United States Patent

Collins

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[54] **CABLE LOAD INDICATOR**

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[52] **U.S. Cl.** .....**340/272,** 200/85 R, 340/267 C

[51] **Int. Cl.**.....**B66c 1/40**

[58] **Field of Search**.....340/267 C, 272, 282; 294/78 AR; 116/68; 200/85 R

[56] **References Cited**

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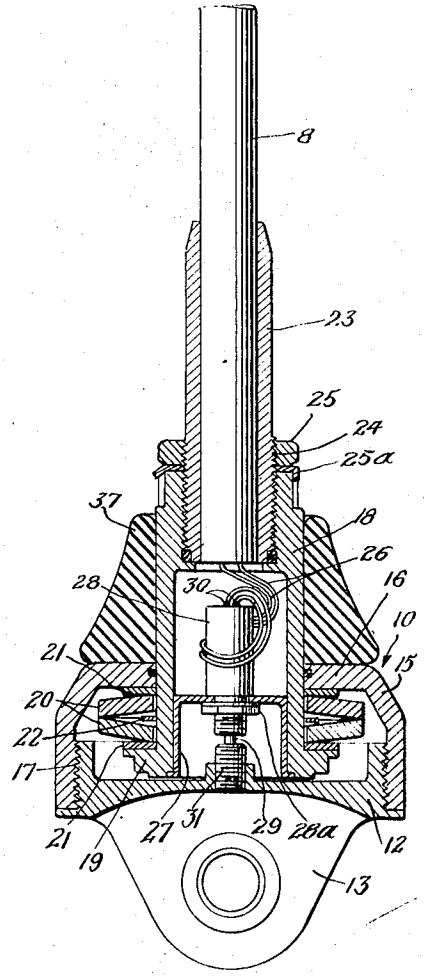
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[57] **ABSTRACT**

A cable with a terminal construction to transfer a load. Load transfer parts are structurally related with resilient load carrying elements interposed to give a controlled relative movement between the transfer parts. An electrical switch is supported in the terminal and the movement is used to actuate the switch which is included in an electrical circuit to give an indication such as a light when a selected load is applied to the terminal. An adjustable screw mounted in one of the load transfer parts provides the capability of varying the actuation of the switch to obtain the particular load selection desired.

7 Claims, 3 Drawing Figures



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Fig. 1.

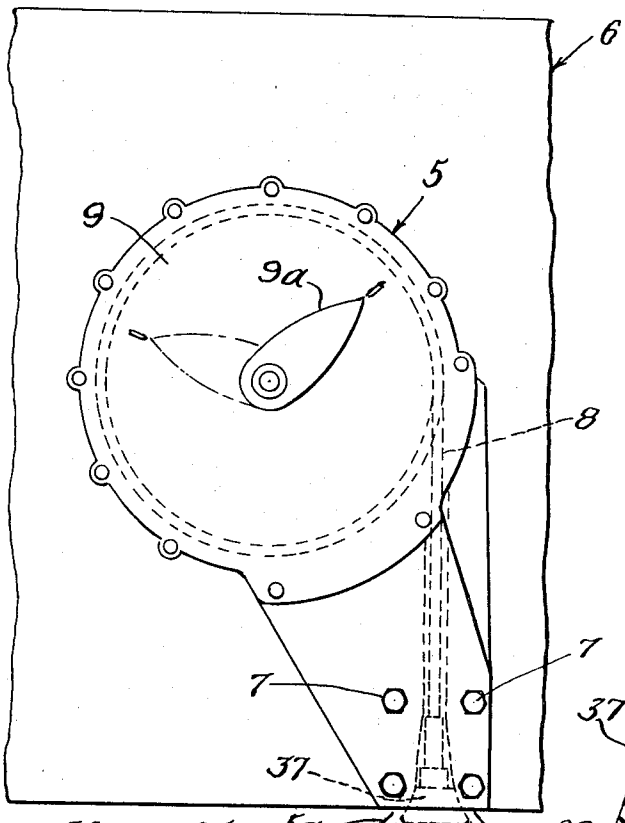


Fig. 2.

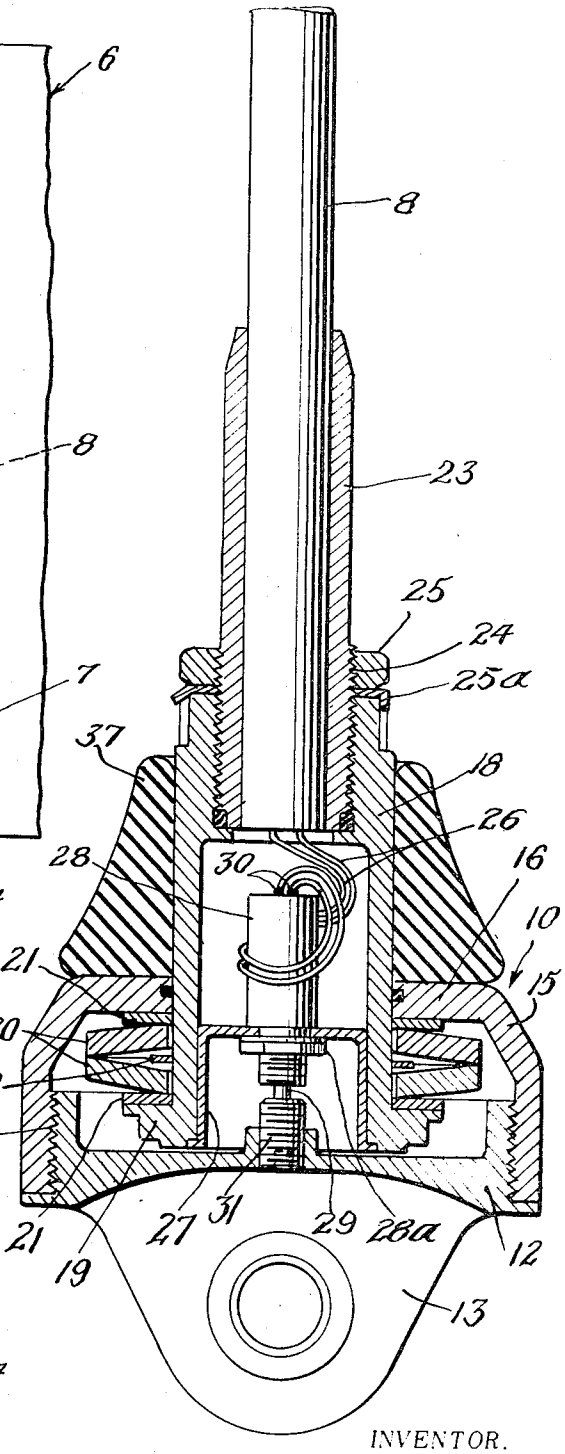
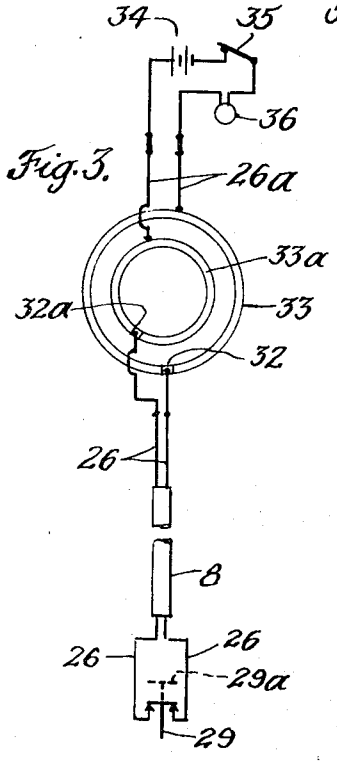


Fig. 3.



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CABLE LOAD INDICATOR

BACKGROUND OF THE INVENTION

This invention relates to cable terminal construction and is particularly concerned with a terminal having parts arranged for controlled relative movement under load to give a method for controlling a load indicating device.

When a cable is used to support a load, it is sometimes desirable to have a signal to warn when a maximum operating load is reached. This is particularly useful in the lifting system of a helicopter crane where the margin between operating load and breaking load is kept small in order to reduce the weight of the carrying parts of the system.

SUMMARY OF THE INVENTION

The example used in the present cable terminal illustration is for a cable used as one of the load supporting cables for a four point suspension system for use with a helicopter type flying crane. Each cable is supported by a storage reel attached to the structure of the helicopter and the cable is pulled out the required amount to connect to one corner of a load, for example a vehicle, to be transported. The pulling out action is accomplished while the cable is maintained in taut position by the rewind spring provided for retracting the cable into the storage reel. After the cable is attached to the load, a locking device at the reel is operated to lock the drum of the reel in adjusted position where it can transmit its load into the reel housing and by means of the mounting bolts into the helicopter structure upon lifting the load clear of the ground.

The extended portion of the cable may be vertical to the reel or it may pull out at an angle depending on the location of the load. The terminal structure regardless of angle will carry the load actually being applied to the extended portion of the cable which will be the greatest load in any section of the cable.

The main object of the present invention is to provide a load transmitting terminal which will give controlled movement between parts of the terminal to actuate an electrical switch mounted in the terminal structure.

A secondary object is to provide a suitable terminal structure which is configured to extend a minimum of axial length to reduce the distance which the cable connecting parts extend beyond the reel.

A further object is to provide an indicating terminal with simple means for accurately adjusting the setting to give the particular load indication desired.

BRIEF DESCRIPTION OF THE DRAWINGS

How the foregoing objects and advantages may be accomplished will be clear by reference to the description of the drawing in which:

FIG. 1 is an elevational view of a cable reel mounted on the fuselage of a helicopter.

FIG. 2 is an enlarged sectional view of the cable terminal.

FIG. 3 is an electrical diagram illustrating the system which may be used with the cable terminal structure.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the figures, FIG. 1 illustrates a reel assembly which includes a cable adapted to utilize the terminal of the present invention. The reel assembly **5** is shown connected to a helicopter fuselage structure **6** by means of mounting bolts **7**. The reel **5** is equipped with an extendable cable **8** which, when in a retracted position, is stored on a storage drum in the upper circular part of the reel housing **9**. The terminal unit **10** to which is attached the hook **11**, provides for attaching a load which may be transferred through the terminal structure **10** to the cable **8**. The cable is normally held in retracted position in the reel by means of a rewind spring (not shown) connected to the drum. An external handle **9a** is provided so that the operator can lock the drum to the housing at any point, thus providing for the transmission of load through the cable at any degree of extension.

It will be understood that the fuselage structure **6** is preferably located a considerable distance above the ground line of the helicopter, so that the vehicle or other load may be moved in under the lower surface of the fuselage. Four reels may be used suitably spaced to permit the cables to be drawn out the desired distance to engage the lifting fittings on a vehicle or other piece of equipment which is to be lifted. After each terminal is attached to the load, the reel lock is engaged by the ground crewman. The cable is shown in partly extended position at *8a* in broken outline. It will also be evident that the cable may pull off at an angle to the vertical. The bellmouth *5a* at the lower end of the reel provides a guide for the cable and protects it against damage when used in an angular position.

FIG. 2 shows the construction of the terminal assembly **10** which transmits the load from the hook **11** into the cable **8**. Terminal part **12** is constructed with a pair of extending legs **13** between which the hook **11** is supported by means of bolt **14**. A housing part **15** is provided with an inward flange **16** and is connected to the terminal part **12** by a threaded connection **17** to form an integral unit with the terminal part **12**. Another terminal part **18** has an outward flange **19** and a pair of disc springs **20, 20** are supported between the flange **19** and the flange **16** with bearing washers **21** located above and below the disc springs **20**. A small spacer washer **22** is located at the inner ends of the disc springs **20, 20**, to prevent complete flattening of the disc springs under overload conditions. A cable engaging terminal part **23** is preferably swaged into load transmitting contact with cable **8**, and terminal part **23** is provided at its lower end with a thread **24** to transfer the load from the terminal part **18** to the terminal part **23**. A locknut **25** and lockwasher **25a** function to make this connection a unified assembly.

The load supporting cable **8** is provided with a pair of electrical conductors **26, 26** which extend through the central portion of the cable **8**. An adapter part **27** which fits into load carrying cable part **18**, supports an electrical switch **28** which is secured in position by means of a suitable locknut **28a**. Actuator **29** extends beyond the end of the switch **28** in position to be in engagement with adjusting screw **31** which is threadedly supported in the terminal part **12**. The ends of the conductors **26, 26** are connected to the switch terminals **30**

thus including the switch **28** into the electrical circuit for the system. A resilient bumper **37** is provided to cushion the contact of the terminal assembly with the reel when the cable is retracted.

A suitable electrical system for use with the cable indicating terminal is shown in FIG. **3**. Here the actuator **29** is shown in full outline in the normally closed position. The conductors **26**, **26** are shown extending through the cable **8** to the other end of the cable where they are connected by means of contact brushes **32**, **32***a* to suitable slip rings **33**, **33***a*. The slip rings **33**, **33***a* are attached to the housing of the reel and thus provide for relative rotation of the drum on which the cable is supported and the housing on which the slip rings are supported. The slip rings in turn are connected into the aircraft electrical system by conductors **26***a* extending to provide connections with a battery or other source of electrical power **34** and system switch **35** which is connected into the system which includes indicator light **36**.

Operation of the system which includes the terminal assembly of the present invention will be clear from the following outline with reference to the figures. When a load is to be carried by the system, the cable reel is unlocked by moving handle **9***a* to the dotted outline position and the cable pulled out to the length required to engage the load as indicated by the dotted cable position **8***a*, FIG. **1**. After the hook **11** has been attached to the load, the cable is permitted to reel back into the reel until it is taut and then the drum is locked by moving the handle **9***a* to full line position. When multiple attachment points are involved all points are attached in the same manner as that just described. When the load is lifted, each cable transfers its load from the hook **11** to the cable **8** through the terminal assembly **10**. Upon transfer of the load through the parts of the assembly, the disc springs **20** deform and permit relative movement between the movable part **12**, which moves with part **15** and flange **16** and the flange **19** of part **18** which is fixed with respect to the cable **8**. With no load the terminal parts are such that the threaded adjustment part **31** contacts the actuator **29** and holds it in dotted position **29***a*, FIG. **3**. Adjusting screw **31** has been previously set so that at the predetermined load, which by way of example may be 8,000 pounds, the deflection in the disc springs **20** is sufficient so that at the 8,000 pound load the actuator **29** moves to the closed position as shown by full lines in FIG. **3**. This then completes the circuit in the electrical system and lights the indicator light **36** in the operator's compartment. The light **36** remains on until the load is reduced to slightly below 8,000 pounds, when the actuator is again displaced to the dotted line position **29***a* thus opening the switch **28**.

This compact load transfer terminal construction provides a relatively simple assembly to give accurate control of an electrical switch to operate a load indicating system.

I claim:

1. A load supporting cable having an insulated electrical conductor embedded therein and extending therethrough, a terminal assembly constructed to transfer a load to the cable, said assembly including

a. a first terminal part attached to the cable,
b. an electrical switch supported in said terminal assembly and having a connection to said conductor,
c. a movable actuator operatively associated with said switch,
d. a second terminal part mounted with provision for axial movement with respect to said first terminal part,
e. spring disc resilient means reactively interposed between said terminal parts to provide for controlled axial movement dependent on the load,
f. means associated with said assembly positioned to contact said actuator and actuate said switch upon application of a predetermined load on said second part.

2. A construction according to claim **1** in which an adjustable element is mounted on one of said terminal parts in position to contact said actuator to provide for adjusting the switch operation to the desired setting.

3. A construction according to claim **1** in which the means positioned to contact the actuator is a threaded element adjustable with respect to one of said terminal parts to provide the desired setting for switch actuation.

4. A load supporting cable, a pair of insulated electrical conductors embedded in said cable and extending therethrough, a terminal assembly constructed to transfer a load to the cable, means incorporated in said terminal assembly which respond to a particular applied load to provide an indication, said means including

a. a first terminal part attached to said cable,
b. a normally closed electrical switch connected to said conductors and supported on said first terminal part, said switch having an actuator extending therefrom,
c. a second terminal part mounted for axial movement relative to said first terminal part,
d. an element projecting from said second terminal part in position to depress said switch actuator a predetermined amount when said second terminal part is in the no-load position,
e. spring disc resilient means reactively interposed between said terminal parts to provide for controlled axial movement dependent on the load, said resilient means providing for movement between said parts sufficient to allow movement of said actuator to the normally closed position upon application of the particular applied load thereby providing for completion of an indicating circuit.

5. A construction according to claim **4** in which the element projecting from said second terminal part is a threaded element to provide for adjustment relative to said second terminal part.

6. A construction according to claim **4** in which the resilient means incorporate a pair of spring discs mounted with their outside diameters in opposed relationship.

7. A construction according to claim **4** in which the resilient means include two spring discs with their outer peripheries in engagement and a spacer washer is located between the discs adjacent their inner diameter.

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