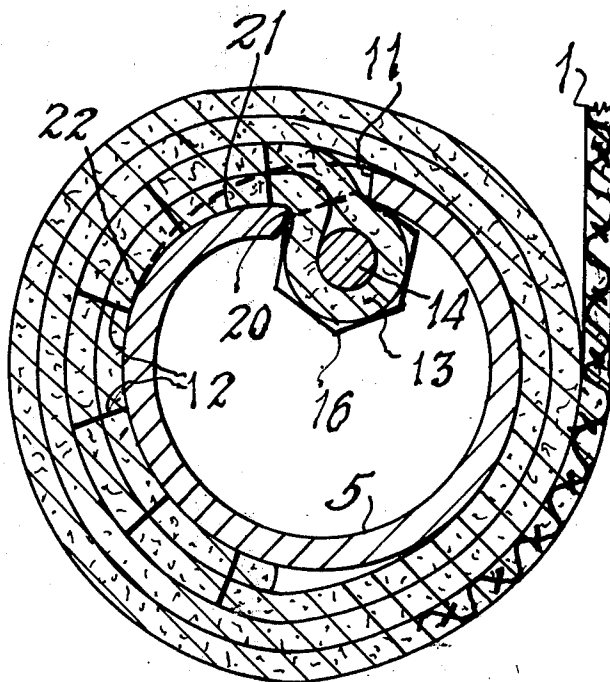
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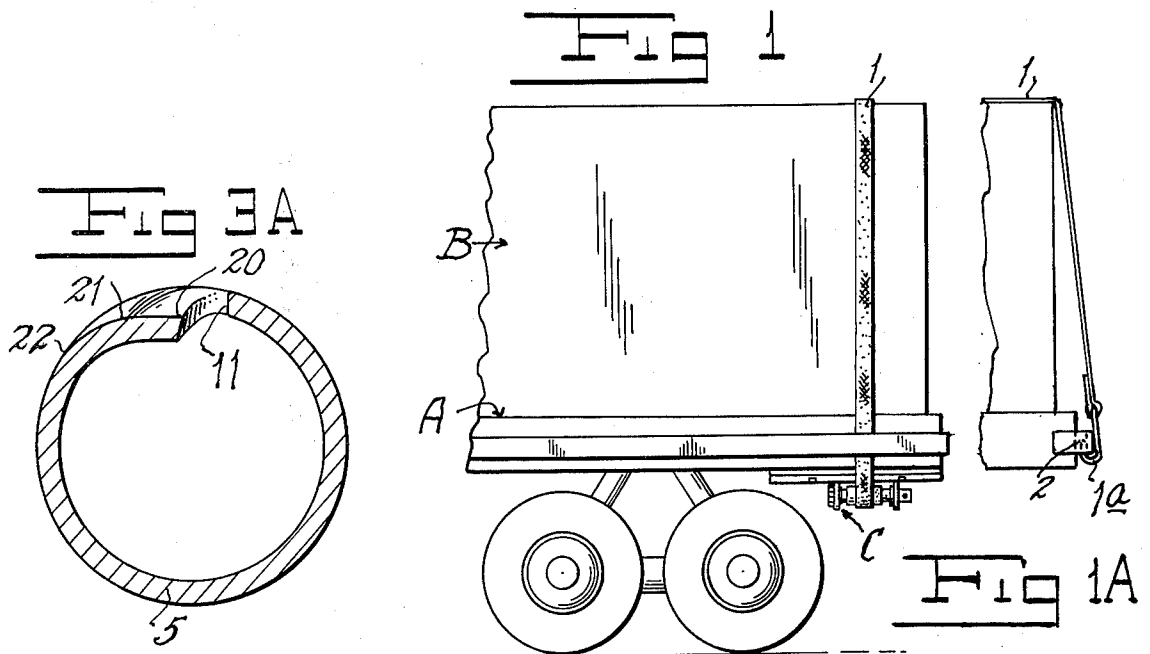
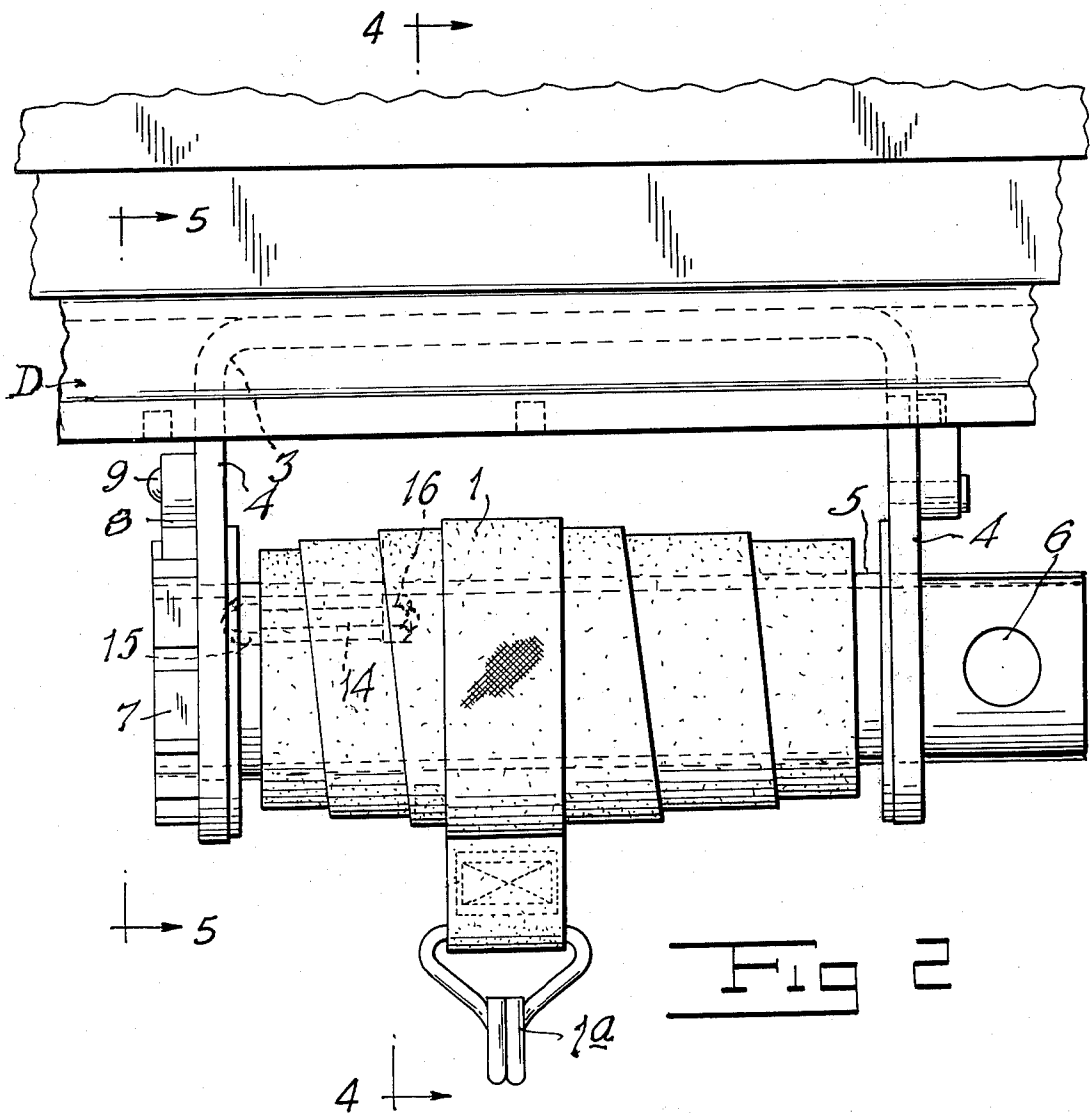
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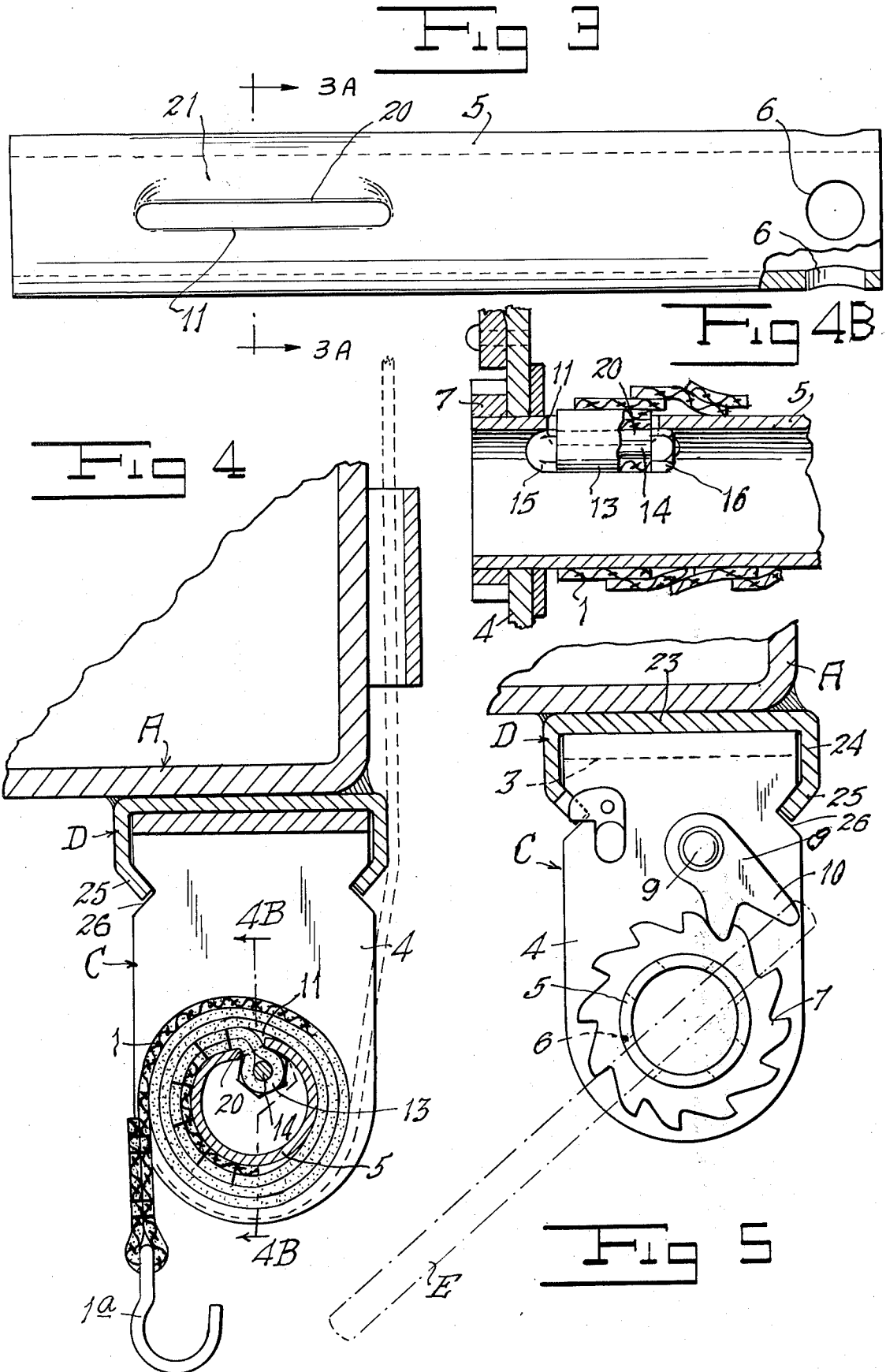
[57] **ABSTRACT**

The tubular drum of a winch, for example, in a cargo tie-down apparatus, has a cylindrical outer surface and a longitudinal slot through which one end of a strap extends into and is secured in the drum, and the longitudinal edge of said slot over which the strap is drawn during winding of the strap on the drum is disposed inwardly of said cylindrical surface. Desirably, a convex curved surface of small curvature along said edge merges gradually into said cylindrical surface. The invention eliminates or reduces to the minimum the possibility of fraying or cutting of the strap by the slot edge, and the strap during winding thereof is capable of withstanding extremely high tensions over long periods of time.

2 Claims, 13 Drawing Figures







HEAVY DUTY WINCH FOR CARGO TIE-DOWN

BACKGROUND OF THE INVENTION

This invention relates in general to cargo tie-down devices of the type which includes a flexible binder such as a chain or a relatively wide web, strap or band of nylon webbing or steel webbing, having its ends connected to a vehicle bed and its intermediate portion drawn tightly over a load on the bed, at least one end being wound on the drum or spool of a winch that is secured on the bed, for tightening the strap over the load. The loads generally are large and high and therefore the binder must be maintained under extreme tension, for example, 10,000 pounds to hold the load firmly on the bed, and chains have been required to connect the binder to the winch drum although it is more desirable to use webbing if feasible.

In common prior art constructions utilizing a fabric web or strap, the spool or drum has a cylindrical and tubular body in which a straight longitudinal slot parallel to the body axis and of a length greater than the width of the webbing or strap through which one end of the strap extends into the drum, and there is means connected to the strap inside the drum to prevent the strap from being pulled out of the slot as the strap is wound on the drum. The outer edges of the side walls of the slot lie in the cylindrical peripheral surface of the drum body, and during use of winch, when the strap is pulled under tension over a load the edge of the slot over which the strap is drawn causes fraying or cutting of the strap.

This construction leaves much to be desired in that it cannot be relied upon to perform its intended function; the strap is short-lived and even when new, it is liable to break under relatively low tension, for example, of the order of 4 or 5,000 pounds. Moreover the construction is not satisfactory for use in installations in which the strap must withstand higher tensions of, for example, 8,000 to 10,000 pounds and more.

SUMMARY OF THE INVENTION

A primary object of the invention is to provide a winch spool or drum of the general character described embodying a novel and improved construction which overcomes the objections to and disadvantages of the prior art devices, which is reliable in operation, long-lived, and in which the possibility of fraying or cutting of the strap by the edge of the web slot in the drum is eliminated or reduced to the minimum and the strap during winding thereof on the drum is capable of withstanding extremely high tension.

In the winch spool or drum of the preferred form of the invention, the edge of the web slot over which the strap is drawn during winding of the strap on the drum, is disposed inwardly of the cylindrical peripheral surface of the drum and there is a convex curved surface extending from said edge of the slot outwardly of the drum and gradually merging into the cylindrical surface of the drum. Preferably, the portion of the drum adjacent said edge of the slot is depressed or bent inwardly of the drum to so locate the slot edge and form said convex curved portion.

BRIEF DESCRIPTION OF THE DRAWINGS

For a complete understanding of the invention, reference should be had to the following description in conjunction with the accompanying drawings in which

FIG. 1 is a fragmentary side elevational view of a motor trailer body carrying a load secured by hold-down straps that are tightened by winches embodying the invention;

FIG. 1A is a fragmentary end elevation of the trailer body showing the end of the hold-down strap opposite the winch connected to the rub-rail of the truck body;

FIG. 2 is an enlarged fragmentary elevation of one of the winches on the trailer body which is shown fragmentarily with the tie-down strap wound on the winch drum in out-of-use position;

FIG. 3 is a detached side elevational view of the winch drum showing the web slot embodying the invention;

FIG. 3A is an enlarged transverse sectional view on the plane of the line 3A—3A of FIG. 3;

FIG. 4 is a fragmentary transverse vertical sectional view taken approximately on the plane of the line 4—4 of FIG. 2;

FIG. 4A is a greatly enlarged fragmentary transverse sectional view of the winch drum and the strap wound thereon as shown in FIG. 4;

FIG. 4B is a fragmentary longitudinal sectional view approximately on the plane of line 4B—4B of FIG. 4;

FIG. 5 is a vertical sectional view on the plane of the line 5—5 of FIG. 2 showing the winch in end elevation;

FIG. 6 is a fragmentary side elevational view illustrating another manner of mounting the winch on a trailer body;

FIG. 7 is a vertical sectional view approximately on the plane of the line 9—9 of FIG. 7;

FIG. 8 is a schematic view showing the winch drum in a longitudinal section and illustrating the manner of attaching the end of the strap to the winch drum in a winch fixedly mounted on the trailer body as shown in FIGS. 6 and 7;

FIG. 9 is a detached respective view of a support element for attaching the winch to the trailer body.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Specifically describing the invention, the reference character A designated a elongated substantially flat deck, floor or body of a transport vehicle, for example, a trailer of a motor truck, which is shown only fragmentarily. In accordance with the general practice, a load B is placed on the trailer body and tied or held against movement on the deck by one or more tie-down straps 1 each of which has one end connected to any suitable means, for example, a rub-rail 2, or a stake, or an anchor ring secured to the deck at one side of the load, while the other end of the strap is wound or tightened on a winch generally designated C at the other side of the load.

In the present instance, the winch is shown as comprising a U-shaped frame mounted on a rail D on the vehicle deck and having a bottom or main portion 3 and parallel arms 4 in and between which is journaled a winding spool or drum 5 on which the strap is wound during rotation of the drum in one direction. As shown, one end of the drum projects outwardly beyond one of the arms 4 and has a plurality of transverse openings 6 to receive a handle pin E shown by dot and dash lines in FIG. 5 for rotating the drum. Of course, other means may be utilized for rotating the drum to wind and unwind the strap thereon. To prevent accidental backward rotation of the drum, the other end of the drum

has rigidly secured thereto a ratchet 7 with which operates a pawl 8 pivoted at 9 on the arm 4 of the frame and normally urged by gravity into engagement with the ratchet as shown in FIG. 5. Desirably the pawl has a finger lug 10 for lifting the pawl out of engagement with the ratchet when that is desired.

The invention is particularly concerned with the connection of one of the strap to the winch drum 5. The drum is cylindrical and tubular and is of a length to permit the strap to be wound thereon in overlapping convolutions as best shown in FIGS. 2, 4 and 4A. The width and thickness of the strap and the material of which it is formed depends upon the conditions under which the strap is used, that is, the amount of tension that the strap must withstand when it is tightened to hold down a load in the vehicle body. Preferably the strap is in the form of webbing of known construction, for example, sling-weave nylon or polyester of a width of the order of 1¼ inches to 3 inches and capable of withstanding tension of the order of from 10,000 to 16,000 pounds.

The winch drum has a straight longitudinal web slot 11 parallel to the axis of the drum through which one end of the strap extends into the drum. As shown, the said end portion of the strap is returned upon the main portion of the strap and stitched thereto as indicated at 12 so as to form a loop 13. The loop is inserted into the drum through the slot 11 and is held against being pulled out by suitable means, for example, by either the shank 14 of a bolt having a head 15 at one edge of the strap and a nut 16 on the other end at the other edge of the strap (see FIG. 4, 4A, 4B and 9) or by a pin 17 having enlarged end portions 18 and 19 at opposite edges of the strap as shown in FIG. 8. The head, nut and enlarged end portions preferably are greater in diameter than the loop so that when the strap is placed under tension during the winding of the strap on the drum, said head and nut, or the enlarged end portions, as the case may be, are drawn into contact with the inner surface of the drum and prevent the pulling of the strap out of the slot (FIGS. 4, 4A, 4B and 9).

As usual, during the winding of the strap it is drawn over one longitudinal edge of the web slot, and in accordance with the invention said edge of the web slot which is designated 20 is disposed inwardly of the outer cylindrical peripheral surface of the drum (see FIGS. 3A, 4 and 9) and there is a convex curved surface 21 that extends outwardly of the drum from said edge of the slot and gradually merges into the cylindrical surface of the drum as indicated at 22. The portion of the drum adjacent said edge of the slot may be depressed or bent inwardly of the drum to locate the slot edge as above described and to form said convex curved portion. FIGS. 3 and 3A show the slot, the depressed slot edge and the convex curved portion without the web. The convex curved portion is in effect eccentric to and of a smaller degree of curvature than the cylindrical surface of the drum.

It has been found that with the slot formed in the winch drum in accordance with the invention, the possibility of fraying or cutting of the strap by the edge 20 of the web slot is eliminated or reduced to the minimum, and the strap during winding thereof on the drum to tie down a load on the trailer body is capable of withstanding extremely high tension without breaking or cutting of the strap at the slot edge. We believe this result is achieved because due to the depression of the

slot edge 20 and the difference in curvature between the portion 21 and the cylindrical surface of the drum, the second convolution and following convolutions of the strap during winding thereof exert only slight pressure on the first convolution at the slot edge. See FIG. 4A. Also, we believe that the first convolution frictionally grips the convex curved portion in closely spaced relation to the slot edge so as to prevent the increasing tension on the convolutions as the strap is wound, from being transmitted to the area of the strap that lies on the slot edge.

In the form of the invention shown in FIGS. 1 through 5, the winch is adjustable longitudinally of the trailer body. The rail D has a base 23 from which extends spaced apart side flanges 24 which have inwardly projecting portions 25 and the frame of the winch is slidably mounted between said flanges and has recesses 26 receiving said inwardly projecting portions in slidable relation thereto. The bolt or pin can be easily inserted through the belt loop from one end of the winch drum in this structural combination where the ends of the drum are freely accessible, but difficulty may arise when the ends of the drum are not easily accessible as shown, for example, in FIGS. 6 and 7. Here the winch frame F is installed in a box-like structure 26 that is welded in an aperture 27 in the chassis G of the trailer body, and it is extremely difficult to insert a bolt or pin into the strap loop that is inserted through the aperture 27 and through the strap slot 11 in the drum from the outer side of the chassis.

FIG. 8 shows schematically a method to facilitate the insertion of the pin into the strap loop. One end of a flexible cord 28 is looped and tied through a hole in the enlarged end portion 18 and the other end of the cord is inserted into one end of the drum 5, then outwardly through the strap slot, then through the strap loop 13, backwardly through said slot and out of the other end of the drum as shown in FIG. 8. Then the second mentioned end of the cord is pulled so as firstly to draw the strap loop into the drum and secondly to pull the pin into the loop.

The winch embodying invention makes it possible to utilize a known type of strap formed of fabric or webbing, for example, a standard nylon strap, in a cargo tie down apparatus so as withstand high tensions of the order of ten thousand to sixteen thousand pounds for long periods of time without serious fraying or breaking of the strap.

We claim:

1. A winch for winding a strap comprising the combination of a frame, a winding drum having a tubular wall journaled to rotate in said frame, and means for rotating said drum, said wall having a cylindrical outer surface for winding such a strap thereon and having intermediate its ends a longitudinal slot extending radially therethrough providing for passage of said strap radially through said slot, the longitudinal edge of the slot over which said strap is drawn during winding of the strap being disposed inwardly of said cylindrical outer surface and there being an exterior curved surface extending convexly from said edge of the slot eccentric to and gradually merging into said cylindrical surface thereby to reduce the possibility of fraying of the strap by said edge of the slot.

2. The combination of a frame, a tubular drum journaled to rotate in said frame and having a cylindrical outer surface and a longitudinal slot extending radially

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therethrough, means to rotate said drum, a strap to be wound on said cylindrical surface and extending radially through said slot with one end portion disposed within said drum and means to hold said end portion against being pulled out of said drum through said slot, characterized in that the longitudinal edge of said slot over which the strap is drawn during winding of the

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strap is disposed inwardly of said cylindrical surface and there is a convexly curved surface that extends outwardly from said edge and merges gradually into said cylindrical surface thereby to reduce the possibility of fraying of the strap by said edge of the slot.

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