Sept. 29, 1964 F. E. AHLBIN 3,150,861

WINCH CABLE GUIDE

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FIG. 1

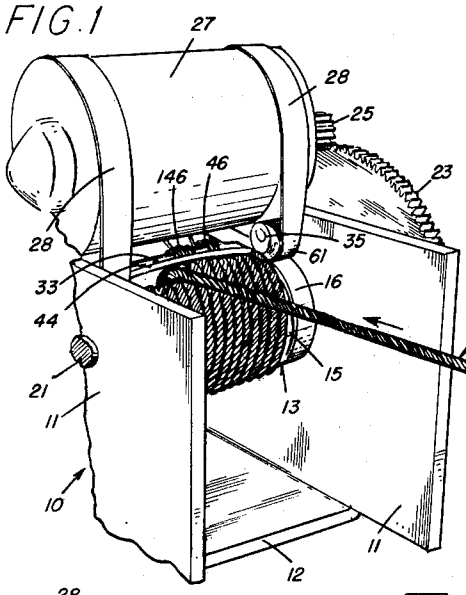

FIG. 2

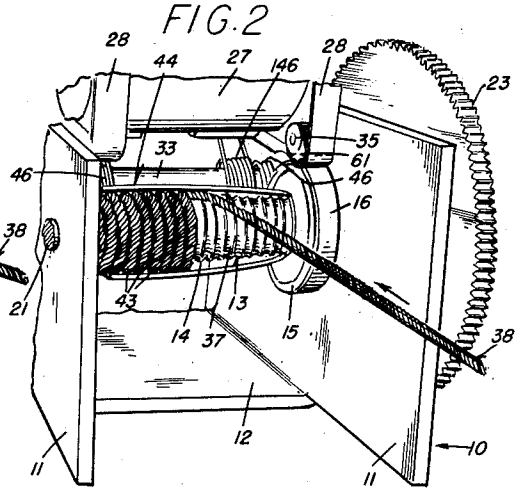

FIG. 5

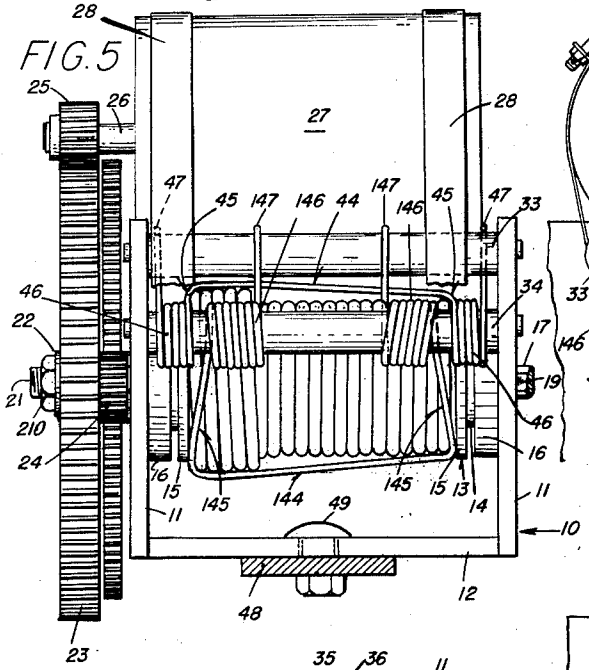

FIG. 3

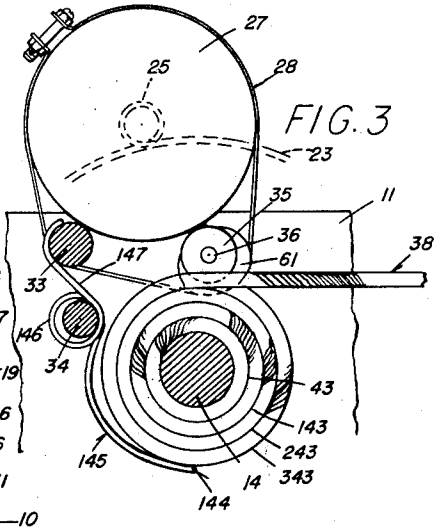

FIG. 4

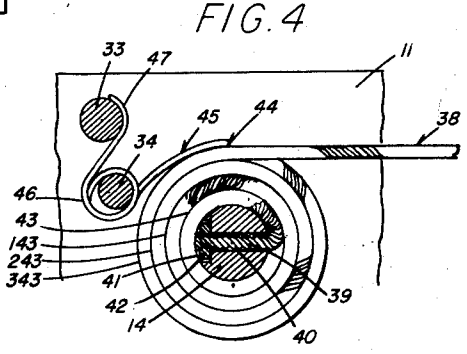

FIG. 6

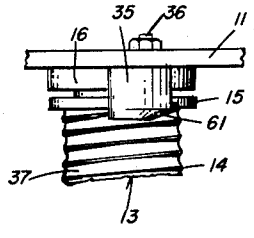

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FIG. 7

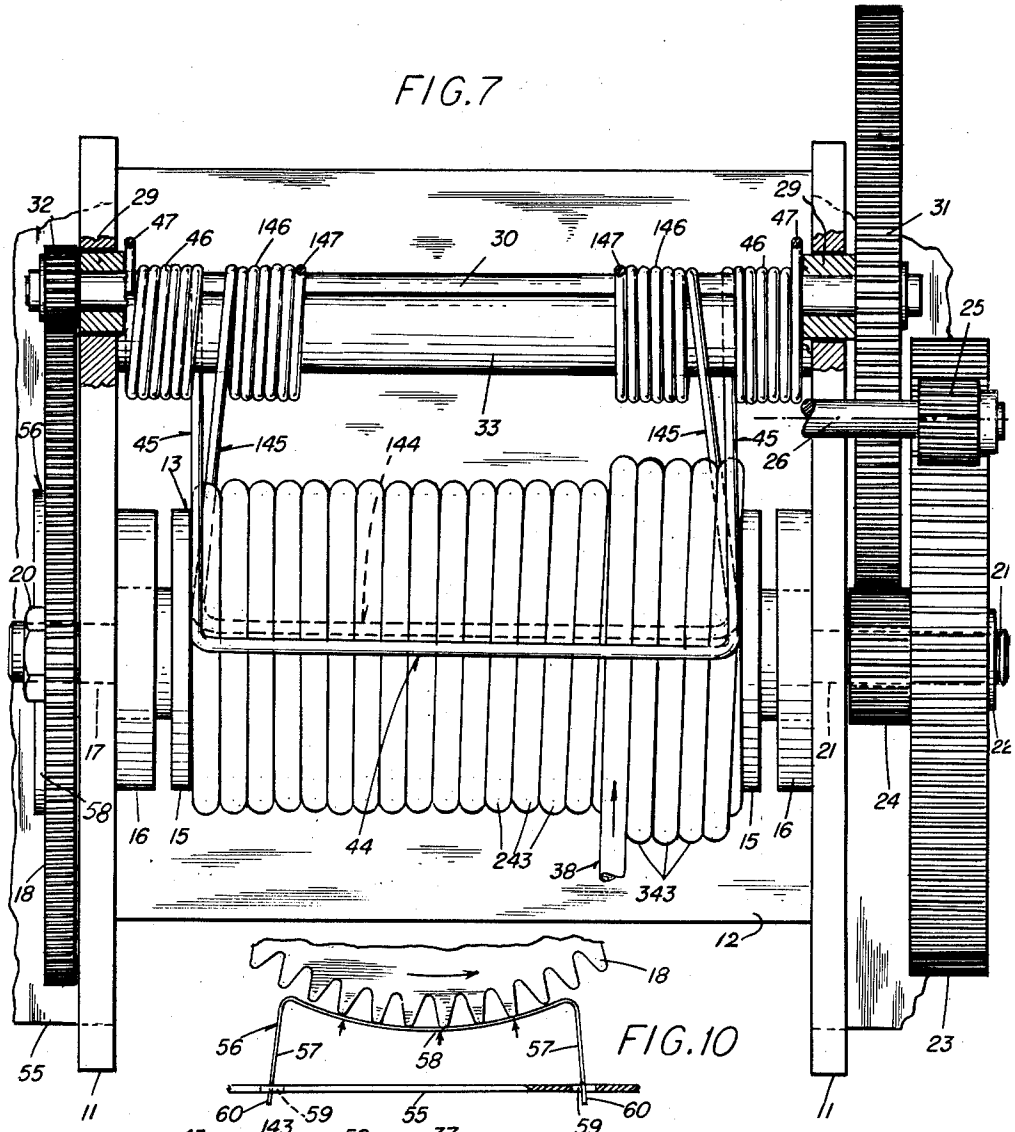

FIG. 10

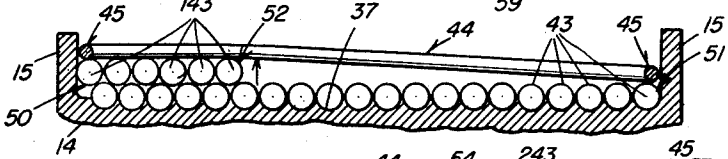

FIG. 8

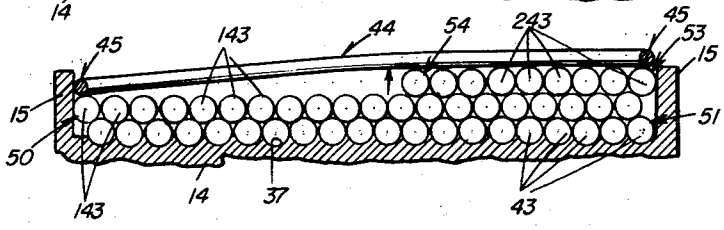

FIG. 9

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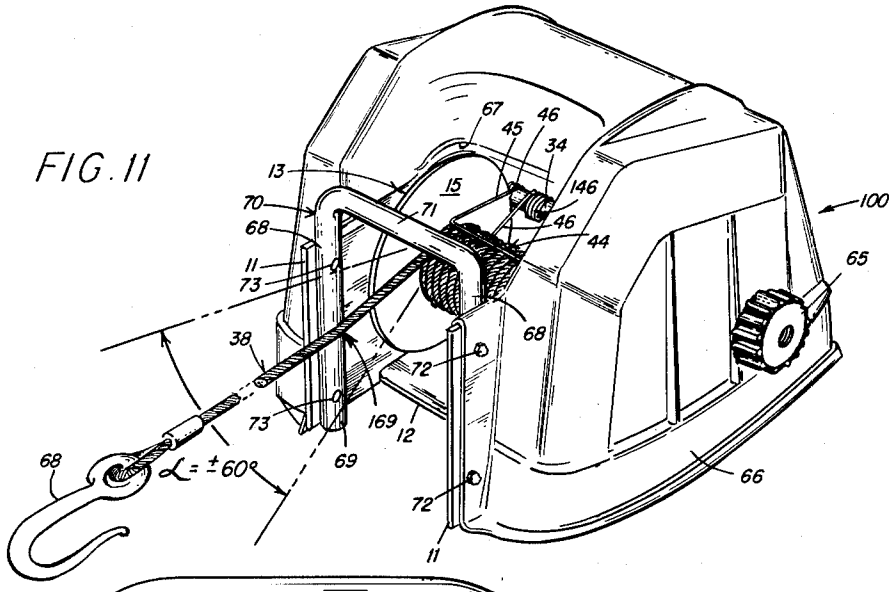
FIG. 11



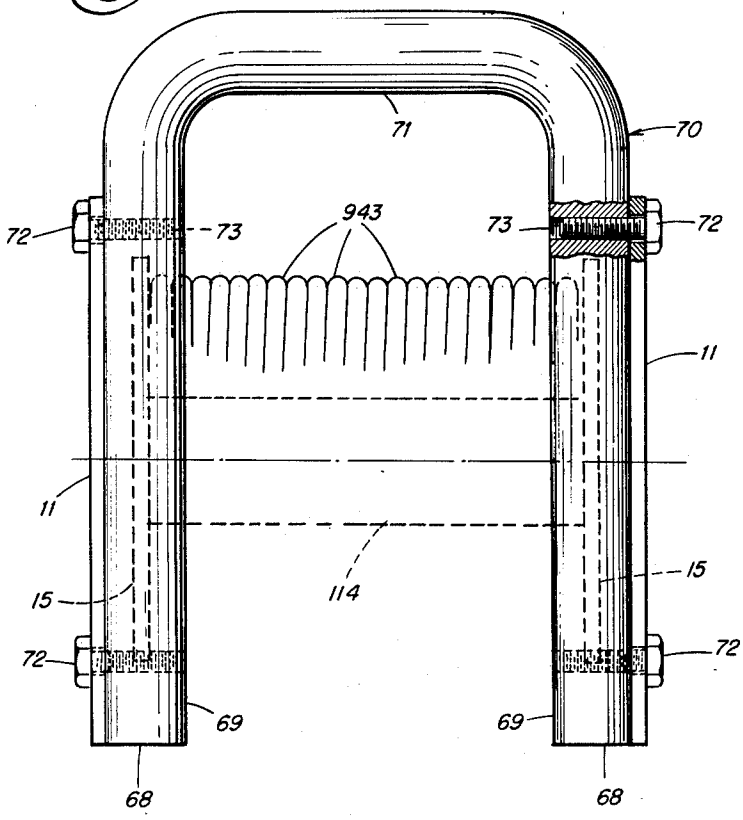


FIG. 12

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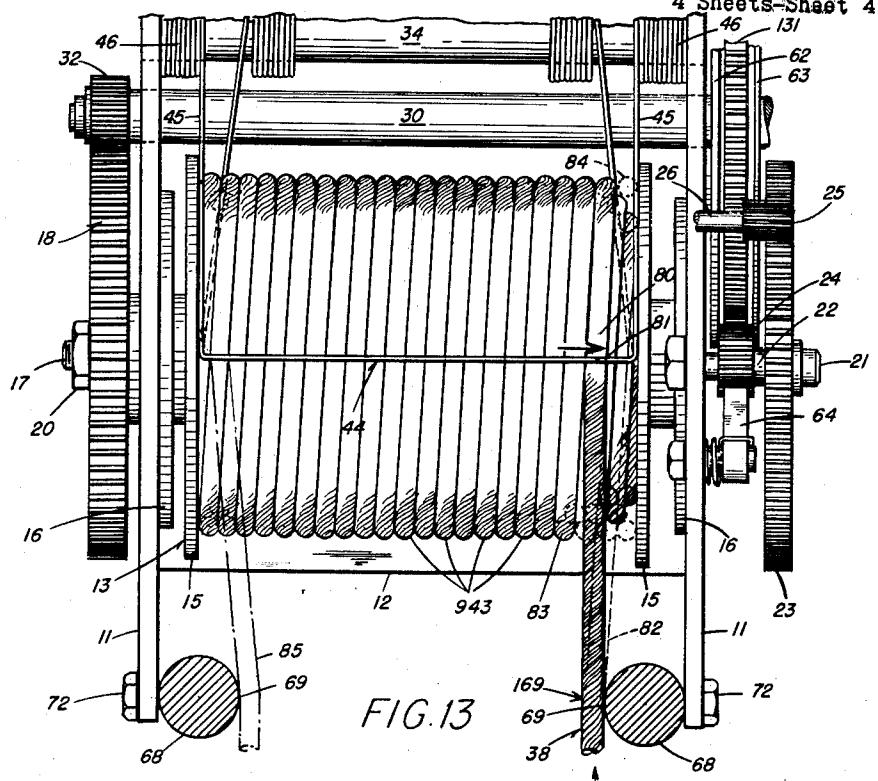

FIG. 13

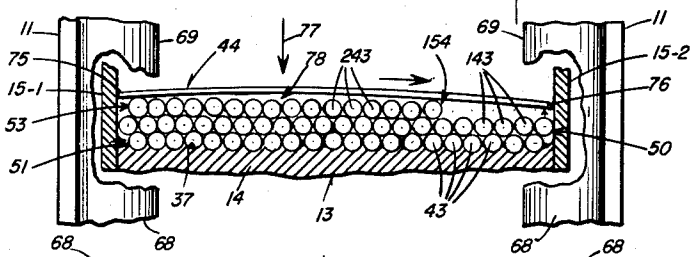

FIG. 14

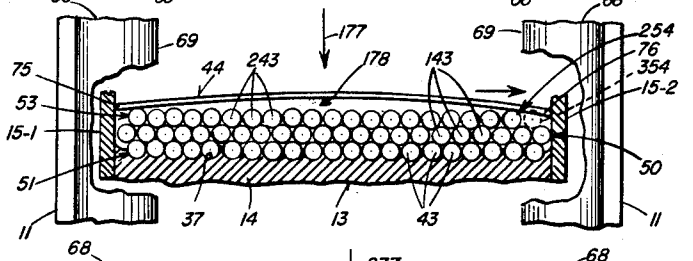

FIG. 15

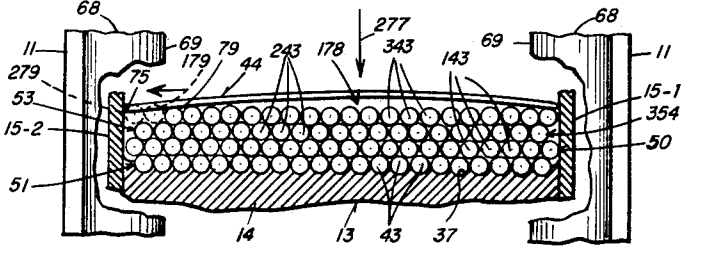

FIG. 16

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3,150,861

WINCH CABLE GUIDE

Fred E. Ahlbin, 3663 Congress St., Fairfield, Conn.

Filed Apr. 10, 1962, Ser. No. 188,298
7 Claims. (Cl. 254—190)

The present invention relates to cable winches in which a driven reel winds up a length of cable thereon, and the present application is a continuation-in-part of my prior application Serial No. 827,639, filed July 16, 1959, and now abandoned.

Prior to the present invention many types of winches have been devised to wind up on reels lengths of relatively stiff wire rope or steel wire cable. Experience of those skilled in the practical art has led them to adopt uniformly the conclusion that such cable, even when of the small diameters, could not be wound up consistently on reels with the successive turns in each course or layer neatly laid down about the reel tread or core barrel in adjacent orderly fashion if the core barrel or tread is less than three inches in diameter. This was particularly evident after a cable had been repeatedly strained under loads during successive reelings and become worn or abraded by considerable service. Turns of a steel wire cable have considerable spring action tending to straighten out the lengths thereof in the turns, which tendency is greater in turns of smaller diameter. Consequently, when such strained and worn cable is wound up on drums or reel barrels of small diameter without suitable guiding confinement the turns frequenly skew and the cable kinks and tangles up on the small drums or barrels during the winding. This tendency is also present to a degree in the use of larger reeling drums and barrels. Many complicated and costly traveling guiding devices have been devised for the purpose of eliminating or minimizing this difficulty and these have had a degree of success in heavy winch equipment for large cables. However, it is not practical to use such devices in economical winch structures for the smaller cables. It is an object of the present invention to eliminate these problems or minimize them to a practical degree.

Another object of the present invention is to provide a very simple constructed guiding means for small diameter cable, e.g., of the order of five thirty-seconds of an inch (5/32") in diameter, which is economically produced in mass manufacturing procedure and readily mounted in simple winches for such service, such guiding means requring no traverse traveling parts while serving effectively to lay down on the reels thereof in orderly fashion the successive cable turns.

A further object of the present invention is the provision of such cable guiding means in winches for small diameter cable which efficiently features one or more "walking" members with each rocking inward and outward in a particular manner in the reeling operation resiliently to bias each cable turn intermediate the two first and final end turns in a full course thereof as it is laid down on the reel core barrel effectively both radially inward and laterally against the next preceding turn.

Still another object is to provide, as a part of the cable guiding means, cable end turn lateral camming means which, during the reeling up of the loaded cable in any particular full course of turns thereof laid down on the reel from either end of the latter, feeds it obliquely inward in a lateral direction during the laying down of the few last turns of this course cooperatively to supplement the lateral biasing of one or more of the intermediate turns immediately preceding the last turn in this course by the "walking" means, and effectively to guide the laying down in orderly fasion of the first few turns of the next succeeding course over the last few turns of the underlying course thereby efficiently avoiding in a simple manner undesirable piling up of turns against the inner side of the adjacent cable-confining reel end means or end flange of the reel.

A still further object of the invention is to provide such oblique camming means in a form to serve in a simple and unique manner as means to facilitate the manual handling and portability of the winch.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a front perspective view, with parts broken away and in section, showing an embodiment of the cable winch of the present invention with a length of steel wire cable reeled up a plurality of layers or courses upon the power driven reel, a length of the cable extending forwardly in a straight line suggesting connection to a load;

FIG. 2 is another front perspective view of the embodiment of the invention shown in FIG. 1, with parts broken away and in section, illustrating the start of a reeling operation with only a few turns of the cable wrapped around or wound up on the reel tread or core barrel, a length of the cable extending forward in a straight line likewise suggesting anchorage to a load;

FIG. 3 is a transverse sectional view of the reel and the support means for a pair of cable guiding means of the invention in the form of cable turn biasing means associated with cable guiding cam means and a driving motor, parts being shown in side elevation, only such bottom cable guiding means being illustrated while the other is omitted for the purposes of clarity, stranding of the cable being illustrated only in certain areas with the understanding that it is like that shown in FIGS. 1 and 2 throughout;

FIG. 4 is a view similar to FIG. 3, but with certain cable guiding cam means and driving motor structure omitted, the section through the reel tread or core barrel being at the near end where one end of the cable is anchored thereto, the other top cable guiding means being illustrated therein;

FIG. 5 is a back elevational view of the cable winch shown in FIGS. 1 and 2, with parts broken away, showing the effective operation of the cable guiding means in snugging successive turns of the cable on to the reel, dimensions of some parts and spacings thereof being exaggerated for clarity;

FIG. 6 is a top plan detail view, with parts broken away, showing a cable end turn guiding cam and a portion of one end of the rell in relation thereto;

FIG. 7 is a top plan view to an enlarged scale of the structure shown in FIG. 5, but with parts broken away and sectioned and with the driving motor omitted;

FIG. 8 is a diagrammatic view of one full course or layer of cable turns and a few turns of the next course being laid down thereon, illustrating operation of cable guiding means of the present invention;

FIG. 9 is a diagrmmatic view similar to FIG. 8, but illustrating completion of the second course, only a few turns of which are shown in FIG. 8, and showing a number of turns of the third course being laid down thereon for illustration of the "walking" action of the cable guiding means;

FIG. 10 is a side elevational detail, with parts broken

away and in section, of brake means shown in FIG. 7 for the purpose of applying braking action to the gearing which drives the reel;

FIG. 11 is a front prospective view, with parts broken away, of another embodiment of the winch of the present invention employing a modified form of cable end turn lateral camming means;

FIG. 12 is an enlarged front elevational view, with parts broken away and in section, of the FIG. 11 winch structure, showing details of the cable end turn lateral camming means with cable turns of one of the later courses thereof laid down on the reel being indicated in phantom, the parts shown being substantially to the scale thereof in a winch produced for marketing;

FIG. 13 is a top plan view, with parts broken away and in section, of the winch structure shown in FIGS. 11 and 12, and substantially to the scale of FIG. 12; and

FIGS. 14, 15 and 16 are diagrammatic sectional views, with parts broken away, of the FIGS. 11 to 13 incl. winch structure, further illustrating the "walking" action of the cable turn biasing means in the laying down of the cable turns of the third course and the completion of the fourth course, these views being taken from the front of the winch as contrasted with diagrammatic views 8 and 9 taken from the back of the winch.

The embodiments of the invention which are illustrated by way of example in the attached drawings are characterized by a rotatable driven reel having a generally cylindrical and elongated core barrel carrying at opposite ends thereof a pair of axially-spaced, radial, first and second cable-confining reel end means or end flange structures which extend generally radial to the axis of the core barrel. The reel is provided with means for anchoring one end of a steel wire cable thereto with turns of the cable wrapped around the core barrel and with these turns inherently having spring action when unconfined upon the reel due to the characteristic stiffness of such cable which is amplified by the fact that the turns are of relatively small diameter. There is associated with this loaded reel, cable guiding means which includes as cable turn biasing means an elongated, flexible, rod-like, generally straight, cable turn-engaging spring element extending longitudinally of the core barrel between the end flange structures mounted thereon. The cable guiding means also includes a pair of longitudinally-spaced, transversely-extending, spring-biasing support arms, each mounted to one end of the cable turn-engaging spring element for support thereof. Means are provided for independently supporting these support arms with the cable turn-engaging spring element snugged against outside turns of the cable which are laid down on the core barrel at least at opposite ends of the latter and with this cable turn-engaging spring element being at least bridged across the intervening cable turns. Driving means are provided to rotate the reel in a direction to wind up more cable turns thereon with the cable turn-engaging spring element pressing inward against turns of the cable wrapped around the core barrel and biasing each additional turn as it is laid down on the reel radially inward and laterally against the next preceding cable turn laid down in the same course or layer of turns, except of course the first turn in the course which is similarly biased laterally against the adjacent reel end flange structure. Brake means is associated with the reel, such as by connection to its driving means, preventing free rotation of the reel while it is not being driven and with turns of the cable thereon exerting coil spring action which would otherwise tend to rotate the reel backwards with consequent loosening of the turns. This structure is also provided with cable-guiding cam means supported at opposite ends of the reel radially beyond the end flange structures so as to guide end turns of the cable upon those previously laid down upon the core barrel, such as when there are sufficient courses of the laid down turns to tend to cause additional end turns to slip off over the end flange structures as these additional turns are laid down adjacent thereto, and

to assure orderly reversal of the laying down of the first few turns of any overlying top course.

Referring to the drawings, in which like numerals identify similar parts throughout, it will be seen that the embodiment of the invention illustrated in FIGS. 1 to 10 incl. includes a suitable base structure 10 consisting of a pair of laterally-spaced upstanding side walls 11, 11 and a base panel 12, all of which may be made of steel plate with the edges of the bottom panel welded to bottom edges of the side walls. The laterally-spaced side walls 11, 11 rotatably support therebetween a reel structure 13 consisting of a reel tread or core barrel 14 and a pair of longitudinally-spaced or axially-spaced, generally radially-extending, first and second cable-confining reel end means, such as end flange structures 15, 15. For this purpose, each side wall supports a suitable bearing unit 16 with extensions of the ends of the core barrel beyond the radial end flanges rotatably supported through these bearing units. As will be best understood from FIG. 5 and 7, the left hand end of the core barrel 14 as viewed from the front of the winch, which is rotatably supported by one bearing unit 16, is reduced in section to provide a shaft stub 17 extending through the left side wall 11 to carry therebeyond a reel driving spur gear or bull wheel 18. For this purpose this shaft stub 17 may be flattened off, such as at 19 in FIG. 5, with the hole in the hub of spur gear 18 being of complemental shape for driving support thereon and, if desired, any suitable means, such as a nut 20, may be employed to hold the spur gear on this reduced shaft stub. The right hand end of the core barrel is also reduced in section to provide a shaft stub 21 extending through and beyond the right side wall 11 and bearing unit 16 supported thereby.

A suitable bushing 22 rotatably supported and held on shaft stub 21, such as by a nut 210 threadably engaged with threads on the end of this stub shaft, carries as part of a speed reducing gear train a relatively large spur gear 23 and a relatively small spur gear 24 staked to the latter to be rotatable together freely upon the end of this stub shaft. Spur gear 23 is meshed with a driving pinion 25 fixed on a drive shaft 26 of a suitable power source, such as a battery-powered electric motor 27, which may be mounted to the frame including the side wall plates 11, 11 in any suitable manner, such as by means of anchoring straps 28, 28. Frame plates or side walls 11, 11 also rotatably support, such as by means of bushings 29, 29, a cross-shaft 30 which carries on one end, suitably fixed or anchored thereto, a driven spur gear 31 meshed with spur gear 24. A driving pinion 32 is fixedly carried on the opposite end of cross-shaft 30 and is meshed with the driven spur gear 18 which drives the reel 13. This speed reducing drive for the reel 13 will be best understood from FIGS. 5 and 7.

Cross-rods 33 and 34 extend between and tie together the frame plates or side walls 11, 11. As will be understood from FIGS. 1, 2, 3 and 5, each motor anchoring strap 28 is lapped about cross rod 33 and a projection 35 carried on the inner face of the side wall by any suitable means, such as a supporting bolt 36. As will be explained later, the projection or lug 35 is in the form of a cable guiding cam to perform a certain service in the reeling up of cable upon the reel 13.

The reel tread or core barrel 14 preferably is provided with a spiral groove 37, as will be understood from FIGS. 2 and 6, and this spiral groove guides the laying down of the juxtaposed turns of the cable in the first layer or course thereof. A suitable length of wire rope or steel wire cable, illustrated at 38, has its inner end 39 suitably anchored to the reel tread or core barrel 14, such as in the manner illustrated in FIG. 4. For this purpose, the reel tread or core barrel 14 is provided at the initial end of the spiral groove 37 with a transverse hole 40 which is counterbored at 41 there to receive a clamping ring 42 fixed or crimped on the inner end 39 of the cable.

Embodiments of the present invention are specially

designed for reeling up a steel wire cable of a diameter of five thirty-seconds of an inch (5/32") and the core spindle or barrel 14 is made from one inch (1") steel rod which after dressing and grooving has a diameter of about fifteen-sixteenths of an inch (15/16") across the ridges intervening the successive turns of the spiral groove 37. It will thus be understood that with such a small diameter reel tread, the successive turns of the steel wire cable 43—43 which are first laid thereon within the spiral groove 37 in the first layer or course will have appreciable coil spring action if unconfined upon the reel due to the stiffness of the cable and in part because of the small diameter of the turns.

In accordance with the present invention, unique cable guiding means is provided in order to assure that the successive turns in each course or layer are laid down neatly about the reel tread or core barrel in adjacent orderly fashion and that these turns are confined snugly to the reel so that the inherent tendency to spring out or "clock spring" is overcome when the reel is undriven and no drag is applied to the cable. Such cable guiding means includes cable turn biasing means which, as will be understood from FIGS. 1, 2, 4, 5, 7, 8 and 9, is in the form of an elongated, flexible, rod-like, generally straight, cable turn-engaging spring element 44 extending longitudinally of the core barrel 14 of reel 13 between the end flanges 15, 15 thereof. A pair of longitudinally-spaced, transversely-extending, spring-biasing support arms 45, 45 support the cable turn-engaging spring element 44 with one end of each arm mounted to one end of the spring element. Preferably, each side spring arm 45 extends back from the ends of the cable turn-engaging spring element 44 above the core barrel 14 with each of the spring arms having a coiled spring section 46 therein and with the turns of the latter wrapped around tying cross-rod 36 as a support. Each spring arm 45 has an anchoring end 47 beyond its coiled spring section 46 which is turned to form a hook that may, if desired, be hooked over the top edge of the adjacent frame plate 11, or hooked in front of and over the other tying cross-rod 33, as is proposed in FIG. 4. As a result, the side spring arms 45, 45 bias and hold the cable turn-engaging spring element 44 snugly down against the top side of the core barrel 14 and any cable turns laid down thereon. It will be seen that preferably this cable guiding means is in the form of a length of resilient steel wire or flexible resilient rod stock bent to provide a U-shaped member having as a mid-section the cable turn-engaging spring element 44 and with the end sections thereof shaped to provide the biasing side spring arms 45, 45. Since the cable turn-engaging spring element preferably is of a length substantially equal to the distance between the reel end flanges 15, 15 the side spring arms 45, 45 preferably are located closely adjacent to or in wiping contact with inside vertical faces of the reel end flanges 15, 15.

In operation of the cable guiding means at 44, let it be assumed that the inner cable end 39 is anchored to the reel core barrel 14, such as in the manner illustrated at FIG. 4 adjacent the reel end flange 15 on the left side as viewed from the front. Assume also that the frame is suitably anchored, such as by means of a strap or holding tong 48 indicated in FIG. 5, secured thereto, such as by a bolt 49, which may be mounted, for example, on a boat trailer, with the far end of the cable 38 suitably connected or anchored to a load, such as a boat. When the supply circuit of electric motor 27 is closed, driving pinion 25 drives spur gear 23 which in turn carries with it gear 24 to drive gear 31 for rotating cross-shaft 30, thereby rotating driving pinion 32 to drive spur gear 18 and thus rotate reel 13. As a result, successive turns 43—43 of the cable 38 will be laid down in the spiral groove 37 in the manner illustrated in FIG. 2. It will be noted that as each turn 43 is laid down on core barrel 14, the cable turn-engaging, longitudinal spring element 44 is kept snugly biased against it and the preceding turns by the biasing spring arm 45, 45. In FIG. 2 it is indicated that while the left end of the cable turn-engaging spring element 44 is snugged down over the cable turns 43—43 its right end is bowed to contact the core barrel 14 and, as a consequence, the last laid-down turn of the cable, as it is being laid down, is not only snugged in radially toward the axis of the reel but also laterally back toward the next preceding cable turn which had been previously laid down. As the first course or layer of turns 43—43 is laid down about the reel core barrel 14, these turns are held snugly thereon by the cable turn-engaging spring element 44.

When the final cable turn 43 of this first course is laid down adjacent the right side reel flange 15, as viewed from the front, which is the left side reel flange as viewed from the rear in FIGS. 8 and 9, the next turn of the cable will be overlaid, as indicated at 50 in FIG. 8, as the first turn of the next overlying course or layer of turns 143—143. As this is done, it will be noted that the side spring arm 45 adjacent the right side reel flange 15 in FIG. 8 snugs that end of the spring element 44 down over or against the first course turn 43 at 51, while the other end of this spring element is lifted to the position indicated in FIG. 8 by the turns 143—143 as they are laid down thereunder with lift of the left side arm 45. This tilting action of the cable turn-engaging spring element 44 causes it to bias the last laid-down turn of the second course layer, indicated at 52, both radially inward and laterally to the left because of the tendency for this spring element to bend or bow thereat, as will be seen in FIG. 8. It will thus be apparent that the cable turn-engaging spring element 44 is snugged down against outside turns of the cable on the core barrel 14 at least at opposite ends thereof, at positions 50 and 51, additionally being snugged down against the remainder of the turns 143—143 laid down in the second course, and is at least bridged across the intervening outside cable turns, such as the turns 43—43 intervening position 52 and position 51. Of course, as all of the turns 143—143 of the second course or layer are laid down the cable turn-engaging spring element 44 snugs down against and bridges across all of them to be disposed in a substantially straight line position.

After the final turn 143 of the second course or layer is laid down adjacent the inner face of radial flange 15 on the right side, as viewed in FIG. 8 from the rear, and above the first turn 43 at position 51 in the first course or layer, the laying down thereabove, at position 53 indicated in the FIG. 9 rear view, of the first turn 243 in the third course or layer raises the right end of spring element 44 thereabove so that now this end is higher than the left end, thereby giving a rocking action to the cable turn-engaging spring element. The independent spring-biasing support of the opposite ends of the cable turn-engaging spring element 44 permits this rocking action. In the laying down of additional turns 243—243 of the third course or layer the cable turn-engaging spring element 44 consequently takes the position illustrated in FIG. 9, with radially inward snugging of the last turn at position 54 and lateral crowding thereof toward the right against the next preceding third course turn 243 laid down. As each next succeeding turn 243 of the third course or layer is laid down to the left of position 54 in FIG. 9, the mid-portion of the spring element 44 is raised progressively thereover, to be aligned with the right side portion thereof snugged down against turns 243—243 laid down previously, and upon completion of the laying down of all of the turns 243—243, the shape of the spring element will be changed from the bowed shape illustrated in FIG. 9 to a flat, straight line position. Thereafter, in the laying down of the turns in the fourth course or layer from the left side toward the right side as viewed from the rear in FIGS. 8 and 9, the cable turn-

engaging spring element 44 will again be bowed in the manner illustrated in FIG. 8.

Thus, the cable turn-engaging spring element 44 "walks" or rocks back and fourth with first one end being raised, then the other second end being raised, thereafter the first end again being raised, and then the second end being raised again, this action being progressively repeated step-by-step until all of the turns in the plurality of courses or layers are laid down. It will be noted that in this action the cable turn-engaging spring element is continuously biased or snugged down against outside turns of the cable on the core barrel of the reel at least at opposite ends thereof, being progressively maintained in snug engagement with the last of the turns in the last course or layer as it is being laid down while bridging across intervening outside cable turns of the preceding course or layer which have not as yet been covered by turns of the last course or layer being laid down. It will further be noted that as each turn in a course or layer (except the first turn therein) is laid down, it is only snugged inwardly, but is crowded laterally against the next preceding turn laid down in the same course with the successive turns neatly laid down about the reel tread or core barrel in adjacent orderly fashion and held in such position against tendency to spring out and skew. As is more fully explained hereinafter this radially-inward snugging and the lateral biasing back of the last laid-down turn against the next preceding turn in any top course which is laid down over a preceding course are accomplished by the "walking" or rocking bowed spring element 44. As to the succeeding turns of the first course the spiraled groove 37 in the core barrel 14 assures the orderly laying down thereof when each is snugged or biased radially inward by spring element 44, although similar lateral back biasing of turns which intervene the first and final end turns may be similarly useful if the core barrel is not so grooved. The cable turns of any full course thereof includes the first end turn which is laid down initially and the final end turn laid down last, with the intervening turns being intermediate turns. Such a first cable end turn of a top course has a portion abutted against the inner side of the first of a pair of the cable-confining reel end means or reel end flanges 15, 15 from which the spiraled reeling is being performed progressively toward the inner side of the second of this pair of reel end flanges, and the final cable end turn of this same course has a portion abutted against the latter. One end of the spring element and its directly connected biasing arm 45 overlies this first end turn and engages it at its highest point to snug or bias it radially inward in the laying down thereof. If this course of cable turns be any overlying one following a preceding full course its first end turn has a portion which is crowded into abutment with the inner side of the adjacent reel end flange 15 by this radially-inward biasing and the back pull applied thereto by virtue of its connection to the underlying final end turn of the preceding course. This is supplemented by, but does not require, a degree of lateral back biasing due to oblique engagement down over the advance side of this last laid-down turn by virtue of the fast that the spring element 44 is canted longitudinally. This canting results from the fact that the overlying biasing side arm 45 and the first end of the spring element 44 connected directly thereto are located a distance from the axis of the reel which is greater by one diameter of the cable than the distance between the reel axis and the other end of the spring element and its second biasing side arm 45. As to the final end turn of this common course it will not be biased laterally back against the next preceding cable turn by canting action of spring element 44, but the second end of the latter and its second biasing side arm 45 bear radially inward against the highest point of this final end turn to crowd a portion thereof down into the space between the advance side of the next preceding turn and the opposed inner side of the second reel end flange where this space is of a width equal to the cable diameter, thereby maintaining the orderly arrangement of all turns in this common course. As this space progressively narrows, due to the spiraling of the cable, the latter climbs out with lift of the second end of the spring element 44 and its directly-connected biasing arm to begin the first end turn of the next succeeding top course. The action is then repeated in the reverse direction, with the reel end flange which served as the second of the pair thereof toward which the cable was being spiraled now acting as the first from which the spiraling now progresses toward the other (formerly the first) as the second of this pair. Thus the identities of the reel end flanges 15, 15 reverses as one top course of cable turns is completed and the next succeeding top course is started for lay down thereover.

In order to prevent back lash or free rotation of the reel 13 while it is not being driven through the gearing from motor 27 and with turns of the cable laid down thereon exerting coil spring action which tend to rotate the reel backwards with consequent loosening of the turns if the reel is not securely held from such rotation, suitable brake means is associated with the reel, such as by connection with its driving means. The brake means which is provided for this purpose in the form of the invention as it was originally designed for market is shown in FIGS. 7 and 10. As is there indicated, the left side frame plate 11 (as viewed from the front of the winch) may carry on its outer face along the bottom edge a lateral bracket plate 55 for this purpose on the top of which is supported a spring saddle 56, preferably made from a strip of spring steel and bent into inverted U-shape to provide a pair of supporting side arms 57, 57 and an arcuately curved or concaved drag strip 58 carried by the side arms and biased up snugly against the tips of the teeth on the bottom side of the reel-driving gear 18, as will be best understood from FIG. 10. Preferably, the bracket plate 55 is provided with a pair of longitudinally-spaced vertical holes 59, 59 down into which are fitted the tips of a pair of tongues 60, 60 formed by notching the sides of the ends of the spring arms 57, 57. Thus, in rotation of the reel-driving gear 18, the tips of its teeth drag with appreciable friction down against the curved drag brake strip 58, which is strongly biased upwardly thereagainst to provide the necessary braking action which prevents back lash.

The embodiment of the invention illustrated by way of example in the drawings also preferably includes a second similar cable guiding means which may be in the form of another length of resilient wire bent to provide a U-shaped member also having a mid-section in the form of another elongated, flexible, generally straight, cable turn-engaging spring element 144 supported at its ends by a pair of similar spring arms 145, 145 behind the reel, as will be understood from FIGS. 3, 5 and 7. The cable turn-engaging spring element 144 is adapted to engage the cable turns, as they are laid down, below the reel tread of core barrel 14 approximately diametrically opposite to the locale of the biasing action of the top cable turn-engaging spring element 44, which will be understood from FIGS. 3, 4, 5 and 7, and the lower portions of the pair of laterally-spaced side spring arms 145, 145 extend upwardly from longitudinal spring element 144 behind the reel 13 to coiled spring sections 146, 146 in these side arms, these coiled spring sections also being wrapped around the transverse cross-rod 34 in the space between the coiled spring sections 46, 46 of the first pair of side spring arms 45, 45. Preferably, the second cable turn-engaging spring element 144 is also of a length substantially equal to the distance between the inside faces of the reel end flanges 15, 15, and thus the pair of side spring arms 145, 145 may abut against the inner sides of the other pair of side spring arms 45, 45, with the spaces between the paired coiled spring sections 46 and 146 on each side being only slightly greater than twice the diam-

eter of the wire from which they are made. Such spacings are more accurately shown in FIG. 7 than in FIG. 5, being exaggerated in the latter smaller scale figure for clarity. However, the side spring arms of these cable turn-engaging spring members may be shaped laterally in various ways without altering the actions of the biasing spring members.

The side spring arms 145, 145 terminate beyond their coiled spring sections 146, 146 in hooked anchoring ends 147, 147, which may be lapped against the rear side of the top tying cross-rod 33, as shown, to hold them as they bias the bottom cable turn-engaging spring element 144 snugly against the cable outside turns laid down on the reel.

The top cable turn-engaging spring element 44 has a dual function of guiding each turn as it is laid down about the reel, and snugging it to its proper position. The bottom cable turn-engaging spring element 144 has a similar function of snugging each outside laid down turn to its proper position. It will be seen that in performing its functions the bottom cable turn-engaging spring element 144 also is snugged against outside turns of the cable on the core barrel 14 at least in the vicinity of opposite ends thereof with at least bridging across intervening outside cable turns in similar manner. It has been found in service that these pair of cable guiding means effectively operate together to assure that the successive cable turns are neatly laid down in orderly fashion about the reel tread or core barrel and are kept snugged to their proper positions in the reeling up of a length of cable on the reel and unreeling the same therefrom while together cooperating with the brake associated with the reel, such as by being connected to its drive, to prevent back lash, i.e., to keep the outside turns from springing away from the reel when it is undriven and no load is applied to the forward cable and extending away from the reel.

The pair of projections 35, 35 not only serve as anchoring pegs for the binding straps 28, 28, which hold the motor 27 cradled between them and the top cross-rod 33, but at least the one on the right side (as viewed from in front) provides on its inner end an inwardly sloped cable camming surface 61. The sloped cam surface 61 is located radially beyond the circumferential edge of the adjacent reel flange 15 approximately in the position illustrated in FIG. 6 so that, in laying down courses or layers of cable turns radially outward of the reel flanges 15, 15, the cable is guided in the formation of the adjacent end turn inwardly by the sloping camming surface 61 to prevent such an end turn from slipping off over the reel end flange, as will be understood from FIG. 1. The other projection 35 may also have a suitable camming portion for a similar purpose, which may, if desired, be similar to camming surface 61.

A second embodiment of the small cable winch of the present invention as it was later constructed for marketing is illustrated in FIGS. 11 to 16 incl. Many of the parts thereof are substantial duplicates of the winch construction illustrated in FIGS. 1 to 10 incl., but a few changes have been made therein. One of these changes concerns the drive of the reel 13 which has been modified in character with respect to the means providing drag for reverse rotation pay-out of the loaded cable. Another change is the provision therein of certain novel cable end turn lateral camming means which entirely eliminates any possibility of cable turns piling up against the inner side of one of the reel end flanges 15 as the reeling shifts from the completion of one full top course of cable turns to the beginning of the formation of the next overlying top course thereof.

As will be understood from FIG. 13 the spur gear which is meshed with driving pinion 24 and is carried by the cross shaft 30 for drive of the latter when anchored thereto, may be an element of a combined driving friction clutch and drag brake sub-assembly which is the subject of my copending application Serial No. 12,360, filed March 2, 1960, now Patent No. 3,051,447, for Power Driven Cable Winch and Drive and Brake Means Thereof. As therein taught, the spur gear which is coaxially carried by the drive shaft 30 for drive of the latter is designed freely to rotate thereon. This spur gear is indicated at 131 in FIG. 13, and is shown located between friction clutch discs 62 and 63, non-rotatably supported by the right side end of the cross shaft 30 while being axially movable thereon to clamp this spur gear therebetween. This driving clutch sub-assembly is associated with means to hold the spur gear 131 against reverse rotation so that the parts may serve as a drag brake in pay-out of loaded cable. For this purpose, a spring-biased stop pawl 64 is engaged with driving pinion 24 to limit rotation of the latter to its forward driving direction. Tightening and loosening of the combined driving clutch and drag brake sub-assembly, comprising friction discs 62 and 63 and the intervening free spur gear 131, may be effected by an externally-engageable manual control, such as knob 65 shown in FIG. 11.

Preferably the winch 100 of FIG. 11 includes a housing or hood 66 having a front opening 67 in which the cable reel 13 is exposed to view and from which extends the outer end of the cable 38 for attachment to a load, such as by hook 68. The front opening 67 of the hood 66 and the relative dimensions of the other parts of the front of the winch 100 are such as to permit the front end of the cable to swing up and down through a relatively-large acute angle (α) of orientation in which the loaded front end of the cable may extend forward within this vertical angle from the core barrel of the reel directly towards its load when the latter is in any one of a plurality of elevations relative to the reel core barrel or the winch, as may be dictated by the characteristics of a particular service for the winch or in a certain situation in which the winch is employed. This acute angle (α) may be of appreciable extent, such as about sixty degrees ($\pm 60°$) which is more than sufficient to accommodate the winch to employment in practically all conventional services, most uses causing the loaded end of the cable to swing vertically through an angle which is very much smaller.

The embodiment of the invention illustrated in FIGS. 11 to 16 incl. cooperatively associates with the cable guiding spring element 44, a cable end turn lateral camming means mounted to the front of the winch frame structure forward of the reel 13. This supplemental camming means comprises a pair of laterally-spaced, elongated, upright members 68, 68 of appreciable length fixedly mounted appreciably forward of the reel 13 and extending completely across the relatively-large acute angle (α) of possible vertical orientation of the loaded cable 38. These upright camming members 68, 68 have opposed inner sides 69 against which the loaded cable 38 may drag during the reeling up thereof involving the laying down of the first few and the last few cable turns in a full course, as is illustrated in FIGS. 11 and 13. These upright camming members 68, 68 have their opposed inner sides 69, 69 disposed in substantially parallel planes, which are arranged substantially normal to the axis of the core barrel 14 in the vicinities of but spaced laterally inward of the inner sides of the pair of cable-confiining reel end means or end flanges 15, 15, as will be better understood from FIG. 13. The spacing between either of these two planes and the inner side of the cable-confiining reel end means or end flange 15 at the same end of the core barrel 14 is sufficient to contact at the point 169 the forwardly-extending loaded cable 38 (which is being reeled up toward this end of the core barrel), and then to cam it obliquely inward and laterally toward the other end of the core barrel while at least a portion of the intermediate cable turn next to the final full end turn of the same course and this end turn are being laid down progressively. In a practical embodiment, assuming that the loaded cable 38 extends forward substantially

normal to the axis of the reel 13 (as is the case when a considerable length of cable is employed with such a small winch) the loaded cable will contact the inner side 69 of the adjacent upright camming member 68 at the point 169 during the lay down of the turn which next precedes the final turn of a particular top course, for example, when about one and one-half more turns are to be laid down in this course.

The upright camming members 68, 68 preferably are provided in the form of sections of cylindrical rod stock so as to have virtually line contact with the side of the loaded cable 38. These sections of cylindrical rod stock extend above and below the top and bottom of the reel 13, so as to assure that they satisfy the requirement of completely crossing the acute angle (α) of intended orientation of the incoming loaded cable 38. Preferably the upright camming members 68, 68 constitute parallel depending legs of an inverted U-shaped member 70 having an intervening medial portion 71, as will be best understood from FIG. 12. The inverted U-shaped member 70 may be mounted to the winch frame in any suitable manner, such as by locating its depending leg 68, 68 immediately adjacent the opposed inner faces of the frame side plates 11, 11, and anchoring it in position by a plurality of machine screws 72—72 threadably engaged in internally threaded holes 73—73 in these depending parallel legs. As a result, the intervening transverse portion 71 of the inverted U-shaped member 70 will constitute a manually-engageable bail which will facilitate handling of the winch. The winch 100 is made readily portable by the hand grasp provided by the bail 71.

In operation of the embodiment of FIGS. 11 to 16 incl. let it be assumed that the first two full courses of cable turns, respectively identified as 43—43 and 143—143, have been laid down successively about the core barrel 14 between the end flanges 15, 15, in the manner taught in FIGS. 8 and 9. FIG. 14 diagrammatically illustrates in a front view (FIGS. 8 and 9 being rear views) further progressive lay down of additional turns 243—243 of the third course from the last turn position 54 in FIG. 9 to the last turn position 154 in FIG. 14. In this progressive reeling of the third course of cable turns 243—243 the left side reel end flange 15 as viewed in FIGS. 14 to 16 incl. constitutes the first of the pair thereof, and is thus referenced "15–1" in FIGS. 14 and 15. It will be noted from FIG. 14 that while the left side end 75 of the laterally-extending cable-guiding spring element 44 remains in contact with the first full turn 53 of this third course, the right side end 76 thereof begins lifting from contact of the first full turn 143 of the second full course at 50 because of the progressive drawing of more of the third course turns 243 back beneath this spring biasing element to lay them down appreciably beyond the middle of the core barrel 14. As a result, the portion of the spring biasing element 44 intervening the third course full first end turn at 53 and the last laid-down turn thereof at 154 bows up slightly at a point approximately half way between these two turns, such as at about the location of the arrow 77 in FIG. 14. Thus, the portion of the biasing spring element 44 above the last full turn laid down at 154 is canted downwardly and forward, i.e., obliquely down over the advance side of this last intermediate cable turn, to effect the lateral biasing back toward the first reel end flange 15–1, so to snug this turn against the next preceding laid-down cable turn in this same partial top course. At the point 77 the lift (indicated by the spacing at 78) of the spring biasing element 44 may be of the order of about one thirty-second of an inch ($\frac{1}{32}$"). This intermediate lift of very minor degree between the points of contact of the biasing spring element 44 upon the tops of the first full end turn at 53 and the last full end turn at 154 is of no moment; the cable guiding means need not bear snugly down and radially inward on all of the turns intervening the first end turn and the last laid-down turn because the intervening turns are pulled tightly therebetween after they have been properly guided individually in the progressive laying down thereof. It is important only that there be the described radially-inward biasing and oblique laterally-back biasing with respect to the last intermediate turn as it is being laid down.

It will be noted from FIG. 15 that, as more turns 243—243 of the third top course are progressively laid down toward the second of the pair of reel end flanges, therein identified as "15–2," the far or second end 76 of the biasing spring element 44 lifts still further above the first full turn 143 of the second course at 50, and that the intermediate point of highest lift, indicated by the arrow 177, moves further to the right. The next to the final full end turn in the third course is indicated at 254 in FIG. 15, and it will there be seen that the biasing spring element 44 continues to bow thereover on the advance side to effect the desired lateral biasing thereof back against the next preceding laid-down cable turn in this same top course. This action was also accompanied by a gradual increase in the intermediate lift (indicated by the spacing 178 at the point 177), which may now be of the order of about one-sixteenth of an inch ($\frac{1}{16}$"). The final end turn indicated in dotted lines at 354 in FIG. 15 will now be laid down so that a portion thereof will be snugly crowded into the space between the advance side of the cable turn 254 and the inner side of the second reel end flange 15–2 as this space is progressively narrowed in the forward spiraling of this next to the final end turn. This inward crowding of the final end turn 354, i.e., radially inward toward the axis of the core barrel 14, is effected by the radially-inward biasing imposed thereon by the right side end 76 of the biasing spring element 44 and the spring biasing side arm 45 directly connected thereto. When all of the full turns 243 of this third course, including its final end turn 354, are laid down the central bowing or lift of the biasing spring element 44 is reduced or disappears so that it lies flatly across the tops of all of the cable turns 243 of the full third course. Actually, the full lines at 254 indicate only a portion of the full turn which next precedes the final turn to be laid down at the dotted line position 354 in FIG. 15, i.e., the location of its initial portion at the instant that its advance side comes into contact with the inner side 69 of the upright camming member 68 on the right side of this figure. As has been previously indicated, this is the instant when about one and one-half more turns 243, 243 of the third course remain to be laid down to complete this third top course.

With progressive further reeling of the loaded cable 38 about the core barrel 14, the cable climbs up out of the progressively narrowing space between the next to the last full turn at 254 and the inner side of the second reel end flange 15–2 to begin the reversed laying down of the first end turn of the next succeeding fourth top course. At the same time, the identities of the reel end flanges 15, 15 reverses, so that now the left side reel end flange becomes the second of the pair, as is indicated at 15–2 in FIG. 16, and the right side reel end flange becomes the first of this pair, as is indicated at 15–1 in this figure, for this reverse laying down progressively of the succeeding cable turns 343—343 in the fourth course. At the instant that the advance side of the loaded cable 38 contacts the inner side 69 of the upright camming member 68 on the left side of FIG. 16 a similar portion of the next to the final full end turn remains to be laid down, and this is indicated therein in dotted lines at 179; then the final end turn, indicated in dotted lines at 279, is thereafter to be laid down. The last turn portion of the cable preceding the final one and one-half turns, which are represented in dotted lines at 179 and 279, thus constitutes about a half portion of the next to the final full end turn and is indicated in full lines at 79 in FIG. 16. Again it will be noted that the biasing spring member 44 bows forward over this portion 79 of

the next to the final turn 343 in the fourth course, i.e., obliquely down in front of its advance side, to bias it laterally back snugly against the next preceding full turn. This action again is accompanied by lift of the end 75 of the biasing spring member 44 up from the first full end turn 243 of the third full course at 53 and intermediate lift approximately at the point 277 with accompanying spacing 178 thereat. This is substantially a duplication of the action illustrated in FIG. 15, but in the reverse direction with respect to a succeeding top course.

It will thus be seen that the biasing spring member 44 maintains its canted or oblique backward biasing throughout the laying down of the cable turns in a course which succeed its full first end turn to a point of laying down of the last few turns, such as the final end turn and a portion of the next preceding turn. With the crowding in by the radially-inward biasing of the final end turn of any top course orderly laying down of all of the turns in contiguous and abutting relation is effected by the cable guiding and biasing spring element 44. This results from the rocking or "walking" action of the flexible spring element 44 illustrated in FIGS. 8, 9 and 14 to 16 incl. It will be understood that the greater the flexibility of lateral spring element 44 and the greater the inward biasing of the ends thereof by the side spring arms 45, 45 the larger is the spacing of medial lift, such as at 78 and 178, and the greater the degree of oblique canting thereof over the advance side of the last turn being laid down.

As has been previously indicated, and as is illustrated in FIG. 13, the advance side of the loaded cable 38 will be brought to contact of the inner side 69 of the upright camming member 68 toward which the spiraling is progressing at an instant when there may remain only the final end turn and a portion of the next preceding turn of a particular top course to be laid down. FIG. 13 illustrates such a condition when about one and one-half turns of the cable remain to be laid down in this course, which may be the ninth course with the turns thereof indicated at 943—943. The half portion of the next to the final end turn in this course is indicated in full lines at 80, and the loaded front end portion of the cable 38 which extends forward from the point of biasing at 81 to the point of contact at 169 with the inner side 69 of the right side upright camming member 68 is also shown in full lines in FIG. 13. In the laying down of the last one and one-half turns of this ninth top course, the loaded front end of the cable 38 is gradually cammed over to the dotted line position indicated at 82 in FIG. 13, i.e., oriented progressively more obliquely back toward the inner face of the reel end flange 15 on the right side. This action cooperates with the oblique lateral backward biasing of the portion 80 of the next to the final full end turn of this ninth course to assure that, as the remaining portion of this full turn is laid down, it will be snugged back against the advance side of the next preceding full turn shown in full lines at 83. As the final full end turn of this ninth course is crowded into the remaining space, such as is indicated in dotted lines at 84, this space becomes progressively narrower than the diameter of the cable so that the latter gradually climbs upward, eventually to lap back over the final full end turn and begin laying down as the first full end turn in the next successive overlying top tenth course. Since, at this instant, there is no oblique laterally-backward biasing of the cable by the lateral flexible cable guiding element 44, i.e., forward in the direction of progressive spiraling of the turns in this next course, occasionally the reeling action may, in the absence of camming member 68, tend to pile up turns adjacent the inner side or face of the juxtaposed reel end flange. Such a tendency is eliminated by the upright camming member 68 on the right side of FIG. 13 due to the fact that the cable extends from its inner side 69 obliquely back along the dotted line position 82 to this reel end flange. This is equivalent to pushing the loaded cable back toward the other end of the reel in the laying down of the first few turns of the next succeeding top course, until there are sufficient turns to permit the loaded cable to work over in that direction away from contact with this upright camming member. But, this oblique disposition of the feed of the loaded cable 38 back to the reel 13 during the lay down of the first few turns in the next succeeding top course (such as the tenth) may, in the absence of the cable-biasing spring element 44, tend to cause these turns to lead a greater distance than a diameter of the cable, so as to separate the successive turns from complete adjacency and cause disorderly reeling. The latter is compensated for or prevented by the biasing action of the lateral spring element 44. By bowing down over the advance side of these first few turns, and progressively onward, each cable turn, as it is laid down, is biased backward to contact with the next preceding laid-down turn. Accordingly, in completing a course of turns the upright camming member 68 at that end of the reel 13 assists the biasing action of the lateral spring element 44, but in the laying down of the first few turns of the next succeeding overlying top course the latter assists the former in assuring that the camming action will not be so great as to separate them. Such action is duplicated at the opposite end of the reel 13, as is indicated in dot-dash lines at 85.

By having the upright camming members 68, 68 extend completely across the intended, relatively large, acute angle of orientation (α) one is assured that the camming action effected thereby will be present for the progressive laying down of the few end turns in each course when the winch is used in a conventional manner. Further, the extended lengths of the upright camming members 68, 68 assures that the transverse manual bail 71 will not interfere with the free movement of the forwardly-extending loaded cable 38. Bail 71 is located high enough so that the loaded forward end of the cable will not drag therebeneath. It is to be understood that the upright camming members 68, 68 need not be sections of cylindrical rod stock, and that their desired camming action may be attained by hollow tubing or by crowned ribs made integral with side plate structure of the frame, or that freely rotatable vertical rollers may be substituted for such fixed rod sections.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained by the simple and economical cable guiding means of the present invention in the reeling of small steel wire cable upon reels having unusually small reel treads or core barrels without resort to complicated and expensive traveling guiding equipment and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a small cable which, the combination with

(*a*) a frame rotatably supporting a driven reel having

(*b*) a lateral, substantially cylindrical, core barrel of relatively small diameter carrying at opposite ends thereof

(*c*) a pair of axially-spaced, radial, first and second cable-confining reel end means having opposed inner sides between which successive courses of a plurality of spiraled turns of small steel wire cable are to be laid down progressively about said barrel when said cable has one end anchored to said reel and the other end loaded and extending forward from said core barrel generally normal thereto; of

(*d*) cable turn biasing means including an elongated, flexible, rod-like, generally straight spring element extending longitudinally of said core barrel between

the opposed inner sides of said pair of cable-confining reel end means with the ends of said spring element located in the immediate vicinity of the latter and sufficiently close thereto to engage and bear radially inward against the highest points of first and final laid down turns of a full top course of cable turns;

(*e*) a pair of longitudinally-spaced, transversely-extending, independently-supported, spring-biasing support arms each mounted to one end of said spring element for support thereof and independently snugging said flexible spring element radially inward against cable turns of a partial top course with said spring element being bowed by the spring-biasing support of the ends thereof obliquely down over the advance side of the last intermediate cable turn as it is being laid down with successive biasing of each last laid down intermediate cable turn laterally back against the next preceding laid down cable turn in this partial top course;

(*f*) and cable end turn lateral camming means comprising

(*g*) a pair of laterally-spaced, elongated, upright members of appreciable length fixedly mounted appreciably forward of said reel and extending completely across an intended, relatively-large acute vertical angle of orientation of the loaded end of said cable as it extends forward toward its load

(*h*) said camming members having opposed inner sides disposed in substantially parallel planes arranged substantially normal to the core barrel axis in the vicinities of but spaced laterally inward of the inner sides of said pair of cable-confining reel end means,

(*i*) the spacing between either of these planes and the inner side of the cable-confining reel end means at the same end of said core barrel being sufficient to contact the forwardly-extending, loaded cable being reeled up toward this end of said core barrel and cam it obliquely inward laterally toward the other end of said core barrel while at least a portion of the intermediate cable turn next to the final full end turn of the same course and this end turn are being laid down progressively.

2. The winch structure as defined in claim 1 characterized by similar cable biasing means having another elongated, flexble, rod-like spring element biased in similar manner against the cable turns on said barrel on the opposite radial side of the latter.

3. The winch structure as defined in claim 1 characterized by said pair of support arms also being elongated, flexible, rod-like spring elements with each having an anchoring end and a coiled spring section between the latter and said cable turn biasing element, a support bar fixedly mounted generally parallel to said reel and offset transversely therefrom with said bar extending through said coiled spring sections, and fixed means transversely beyond said support bar holding the anchoring ends of said spring arms.

4. The winch structure as defined in claim 3 characterized by said cable turn biasing spring element and said spring arms respectively forming a mid-section and end sections of a length of resilient metal wire bent to provide a generally U-shaped member having in the sides thereof the coiled spring sections.

5. The winch structure as defined in claim 4 characterized by a second similar cable turn biasing member in the form of a generally U-shaped length of resilient metal wire having similar coiled spring sections in its side arms, said second U-shaped member being supported and anchored in similar manner with its mid-section biasing cable turns toward said barrel on the opposite radial side of the latter.

6. The winch structure as defined in claim 1 characterized by said cable and turn lateral camming means providing said upright members in the form of sections of cylindrical rod stock extending above and below the top and bottom of said reel.

7. The winch structure as defined in claim 6 characterized by said cable end turn lateral camming means being in the form of an inverted U-shaped member fixed to said frame with parallel legs of said U-shaped member constituting said upright member sections and with the intervening portion of said U-shaped member constituting a manually-engageable bail to facilitate handling said winch.

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1,060,103	Leihy	Apr. 29, 1913

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,150,861 September 29, 1964

Fred E. Ahlbin

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 30, for "frequenly" read -- frequently --; line 43, for "simple" read -- simply --; lines 47 and 48, for "requring" read -- requiring --; line 71, for "fasion" read -- fashion --; column 2, line 23, after "up" insert -- in --; line 58, for "rell" read -- reel --; line 66, for "diagrmmatic" read -- diagrammatic --; column 4, line 19, for "FIG." read -- FIGS. --; line 25, for "flattened" read -- flatted --; column 5, line 9, after "laid" insert -- down --; line 36, for "36" read -- 34 --; column 6, line 2, for "arm" read -- arms --; line 40, for "position. 51." read -- position 51. --; column 7, line 4, for "fourth" read -- forth --; column 8, line 58, for "of" read -- or --; column 10, lines 63 and 66, for "confiining", each occurrence, read -- confining --; column 14, line 60, for "which" read -- winch --; column 15, line 46, for "flexble" read -- flexible --.

Signed and sealed this 2nd day of February 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents