Feb. 10, 1970 J. P. BOHAN 3,494,595

CABLE-TO-HOIST DRUM ATTACHMENT MECHANISM

Filed June 26, 1968 3 Sheets-Sheet 1

FIG_1

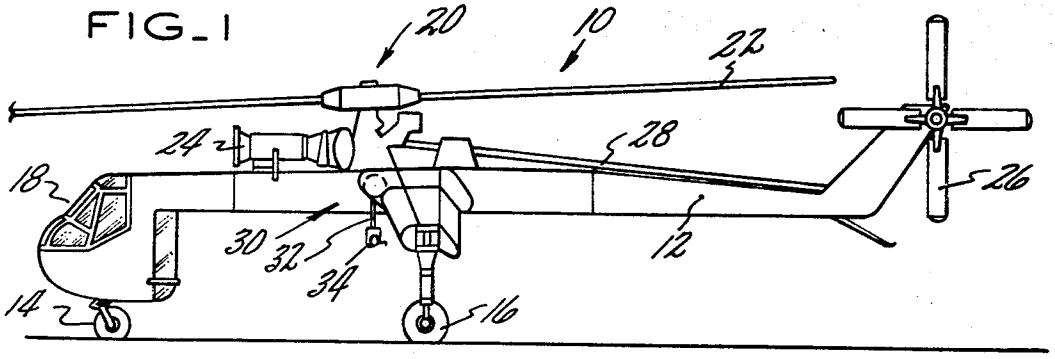


FIG_2

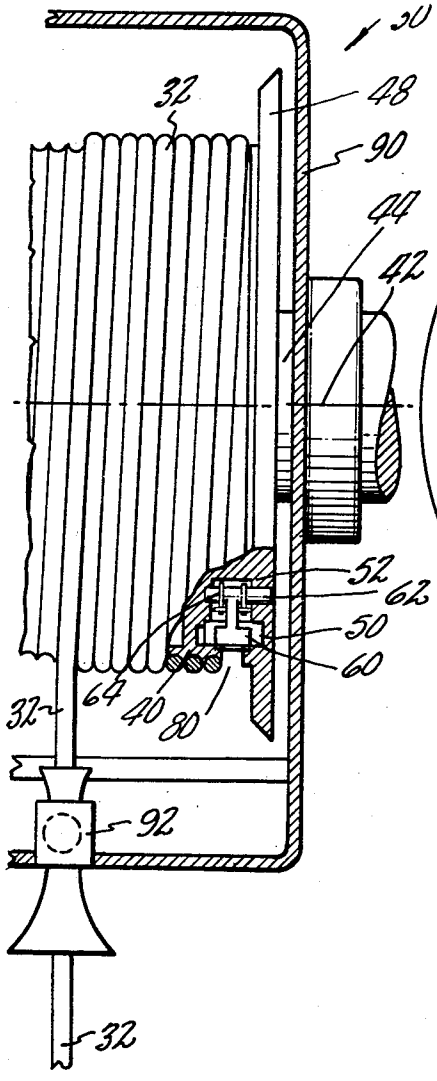
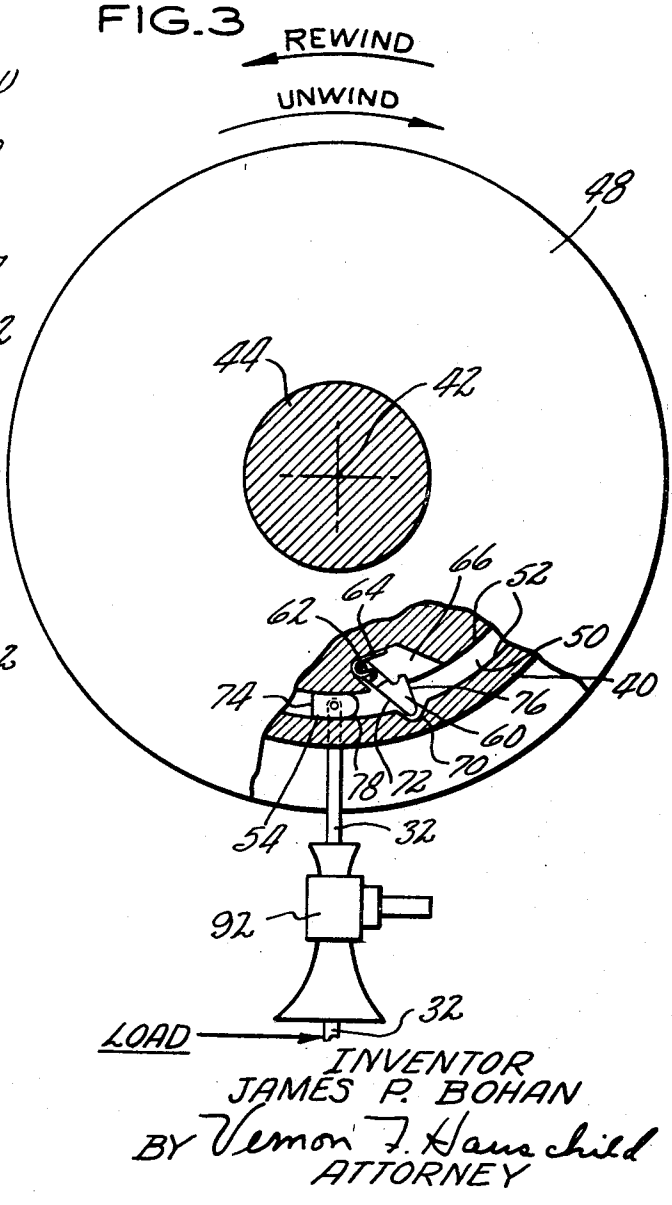


FIG_3



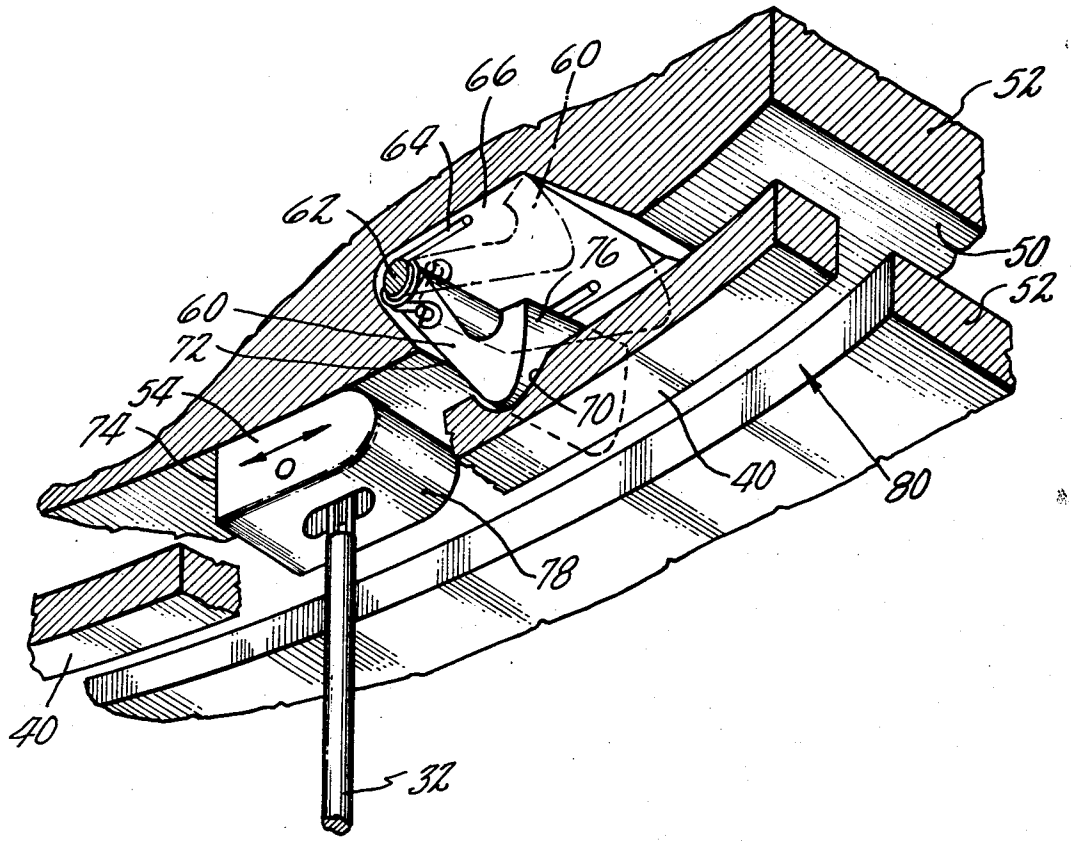
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CABLE-TO-HOIST DRUM ATTACHMENT MECHANISM

Filed June 26, 1968 3 Sheets-Sheet 2

FIG_4



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CABLE-TO-HOIST DRUM ATTACHMENT MECHANISM

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FIG. 5

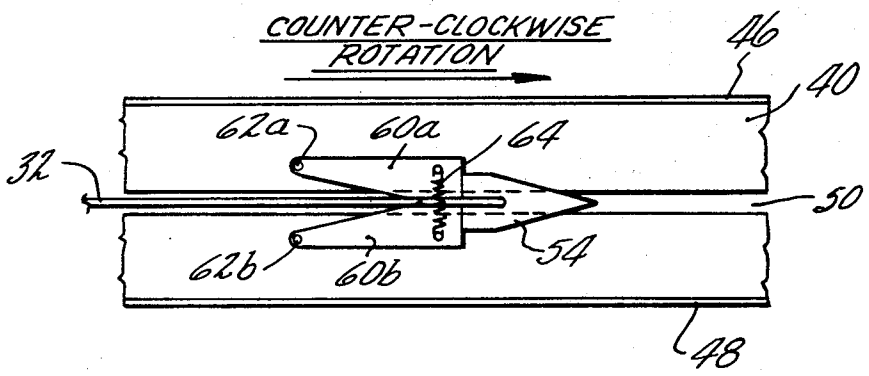


FIG. 6

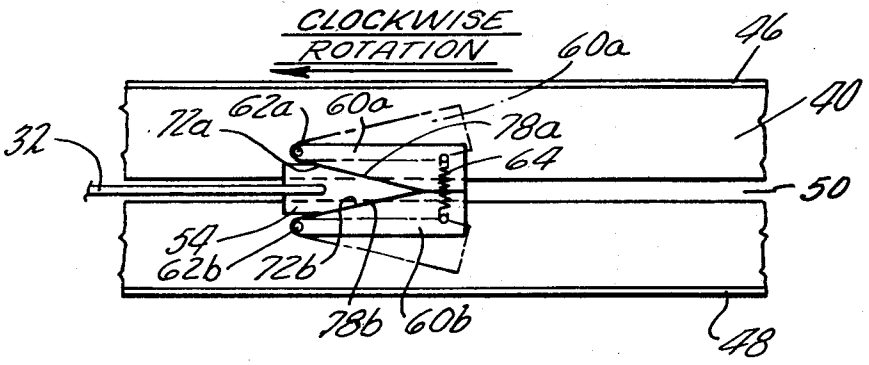
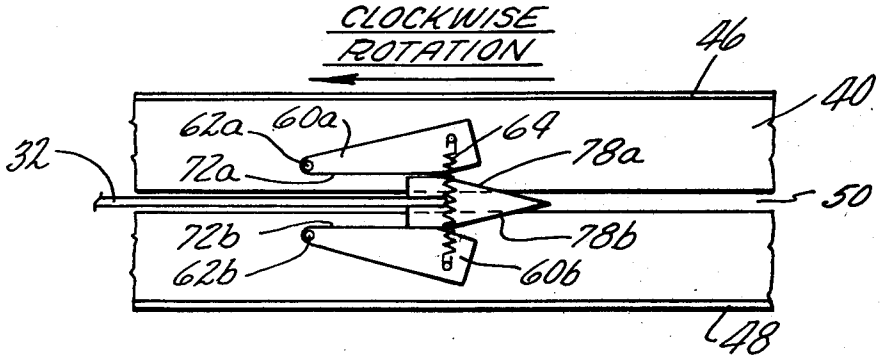


FIG. 7



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United States Patent Office 3,494,595
Patented Feb. 10, 1970

3,494,595

CABLE-TO-HOIST DRUM ATTACHMENT MECHANISM

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Filed June 26, 1968, Ser. No. 740,234
Int. Cl. B66d 1/00, 1/34
U.S. Cl. 254—150 9 Claims

ABSTRACT OF THE DISCLOSURE

A cable hoist system including a rotating drum having a continuous track mechanism in which a sliding block member is positioned for motion relative to the drum and with the cable end attached thereto and further including a blocking member which rotates with the drum and is biased to extend into the track passage and is contoured so that the sliding block member can pass thereby when moving in one direction within the track but cannot pass thereby in the other direction so that this arrangement not only connects the cable to the drum but permits the drum to rotate after the cable has been fully paid out without inadvertently rewinding the cable onto the drum in the opposite direction.

BACKGROUND OF THE INVENTION

Field of invention

This invention relates to mechanism for attaching the end of a cable to the hoist drum onto which the cable is to be wound and from which the cable is to be paid out and, more particularly, to such mechanism so that the drum can continue to rotate after the cable is fully paid out without rewinding the cable onto the drum in the opposite direction.

Description of the prior art

In the cable hoist art, the friction of the cable on the drum has been used to retain the cable on the drum and down-limit switches have been used to signal the pilot when the last three or so revolutions of the cable remain on the drum so that the pilot may stop the drum from rotating and thereby stop paying out cable and thereby avoid dropping the load. Experience has shown that these limit switches malfunction and that pilots, due to inadvertence or distraction, fail to heed their warning signal so that the drum continues to rotate and pay out the cable until the cable and load are lost from the drum.

In addition, the prior art constructions have positively anchored the cable end to the drum or reel and while this accomplishes the purpose of retaining the cable and its load, it presents a serious problem when the drum continues to rotate after the cable is fully paid out in that this continued rotation of the drum causes the cable to rewind onto the drum in the opposite direction and therefore inadvertently commences hoisting in the load.

SUMMARY OF INVENTION

A primary object of the present invention is to provide an improved cable-to-hoist drum connection which not only prevents the cable and its pay load from being separated from the drum but also prevents the cable from being inadvertently rewound onto the drum if the drum should continue to rotate after the cable has been fully paid out.

In accordance with the present invention, the drum is mounted for rotation in either direction so as to either wind in or pay out the cable and its load and is provided with a continues track or groove defining mechanism which rotates with the drum and which carries a sliding block therewithin to which the cable end attaches to retain the cable attached to the drum. The invention further includes a block mechanism which is biased to extend into the track or groove and which is shaped so that the sliding block may pass thereby when moving with respect to the drum in one direction but is prevented from passing thereby when moving with respect to the drum in the opposite direction. This one directional or diode-type sliding block prevents the cable from being rewound onto the hoist drum or reel when the drum continues to rotate after the cable is fully paid out and also permits the cable to be wound upon the drum depending upon the direction of rotation of the drum.

Other abjects and advantages will be apparent from the specification and claims and from the accompanying drawings which illustrate an embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation of a modern helicopter of the crane type embodying my invention.

FIG. 2 is a showing of a hoist system including a cable and drum embodying my invention, and is partially broken away for purpose of illustration.

FIG. 3 is a side of the embodiment of my invention shown in FIG. 2 wherein the housing has been removed, the cable unwound, and the drum is partially broken away for purpose of illustration.

FIG. 4 is an enlarged partially broken away showing of a portion of my invention.

FIGS. 5, 6 and 7 are schematic showings of another embodiment of my invention for the purpose of illustrating the operation of the device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1 we see modern aircraft helicopter **10** of the crane type which consists of fuselage **12** supported from the landing strip by landing gear **14** and **16** and defining pilot compartment **18**. Lift rotor **20** is supported for rotation from fuselage **12** and carries rotary blades or wings **22** therewith to generate lift. Engine **24** drives rotor **20**. Tail rotor **26**, which performs the function of reacting the torque generated by lift rotor **20**, is also driven through conventional drive mechanism **28** by engine **24**.

Lift or hoist system **30** is supported in fuselage **12** and, as described hereinafter, carries a cable **32** with a conventional cargo hook **34** suspended from the end thereof to be attached to any load which is to be carried by helicopter **10**. This load may be a passenger pod, a pallet of ammunition or the like.

Helicopter **10** may be of the type more fully described in U.S. Patent No. 2,925,130 and rotor **20**, may be either of the articulated or rigid rotor type disclosed in U.S. Patent Nos. 3,097,701 and 3,135,335, respectively. Blades **22** may be of the type more fully disclosed in U.S. Patent No. 3,333,642 and engine **24** and transmission therebetween to lift rotor **20** and anti-torque rotor **24** may be of the type more fully described in U.S. Patent No. 2,811,324.

Viewing FIGS. 2, 3 and 4 we see hoist system **30** in greater particularity. Hoist system **30** includes drum **40**, which is preferably cylindrical and mounted for rotation in clockwise or counterclockwise direction about axis **42** by drive motor **44**. The method of supporting and driving hoist drum or reel **40** is conventional and may be of the

type more fully disclosed in U.S. Patent No. 2,403,099. Cable **32** is either wound onto in spool fashion or paid out from drum **40** as the drum is caused to rotate in opposite directions. Disc members, such as **48**, are positioned at the opposite ends of the cable receiving portion of drum **40** to prevent the cable from sliding off the ends of drum **40**, and may or may not rotate therewith.

As explained above, it is an important teaching of this invention to attach cable **32** to drum **40** so that the load being supported by the cable is not lost if the cable is fully paid out and also, so that if the drum continues to rotate after the cable is fully paid out the cable will not rewind upon the drum in the opposite direction from its normal winding action. The portion of my invention which permits this cable attachment and anti-rewind function is more fully disclosed in the broken away portions of FIGS. 2, 3 and 4 and includes continuous, annular track or slot **50**, which is defined within drum **40** by drum wall members **52** and therefore rotates with drum **40** about axis **42**, and sliding block member **54** which is loosely received in track **50** so that block **54** may slide within track **50** with respect to drum **40**, and still further includes stop, blocking or intercepting member **60**, which is pivotally connected to drum **40** about pivot axis **62** and which is biased by spring **64**, which extends between drum housing **52** and blocking member **60**, to extend across continuous, circumferential slot or track **50** as shown in FIGS. 3 and 4. Spring **64** could also be of the coil type positioned about axis **62** and reacting against drum **40** to bias blocking members **60** to its FIG. 4 solid line position. It will be obvious that the cross-sectional shape of slot **50** may be any shape consistant with the shape of member **54**.

By viewing FIGS. 3 and 4 it will be noticed that blocking member **60** is pivotally connected to rotating drum **40** at pivot axis **62** which is recessed in indented chamber **66** in drum housing or wall member **52** so that, with spring **64** overcome, pivotable blocking member **60** can be recessed fully into recess chamber **66**, as shown in phantom in FIG. 4, so as to clear track or slot passage **50** for the passage of sliding member **54** therepast. Member **60** may be gravity actuated but is preferably biased by a suitable mechanism such as spring **64**. It will further be noted by viewing FIGS. 3 and 4 that blocking member **60** cannot move in a clockwise direction past its FIG. 3 and FIG. 4 (solid line) position in view of the fact that it abuts recess **70** in drum **40**.

As best shown in FIGS. 3 and 4 it is important to note that blocking or intercepting member **60** is positioned, supported and selectively contoured so that it will not block the passage of sliding block **54** when the block **54** travels in a counterclockwise direction in track or slot **50** of drum **40** but will block the passage of sliding block **54** through track or slot **50** when drum **40** rotates in a counterclockwise direction. More specifically, if, as shown in FIGS. 3 and 4, drum **40** rotates in a clockwise direction with respect to block **54**, block **54** would contact blocking member **60** at angular surface **72** and overcome the force of spring **64** and depress blocking member **60** into cavity **66** so as to permit the passage of sliding block **54** thereby. If, however, drum **40** rotates in a counterclockwise direction with respect to sliding block **54**, when sliding block **54** reaches blocking member **60**, its flat surface **74** comes into direct engagement with flat surface **76** of blocking member **60**. Since blocking member **60** is prevented by the detent action of recesses **66** and **70** from pivoting further in a clockwise direction as shown in FIGS. 3, and 4, blocking member **60** will prevent the passage of sliding block **54** therepast in track **50** with respect to drum **40** and block **54** will thereafter rotate with drum **40**. Accordingly, it will be seen that sliding block **54** is free to pass blocking element **60** when drum **40** rotates in a clockwise direction but is not free to pass element **60** when drum **40** rotates in a counterclockwise direction so that we, in effect, have a mechanical diode.

As best shown in FIGS. 3 and 4, the end of cable **32** opposite to the load carrying end is connected in any convenient fashion to sliding block **54** and extends therefrom through circumferential slot **80** to the exterior of drum **40**. It will be noted that circumferential slot **80** communicates with track **50** and also communicates with the exterior of drum or reel **40** so that cable **32** can pass therethrough unrestricted. Slot **80** is defined between drum **40** and end plate **82** which is attached thereto in spaced relation in conventional fashion and which may be formed in disc **48**.

By way of operation of hoist system **30**, let us assume that cable **32** is wound onto drum **40** as best shown in FIG. 2 and we wish to lower the load which is suspended from hook **34** at the end of cable **32**.

To accomplish this cargo lowering function, the pilot will operate drive motor **44** and its associated mechanism to cause drum **40** to rotate in a clockwise direction as viewed in FIG. 3. This clockwise rotation of drum **40** will cause the various layers of cable **32** to be consecutively paid out from drum **40** until the cable is fully paid out and in the condition shown in FIG. 3. Since the nonload carrying end of the cable **32** is attached to drum **40** by sliding block **54** and is free to move within track **50** with sliding block **54** as the drum **40** continues to rotate in a clockwise direction when angular surface **72** of blocking member **60** eventually comes into contact with curved surface **78** of sliding block **54**, and this will occur at the bottom of drum **40** since gravity will cause the free sliding block **54** to assume the bottom-of-the-drum position, blocking means **60** will be depressed into cavity **66** to permit the passage of blocking member **60** and sliding block **54** past each other so that drum **40** can continue to rotate in a clockwise direction without inadvertently rewinding cable **32** onto drum **40** in the opposite direction to its normal winding motion.

If, with cable **32** in its fully paid-out condition as shown in FIG. 3, the pilot wished to hoist the load or rewind the cable onto the drum **40**, he actuates drive motor **44** so as to cause drum **40** to rotate in a counterclockwise direction as shown in FIG. 3 so that, with sliding block **54** and cable **32** remaining at the bottom of rotating drum **40**, blocking member **60** will be carried with drum **40** in a counterclockwise direction until it eventually travels through almost 350° in that direction from its FIG. 3 position until flat surface **76** thereof contacts corresponding flat surface **74** of sliding block **54**, whereupon, due to the coaction of blocking member **60** against detents **70** and **66**, blocking member **60** will prevent the passage of sliding block **54** therepast in track **50** and thereby cause sliding block **54** and hence cable **32** to rotate in a counterclockwise direction with drum **40** and thereby wind or rewind cable **32** onto drum **40**.

A second embodiment of my invention is shown in FIGS. 5–7 and will not be described. Reference numerals have been used in FIGS. 5–7 which correspond wherever possible with the reference numerals already used to describe corresponding apparatus in the FIG. 2–4 construction. The FIG. 5–7 construction differs from the FIGS. 2–4 construction in that it utilizes two blocking members **60*a*** and **60*b*** which are pivotally connected to rotating drum **40** at pivot points **62*a*** and **62*b*** and which are biased toward one another by spring member **64**, which may be either attached to both blocking members **60*a*** and **60*b*** as shown or may extend between end discs **46** and **48** of drum **40** and the blocking members, or may be of the coil variety and concentric about pivot axes **62*a*** and **62*b***.

As best shown in FIG. 5 hoist drum **40** is rotating in a counterclockwise direction as indicated and carrying blocking members **60*a*** and **60*b*** therewith so that they extend across track **50** to block the passage of sliding block **54** thereby. Sliding block **54** is riding in the bottom of annular track **50** and is shown in FIG. 5 in a position where blocking members **60*a*** and **60*b*** are positively

contacting sliding block **54** and carrying sliding block **54** and hence cable **32**, which is attached to sliding block **54**, therewith in counterclockwise rotation with drum **40** so as to cause cable **32** to wind onto drum **40** in layer fashion, thereby hoisting the load which is attached to the other end of cable **32**.

If it is desired to lower the load, the cable is caused to unwind from drum **40** by causing the drum to rotate in a clockwise direction as shown in FIGS. 6 and 7. After the last layer of cable **32** has been paid out, and drum **40** continues to rotate in a clockwise direction, blocking members **60***a* and **62** will continue to rotate in that clockwise direction with drum **40** while sliding block **54** and cable **32** will ride in the bottom of circumferential track **50**. Each time that blocking members **60***a* and **60***b* revolve so as to be at the bottom of drum **40**, they encounter sliding block **54** and, due to their selectively contoured surfaces **72***a* and **72***b*, which coact with selectively contoured surfaces **78***a* and **78***b* of sliding block **54**, blocking members **60***a* and **60***b* are caused to pivot about their pivot axes **62***a* and **62***b* into their FIG. 6 position to permit sliding block **52** and hence cable **32** to pass thereby in track **50** so that the continued clockwise rotation of drum **40** after cable **32** is fully paid out will not cause cable **32** to rewind onto drum **40** in the direction opposite to the normal cable winding action.

Hoist drum **40** is preferably housed in housing **90** as shown in FIG. 2. Should the pilot wish to release cable **32** and its load from drum **40** on an emergency basis, remotely actuatable guillotine assembly **92** is provided as best shown in FIGS. 2 and 3. Guillotine assembly **92** may be of the knife-edge or scissors type.

While the invention has been described in the aircraft cable-hoist drum environment, it will be obvious to those having ordinary skill in the art that it is equally applicable to any environment in which a load carrying line or cable must be reeled-in and paid-out.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. In a hoist system:

(1) a hoist drum mounted for rotation and adapted to have a load-carrying cable wound thereonto and paid out therefrom in response to drum rotation,

(2) means adapted to attach the end of the cable to the drum and to permit said drum to rotate after the cable has been fully paid out without having the cable rewind onto the drum comprising:

(a) continuous track slot-defining means adapted for rotation with said drum,

(b) a slidable member received loosely in said slot-defining means so as to be freely movable therearound and adapted to have the cable end attached thereto,

(c) stop means attached to said drum for rotation therewith and positioned and biased so as to extend into said slot-defining means and selectively shaped so that as said slidable member moves in said slot-defining means with respect to said drum in a first direction, said slidable member will displace said stop means and pass thereby and, further, so that as said slidable member moves with respect to said drum in said slot-defining means in the opposite direction, said slidable member will positively abut said stop means so that said slidable member thereafter is not free to move in said second direction with respect to said drum.

2. Apparatus according to claim **1** wherein said stop means is pivotally connected to said drum and spring biased so as to normally extend across said slot-defining means.

3. A hoist system including:

(1) a cyclindrical hoist drum mounted for rotation about an axis and including:

(a) a continuous circumferential track mechanism,

(2) a slide member slidably connected to said track mechanism and free to move thereabout with respect to said hoist drum,

(3) an intercepting member pivotally connected to said hoist drum and biased so as to normally intercept the path of said slide member about said track mechanism and being selectively shaped so that said slide member will depress said intercepting member when travelling about said track mechanism in a first direction so as to pass by said intercepting member and, further, so that said slide member will positively abut and be restrained by said intercepting member from further motion about said track mechanism with respect to said drum in the opposite direction,

(4) a hoist cable having one end connected to said slide member so as to move therewith about said track mechanism and to be wound therefrom about said hoist drum so that as said drum is rotated in a first direction, said cable is paid out from said drum to lower any load attached to the cable and, so that, when said cable is fully paid out from said drum said cable is still attached to said drum through said slide member and is able to move about said track mechanism with said slide member with respect to said drum as said drum continues to rotate in said first direction without rewinding onto said drum, and, further so that, as said drum is rotated in the opposite direction, said slide member will abut said stop member and be prevented from further motion thereby about said track mechanism so that said cable will wind onto said hoist drum, thereby elevating any load attached from the cable.

4. Apparatus according to claim **3** and including means to cause said hoist drum to rotate in both a clockwise and a counterclockwise direction.

5. Apparatus according to claim **3** wherein said track mechanism is a continuous annular chamber concentric about said drum axis of rotation and positioned within said drum and is of substantially rectangular cross-section to receive said slide member and which includes a circumferential slot communicating therewith and with the exterior of said drum and through which slot said cable passes and is free to travel with respect to said drum as said slide member moves with respect to said drum.

6. A cable hoist system including:

(1) a hoist drum mounted for rotation about an axis so that cable may be paid out therefrom or wound thereonto as said drum is rotated about said axis, and including:

(a) a continuous track means extending around said drum,

(2) sliding block means slidably connected to said track means for motion thereabout with respect to said drum and adapted to receive a cable end,

(3) blocking means connected to said drum for rotation therewith and positioned with respect to said track means and shaped to permit passage of said sliding block therepast with respect to said drum in a first direction and to prevent passage of said sliding block therepast with respect to said drum in the opposite direction.

7. In a hoist system:

(1) a hoist drum mounted for rotation and adapted to have a load-carrying cable wound thereonto and paid out therefrom in response to drum rotation,

(2) continuous track means connected to said drum for rotation therewith,

(3) means adapted to connect the end of the cable to the said track means and to slidably carry the cable end in said track means when said cable has been fully paid out to thereby prevent the cable rewinding onto the drum.

8. Apparatus according to claim **7** and including ıousing means to house said hoist drum.

9. Apparatus according to claim **7** and including means ɔperatively associated with said hoist drum and actuatable o disconnect the cable from the hoist drum.

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HARVEY C. HORNSBY, Primary Examiner

U.S. Cl. X.R.

242—117, 125.1; 254—186, 190