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WINCH OVERLOAD LIMITING DEVICE

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Fig. 2.

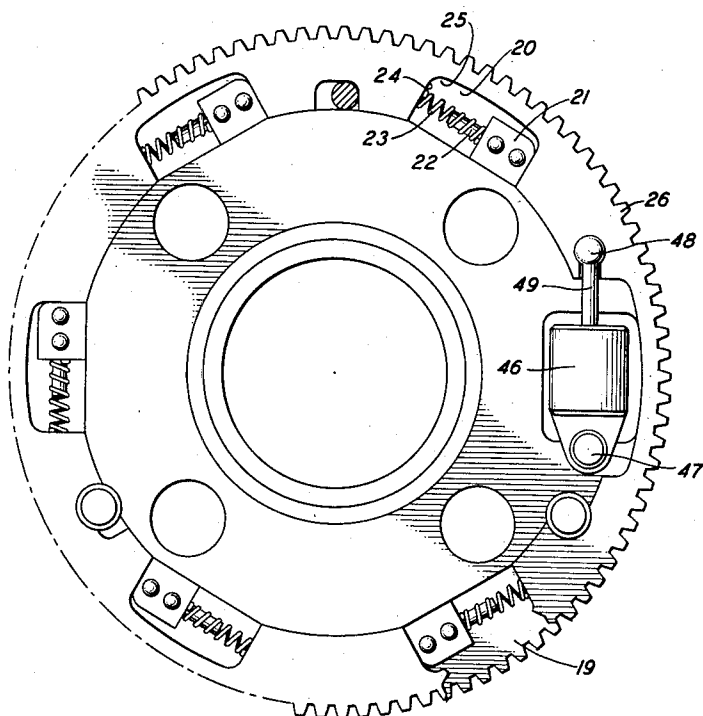
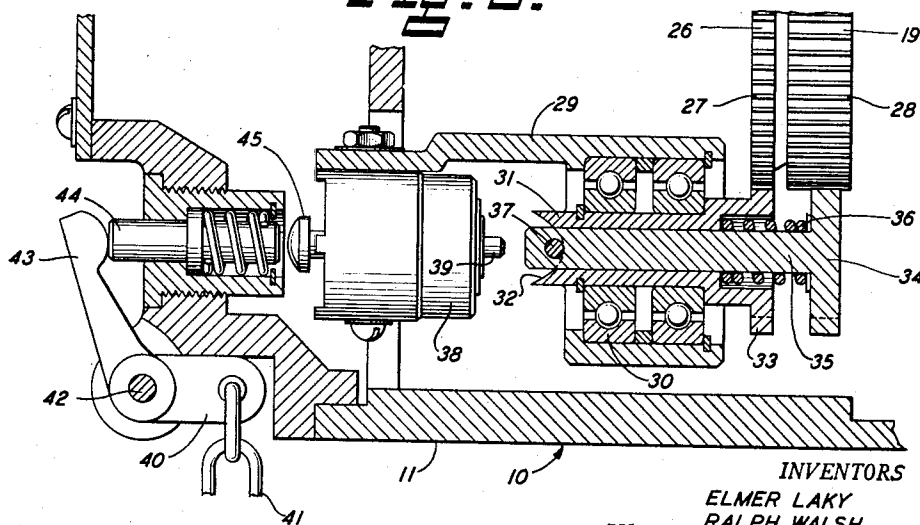


Fig. 3.



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WINCH OVERLOAD LIMITING DEVICE

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This invention relates to winches and specifically to mechanisms for protecting winches from the effects of overloading.

Presently known winches used in conjunction with rescue operations, aircraft and the like, are often subject to severe overloading resulting in damage to the mechanism of the winch. Various devices in the nature of slipping clutches and the like have been employed to protect winches from this danger. However, slipping clutches and presently known devices are deficient in that they greatly interfere with the ordinary operation of the winches and fail to stop the winch motor.

Accordingly, it is an object of the present invention to provide a device for protecting a winch from overloading.

Another object of the present invention is to provide a winch torque controlling device which will not be upset by sudden sharp strains imparted to the winch cable.

A further object of the present invention is to provide a winch torque absorbing and controlling device which will occupy a minimum amount of space.

Another object of the present invention is to provide a torque limiting device for a winch which will interrupt the operation of the winch upon the application thereto of extreme loads.

A feature of the present invention is its use of a gear arrangement secured to the cable drum gearing whereby excessive load torque is employed to interrupt the operation of the winch motor.

Another feature of the present invention is its use of spring means for driving the cable drum through the torque limiting gearing.

A further feature of the present invention is its use of a small dash pot to absorb sudden loads upon the winch cable.

Still another feature of the present invention is its use of a novel switch actuating means which is responsive to overload conditions of the winch.

The invention consists of the construction, combination and arrangement of parts, as herein illustrated, described and claimed.

In the accompanying drawings, forming a part hereof, is illustrated one form of embodiment of the invention, and in which:

Figure 1 is a view in side elevation, partially broken away, of a complete embodiment of the present invention.

Figure 2 is a cross-sectional view taken on line 2—2 in Figure 1.

Figure 3 is an enlarged detailed fragmentary view of the winch switch actuating mechanism in accordance with the present invention.

Referring to the drawings, and specifically to Figure 1, 10 indicates a winch structure including a housing 11 and a drum 12 carried within the said housing. A cable 13 is wound upon the drum 12 and led through a level wind device 14. The drum 12 is driven by means of a motor 15 through a gear train 16 within the housing 11.

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The gears 16 are connected to a shaft 17 having a gear 18 formed on the inner end thereof. The gear 18 is in mesh with a large driven gear 19. The gear 19, best shown in Figure 2, is provided with a series of cavities 20 in each of which there is secured a block 21. Each block 21 extends outwardly from the face of the gear 19 and has secured thereto a pin 22 over which there is slipped one end of a coil spring 23. The coil spring 23 extends from the pin and bears against the wall 24 of an opening 25 cut into a gear 26 hereinafter called a reference gear which is disposed adjacent the large gear 19. The gears 19 and 26 are of the same diameter and have an equal number of teeth. Power supplied by the motor 15 to the gear 19 through the gear train previously described is transmitted to the reference gear 26 by means of the block 21 and the springs 23. Under normal load conditions the strength of the springs 23 prevents their deflection and the two gears 19 and 26 rotate as a unit with their respective gear teeth in alignment. Power imparted to the gear 26 by the gear 19 through the springs 23 is transmitted to a planetary gear drive (not shown) within the drum 12 of the winch.

In the event that the load upon the cable 13 exceeds the desired limit for the operation of the winch, the torque imparted to the gear 26 by the drum 12 will exceed the combined strength of the coil springs 23. The coil springs 23 will then become longitudinally deflected as a result of the overload conditions. The gears 19 and 26 will thus rotate with respect to each other. The gear teeth 27, 28 of the gears 26 and 19, respectively, will move out of their alignment and will thereupon actuate the motor control mechanism best shown in Figures 1 and 3.

The motor control mechanism consists of a housing 29 within which is carried ball bearing members 30. The ball bearing members 30 rotatably support a hollow shaft 31 having a cam 32 cut into one end thereof. The opposite end of the shaft 31 is formed into a gear 33 hereinafter called the metering gear. The gear 33 is in mesh with the reference gear 26. A switch operating gear 34 is in mesh with the gear 19 and has a shaft 35 which is journaled within the hollow shaft 31 and extends therethrough. The gear 34 is kept separated from the metering gear 33 by means of a coil spring 36 which is carried around the shaft 35 between the said gears. A pin 37 is carried by the shaft 35 at the cam end thereof and is disposed in a direction normal to the longitudinal axis of said shaft 35. The pin 37 extends beyond the shaft 35 and is adapted to slide upon the surfaces of the cam 32.

The teeth of the gear members 33 and 34 are in alignment during normal operation of the winch. However, should the teeth 27, 28, of the gears 19, 26, become out of alignment they will also disturb the alignment of the teeth of gears 33 and 34.

As the metering gear 33 moves out of alignment with the switch operating gear 34, by reason of the unequal rotation of the gears 19 and 26, the shaft 35 will be caused to rotate. The rotation of the shaft 35 causes the pin 37 attached thereto to ride upon the cam surfaces 32. The disposition of the cam 32 is such that the travel of the pin 37 upon the cam 32 will pull the shaft 35 laterally and into the hollow shaft 31. The spring 36 will then be compressed and the gear 34 will slide laterally across the teeth of the wide gear 19. A switch member 38 is carried by the housing 29 adjacent the pin end of the shaft 35. The switch actuating plunger 39 of the switch 38 is positioned to lie in the path of the shaft 35 as it moves laterally through the hollow shaft 31. Accordingly, as the shaft 35 shifts in response to the rotation of the gear 34, the end of the said shaft will force the plunger 39 into the switch 38.

The switch, which is connected to the motor 15 will then interrupt the current flow to the said motor. All operation of the winch will thereupon cease and the overload condition can be corrected before the winch is again put in operation. When the overload condition is removed, the springs 23 will restore the gears 19 and 26 to their original alignment. The metering gear 33 and the switch operating gear 34 will then resume their original condition as illustrated in Figure 3. The winch is then ready for operation and the current flow to the motor may be restored by means of the reset mechanism shown in Figures 1 and 3.

The reset mechanism comprises a pivoted member 40, secured to the housing 11 as indicated at 42 and actuated by a chain 41. The arm 43 of the crank member bears against a small plunger 44 which in turn contacts the switch reset button 45.

During the normal operation of winches sudden loads of temporary duration may be applied to the winch mechanism which loads can neither be avoided nor are excessively harmful to the structure of the winch. In order to prevent such jolts from tripping the overload protecting mechanism hereinabove described, there has been provided a dash-pot 46 shown in Figure 2. The dash-pot 46 is connected at one end 47 to the gear 19 and at its other end 48 to the reference gear 26. When a sudden load is applied to the cable 13 the dash-pot resists rotation of the gears 19 and 26 with respect to each other for a short period of time. Prolonged loads on the cable 13 will, of course, cause the plunger 49 of the dashpot 46 to be forced into the cylinder (not shown) of the dash-pot thereby allowing the springs 23 to be compressed as hereabove set forth.

From the foregoing it will be seen that there has been provided a torque limiting device for a winch or similar structure whereby overloading of the said winch can be caused to interrupt the operation of the winch until the undesirable condition has been remedied. There has further been provided an overload control device which will restore itself automatically and which will be responsive only to continued overloading conditions without being interrupted by jolts of the cable 13 or other excessive short pulls thereon.

We claim:

1. An overload limiting device for use between the motor and cable drum of a winch comprising, a driven gear coupled to the motor, a reference gear adjacent the driven gear, yieldably coupled to the said driven gear and connected to the drum of the winch, said driven and reference gears having equal diameters and number of teeth, a metering gear in mesh with the reference gear, a hollow shaft secured to and supporting the metering gear, a switch operating gear in mesh with the driven gear, said metering and switch operating gears having equal diameters and number of gear teeth, a shaft on the switch operating gear journaled within the hollow shaft, a cam surface on the end of the hollow shaft opposite the metering gear, a pin secured to the switch gear shaft at the cam end thereof normal to the longitudinal axis of the said shaft and in contact with the cam, a motor switch adjacent the pinned end of the shaft, and means consisting of the torque applied to the reference gear by excessive loads on the cable drum for rotating the switch operating gear with respect to the metering gear whereby the pin will ride up on the cam and cause the end of the shaft to trip the switch deenergizing the motor.

2. An overload limiting device for use between the motor and cable drum of a winch comprising, a driven gear coupled to the motor, a reference gear adjacent the driven gear and parallel thereto, a plurality of openings in the reference gear, a plurality of spring members secured at one end to the driven gear and in contact with the walls of the reference gear openings whereby the reference gear is yieldably coupled to the said driven gear, said reference gear being connected to the drum

of the winch, said driven and reference gears having equal diameters and number of teeth, a metering gear in mesh with the reference gear, a hollow shaft secured to and supporting the metering gear, a switch operating gear in mesh with the driven gear, said metering and switch operating gears having equal diameters and number of gear teeth, a shaft on the switch operating gear journaled within the hollow shaft, a cam surface on the end of the hollow shaft opposite the metering gear, a pin secured to the switch gear shaft at the cam end thereof normal to the longitudinal axis of the said shaft and in contact with the cam, a motor switch adjacent the pinned end of the shaft, and means consisting of the torque applied to the reference gear by excessive loads on the cable drum for rotating the switch operating gear with respect to the metering gear whereby the pin will ride up on the cam and cause the end of the shaft to trip the switch deenergizing the motor.

3. An overload limiting device for use between the motor and cable drum of a winch comprising, a driven gear coupled to the motor, a reference gear adjacent the driven gear and parallel thereto, a plurality of openings in the reference gear, a plurality of spring members secured at one end to the driven gear and in contact with the walls of the reference gear openings whereby the reference gear is yieldably coupled to the said driven gear, said reference gear being connected to the drum of the winch, a dashpot secured between the driven and reference gears, said driven and reference gears having equal diameters and number of teeth, a metering gear in mesh with the reference gear, a hollow shaft secured to and supporting the metering gear, a switch operating gear in mesh with the driven gear, said metering and switch operating gears having equal diameters and number of gear teeth, a shaft on the switch operating gear journaled within the hollow shaft, a cam surface on the end of the hollow shaft opposite the metering gear, a pin secured to the switch gear shaft at the cam end thereof normal to the longitudinal axis of the said shaft and in contact with the cam, a motor switch adjacent the pinned end of the shaft, and means consisting of the torque applied to the reference gear by excessive loads on the cable drum for rotating the switch operating gear with respect to the metering gear whereby the pin will ride up on the cam and cause the end of the shaft to trip the switch deenergizing the motor.

4. An overload limiting device for use between the motor and cable drum of a winch comprising, a driven gear coupled to the motor, a reference gear adjacent the driven gear and parallel thereto, a plurality of openings in the reference gear, a plurality of blocks each of which is secured to the driven gear and extends into an opening in the reference gear, a plurality of coil spring members secured at one end to the blocks in the driven gear and having their free ends in contact with the walls of the reference gear openings whereby the reference gear is yieldably coupled to the said driven gear, said reference gear being connected to the drum of the winch, said driven and reference gears having equal diameters and number of teeth, a metering gear in mesh with the reference gear, a hollow shaft secured to and supporting the metering gear, a switch operating gear in mesh with the driven gear, said metering and switch operating gears having equal diameters and number of gear teeth, a shaft on the switch operating gear journaled within the hollow shaft, a cam surface on the end of the hollow shaft opposite the metering gear, a pin secured to the switch gear shaft at the cam end thereof normal to the longitudinal axis of the said shaft and in contact with the cam, a motor switch adjacent the pinned end of the shaft, and means consisting of the torque applied to the reference gear by excessive loads on the cable drum for rotating the switch operating gear with respect to the metering gear whereby the pin will ride up on the

cam and cause the end of the shaft to trip the switch
deenergizing the motor.

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