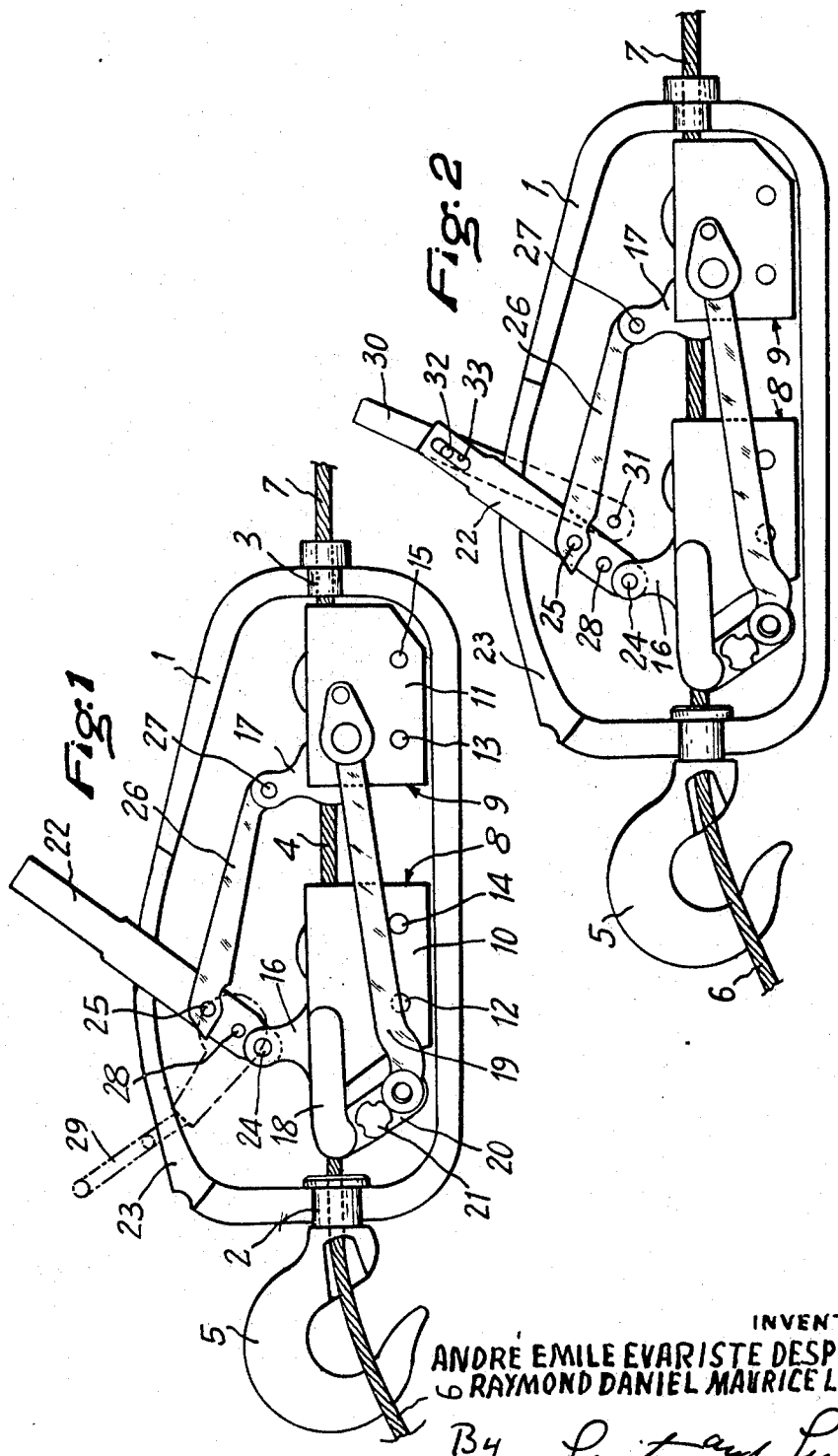
Dec. 23, 1969 A. E. E. DESPLATS ET AL 3,485,478

SAFETY DEVICE OF CABLE-CLAMPING TRACTION APPARATUS

Filed Oct. 20, 1967 3 Sheets-Sheet 1



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SAFETY DEVICE OF CABLE-CLAMPING TRACTION APPARATUS

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Fig. 5

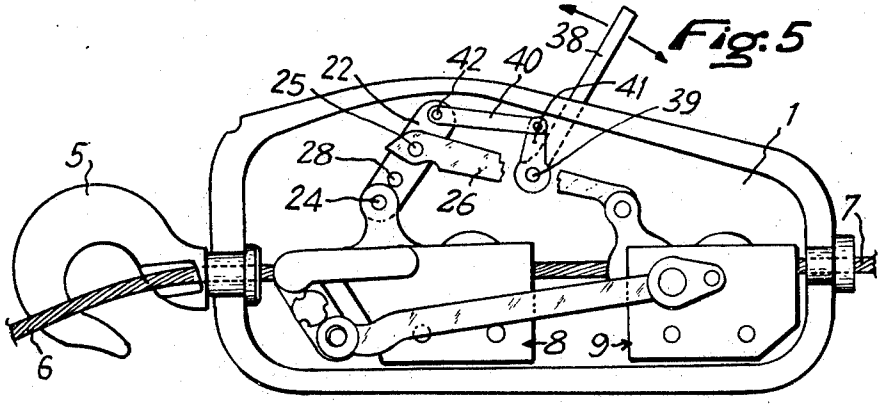

Fig. 3

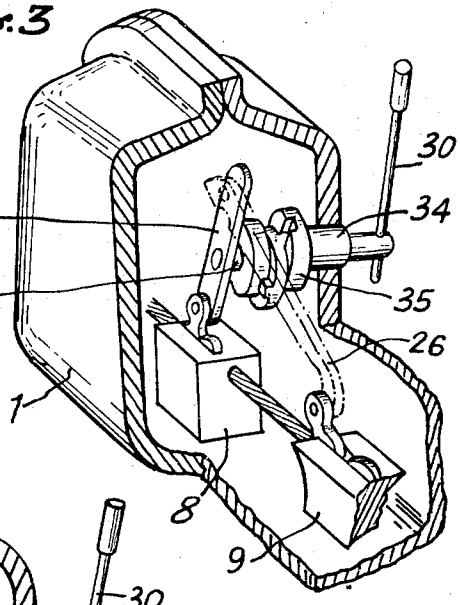

Fig. 4

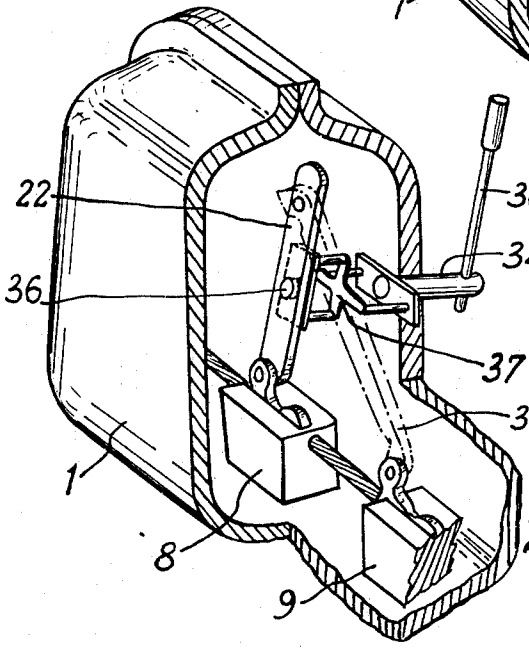

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Fig. 6

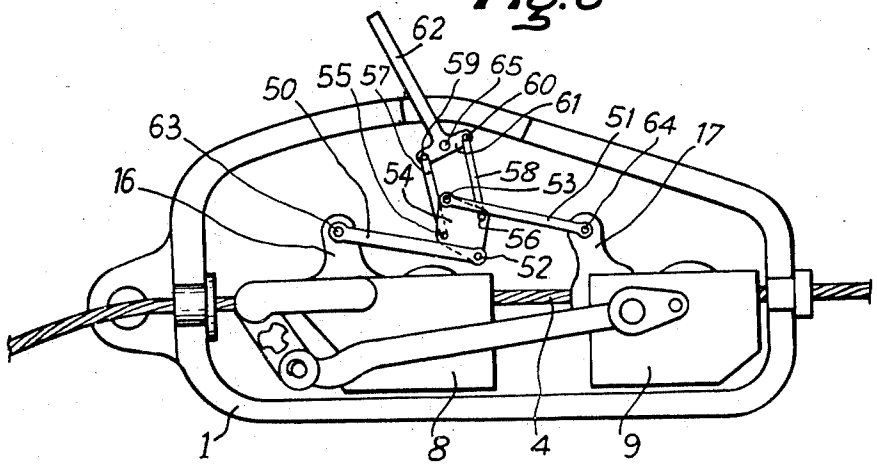


Fig. 7

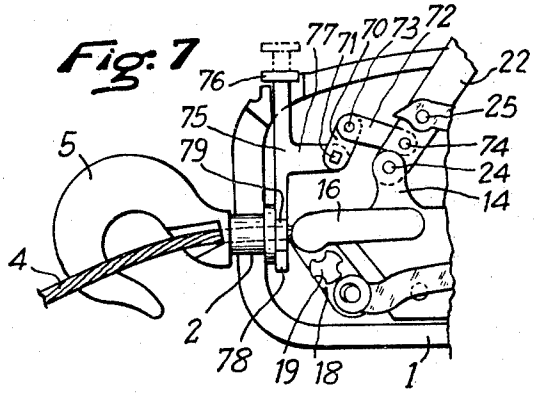


Fig. 8

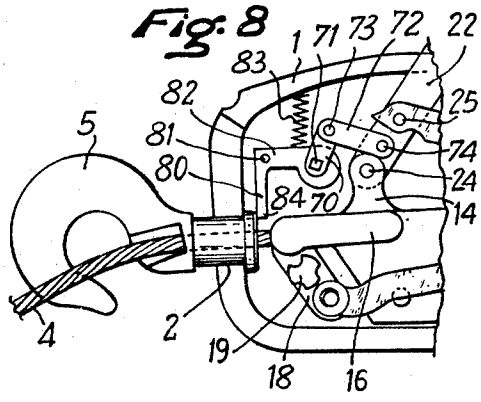
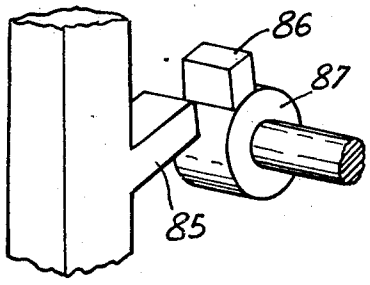


Fig. 9



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SAFETY DEVICE OF CABLE-CLAMPING TRACTION APPARATUS

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Int. Cl. B66f 3/12
U.S. Cl. 254—106 8 Claims

ABSTRACT OF THE DISCLOSURE

A traction and hoisting apparatus which feeds a cable attached to a load in response to alternative actuation of two clamping units by operation of forward and reverse control levers. The reverse control lever rotates about a floating pivot and means are provided which prevent the accidental translation of the floating pivot in the direction to cause the simultaneous opening of the clamping unit jaws, so as to prevent the accidental release of the apparatus.

Traction and hoisting apparatus of the nipper type are already known which act upon a cable of which the feed movement is obtained by operating a pair of levers actuated separately according to the direction in which it is desired to move the cable.

This invention is applicable more particularly to apparatus of this character which comprise two clamping units through which the cable is passed, these clamping units being reciprocable in opposite directions, each unit comprising jaws of which the cable clamping or release movements are controlled automatically by actuating each lever so as to cause the traction or hoisting cable to move through the device, one end of said cable being attached to the load to be transferred.

In the following disclosure the term "forward motion" designates the operation obtaining by actuating the lever causing the cable to move in the direction exerting a pull or traction on the load, the term "reverse motion" means the operation obtaining by actuating the other lever causing the cable to move in the opposite direction, the cable in this case being either pulled by the load or caused to retain this load if the latter tends to move away from the device.

The forward motion lever is adapted to actuate via suitable linkage means the bodies of a pair of clamping units and the reverse motion controls via other linkage means a link system mounted in the clamping units and adapted to open and close the clamping jaws proper.

Whether in the forward motion or reverse motion condition, the operation of this device consists in alternatively opening a clamp with respect to the cable while the other clamp is being closed to grip the cable, and any one of the control levers produces simultaneous opposite actions upon these two clamps when said control lever is operated.

More particularly, operating the reverse motion control lever will exert simultaneous but opposite actions upon the links controlling the jaws of the two clamps. This action is obtained because this lever operates links associated with each clam by exerting forces directed on either side of a given point of said lever which may be considered as constituting a "floating" fulcrum thereof since its position is adjusted automatically according to the conditions of operation of the apparatus and must

adapt to the cable compressibility and to the variable degree of wear of the jaws co-acting with the cable.

In known apparatus to which this invention is applicable a third control lever fulcrumed on said reverse control lever about said "floating" pivot point permits, by producing a movement of translation of said reverse control lever, of exerting a simultaneous tractive effort in the same direction on the links controlling the jaws of the pair of clamps, thus producing the simultaneous opening of both clamps when it is desired to insert the cable through the apparatus or cause this cable to travel at a fast rate therethrough. In order to simplify the disclosure, this third lever will be referred to hereinafter as the "clutch lever" since its function is to release or disengage the cable from the clamping action of said jaws.

A normal actuation of the reverse control lever is attended by a rotation of this lever about said floating pivot point but without producing any movement of translation which would cause the simultaneous release of both clamps.

However, the possibility of faultily and inadvertently operating this reverse control lever under moderate load conditions, for example if the operator caused a movement of translation of this lever so as to move the jaw control links of both clamps simultaneously in the release direction, would cause the load to be released. If this possibility were not precluded, the apparatus would constitute a serious danger, notably if it is applied to the hoisting of persons or heavy loads.

It is the object of the present invention to avoid the risk set forth hereinabove by positively preventing the release of the apparatus when the reverse control lever is actuated. To this end, the reverse control lever of hitherto known apparatus of this character is replaced by a reverse control transmission system connected on the one hand to the jaw control links and on the other hand to a reverse control lever proper fulcrumed about a pivot axis which is fixed with respect to the case of the apparatus, the function of said system consisting in transmitting the movement of rotation of the control lever irrespective of the degree of wear of the jaws, and of the relative movements of the component elements connected by said transmission system.

Thus, whatever the action exerted on the control lever, the transmission system cannot receive a movement of translation likely to produce an undesired release of the clamping action normally exerted by said jaws.

The operative connection between the control lever and the transmission system, for example if this system comprises an actuating lever, may consist of pins rigid with one of the control or actuating levers and extending through elongated holes formed in the arms of a fork rigid with the other lever, in order to permit a certain "adaptation" or lost-motion of the actuating lever in spite of the mounting of the control lever on a fixed pivot pin.

This connection may also take place through a transmission joint permitting the transmission of a movement of rotation between two members operating in different planes, such as an Oldham joint or a universal joint.

This connection may also consist of a suitable hinged linkage providing the necessary free motion of the actuating lever.

Another possible connection consists of a coupling having two pairs of pivot points, one pair being connected by means of rods to the links controlling the jaws of the two clamps, and the pivot points of the other pair are connected, via identical parallel links, extending substantially at right angles to the cable passing through the apparatus, to a control lever fulcrumed about a fixed point of the case.

Since the control lever is separate from the transmis-

sion system disposed in the median plane of the case of the apparatus which contains the axis of the traction and hoisting cable, it is not compulsory to dispose this control lever in the median plane of the apparatus and more particularly it can be disposed laterally and adapted to drive a shaft extending through a lateral bearing into the case and having its inner end operatively connected to a transmission linkage of the above-defined transmission system.

In this case it is not necessary to provide a slot or like elongated passage for permitting the movements of the control lever, and the protection of the internal mechanism is more efficient than in hitherto known apparatus of this type.

In order definitely to preclude any possibility of accidental or untimely release of the traction and hoisting apparatus, a modified clutch mechanism may be provided to eliminate any risk and which is applicable to all types of apparatus of this character.

This invention also contemplates the combination of the clutch mechanism with means preventing the access or operation thereof when the apparatus is in its operative conditions.

To this end, the permanent member controlling the clutch operation by exerting a tractive effort, as commonly used in known apparatus, is replaced by a detachable or fixed handle adapted to rotate a control shaft which, by means of a crank arm, is connected to the "floating" center of rotation of the reverse transmission system mentioned hereinabove, in order to cause the movement of translation of this system when the clutch is operated. Thus, controlling the clutch release by means of a twist-grip or like control handle will safely avoid any risk of faulty operation, notably by unskilled or careless operators.

Moreover, the above-described mechanism is advantageously combined with a safety device preventing the access to or the operation of this mechanism when the apparatus is being operated, notably if it is used as a scaffolding elevator.

The safety device according to this invention may also comprise a two-position movable member having a safety position imposed thereto by the operative condition of the apparatus and preventing the access to or the operation of the control shaft.

If the clutch mechanism is operable only by means of a detachable key or spanner, the safety movable member may be so arranged that in its safety position one of its portions blocks the passage of said key. On the other hand, if the clutch mechanism is controlled by means of a lever or knob mounted as a permanent attachment on the apparatus, the aforesaid movable member will be so arranged that in its safety position one portion thereof will prevent the clutch operation by projecting for example across the path of a component element of the clutch mechanism. In either case the clutch operation cannot take place as long as the movable safety member is in its safety position.

In order to afford a clearer understanding of this invention and of the manner in which the same may be carried out in practice, reference will now be made to the accompanying drawings illustrating diagrammatically by way of example various forms of embodiment of the safety device constituting the subject matter of this invention. In the drawings:

FIGURE 1 is a diagrammatic sectional simplified view of a known apparatus to which this invention is applicable;

FIGURE 2 is a similar section showing an apparatus modified according to a first form of embodiment of the invention;

FIGURE 3 is a diagram illustrating in part-sectional and isometric view an operative connection between the shaft of the control lever and the floating pivot pin of the actuating lever, using an Oldham joint;

FIGURE 4 is a similar view wherein a universal joint is used in said connection;

FIGURE 5 is a section similar to FIGURE 2 showing a different form of embodiment of the invention;

FIGURE 6 is a diagrammatic view showing another operative connection between said control shaft and actuating lever;

FIGURE 7 is a fragmentary longitudinal simplified section showing the apparatus incorporating another possible form of embodiment of this invention, in the case of a clutch mechanism control actuated by means of a detachable key, this figure showing only the parts necessary for a proper understanding of the invention;

FIGURE 8 is a fragmentary longitudinal section similar to FIGURE 7, showing an apparatus constructed according to a different form of embodiment of the invention, in the case of a clutch mechanism controlled by means of a detachable key, and

FIGURE 9 is a detail view showing the adaption of anyone of the two forms of embodiment depicted in FIGURES 7 and 8, in the case of a clutch mechanism control actuated by means of a lever mounted as a permanent element on the apparatus.

The known apparatus illustrated in FIGURE 1 comprises a hollow body **1** constituting a case comprising for example two shells assembled by means of bolts (not shown). This case carries two axially aligned bushes **2, 3** permitting the longitudinal passage of a traction cable **4**, one bush **2** being rigid with, or forming an integral part of, an anchor member such as a hook **5**. The cable end **6** on the hook end is free, and the opposite end **7** of the cable is anchored to a load to be transferred or hoisted (not shown).

The cable portion extending within the case **1** is passed through a pair of tandem-disposed similar clamping units **8, 9** each comprising a pair of clamping jaws mounted between side plates **10, 11**. The jaws of each clamping unit are actuated by two pairs of control links adapted to move said jaws towards or away from the cable by imparting a movement of translation thereto. These links are pivotally mounted on the aforesaid side plates **10, 11** by means of pivot pins **12, 14** (clamping unit **8**) and **13, 15** (clamping unit **9**). In each clamping unit one pair of links has extensions **16, 17** opposite the pivot pin in relation to said cable.

The clamping units **8, 9** are connected via rods **18, 19** respectively to the ends of a two-armed lever or double crankpin **20** rigid with a shaft **21** carrying a forward motion lever (not shown).

The reverse motion lever **22** emerges form the case **1** through a slot or like elongated aperture **23** and is pivoted at **24** to the link extensions **16** and at **25** to an arm **26** pivoted in turn at **27** to the extensions **17** of the other links. Means (not shown) are provided for constantly urging the link extensions to the right as seen in FIGURE 1, i.e. in the direction to close the jaws.

When the lever **22** is actuated it rotates substantially about a floating center **28** located half-way between the pivot pins **24, 25**, and a clutch release lever **29** is fulcrumed at this floating point on the lever **22** so that the pivot pins **24, 25** can be pulled bodily to the left and thus cause the simultaneous opening of both clamping units **8, 9** of the apparatus.

With this construction it is clear that if the operator by moving the lever **22** were able to impart a movement of translation thereto towards the left, instead of causing only its rotation substantially about the floating center **28**, the possibility of an undesired clutch release movement would not be precluded, although under normal conditions the reaction exerted by the links of the clamping unit being released is attended by the cable-clamping action exerted by the links of the other clamping unit by creating a bearing or reaction point for the lever **22** where this lever is connected to the links of the clamping unit being opened.

In the specific form of embodiment illustrated in FIG-

URE 2 this control lever **22** is reduced to the portion necessary to constitute a link operating lever, but it cannot be used as a reverse motion control lever. This reverse motion control lever designated by the reference numeral **30** is pivoted on a fixed pin **31** and operates the control lever **22** only through the medium of adequate connecting or coupling means. In this example it is assumed that the reverse motion control lever **30** carries side pins **32** engaging slots **33** formed in a fork-shaped outer end portion of said forward-motion control lever **22**.

The fixed pivot pin on which said reverse motion control lever is fulcrumed may be aligned with the mean position of the floating center of rotation **28**, and the control lever may then be rigid with a rotary shaft **34** journalled in a lateral bearing of the case **1** and connected for example through an Oldham joint **35** to a shaft **36** carried by the lever **22** at its fulcrum which would thus remain floating (FIGURE 3).

Alternately, a universal joint **37** shown diagrammatically in FIGURE 4 may also be provided between the shafts **34** and **36**.

FIGURE 5 illustrates the provision of a lateral control lever **38** rigid with a shaft **39** carried by one side of the case and operatively connected to the forward motion control lever **22** by means of a link **40** pivotally connected at one end to an arm **41** of shaft **39** and at the other end to the outer end **42** of lever **22**. The clutch control lever **29** is omitted from this figure, this lever being adapted to extend through a relatively narrow aperture in the case **1** since it has only to be pulled for operating the clutch mechanism, and therefore the elongated aperture or slot usually provided in the case for permitting the movements of a reverse motion control lever can be dispensed with.

In FIGURE 6, the link extensions **16** and **17** of clamping units **8** and **9** are connected via rods **50**, **51** to two opposite pivot points **52**, **53** of a coupling lozenge-shaped plate **54**. The other pair of pivot points **55**, **56** of coupling plate **54** are engaged by the corresonding ends of a pair of identical parallel links **57**, **58** extending substantially at right angles to the cable portion **4** passing through the apparatus. The upper ends of these links **57**, **58** are pivoted at **59**, **60** to the substantially horizontal arm **61** of a T-shaped reverse motion control lever **62** fulcrumed on a fixed pivot pin **65** carried by the case **1** and extending through the middle portion of said arm **61**.

Thus, the pivot points **55**, **56**, **59** and **60** constitute a parallel motion and the same applies to pivot points **52**, **63**, **53** and **64**, points **63** and **64** constituting the pivot points of links **50** and **51** on the link extensions **16** and **17** of the clamping units.

It will be seen that with this arrangement as the cable **4** and the jaws of clamping units **8** and **9** wear away the link extensions **16** and **17** are inclined to the right as seen in FIGURE 6, thus bringing about a movement of translation of coupling member **54** in relation to the cable **4**. This movement of translation is attended by a pivotal movement of links **57** and **58**, whereby any lateral strain is avoided in the coupling member **54** and therefore in the link extensions **16** and **17**. Therefore, the cable and jaw wear will not interfere with the position and operation of control lever **62**.

Referring now to FIGURES 7 and 8, a clutch mechanism is illustrated therein which comprises an arm **70** fulcrumed about a fixed pivot pin and actuated by means of a key inserted through a hole provided to this end in a lateral wall of the case, this key being adapted to engage a square hole **71** formed in said arm **70**, the axis of this hole being coincident with the pivot axis of the arm **70**. This arm **70** is connected to the reverse motion control transmission mechanism, i.e. to the actuating lever **22** in the specific example contemplated herein (in a construction of the type illustrated in FIGURES 2 to 5) by means of a connecting arm **72** pivoted at **73** to arm **70** and to lever **22** at a point **74** located substantially intermediate the pivot pins **24** and **25**.

The movable safety member comprises a shutter adapted in the safety position to be interposed between the case hole provided for the ingress of the control key and the square hole **71**.

In the alternate form of embodiment illustrated in FIGURE 7 the safety member consists of a two-position sliding member **75** extending through the case **1** and comprising an external actuating knob **76**. This preferably T-shaped member **75** comprises a shutter lug **77** adapted to mask the access to the hole **71** in the safety position, and another lug **78** adapted in the other position to block the passage of the cable **4** through the end of case **1** which carries the anchor member or hook **5**, this passage being free only when the member **75** is in its safety position illustrated in the drawing. In the example illustrated, this cable passage is then permitted by an opening **79** formed in said lug **78**.

It will be understood that the aforesaid member **75** cannot be moved to the position permitting the operation of the clutch mechanism (which is illustrated in dash-and-dot lines) unless the cable **4** does not extend through the corresponding end of case **1**. Thus, if the operator tries to further insert the cable the latter will abute against the lug **78** and cannot clear the bushing **2** before the member **75** has been fully depressed (in the example illustrated) to its safety position. In this last position the member **75** positively prevents the actuation of the clutch release mechanism.

Any suitable braking means may be provided for retaining this member **75** in its two positions. Thus, for example, detent-positioning means may be provided to this end.

In the specific form of embodiment illustrated in FIGURE 8, the movable safety member consists of a member **80** pivotally mounted in the case **1** on a fixed pivot pin **81** and comprising likewise a shutter-forming lug **82** having the same function as the lug **77** of FIGURE 7. A spring **83** urges this member to its safety position in which an arm **84** of this member bears against the inner end of bushing **2** rigid with the anchor member, for example with the hook **5**.

The anchor member **5** and bushing **2** are so designed that they can slide to a limited extent in relation to the case and in the axial direction of the cable. During the operation, the assembly **2**, **5** is urged to the left as seen in the figure, in relation to the case, not only by the action of spring **83** but also by the reaction exerted by the cable **4** on the apparatus when a load is attached to the cable, so as to pull the latter to the right as seen in the figure.

To free the access to the clutch mechanism by pivoting the movable member **80** the hook **5** must first be moved to the right in relation to the case **1** (or alternately the case **1** to the left in relation to said hook **5**), and it is obvious that this relative movement cannot take place unless the apparatus is free or the case is free of any traction effort transmitted via said cable when the latter is under load.

The above-described forms of embodiment illustrated in FIGURES 7 and 8 of the drawings are applicable in the case of a clutch mechanism actuated by inserting a detachable key into a suitable hole provided to this end in the apparatus, but a very simple modification may be brought thereto for adapting the apparatus to the control of said mechanism by means of a lever or push-button mounted permanently on the apparatus. In fact, it is only necessary to provide on the movable safety member **75** or **80**, instead of the shutter-forming lug **77** or **82**, an abutment lug **85** (FIGURE 9) adapted, in the safety position, to register with a boss **86** formed in the control shaft shown at **87** and carrying the arm **70**, so as to positively prevent the clutch release control movement.

It will also be understood that even in the case of an apparatus wherein the anchor member **5** is rigid with the case **1**, the safety feature may be obtained in a similar manner due to the necessity for the operator of carrying

out two separate operations in a well-defined order to firstly clear the shutter device and subsequently actuate the clutch mechanism, thus making the apparatus fool-proof.

What we claim is:

1. Traction and hoisting apparatus of the clamp and cable type comprising a reverse motion control lever adapted, by rotating about a floating pivot point, to actuate the clamping units of the apparatus through the medium of their jaw control members, characterised in that it comprises a device positively preventing the translation, in the direction to cause the simultaneous opening of the jaws, of the floating pivot point of said reverse control lever during the actuation of said lever, so as to prevent any untimely or accidental release of the apparatus.

2. Apparatus according to claim 1, characterised in that said device preventing the operation of said clutch comprises a reverse motion control lever adapted to pivot about a fixed pivot point which is connected to the reverse motion actuating lever through transmission means giving to said actuating lever its necessary lost-motion without any possibility of imparting an accidental movement of translation thereto which might bring about the simultaneous opening of the both clamping units.

3. Apparatus according to claim 2, characterised in that the operative connection between said reverse motion control lever and said reverse motion actuating lever controlled thereby comprises transmission means including a shaft having a fixed axis, said shaft being rigid with said control lever and carried by said case, the other parts of said transmission being enclosed in the case so that the elongated aperture usually formed therein for the passage and the movements of the reverse motion control lever can be dispensed with.

4. Apparatus according to claim 1, characterised in that said device preventing the operation of said clutch consists of a coupling plate having two pairs of pivot points, the diametrally opposite points of the first pair being connected the one by means of a first rod to the member controlling the opening of one of said clamping units, the other by means of another rod to the member controlling the opening of the other clamping unit, the diametrally opposite pivot points of the other pair being connected to the reverse motion control lever by means of a pair of identical parallel links extending in a direction substantially at right angles to the cable, the reverse motion control lever being fulcrumed to a fixed pivot pin rigid with the external case.

5. Apparatus according to claim 1, characterised in that said device for preventing the untimely operation of the clutch mechanism consists of a pivoted arm having one end connected to the reverse motion control lever at the level of its floating pivot point and the other end rigid with a control shaft rotatable only by means of a twist-grip or like handle.

6. Apparatus according to claim 5, characterised in that it comprises a two-position movable safety member having one safety position imposed by the operative condition of the apparatus and preventing the access or the operation of the control shaft.

7. Apparatus according to claim 6, characterised in that only said safety position of the movable safety member permits the passage of a cable through the apparatus, the other position blocking said passage at the outlet end opposite to the load to be actuated.

8. Apparatus according to claim 6, characterised in that safety position of the movable safety member is imposed by the limited sliding movement of the anchor member of the apparatus in relation to the body of said apparatus under the control of the tractive force transmitted by the cable to the anchored apparatus when a load is pulling said cable, whereby the operation of said clutch mechanism is positively prevented as long as a load is applied to the apparatus by means of its traction cable.

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U.S. Cl. X.R.

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