May 12, 1942. N. P. LARSEN ET AL 2,282,731

WINCH

Filed Feb. 16, 1938 2 Sheets-Sheet 1

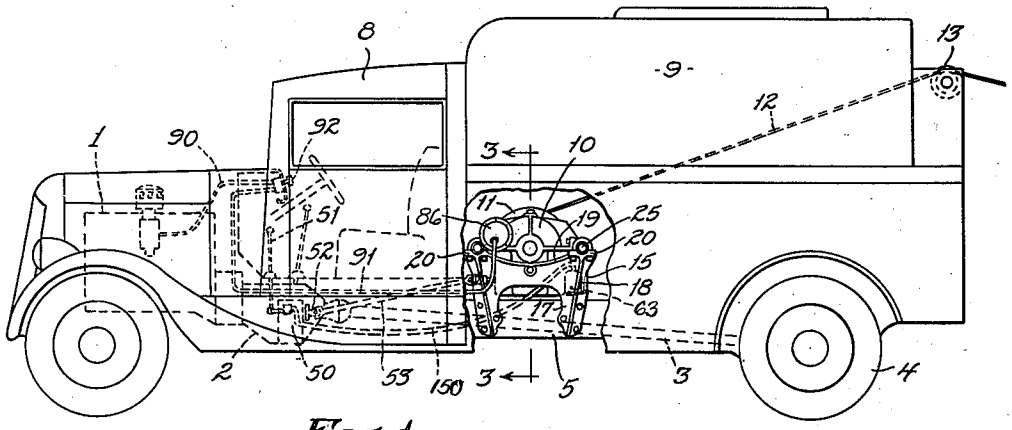


FIG. 1

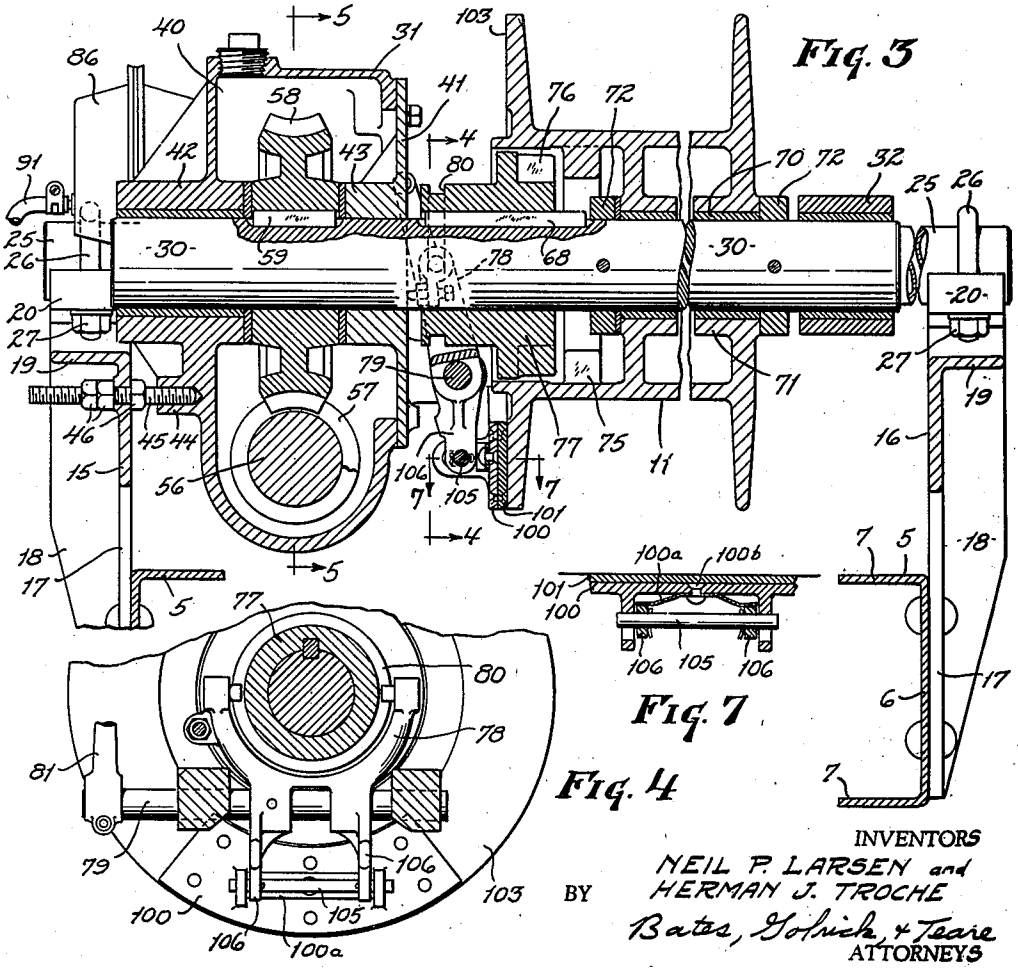


FIG. 3

FIG. 4

FIG. 7

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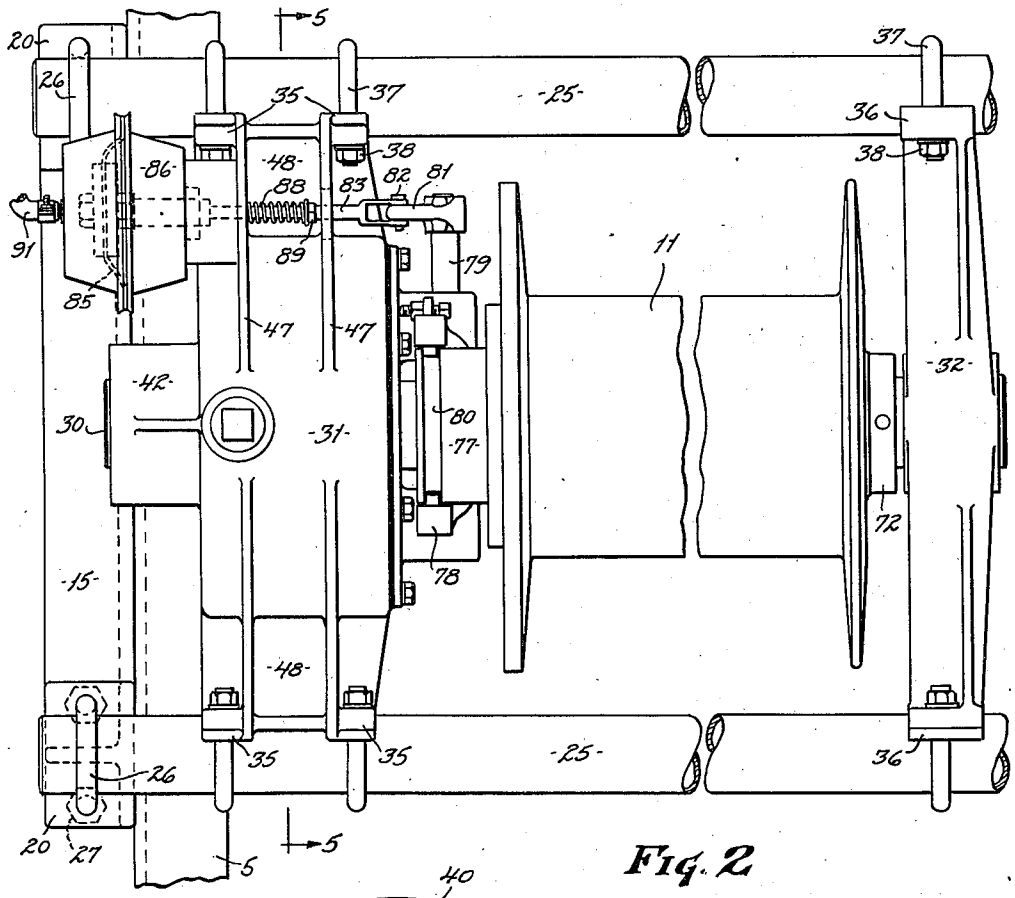


Fig. 2

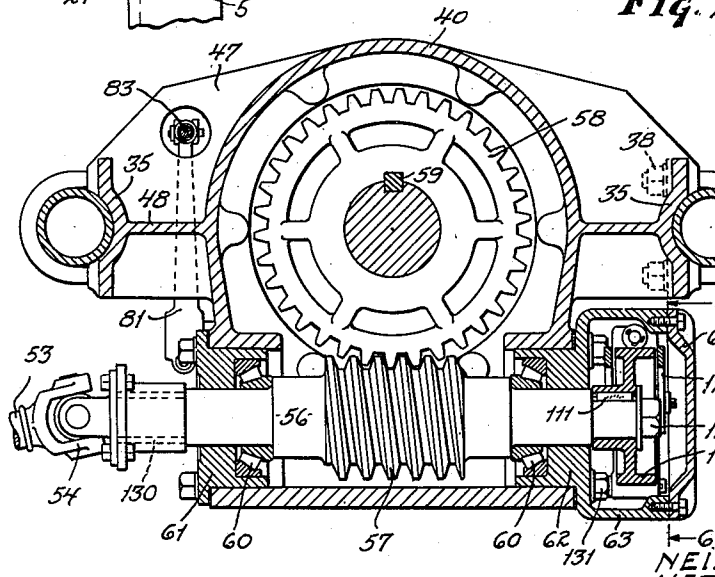


Fig. 5

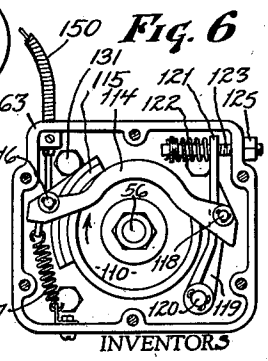


Fig. 6

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WINCH

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Application February 16, 1938, Serial No. 190,760

4 Claims. (Cl. 254—187)

This invention relates to power winches, particularly of the type adapted to be mounted on a motor vehicle and controlled from the driver's cab. The general object is to provide an improved winch mechanism of the class above indicated.

Power winches, when designed to be mounted on a road vehicle, must be light in construction and if operable from the driver's cab have a sufficiently simple control arrangement so that the operator will not require any great amount of training in the operation of hoists, beyond what would be expected of him as a vehicle operator.

Another problem is presented by the variation in design of road vehicles, wherefore, it is desirable that the winch be adapted to be secured to different makes and types of vehicles available to support them. It is also highly desirable that the winches be so arranged as not to be accidentally disconnected from the power source when lifting a load, as in the erection of telephone and light wire poles, for the reason that such disconnection at inopportune times can cause great personal and property damage.

Other desirable features are so to arrange the mechanism that it may be secured very firmly in place, and all looseness of connections taken up as quickly and simply as possible. Moreover, because the winch drum may be required to occupy one position on one vehicle and a different position on another vehicle, it is desirable that movement of the drum and its driving means on a main frame may be had, without resort to costly, insecure or complicated holding means for the essential mechanism in the different positions it may occupy.

A further desired feature is the availability of the parts and sub-assemblies for removal, replacement and servicing.

Another desirable feature is the arrangement of a supporting framework for a hoisting drum such that the forces imposed by the load are taken up as directly as possible by strong load-resisting frame parts situated close to or in the plane in which such forces are concentrated.

With the above in view, a further object of the invention is the provision of a simple and effective winch construction in which any one or various combinations of the desirable features referred to are present.

A more specific object is to provide an improved driving brake for a worm-driven winch.

Another object is to provide a winch control arrangement adapted to be operated by power supplied from a vehicle engine (as by engine vacuum) in order to disengage the winding drum from the source of power which drives it.

A further object is to provide an automatic unwinding drum brake, which mill operate to prevent free unreeling of cable whenever the drum is disconnected from its power drive.

Other objects and features of the invention will become apparent from the following description relating to the accompanying drawings, showing the preferred form. The essential characteristics are summarized in the claims.

Referring to the drawings, Fig. 1 is a side elevation of a motor vehicle, partly broken away to show the winch; Fig. 2 is a fragmentary plan view, in a larger scale, of the winch mechanism and its supporting framework; Fig. 3 is a sectional view, in a vertical plane, taken substantially along the line 3—3 on Fig. 1; Fig. 4 is a detail view thereof, as indicated by the line 4—4 on Fig. 3; Fig. 5 is a sectional view through the worm-driving gearing for the winding drum, as indicated by the lines 5—5 on Figs. 2 and 3; Fig. 6 is a detail end view of the working parts of an automatic worm brake, as indicated by the line 6—6 on Fig. 5; and Fig. 7 is a sectional detail view as indicated by the line 7—7 on Fig. 3.

Referring to Fig. 1, the vehicle shown is of the automobile type, having an internal combustion motor 1, a change speed mechanism 2, and the usual driving connections including a propeller shaft 3 leading to a set of traction wheels 4. The chassis includes the usual longitudinal frame members or sills 5, portions of which are shown in Figs. 1 and 3, with vertical webs 6 and horizontal flanges 7. The driver's cab is indicated at 8, and a covered load-carrying body at 9 designed, for example, for carrying tools and materials incident to installing and servicing of poles, etc., for electric transmission lines.

The winch mechanism indicated generally at 10, is shown as located near the forward portion of the body 9, inside it, behind the driver's cab; and the single winding drum 11 has a cable 12 extending rearwardly as over a guiding sheave 13 supported at the upper rear portion of the body.

The main framework of the winch includes two upright hanger brackets 15 and 16, the former of which is shown in Fig. 1. These are similarly constructed, one a right and one a left, and have leg portions 17 provided with upright and horizontal stiffening flanges 18 and 19 respectively. The legs have flat surfaces adapted e. g. to be bolted, riveted or welded in face-to-

face contact with the web portions 6 of the vehicle sills to support the drum at various heights thereabove or between them.

At the upper portions of the hanger brackets 15 and 16, both forwardly and rearwardly of the winch mechanism, are circularly recessed perches 20 interconnected in a fore and aft direction by web and flange portions of the brackets, including the flanges 19. Secured in the rests 20 of the hanger brackets are relatively light but stiff cross-frame bars 25. These are preferably straight steel tubes furnished in whatever lengths are required to extend from the vertical plane of one chassis frame sill 5 to the other. The tubes can be furnished in standard lengths and cut off in the field if too long. The winch mechanism, as will later be shown, forms a unit with both tubes 25; and, in order to permit lateral adjustment of such unit relative to the vehicle frame, the ends of the tubes are secured against the circularly recessed perches 20 of the hanger brackets by U-bolts 26, with nuts 27 on the undersides of the perches.

The winding drum 11 is borne by a heavy cross-shaft 30, which is supported, substantially in the horizontal plane of the tubes 25, partly by a worm-gear housing 31 and partly by a vertically and horizontally flanged beam 32, the housing and beam each being anchored to both tubes 25. The housing 31 and beam 32 may be adjusted crosswise of the vehicle frame on the tubes 25, separately or unitarily, the preferred securing means comprising circularly recessed end portions 35 and 36 on the housing 31 and beam 32 respectively, said portions snugly embracing adjacent surfaces of the tubes and being clamped thereagainst by U-bolts 37 and nuts 38. For standardization of parts, all the U-bolts can be identical.

The housing 31 (see Fig. 3), has a hollow enlarged and circular central portion 40, closed at one side by a detachable wall 41, secured as by cap screws. Opposite walls of the housing members have thickened portions, 42 and 43, respectively, to form or support bearings for the shaft 30. Parallel spaced vertical flanges 47 (see Figs. 2 and 5), above and below webs 48 connect the generally circular hollow portion 40 of the housing 31, with the circularly recessed portions 35, which are clamped to the tubes 25.

The housing 31 may have an adjustable stabilizing connection with one of the hanger brackets; such being shown in Fig. 3 as a stud 45 threaded into a boss 44 on the housing. The stud has a threaded portion extending through the vertical web of the hanger bracket 15 and secured as by adjusting and securing nuts 46 on one or both sides of it. The outermost nut shown is a lock-nut for maintaining adjustment.

For driving the winch drum, an auxiliary transmission 50 of suitable type (shown in dotted lines, Fig. 1) may be arranged adjacent the main transmission mechanism 2 of the vehicle power unit, which auxiliary transmission, has a control lever 51 and tail shaft 52. The tail shaft has a universal connection of suitable form with a shaft 53, the rearward end of which, as illustrated in Fig. 5, is connected by a suitable universal joint 54 with the forwardly extending end of a worm-shaft 56, having a worm 57 thereon within the lower portion of the housing 31. The worm meshes with a worm wheel 58 which, as shown in Fig. 3, is drivingly keyed to the shaft 30 as at 59.

The auxiliary transmission includes suitable reverse gearing so that the winding drum can be driven selectively to pull in or pay out cable attached to it.

The worm-shaft 56, as shown in Fig. 5, has reduced end portions supported in anti-friction bearings 60 of the end and radial thrust type. The bearings are supported in removable caps 61 and 62, bolted to the lower side walls of the housing portion 40. The bearing supporting cap member 62, at the right in Fig. 5, has a hollow enlarged extension 63 thereon, adapted to serve as a housing for an automatic reverse-preventing brake mechanism for the worm-shaft, the details and functions of which will be fully described below. This can have control connections with the auxiliary transmission so that when it is necessary to drive the winding drum in the direction to pay out cable, the automatic brake will be rendered inoperative. The outer end of the brake casing 63, has a detachable plate 65 closing it.

The driving connections between the winding drum and the worm gear mechanism are arranged as follows: The drum is loose on the shaft 30, being supported as on appropriate bearing sleeves 70 inside hub members 71 of the drum structure. At opposite ends of the hub portions 71 are rings 72, which may be pinned to the shaft and operatively abut respective hub members 71 to secure the drum against endwise movement on the shaft. The end of the drum adjacent the worm gearing is open, and has formed in it a plurality of heavy plain-faced clutch teeth 75 adapted to be engaged by a complementary set of teeth 76 on a sliding clutch sleeve 77, keyed to the drum driving shaft 30, as by oppositely positioned keys or splines, one key being shown at 68. The sets of clutch teeth are normally held in mesh with each other by a lever mechanism, including yoke arms 78 on a cross-shaft 79, secured in suitable brackets extending from the detachable wall member 41 of the worm gear housing. Pins on the yoke arms 78 engage a groove 80 in the sleeve 77 in the usual manner.

At the outer end of the shaft 79, as shown particularly in Fig. 2, is an arm 81, connected as at 82 with an operating rod 83, which extends through an enlarged opening in one of the flanges 47 of the worm gear housing to the driven element of a motor device 86, adapted to be operated by fluid pressure or pneumatically, as by engine vacuum. As shown in broken lines at 85, said element is a diaphragm. A coil spring 88 on the rod engages an adjustable abutment 89 (a nut, as shown) on the rod at one end, and one of the flanges 47 at the other. The spring normally maintains the rod 83 in a position to hold the clutch teeth 75 and 76 in mesh. Opposite motion of the rod 83 to disconnect the teeth can be accomplished by a vacuum line 90—91, Fig. 1, having an interposed control valve 92, within reach of the driver or operator, as on the dash or instrument panel in the cab. The portion 90 of the vacuum line may be connected with the intake manifold of the motor and the portion 91 with the device 86 in a manner to pull the diaphragm 85 against the action of the spring and release the clutch whenever the valve 92 is opened.

Assuming that the vehicle is suitably blocked with the engine in operation and the auxiliary transmission 50 adjusted to deliver power to the worm gear mechanism and the drum 11, continued operation of the engine will wind the cable onto the drum to lift a load such as a light pole,

Reversing drive of power take-off 50 lowers the pole into position. When such pole has been set, the operator in the cab releases the control valve 92 of the vacuum system, thus releasing the clutch teeth 75 and 76 from engagement and freeing the drum on its bearing 70. To prevent overrunning of the drum 11 when unreeling cable, as by hand, we have connected with the clutch release mechanism an automatic adjustable brake for the drum, shown as a flat shoe 100, Figs. 3 and 4, with friction material thereon at 101, adapted to bear against the near smooth face 103 of the drum. The shoe 100 has a pin and slot connection 105 with the lower ends of two arms 106, connected with the clutch shifter arms 78, so that whenever the shifter arms are moved by the fluid pressure operated device 86 to disconnect the dental clutch 75—76, the friction shoe 101 is maintained by said device in forcible contact with the drum, checking free movement of it in either direction.

In order to maintain the shoe 100 against the surface 103 of the winding drum when the dental clutch is engaged and the arms 106 are moved away from said surface 103, we have provided a bowed leaf spring 100*a* (see Fig. 7) connected to the shoe as at 100*b* and having its free ends 100*c* bearing outwardly on the arms 106. Operating pressure of the shoe 100—101 on the drum may be adjusted to the operator's desire, by movement of the nut 89 toward or from the spring 88 on the operating rod 83. The force applied by the friction brake 100—103 is not sufficient to prevent pulling out of the cable 12 manually, as in order to secure the cable to a new load.

Positive locking of the drum is effected when the worm 57 is not being driven, assuming the vacuum control valve 92 has not been operated to disengage the dental clutch. From the nature of the dental clutch, described above, it will be seen that the force applied by engine vacuum, is insufficient to disconnect the clutch teeth from each other while the drum and cable are under load. If, at such time, the auxiliary transmission is shifted to neutral, non-driving position, then, it might be possible for the worm wheel 58 to drive the worm 57 backward and allow the load to fall. The automatic brake shown in Figs. 5 and 6 is provided to prevent the reversal of the worm 57 in such case.

As shown, the automatic worm brake comprises a drum 110 secured as by a key 111 and nut 112 to one reduced extremity of the worm-shaft 56. Extending on opposite sides of the drum are a pair of bent arms 114, the lefthand ends of which, as illustrated in Fig. 6, are connected to a brake shoe 115, as by a pivot pin 116. A coil spring 117 connected to the outer ends of the arms and wall of the housing exerts sufficient force to keep the shoe in contact with the drum. The opposite ends of the bent arms 114 are pivotally secured as at 118 to a lever 119, which has its lower end pivoted at 120 to the housing 63. The lever 119 has an upwardly extending arm 121, against which a coil spring 122 on an adjustable rod 123 acts to move the arms 114 in a direction to seat the shoe 115 against the drum. The effective force of the spring 122 is controlled for adjustment by an externally positioned nut 125, threaded to the rod 123 which carries the spring. It will be noted that the pivotal connections 116 and 118 are in a plane sufficiently above the drum axis so that in the normal rotation of the drum, indicated by an arrow thereon in Fig. 6, the brake has no appreciable retarding influence upon the worm 67. However, the pivots 116 and 118 are sufficiently close to alignment with the drum axis so that upon attempted reversal of the worm and drum 110, the shoe is self-energized to grip the drum tightly and prevent reverse rotation of the worm.

In order to drive the worm in winding-drum-reversing direction the arms 114 and the brake shoe 115 can be moved bodily upwardly away from the drum 110 by a flexible cable 150 connected with the power take-off or auxiliary transmission control lever 51, whenever such lever is moved to reverse drive position.

The end of the worm-shaft opposite the brake mechanism has a splined connection at 130 with the universal joint and the brake housing is secured to the worm gear housing portion 40 by cap screws 131, so that when the cap 65 is removed (permitting access to the screws 131) the reverse-preventing drum mechanism and the worm-shaft can be removed from the housing 31 as a unit for inspection or repair. The worm can also be removed from the opposite side of the housing, upon removal of the cap 61, the plate 65 and the nut 112.

It will be seen that the mechanism and construction described accomplishes the objects heretofore outlined, and has the desirable features referred to in the opening paragraphs.

We claim:

1. In a hoisting mechanism of the class described, a cable winding drum, driving means for said winding drum, a jaw clutch interposed between the winding drum and the driving means and operable to selectively connect and disconnect the driving means with the drum, said clutch being arranged and adapted so that the jaws thereof cooperate with the winding drum when the clutch is in a drive connecting condition, a brake for said drum, a vacuum operated means connected to the brake and clutch to simultaneously apply said brake to the drum and disconnect the clutch from its driving relation with the drum, said vacuum operated means being arranged and adapted to effect the disconnection of the jaw clutch from the drum and to effect the application of the brake to the drum only when there is no load on the winding drum.

2. In a power winch, a winding drum and power means for driving it, a toothed clutch movably arranged to connect and disconnect the drum from the driving means, a device operated by said power means and operatively connected with the clutch in a manner to disconnect the drum and driving means, said clutch and device being arranged and adapted so that the device has insufficient power to cause such disconnection when the drum is operating to move a load or is holding a load against movement.

3. In a power winch, a shaft, a drum freely rotatable on the shaft axis, a driving gear including a worm-gear drivingly connected with the shaft and a worm in mesh with the gear, a power connection for driving the worm, a dental clutch splined to the shaft and adapted to mesh with teeth on the drum, a vacuum device adapted to release the clutch when not under load but having insufficient power to release it when under load, and means constantly tending to hold the clutch in position to connect the gear and drum.

4. In a hoisting mechanism of the class described, a cable winding drum, power driving means for said winding drum, a jaw clutch in-

terposed between the winding drum and the driving means and operable to selectively connect and disconnect the driving means with the drum, said clutch being arranged and adapted so that the jaws thereof cooperate with the winding drum when the clutch is in a drive connecting condition, a vacuum operated means supplied by the power which operates the driving means and operating to withdraw said clutch, said vacuum operated means being arranged and adapted to effect the withdrawal of said clutch only when there is substantially no load on the winding drum.

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