April 26, 1966 R. C. HALLEN 3,248,087

CABLE-TYPE HOIST

Filed Jan. 24, 1964 5 Sheets-Sheet 1

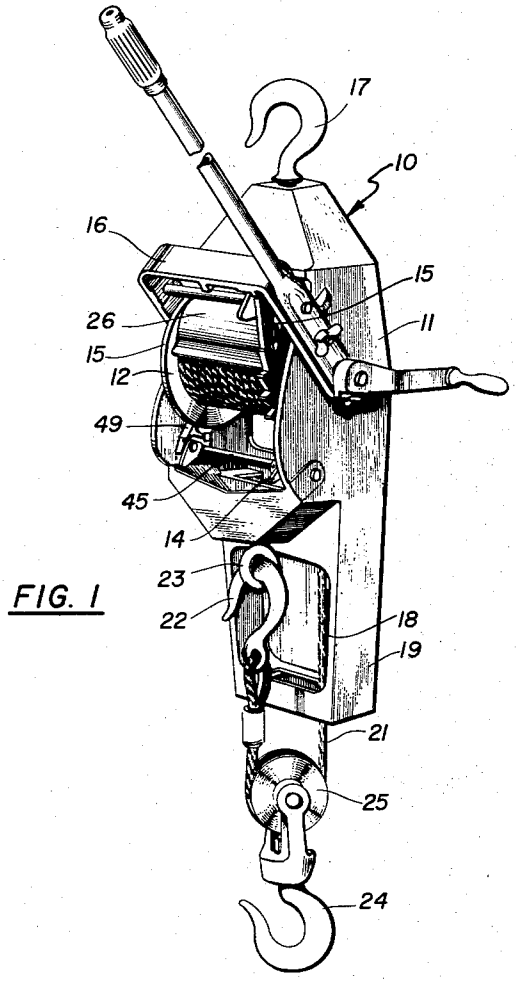


FIG. 1

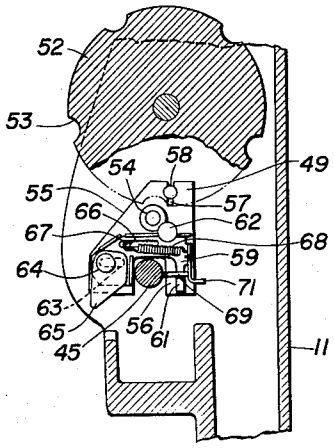


FIG. 5

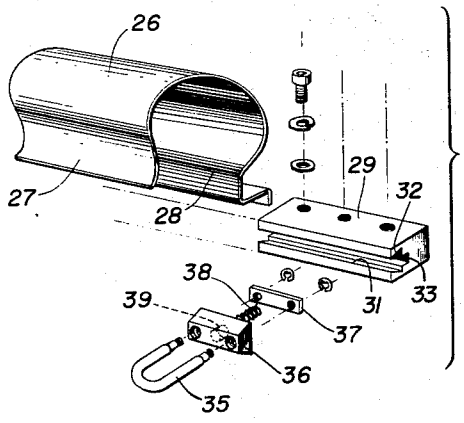


FIG. 6

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April 26, 1966 R. C. HALLEN 3,248,087

CABLE-TYPE HOIST

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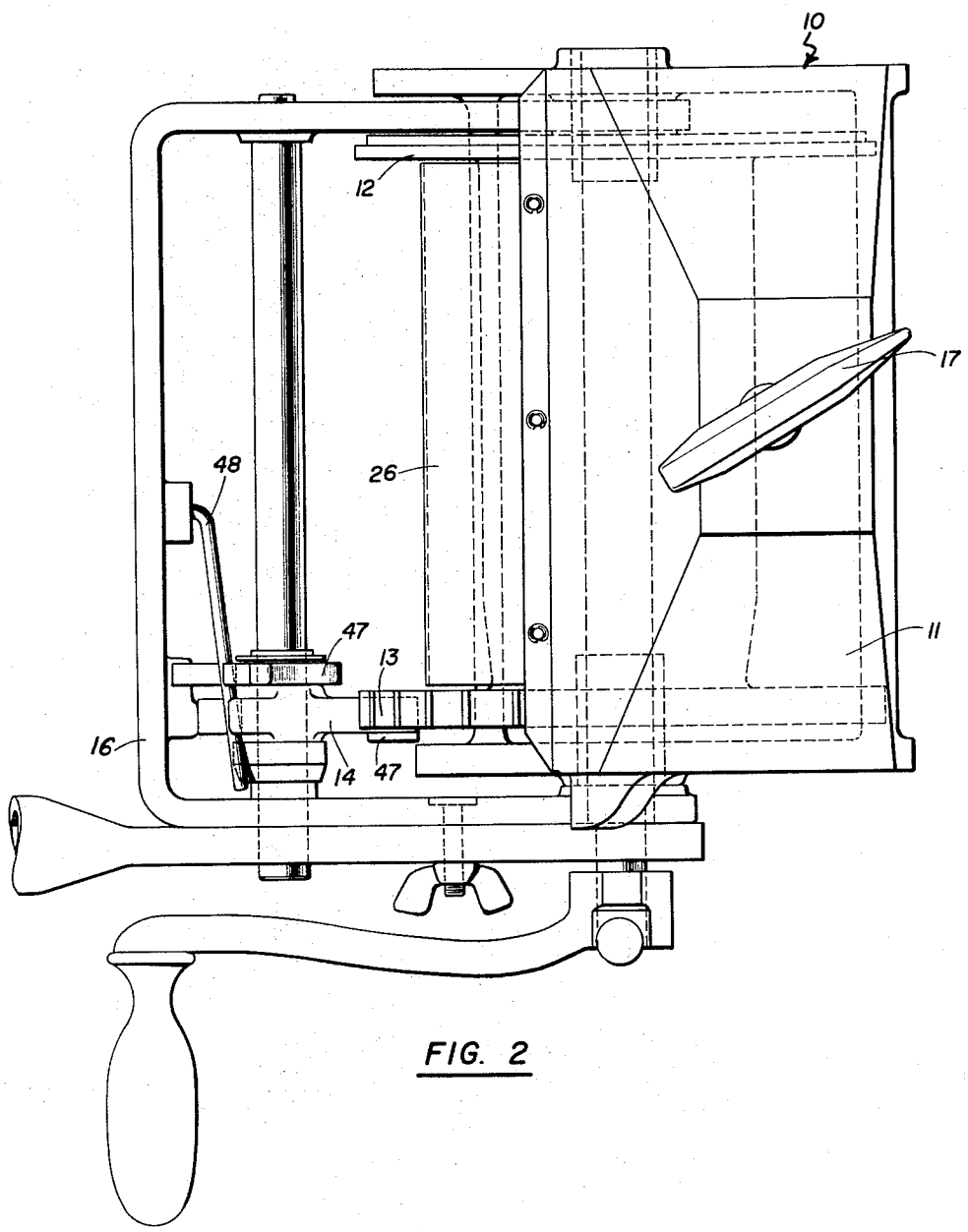


FIG. 2

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CABLE-TYPE HOIST

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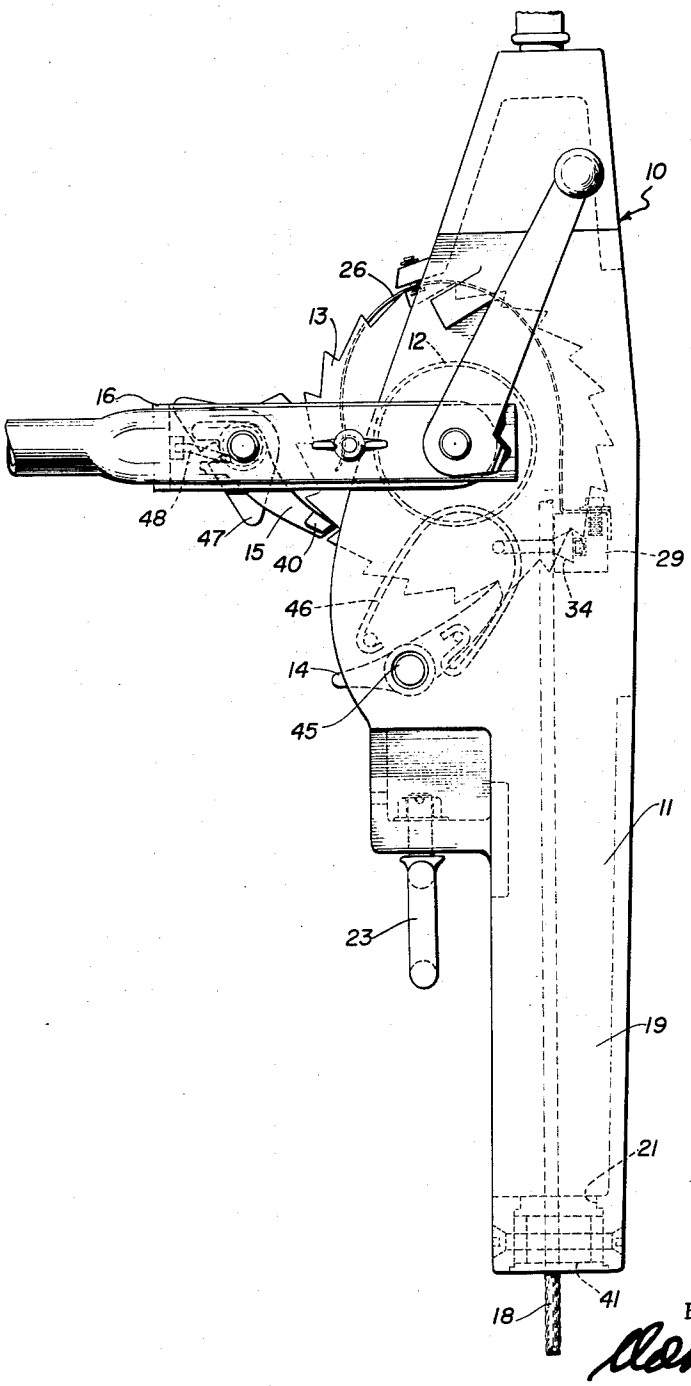


FIG. 3

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April 26, 1966 R. C. HALLEN 3,248,087

CABLE-TYPE HOIST

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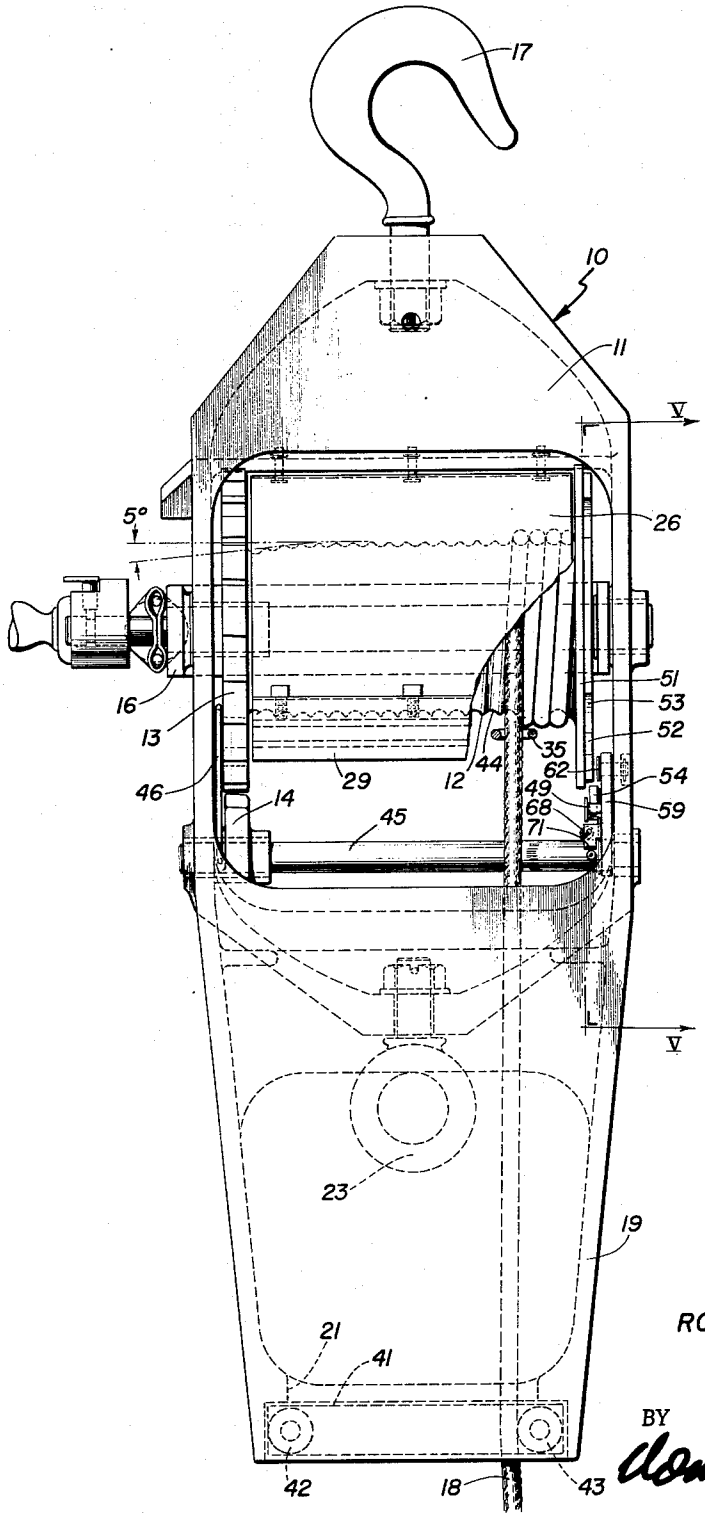


FIG. 4

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CABLE-TYPE HOIST

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FIG. 7

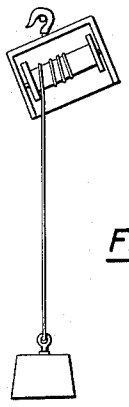


FIG. 8



FIG. 9



FIG. 10

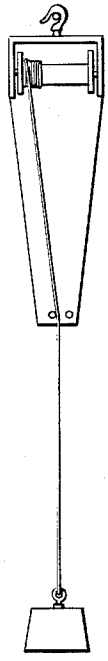


FIG. 11

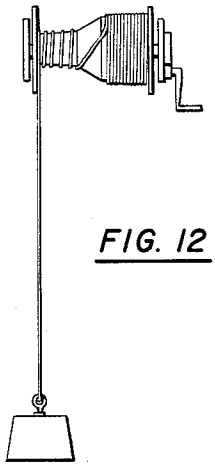


FIG. 12

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United States Patent Office 3,248,087 Patented Apr. 26, 1966

3,248,087

CABLE-TYPE HOIST

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Filed Jan. 24, 1964, Ser. No. 339,970
6 Claims. (Cl. 254—167)

This invention relates to a hoist and, more particularly, to apparatus arranged to raise and lower loads and otherwise exert extremely large forces through a cable.

In the operation of cable hoists, the load is transmitted to the hoist drum by the cable and from there to the hoist housing through the ratchet and pawl mechanism. This means that the pressure of the outer layer of cable upon the other layers of the cable wrapped around the drum is very large and this presents a number of problems. For instance, the camming action of the last convolution (as it lies between the two previously-formed convolutions of cable) can cause the last convolution to force its way between the two strands. This can lead to uneven wrapping of the cable around the drum and to crossing of the cable with attendant wear and damage to the cable. Such wear can lead to fraying and eventual breakage of the cable. As a practical matter, of course, it means that the cable must be replaced within a relatively short time. In the past, when one attempted to make the drum fairly long to hold more cable, the inclination of the hoist body, due to forces in the cable at extreme ends of the drum, caused the cable to bear against ratchet teeth with consequent damage to the cable. Furthermore, in attempting to wrap many layers of cable on a long drum, considerable problem was presented in assuring that the layers were formed with the convolutions tightly pressed together and evenly formed. These and other difficulties experienced with the prior art devices have been obviated in a novel manner by the present invention.

It is, therefore, an outstanding object of the invention to provide a hoist capable of storing extremely long lengths of cable.

Another object of this invention is the provision of a hoist in which the cable is laid on the drum in even layers with the convolutions pressed tightly against one another.

A further object of the present invention is the provision of a hoist having an extremely long cable without the possibility of damage or rapid wear to the cable.

It is another object of the instant invention to provide a hoist having means for assuring that the convolutions of cable are formed in closely pressed relationship to one another.

It is a further object of the invention to provide a hoist capable of carrying a plurality of layers of cable in which the outermost convolution of cable under load does not force its way between strands of a lower layer or produce crossing of strands of cable.

A still further object of this invention is the provision of a hoist having a long drum wherein the cable is prevented from contacting sharp operative elements of the hoist.

It is a still further object of the present invention to provide a hoist which is simple in construction, inexpensive to manufacture, and which is capable of a long life of useful service with a minimum of maintenance.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

The character of the invention, however, may be best

understood by reference to one of its structural forms as illustrated by the accompanying drawings in which:

FIG. 1 is a perspective view of a hoist embodying the principles of the present invention,

FIG. 2 is a plan view of the hoist,

FIG. 3 is a side view of the hoist,

FIG. 4 is a back elevational view of the hoist,

FIG. 5 is a sectional view of the hoist taken on the line V—V of FIG. 4,

FIG. 6 is an exploded view of a portion of the invention, and

FIGS. 7 through 12 are schematic views showing the principles of operation of the hoist.

Referring first to FIG. 1, wherein are best shown the general features of the invention, the hoist, indicated generally by the reference numeral **10**, is shown as consisting of a main frame **11** carrying a drum **12** rotatably mounted on a transverse shaft. Formed as a rim of the drum at one end is a toothed ratchet wheel **13** which is engaged, on occasion, by a locking pawl **14** mounted on the frame **11**. An actuating pawl **15** is mounted on a handle **16** which is pivotally mounted on the housing **11** on the shaft which acts as the rotative mounting of the drum **12**.

Mounted at the top of the housing **11** is a hook **17** by which means the hoist is supported from a beam or the like for lifting and lowering a load. Wrapped around the drum **12** is a cable **18** whose free outer end extends downwardly through a portion **19** of the housing which extends away from the drum **12** and is provided with a passage **21** through which the cable passes. The outer end of the cable is shown in the illustration as being provided with a hook **22** which engages a ring **23** which is mounted on the housing **11**. In the bight of the cable is carried a hook **24** having attached thereto a pulley **25** which provides for smooth rolling action between the cable and the hook.

Fastened to the interior of the housing **11** in the portion directly overlying the drum **12** is a cable clamp **26**. This clamp is formed of sheet metal and, as is evident particularly in FIG. 6, is of a generally U-shaped form, this cross-section consisting of something slightly more than a semi-circle with one free end **27** flared outwardly and with the other free end **28** being bent vertically, horizontally, and vertically to form a configuration for the attachment of a guide block **29**. The cable clamp is formed so that its free ends press inwardly and press resiliently against the drum **12** when the drum is empty or against the outer layer of cable when the drum carries a cable.

Referring particularly to FIG. 6, the guide block **29** is provided with a keyway **31** which extends parallel to the axis of the drum **12**. The keyway is provided with a first portion **32** which has a trapezoidal cross-section with the base of the trapezoidal located inwardly of the keyway. The keyway is also provided with a second portion **33** which is in the form of a square groove in the base of the first portion. Engageable in the keyway **31** and slidable therein is a slide **34** having a guide loop **35**. The slide is provided with a first part **36** which slides freely in the first portion **32** of the keyway **31** and is of a generally trapezoidal cross-section and a second part **37** of rectangular cross-section which slides in the second portion **33** of the keyway **31**. The guide loop is of generally U-shaped form with its legs extending through the first part **36** of the slide and providing pins which extend from the bottom surface of the said first part. The second part **37** of the slide is provided with two apertures which slide freely over the free ends of the guide loop **35**. Extending between the first part **36** and the second part **37**

of the slide is a coil spring **38**, the spring being held in place by partial enclosure in a bore **39** on the bottom side of the first part **36**.

As has been stated before, the housing **11** is provided with a lower portion **19** which has a generally box-like configuration with a rectangular passage **21** in the lower part. Mounted in this passage is a yoke **41** carrying two rolls **42** and **43** on axes which extend perpendicular to the axis of the drum. As is evident in FIG. 4, the rolls lie adjacent the ends of the rectangular passage **21** in a position to be engaged by the cable **18**. These rolls are freely mounted for rolling action about their axes and are formed of metal. Still referring to FIG. 4, it can be seen that the drum **12** is provided with a helical groove **44**. At the right-hand end (as the hoist is viewed in FIG. 4), the drum is provided with a recess (not shown) in which the end of the cable **18** is locked. At the other or left-hand side, the drum is tapered, as indicated by the angle 5°, for a purpose which will be explained more fully hereinafter.

The locking pawl **14** is mounted on a transverse shaft **45** extending through the housing below the drum **12** and is held in engagement with the ratchet wheel **13** by a loop spring **46**. The end of the actuating pawl **15** is provided with a laterally extending finger **47** capable of engaging the spring **46**, on occasion, to release the locking pawl in the well-known manner. The actuating pawl **15** is provided with a reversing lever **47** and a wire spring **48** to permit the changing of the operation of the hoist from lifting to lowering in the manner shown and described in the patent of Wallace No. 2,633,328. The locking pawl **14** is connected by the shaft **45** to a selection mechanism **49** which permits the selection of a one-tooth increment lowering condition or a plural-tooth increment lowering condition. The drum **12** is provided with a rim or flange **51** which is formed on its outer side with an index disk **52** having semi-circular notches **53** which are engageable, on occasion, by a roller **54** mounted on a main body **55** of the selection mechanism **49**. This main body is provided with a slot **56** in its bottom edge which fits closely around the shaft **45** and permits vertical movement of the body. At the upper end it is provided with a similar vertical slot **57** in which resides a pin **58** having a head which is fixed in the side of the housing **11**. The main body is, therefore, movable vertically and guided by the shaft **45** and the pin **58**. The roller **54** is rotatably mounted on that main body. Slidable over the inner surface of the main body is a sheet metal bracket **59** having a slot **61** formed on its lower edge through which passes the shaft **45**. A pin **62** is fastened to the main body **55** and engages a straight horizontal upper edge of the bracket **59**. The bracket is, therefore, constrained to horizontal movement over the inner surface of the main body. The bracket is provided with a horizontal slot **63** and through this slot extends a pin **64** which is mounted in the main body **55**. This pin and slot arrangement serves as a further restriction of the bracket **59** to horizontal movement over the surface of the main body **55**. Pivoted on the pin **64** is a selector finger **65** having two straight edges which are at a right angle to one another, one being spaced a considerable distance from the pivot point furnished by the pin **64** and the other one being fairly close to that pivot point. The bracket **59** is also provided with a horizontal slot **66** in its upper portion and through this slot extends a pin **67** mounted in the main body **55**. From the top of this pin to the other side of the bracket extends a coil spring **68** which serves to bias the bracket **59** toward the front of the hoist. By rotating the selector finger **65** through an angle of 90°, it is possible to bring the selector to either of two predetermined horizontal positions of the bracket **59** relative to the main body **55**. Extending laterally from the shaft **45** is a straight pin **69**. The adjacent edge of the bracket **59** is provided with a vertical flange having a finger **71** bent horizontally from its lower edge in the same plane as the pin **69**.

The operation of the hoist **10** will now be readily understood in view of the above description. The hook **17** is fastened to a support which, when the hoist is used for lifting and lowering a load, would be a beam, or some high support. The load is attached to the hook **24** at the lower end of the hoist. In some situations the hook **24** and its pulley **25** would be removed from the cable, the hook **22** would be removed from the ring **23**, and the load attached to the hook **22**. In this case, of course, in accordance with well-known physical principles, the cable will move twice as fast but the load which it is capable of moving (with a given exertion on the handle **16**) is one-half as much. Assuming that the load is to be lifted, the reversing lever **47** would be placed in the condition shown in FIG. 3 and the handle **16** moved downwardly. The actuating pawl **15** will engage the teeth of the ratchet wheel **13** rotating it counter-clockwise, thus pulling on the cable **18** and winding it around the drum **12**. As the handle **16** is moved downwardly and the actuating pawl **15** rotates the drum, the locking pawl **14** cams up and over successive ratchet teeth. Eventually, the force is removed from the handle **16** and it is moved upwardly, the locking pawl **14** preventing the ratchet wheel from rotating clockwise. When the load is to be lowered, the reversing lever **47** is rotated clockwise about its pin to a condition in which the spring **48** is directed upwardly instead of downwardly. In that condition, the actuating pawl **15** is free of the ratchet teeth as the handle is moved downwardly. At the bottom of the stroke, however, the finger **40** strikes the spring **46** and this cams the actuating pawl **15** inwardly toward the drum and into engagement with one of the teeth on the ratchet wheel **13**. At the same time that the load is taken over by the handle **16**, the load is released from the locking pawl **14** so that its spring (which is now in a compressed condition) is able to move the pawl out of engagement with the ratchet tooth. The load is then carried by the handle **16**. Then, the handle is released and moved upwardly carrying the drum with it, so that the cable **18** is unwound from the drum and the load is lowered. When the selection mechanism **49** is in the condition shown in FIG. 5, the locking pawl **14** is free to drop into the next tooth, once the pressure of the finger **40** has been removed from the spring **46**. In other words, the handle **16** can be moved upwardly taking the ratchet wheel with it for only one tooth length; then, the locking pawl **14** prevents the ratchet from turning any further. This permits lowering one tooth at a time. If, however, it is desired to lower the load more than one tooth at a time, the selector finger **65** of the selection mechanism **49** is rotated clockwise 90° from the position shown in FIG. 5. Then, when the handle **16** is moved downwardly to lower the load, and the finger **40** presses against the spring **46** and releases the locking pawl **14**, the handle **16** takes over the load. As the handle is moved upwardly under load, the locking pawl **14** attempts to move back into the next tooth to catch the ratchet wheel. However, it is keyed to the shaft **45** which, at the other end, carries the pin **69**. As the locking pawl attempts to return radially inwardly to engage the next tooth of the ratchet wheel, the pin **69** strikes the finger **71** on the bracket **59** and pushes upwardly on it. Now, the main body **55** is slidable vertically because of the slots **56** and **57** and should move vertically, except for the fact that the roller **54** is engaging the outer periphery of the index disk **52** which, because of the arrangement of the apparatus, is not located with a notch adjacent the roller at the particular time. Since the locking pawl **14** cannot return to engage the ratchet wheel **13**, the load is carried upwardly with the handle **16**, permitting the drum to rotate so that several teeth of the ratchet wheel go by the locking pawl without being engaged. Eventually, however, the index disk **52** will rotate clockwise, as shown in FIG. 5, and the next notch **53** will arrive adjacent the roller; the roller will drop into the notch, thus permitting vertical

movement of the main body **55**. This raises the finger **71** and permits the shaft **45** to rotate counter-clockwise a sufficient distance so that the locking pawl **14** can drop into place into engagement with the ratchet wheel. This process can be repeated and the load can be dropped several teeth at a time, depending upon the spacing of the notches **53** on the index disk **52**.

In unwinding a long cable, there is very little difficulty in withdrawing the cable from the drum, assuming that it was laid on the drum properly in the beginning. It is during the re-winding operation under load and under no load that the difficulty occurs. Let us assume that the drum is empty and the cable is attached to the recess in the drum **12** in the usual way. As the load is raised, the cable is wound around the drum and is guided into closely adjacent convolutions in the manner shown in FIG. 4. The first layer of cable on the drum is restricted to a very close relationship of the convolutions because of the helical groove **44** formed on the surface of the drum. Eventually, however, the layer grows until it reaches the left-hand side of the drum and, then, is forced to start winding in the reverse direction to form the second layer of cable. It will be remembered that the cable **18** is under load, so that the pressure force of the cable against the drum is considerable. With an ordinary drum, the return layer will begin, but there would be very little to restrict the cable to being wound with the convolutions touching and tightly pressed against one another. With the present invention, however, because of the tapered portion at the left-hand side of the drum (as observed in FIG. 4), the first layer of cable is tapered just as the drum is tapered, so that, as the cable starts to form in a reverse direction for the second layer of cable, each successive convolution is slightly larger in diameter than the one before it. In other words, the cable has to climb up the outer surface of the first layer of cable. This will cause the successive convolutions of the second layer of cable to be cammed downwardly and to the left, so that several tight convolutions are formed in the tapered portion of the drum. Once this has been done, the rest of the convolutions will be tightly placed across the drum by the guide loop **35**.

The guide loop **35** and its associated equipment slide horizontally back and forth under the impetus of the cable moving from side to side in the hoist. However, in accordance with the size of the spring **38**, the slide **34** encounters considerable friction in moving through the keyway **31** in the block **29**. This means that, in the carrying of the cable across the hoist, the slide and its loop **35** always drag behind the cable. This causes the cable to be pressed tightly against the convolution behind it, which is the desirable condition sought in the present invention. It is desirable that the loop **35** engage the cable in a vertical plane which is tangential to the preceding layer of cable; for this purpose, the block **29** is moved horizontally back and forth as the layers of cable increase. This is accomplished because the block **34** is mounted on the lower free end of the cable clamp **26**. This clamp engages the layers of cable on the drum and, as the thickness of cable increases, the lower end is pressed rearwardly in the hoist carrying the guide loop **35** further and further rearwardly, so that it always remains immediately under the point of contact of the cable as it is rolled onto the drum.

The cable clamp **26** also assists in assuring that the convolutions of cable are laid close together and flatly and that no crossing takes place and no spaces are left between convolutions. The free ends of the cable clamp, being of sheet metal, are resilient and press broadly against the front part of the drum and the back part of the drum. Now, as the first layer of cable is laid, the cable is kept in close convolutions, of course, by the groove **44**. It is assisted in this respect by the fact that the cable clamp is inclined slightly to the axis of the drum because, as the first two or three convolutions of cable are formed on the drum, that right-hand end of the clamp is pressed outwardly by these cables. The rest of the clamp, however, is free and is not supported and, therefore, tends to be warped and move toward the drum. It does not contact the drum because the material is too stiff for that, but the effect is to form a cam pressure plate pushing against the forwardmost convolution of cable being formed on the drum. The cable is pressed against the last convolution in the same manner that a wet watermelon seed is pressed from between the fingers by pressure. This is a camming action which causes the convolutions in the first layer to be pressed tightly together. The same situation exists for succeeding layers of cable. In the second layer, of course, there is a certain degree of persistence in keeping the convolutions together by the fact that the drum and the first layer of cable resting on the drum are tapered, but the inclinational warping of the cable clamp **26** also assists in keeping the succeeding convolutions pressed against one another, and this is true for each succeeding layer of cable as it is placed on the drum. Now, it will be observed that the drum **12** is extremely long to permit the use of a very long cable **18**. It will be understood that certain limits are reached in the number of layers of cable which can be placed on the drum, so that the only other way to increase the cable length is to make the drum longer. In the past, however, this has been presented by the fact that the cable is rapidly worn by engagement with the teeth on the ratchet wheel **13** and certain operating mechanisms in the hoist. In the present case, however, the cable, no matter what position at the ends of the drum that it comes from, engages one of the rollers **42** and **43** before proceeding to the load. This means, of course, that the load will attempt to form a straight line between the upper point of attachment **17**, the bottom point of attachment of the cable **18** to the load, and the point on the drum occupied by the cable. This means that the body **11** will be inclined sideways and, if it were not for the roller **43** in the condition shown in FIG. 4, the cable would engage either the flange **51** or, if the cable were operating at the other end of the drum, would engage the teeth on the ratchet wheel **13**, thus harming the cable and shortening its life. No matter which end of the drum the cable comes from, however, even under load, the cable is kept away from the ratchet teeth or the flange of the drum by the roller **42** or the roller **43**. Since the cable cannot touch the ends of the drum, it is possible to use an extremely long drum and, therefore, to use the hoist with a greater amount of cable.

It can be seen, then, that the present hoist overcomes a great many problems which were presented to the art in the past in attempting to provide a hoist with an extremely large amount of cable. The cable clamp **26** operates on both sides of the drum to assure that the cable convolutions are closely pressed together, so that a "tight" layer of cable is produced. Then, even though the cable, as it comes onto the drum or off the drum, is being subjected to extremely high forces, the uppermost layer being formed cannot force its way between the lower layers and damage the cable and also upset the smooth layer arrangement which is desirable. This forming of closely-contacted convolutions is assisted, particularly in making the reverse turn from the first layer to the second layer, by the tapering of the drum, as has been described above. The action of the cable clamp is assisted by the slide **34** and the loop **35** in dragging along behind the cable as it moves back and forth over the drum. The cable clamp cooperates with the slide by moving it radially toward and away from the drum so that the guide always has the cable extending vertically through it. In other words, the free end of the cable clamps serves a dual purpose; it not only presses against the layer of cable that is being formed and keeps the convolutions close together, but it automatically regulates the position of the slide so that it operates effectively at

all times, irrespective of the number of layers of cable that have been laid on the drum. In addition, it is possible to apply more cable to the drum because the drum is longer and the problem of the cable striking the sides of the drum and the housing has been obviated by the use of the rollers **42** and **43** which prevent the cable from leaving the drum at an outward angle, even though the cable is located at the extreme end of the drum and the force of the load is very, very great. It can be seen, then, that all of these features of the present hoist cooperate to the same purpose; that is to say, to permit the practical use of extremely long lengths of cable on the hoist drum.

In prior hoists of this type, the length of cable that could be used was limited to the amount that could be stored on a relatively short drum hub. To employ relatively long cables it was necessary to find a way to control the winding of the cable on the drum to closely-spaced, even convolutions across the entire hub of the drum (from right to left on the first layer), then again in closely-spaced convolutions from left to right on the second layer, etc. This had to be accomplished under two different conditions:

(1) While the hoist was under load, and
(2) While the cable was being rewound onto the drum with no load.

The two different conditions required two different treatments. It will be shown in what manner the cable is controlled under the two different conditions, i.e., under load and under no load. Several principles are combined to produce control. FIGS. 7 and 8 show a hoist without any lower guide members and with straight drum (that is, a drum hub with a constant diameter and no threaded track). FIG. 9 shows a hoist with control points relatively close together and relatively close to the drum in vertical distance. FIG. 10 shows a hoist with control points that are almost as wide apart as the drum flanges. FIG. 11, which shows a hoist with control points that are relatively close together but a relatively long vertical distance below the drum. As FIGS. 10 through 14 indicate, it becomes obvious that, when the cable is wound onto the drum, under load, that there must be control points and, if these control points are too close to the drum in vertical distance and spaced too close together, the cable will "bunch up" at the center of the drum. If they are spaced too far apart, the cable will wind in progressively longer "lead" towards one flange, after which the inclination of the drum axis is so great that the cable will "bunch up" against that flange. It is also evident that, if the control points could be placed far enough from the drum in vertical distance and close enough horizontally so as to provide for a lead angle of not more than 3½ degrees (when winding a ¼" diameter cable on a 2½" diameter drum hub), then the cable will be wound on the drum in closely spaced convolutions.

Now, as a separate consideration from any of the above, consider a winch with its frame rigidly secured to a solid structure (so that its drum axis cannot swing or be inclined) and with its axis in a perfectly horizontal plane, as shown in FIG. 12. Notice that the drum has a straight (or cylindrical) section "*a*," a section "*b*" that is steeply beveled, and a section "*c*" with a relatively moderate taper. When a cable is wound onto this drum under load, starting at the right-hand flange, it will first wind in closely-spaced convolutions while on section "*a*." Next, when the cable rides over the edge onto section "*b*," it will slide down the steep bevel until it contacts section "*c*." From there on it will wind in evenly-spaced but open convolutions; the amount of space between the convolutions will depend on the degree of taper on the drum. This indicates that some degree of cable control can be obtained by shaping the contour of the drum hub.

As a further means of control, the drum hub can have a helical groove (or thread) to help control the first layer. As the first layer is wound in tight convolutions, a series of regularly spaced "valleys" are provided along the outside diameter of this layer. This series of valleys provides a measure of control for the subsequent layer, even though the layers "cross-thread" each other.

The above three principles are employed in combination in the present invention to provide control of the cable while the hoist is used under load. Notice that, while the hoist is under load, there is little need for a cable clamping shield for the purpose of cable control. However, as a practical matter, the cable shield protects the cable from dirt or injury at all times. With regard to cable control, when being rewound onto the drum with no load, there is, of course, no tension in the cable to hold the cable taut, to provide pull that will swing the hoist body so that the drum axis will be inclined, nor to pull the cable into tight convolutions as guided by the contour of the drum hub or the helical grooves. For that reason, some other provision must be made for obtaining cable control. This is where the cable shield combined with the mechanism shown in FIG. 6 comes into play. The cable shield maintains the cable pressed tightly against the drum hub and prevents it from winding too loosely on the drum. However, the cable shield alone (even while pressing the cable tightly against the drum) would allow it to wind in very open convolutions from side to side; the slide mechanism, by providing a "drag," keeps the convolutions tightly wound. As a practical matter, the contact surface **28** (FIG. 6) should press against the outstretched cable just slightly below the point of tangency (where the cable starts to wrap around the drum). Also, the loop **35** should be close in a vertical distance to the pressure point of surface **28**.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, however, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

The invention having been thus described, what is claimed as new and desired to secure by Letters Patent is:

1. A hoist, comprising
(a) a main frame,
(b) a drum rotatably mounted on the frame,
(c) a toothed ratchet wheel connected to the drum,
(d) operating means mounted on the frame, including a locking pawl, an actuating pawl, and a handle for the actuating pawl,
(e) a cable clamp in the form of a resilient sheet formed with a generally U-shaped cross-section fastened at its central portion to the main frame with one free portion pressing against the outermost layer of cable,
(f) a block mounted on the other free portion of the clamp, the block having a keyway extending parallel to the axis of the drum,
(g) a slide with a guide loop carried in the keyway for sliding movement adjacent the drum, and
(h) means for adjusting the friction between the slide and the keyway.

2. A hoist, comprising
(a) a main frame,
(b) a drum rotatably mounted on the frame,
(c) a toothed ratchet wheel connected to the drum,
(d) operating means mounted on the frame, including a locking pawl, an actuating pawl, and a handle for the actuating pawl,
(e) a cable clamp in the form of a resilient sheet fastened to the main frame and having a free portion pressing against the outermost layer of cable,
(f) a guide loop for the cable mounted on the said free portion for sliding movement parallel to the axis

of the drum, the mounting of the guide loop on said free portion permitting the guide lop to move generally radially of the drum to remain closely adjacent the outermost layer of cable at all times.

3. A hoist comprising

(a) a main frame,

(b) a drum rotatably mounted on the frame, the drum being provided with a helical groove extending from one end to the other, a recess being formed at one end for fastening the end of the cable and the other end of the drug being tapered to assure that the convolutions in the second layer of cable are close together,

(c) a toothed ratchet wheel connected to the drum,

(d) a handle mounted for pivotal action relative to the frame,

(e) a locking pawl movably mounted on the main frame and positioned to engage and hold the ratchet wheel,

(f) an actuating pawl mounted on the handle in position to engage and rotate the ratchet wheel,

(g) a cable clamp in the form of a resilient sheet formed with a generally U-shaped cross-section and fastened in its central portion to the main frame with its free portions pressing against the outermost layer of cable at all times,

(h) a block mounted on one of the free portions of the cable clamp adjacent the drum provided with a keyway extending parallel to the axis of the drum,

(i) a slide with a guide loop carried in the keyway for sliding movement adjacent the drum,

(j) means for adjusting the sliding friction between the slide and the keyway,

(k) a portion of the main frame extending away from the drum provided with a passage for the cable the passage being of rectangular cross-section with its long dimension extending in the direction of the drum axis, and

(l) rollers located at the ends of the passage with their axes perpendicular to the drum axis.

4. A hoist, comprising

(a) a main frame,

(b) a drum rotatably mounted on the frame,

(c) a toothed ratchet wheel connected to the drum,

(d) operating means mounted on the frame, including a locking pawl, an actuating pawl, and a handle for the actuating pawl,

(e) a block mounted adjacent the drum and provided with a keyway extending parallel to the axis of the drum,

(f) a slide with a guide loop carried in the keyway for sliding movement adjacent the drum, the keyway having a first portion having a trapezoidal cross-section and a second portion consisting of a groove of rectangular cross-section formed in the base of the first portion,

the slide having a first part slidable in the first portion of the keyway and a second part slidable in the second portion of the keyway, the second part of the slide slidably mounted on pins extending from the first part, and a spring extending between the two parts of the slide.

5. A hoist, comprising

(a) a main frame,

(b) a drum rotatably mounted on the frame,

(c) a toothed ratchet wheel connected to the drum,

(d) operating means mounted on the frame, including a locking pawl, an actuating pawl, and a handle for the actuating pawl,

(e) a cable clamp in the form of a resilient sheet fastened to the main frame and having a free portion pressing against the outermost layer of cable,

(f) a guide means for the cable mounted on the said free portion for sliding movement parallel to the axis of the drum, the mounting of the guide means on said free portion permitting the guide means to move generally radially of the drum to remain closely adjacent the outermost layer of cable at all times, the guide means consisting of a block mounted adjacent the drum and provided with a keyway extending parallel to the axis of the drum, a slide with a guide loop carried in the keyway for sliding movement adjacent the drum, and means for adjusting the sliding friction between the slide and the keyway.

6. A hoist, comprising

(a) a main frame,

(b) a drum rotatably mounted on the frame,

(c) a toothed ratchet wheel connected to the drum,

(d) operating means mounted on the frame, including a locking pawl, an actuating pawl, and a handle for for the actuating pawl,

(e) a block mounted adjacent the drum, provided with a keyway extending parallel to the axis of the drum, slide with a guide loop carried in the keyway for sliding movement adjacent the drum, and means for adjusting the sliding friction between the slide and the keyway, and

(f) means to cause the guide loop to move generally radially of the drum to remain closely adjacent the outermost layer of cable at all times as layers of cable are added and subtracted.

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