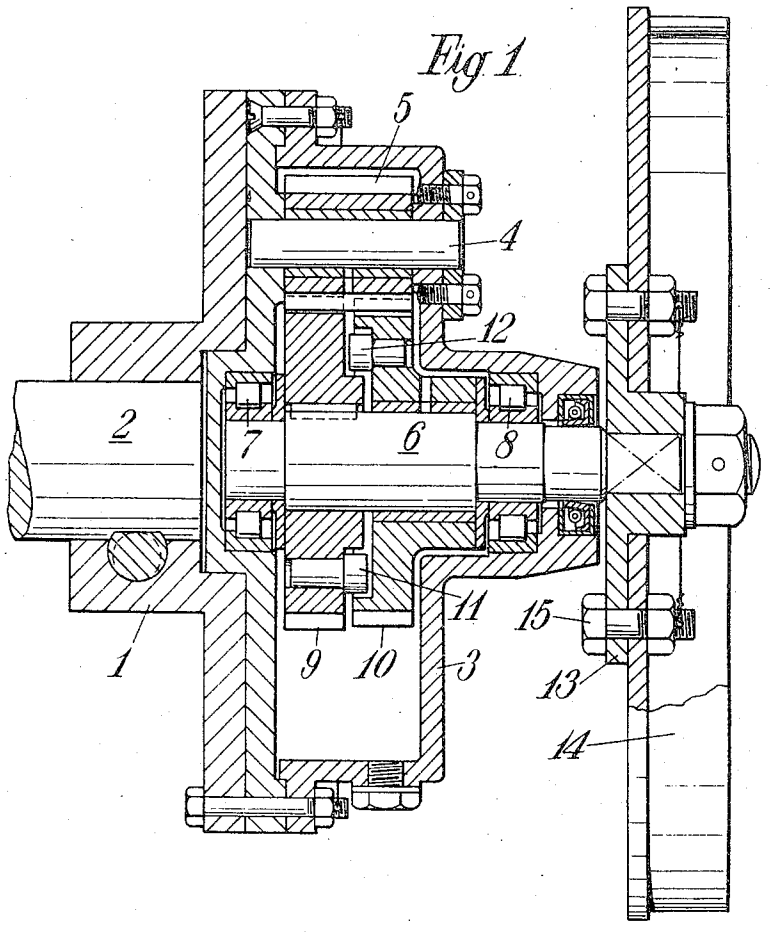
Sept. 16, 1958 S. BURROWS 2,852,630

LIMIT SWITCH ACTUATOR

Filed April 2, 1956 3 Sheets-Sheet 1

Fig 1



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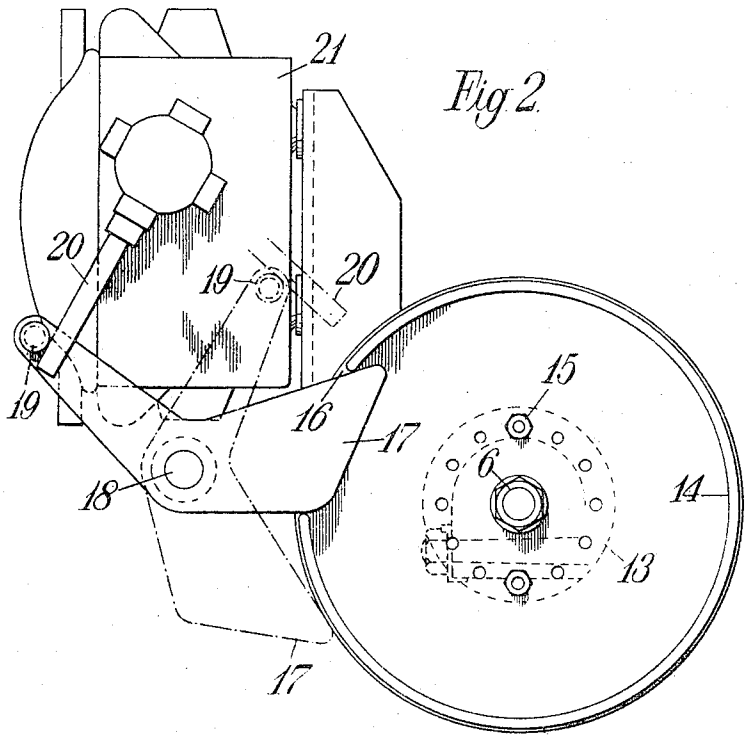

Fig 2.

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Fig. 4

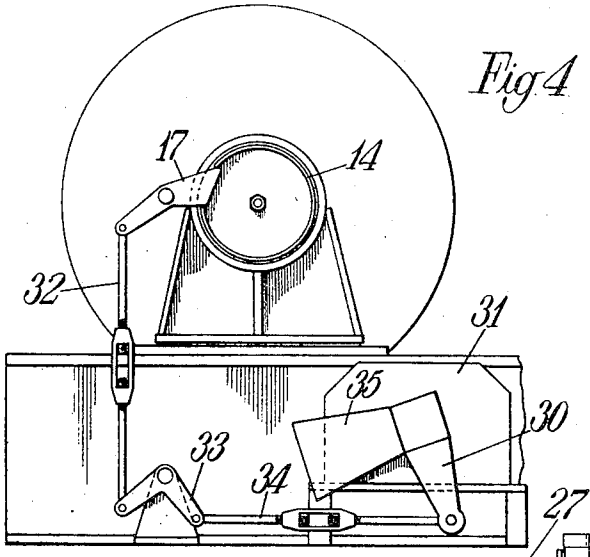
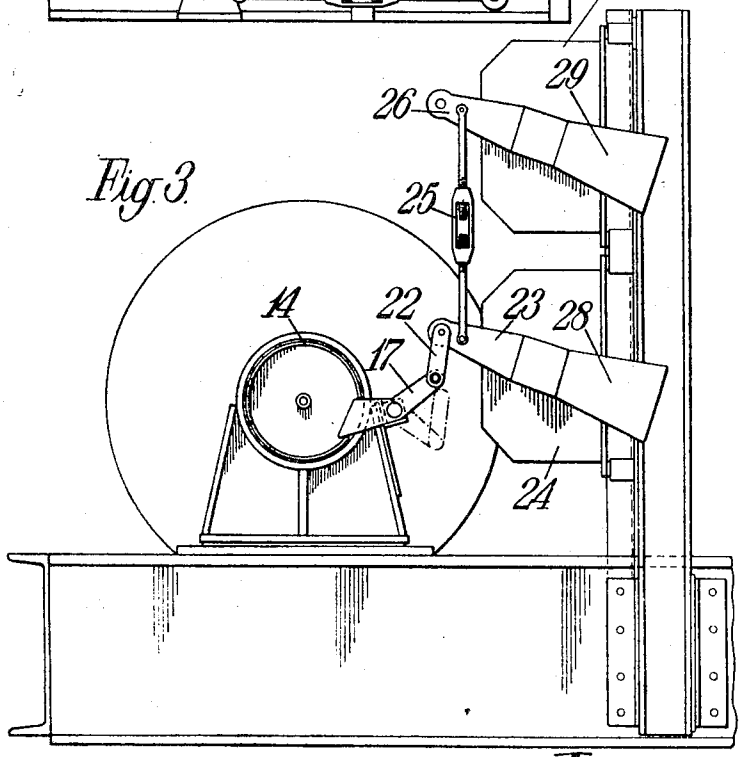


Fig. 3



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United States Patent Office 2,852,630
Patented Sept. 16, 1958

2,852,630

LIMIT SWITCH ACTUATOR

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Application April 2, 1956, Serial No. 575,422

Claims priority, application Great Britain April 4, 1955

5 Claims. (Cl. 200—47)

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 means 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 flange is a casing **3** in which is mounted a pin **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 $(\frac{1}{12}-\frac{1}{14})=\frac{1}{84}$ 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** causes 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 the 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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