S. BURROWS
LIMIT SWITCH ACTUATOR

Fig. 4

Fig. 3

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LIMIT SWITCH ACTUATOR


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This invention has for its object to provide improved means for actuating limit switches on electrically operated cranes, for shutting off the drive to the drum or barrel when the rope or chain is fully wound thereon.

According to the invention, the limit switch operating mechanism includes a shaft carrying two gear wheels having different numbers of teeth, one being fixed on the shaft and the other loose, both meshing with a single pinion which is rotatable in a housing driven by the drum or barrel, the shaft being normally stationary so that the loose gear wheel is rotated thereon as the housing revolves, and the gear wheels having parts which engage with one another after a given number of revolutions of the housing, whereby the shaft is turned to operate the limit switch.

The housing may be mounted on an extension piece secured to the barrel shaft. The gear wheels may have numbers of teeth differing by one, and may each have a dog or stop on the side which faces the other wheel, to enable the one wheel to lock with the other when the dogs come into contact. Since the pinion is then in mesh with two locked gear wheels of slightly different pitch, it also becomes locked on its axis, and further rotation of the housing causes the locked assembly of pinion and wheels to revolve about the axis of the housing.

The shaft may have any convenient means for actuating the limit switch when the shaft is turned, such as a disc having cam surfaces adapted to engage a switch lever for opening or closing the switch, according to the direction of rotation of the shaft. The shaft may be held in its normal position by the switch lever which may be weighted or spring loaded so as to press the cam against a suitable stop.

When the shaft and cam disc are reversed so as to reset the switch after it has been operated, the cam is returned to normal position by the weighted or spring loaded lever.

With this arrangement the limit switch can be reliably operated, and can be re-set by a small reverse movement of the barrel.

Referring to the accompanying drawings:
Figure 1 shows in section a limit switch operating gear in accordance with the invention.
Figure 2 shows one application of the gear to a limit switch.
Figures 3 and 4 show alternative applications.
Referring to Figures 1 and 2, a flanged boss 1 is keyed to a barrel shaft 2 or an intermediate shaft of a crane. Secured to the barrel shaft is a casing 3 in which is mounted a pinion 4 on which a pinion 5 is rotatable. A shaft 6 running in bearings 7, 8 in the casing 3 has a spur wheel 9 keyed to it, and another spur wheel 10 is rotatable on the shaft 6. The wheels 9 and 10 both mesh with the pinion 5, and the wheel 9 has one tooth more than the wheel 10. There are stops 11, 12 on the wheels 9, 10 which come together when the wheels turn relatively to one another. On the end of the shaft 6 is a flange 13, to which is bolted a cam 14. The cam 14 has for example 12 bolt holes while the flange 13 has 14 holes, bolts 15 being inserted in two diametrically opposite holes, so that the cam may be adjusted in steps (1/12—1/14)=1/16 revolution of the shaft 6.

The cam 14 has a recess 16 in its flange, which receives a lever 17 pivoted at 18 and having a pin 19 engaging the operating lever 20 of a limit switch 21. Figure 2 shows the lever 17 in its tripped position in broken lines.

Figure 2 shows the application of the gear to a limit switch having a spring-actuated lever 20 which presses against the pin 19 of the lever 17 causing the latter to hold the cam 14 in the position shown until the cam turns in a counter-clockwise direction, causing the limit switch to be tripped.

As the barrel shaft 2 turns the casing 3, the pinion 5 is rotated by the stationary spur wheel 9 and drives the wheel 10 until the stops 11 and 12 make contact. Since the pinion 5 is then in mesh with two locked gear wheels of slightly different pitch, it becomes locked on its axis, and further rotation of the casing 3 makes the shaft 6 and cam 14 to rotate, and the limit switch 21 to be operated to stop the winding motor. The number of turns of the barrel shaft 2 required to trip the switch 21 depends on the initial angular distance between the stops 11, 12 and this is adjusted by adjusting the position of the cam 14 with respect to the flange 13. For example, if the wheel 9 has 60 teeth, the gear can be adjusted to trip the switch 21 after any number of turns of the barrel shaft up to 55 turns.

The method employed for setting the gear is to set the hoist gear of the crane to the position at which tripping of the switch is required to occur, turn the cam 14 in the hoisting direction of the barrel until the gears lock, then release the cam from the flange 13 and turn the cam to the position in which it trips the switch and finally bolt the cam to the flange 13 in that position.

Figure 3 shows an alternative arrangement in which a lever 17 is connected by a link 22 to the operating arm 23 of a switch 24, the arm 23 being connected by an adjustable link 25 to the operating arm 26 of a second switch 27. The cam 14 turns anticlockwise to trip the switches when the barrel has turned through the desired number of turns. The operating levers 23 and 26 have weights 28, 29 for resetting the switches.

Figure 4 shows another arrangement, in which the lever 17 operates a switch lever 30 of a switch 31, by means of a link 32, lever 33 and link 34. In this case the weight 35 extends at right angles to the switch lever 30.

What I claim is:
1. Means for operating limit switches on an electrically operated crane, for shutting off the drive to the drum or barrel when the rope or chain is fully wound thereon, comprising a housing adapted to be rotated by the crane drum, a shaft rotatable in the housing, a first spur wheel fixed on the shaft, a second spur wheel rotatable on the shaft and having a smaller number of teeth than the first spur wheel, parts on the spur wheels adapted to engage one another as one wheel turns relative to the other, a pinion rotatably mounted in the housing and engaging both spur wheels, the shaft and the first spur wheel remaining initially stationary, and the second spur wheel being rotated on the shaft as the housing revolves until it engages the first spur wheel and drives said first spur wheel and the shaft, and a means fixed on the shaft, adapted to actuate a limit switch when the shaft is turned.
2. Means as claimed in claim 1, in which each spur wheel has a stop member on the side facing the other spur wheel, adapted to engage the stop member on the other spur wheel when one wheel turns relative to the other.
3. Means as claimed in claim 1, in which the shaft
carries a cam disc for actuating a limit switch when the shaft is turned.

4. Means as claimed in claim 1, having a cam disc fixed on the shaft, a flange on the cam disc with a slot therein, and a switch-operating lever engaging the slot, the shape of the lever allowing the cam disc to turn in one direction only.

5. Means as claimed in claim 1, in which the switch actuating means is adjustably secured on the shaft, so that the number of turns to be made by the barrel before the switch is tripped can be adjusted.

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