Feb. 19, 1963 J. G. PAHL 3,077,949

SWITCH OPERATING DEVICE

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Fig. 1

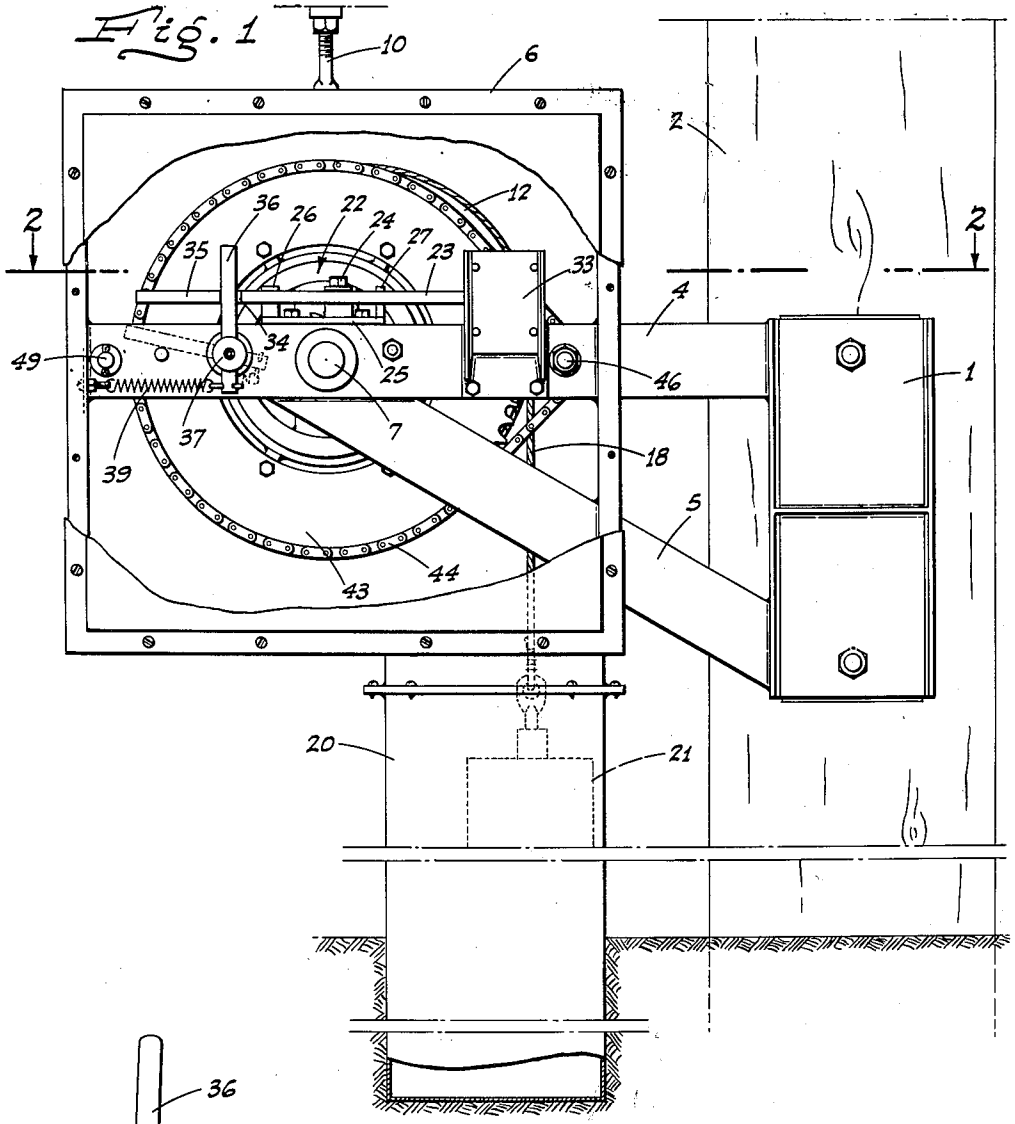
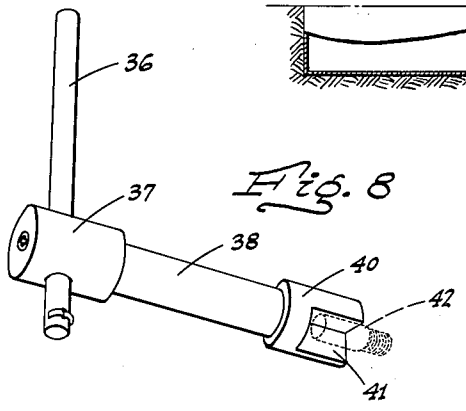


Fig. 8



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Fig. 2

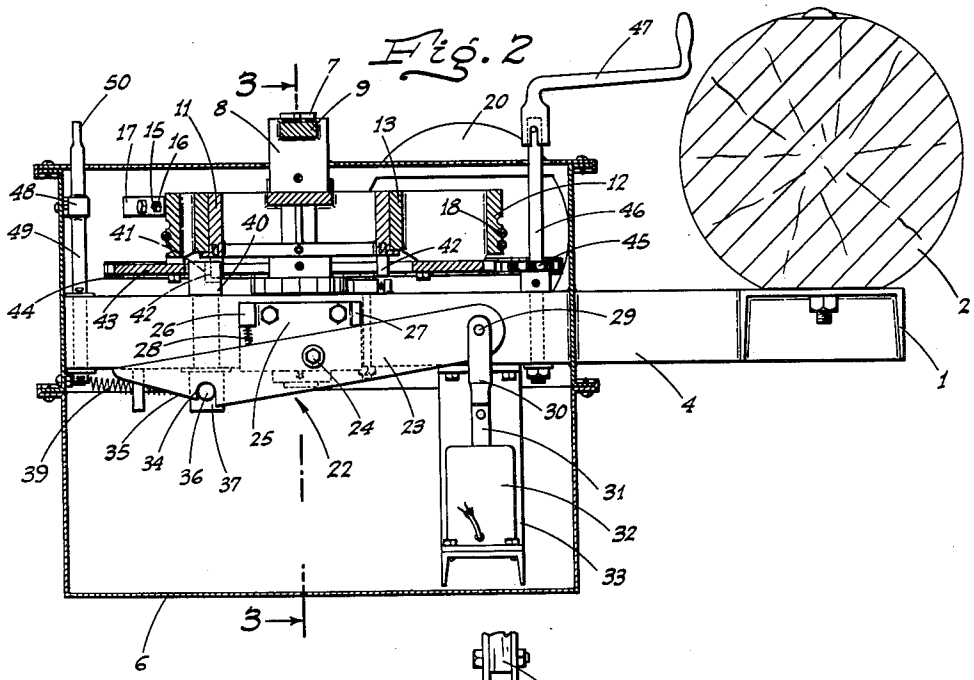


Fig. 3

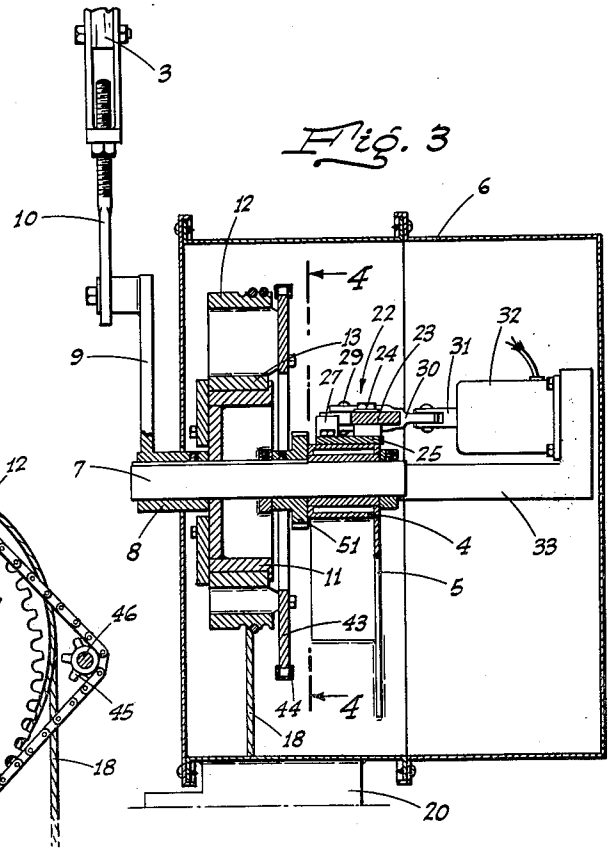
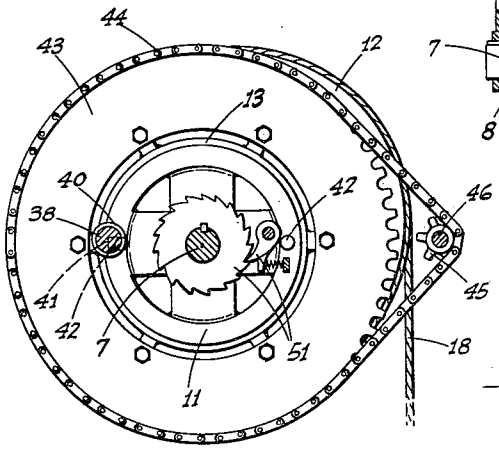


Fig. 4



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Fig. 5

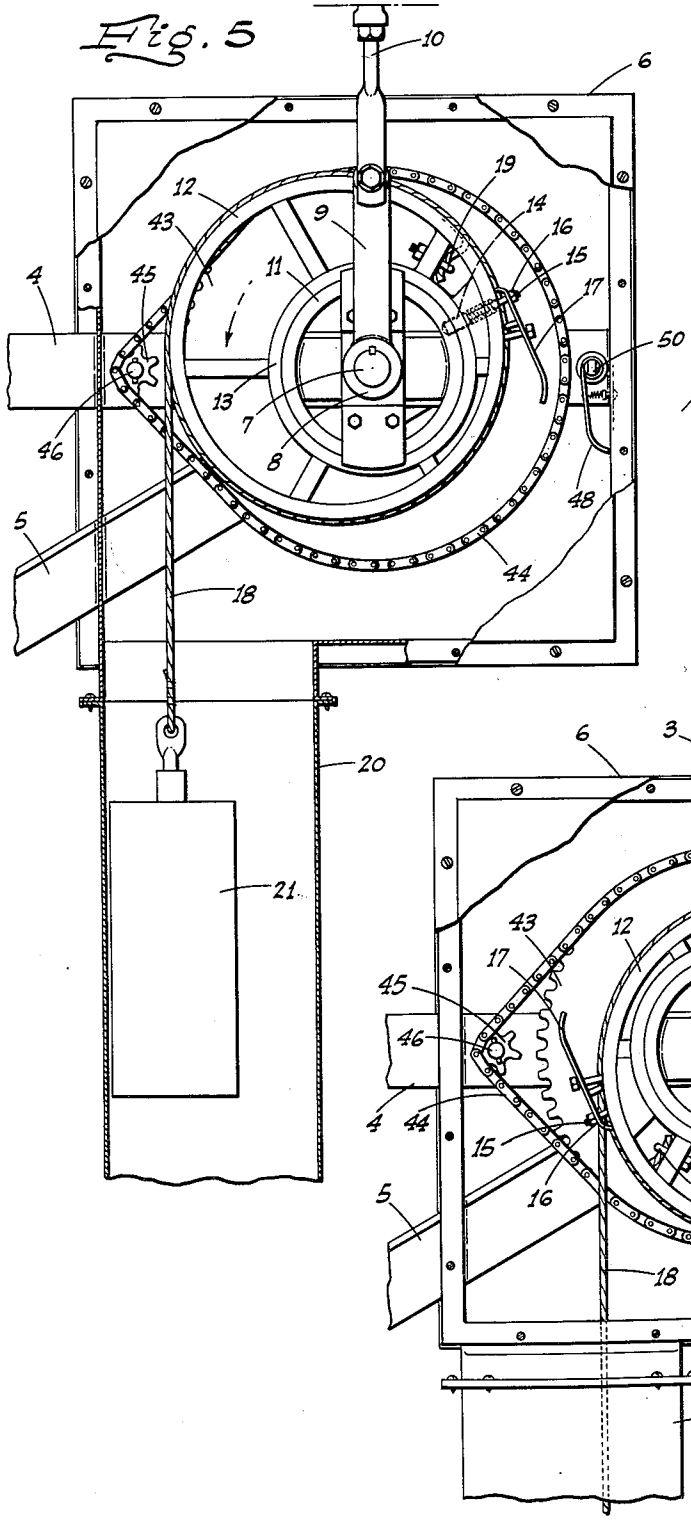


Fig. 7

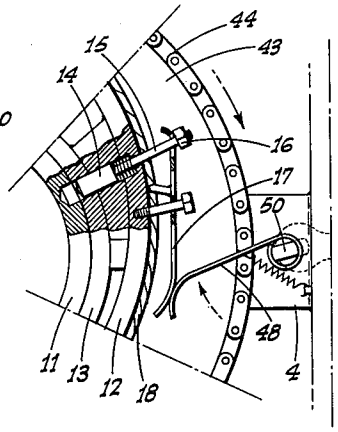
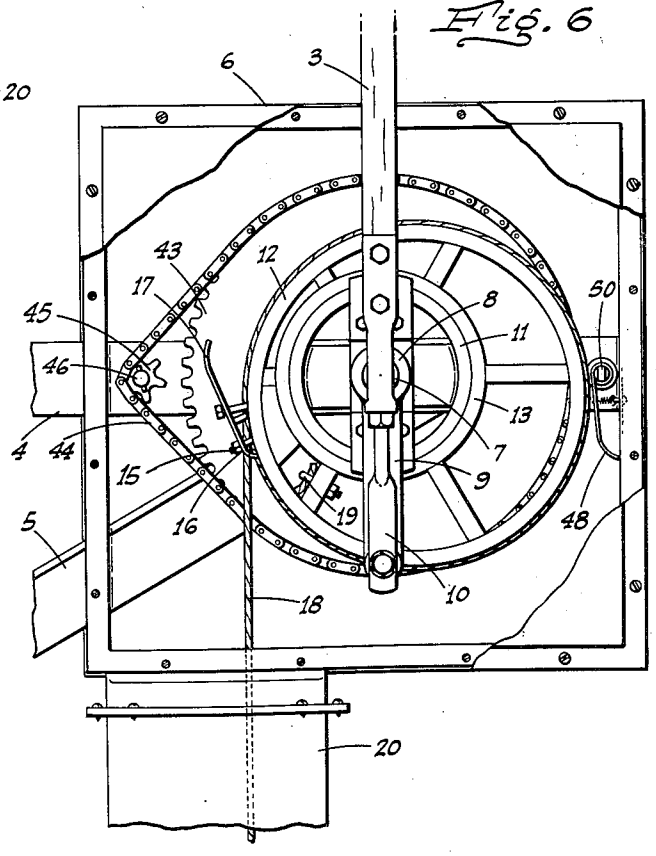


Fig. 6



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SWITCH OPERATING DEVICE

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9 Claims. (Cl. 185—27)

This invention is directed to, and it is a major object to provide, a switch operating device having novel structure and function; the device being especially designed—but not limited—for use to open and close a pole-top electric switch.

This type of switch is conventionally opened and closed by a vertically reciprocable, elongated push-pull rod which depends from the switch on the top of the pole, with the lower end of the rod being manually accessible from adjacent the ground; the rod being pushed up to close the switch and pulled down to open it. Thus, such conventional arrangement requires the presence, at the pole, of a service man to operate the rod for the purpose of opening or closing the switch.

Another object of the invention is to provide a pole-top switch operating device which is adapted to be controlled from a remote point, but which device works in connection with the conventional push-pull rod previously described.

Still another object of the invention is to provide a switch operating device, as in the preceding paragraph, which is mechanically self-actuating when released from a normally latched, inoperative condition; the release of the latch being accomplished electrically, which thus permits of convenient control from a remote point.

An additional object of the invention is to provide a switch operating device, as above, which embodies a normally latched but releasable weight actuated cable drum forming in effect a stored powered motor, and which—through an associated mechanism, including a crank connected to the push-pull rod—is operative to open and close the switch in sequence and at selective times.

It is also an object of the invention to provide a practical, reliable, and durable switch operating device, and one which will be exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

FIG. 1 is a rear elevation of the device as mounted on a power pole; the near wall of the housing being mainly broken away and the working parts of the device being in their initial positions.

FIG. 2 is a sectional plan on line 2—2 of FIG. 1.

FIG. 3 is a vertical sectional elevation, in the axial plane of the device, on line 3—3 of FIG. 2.

FIG. 4 is a fragmentary cross section on line 4—4 of FIG. 3.

FIG. 5 is an elevation similar to FIG. 1, but taken from the front of the device; the near wall of the housing being mainly broken away and a portion of said housing, together with the well, being in section.

FIG. 6 is a view similar to FIG. 5, but shows the position of the parts after the device has acted through the switch opening portion of its cycle.

FIG. 7 is a fragmentary elevation, partly in section, showing mainly the manner of releasing the spring pressed detent between the cable drum and the crank actuating drum.

FIG. 8 is a perspective view, detached, of the latch shaft and parts thereon.

Referring now more particularly to the drawings, and to the characters of reference marked thereon, the device comprises a heavy-duty attachment plate 1 fixed on the power pole 2 at a point below the push-pull rod 3 that depends from the pole-top switch (not shown). The attachment plate 1 is fitted with a rigid, horizontal beam 4 which projects outwardly a distance beyond the power pole 2; the plate 1 being positioned so that such beam is disposed generally below said push-pull rod 3. The beam 4 is stabilized by a brace 5 which extends from the plate 1 upwardly to said beam.

Outwardly of the pole 2 the beam 4, for a major part of its extent, is enclosed within a box-like housing 6 which serves to protect the working parts of the device, as hereinafter described, and to prevent unauthorized access thereto.

Within the housing 6 the beam 4 supports a heavy-duty horizontal shaft 7, one end portion of which is journaled in such beam, as shown, with the other end portion of the shaft projecting out of the front of the housing 6. Such projecting portion of the shaft 7 is fitted with a keyed-on hub 8 which carries a crank 9; the free end of the crank being pivotally mounted, by an adjustable link 10, to the lower end of the push-pull rod 3. The crank 9 is normally disposed in an upstanding starting position, and when in such position the push-pull rod 3 is thrust upwardly so that the pole-top switch is closed.

Within the housing 6, between the front wall thereof and the beam 4, the shaft 7 is fitted with an inner or crank actuating drum 11, such drum being keyed to the shaft.

An outer or cable drum 12 surrounds the inner drum 11; such outer drum having a hub 13 journaled on the inner drum 11 for relative turning motion. However, such relative turning motion between the hub 13 and inner drum 11 is normally prevented by a spring-pressed detent 14 engaged between said hub and drum; such detent including an axial outwardly extending rod 15. The outer end portion of said rod 15 extends beyond the periphery of the outer drum 12 and is fitted with a nut 16.

A fulcrum lever 17—mounted on the periphery of the outer drum 12, as shown in detail in FIG. 7—engages at one end beneath the nut 16 but remains free at the other end. Upon inward depression of the fulcrum lever 17 at its free end, the detent 14 is retracted to free the hub 13 and inner drum 11 for relative turning. This is accomplished for the purpose, at the time and in the manner, hereinafter described.

A cable 18 is anchored at one end to the outer drum 12, as at 19; is thence wound with several turns about said drum; and finally has a portion depending tangentially from the drum 12 at a peripheral point adjacent the pole 2. The depending portion of the cable 18 extends downwardly into a well 20 which communicates through the bottom of the housing 6; such well 20 accommodating a weight 21 attached to the lower end of the depending portion of said cable 18.

With the foregoing arrangement there is provided, in essence, a stored power motor; the weight 21 acting at all times to pull downwardly on the cable and tending to rotate the outer drum 12, together with the inner drum 11.

However, such action is normally prevented by a latch unit, indicated generally at 22, and which comprises the following:

A horizontal latch arm 23 is pivoted intermediate its ends, as at 24, on a base plate 25 attached to the top of the beam 4 generally directly above the horizontal shaft 7; such base plate 25 being provided with a pair of upstanding lugs, indicated at 26 and 27. The latch arm

23 normally abuts the lug 27 nearest the pole 2 by reason of a compression spring 28 engaged between the lug 26 and the adjacent edge of said latch arm 23.

The inner end of the latch arm 23—i.e. the end nearest the pole 2—is pivotally connected, as at 29, by a clevis 30 to the plunger 31 of a solenoid 32. The solenoid 32, which is carried on a bracket 33 extending laterally from beam 4, is disposed so that the plunger 31 works at a right angle to said beam.

Adjacent but short of its opposite or outer end the latch arm 23 is formed with a rearwardly opening notch 34, and the rear edge of said latch arm between said notch 34 and the outer end of the arm is formed as a taper cam 35.

When the latch arm 23 is in its normal position, as in FIG. 2, and at which time the solenoid plunger 31 is advanced, the notch 34 receives an upstanding finger 36 which extends radially from a rear, axially disposed, cylindrical head 37 on the rear end of a horizontal latch shaft 38 journaled in and extending transversely through the beam 4.

The radial finger 36 has a lower end portion that depends below the head 37, and a tension spring 39 connects between said lower end of the finger 36 and a point on the housing 6 beyond the outer end of the latch arm 23 as shown in FIG. 1.

Such tension spring 39 normally acts to rotate the latch shaft 38 in a direction such that the upstanding radial finger 36 rides the cam 35 and snap-engages into the notch 34.

At its forward end, and between the beam 4 and adjacent end of the inner drum 11, the latch shaft 38 is provided with a front, axially disposed, cylindrical head 40 having a right angle notch 41 cut inwardly from its periphery to approximately the axis of said head.

When the radial finger 36 is engaged in the notch 34 of latch arm 23, the notch 41 in the front head 40 is disposed in the path of, and receives, one of a pair of radially opposed stop pins 42 fixed on the adjacent end of the inner drum 11 and projecting toward but terminating clear of the beam 4. The stop pin 42 which is engaged in the notch 41, and bearing against a radial face thereof, tends to rotate the head 40 and shaft 38, but this normally cannot occur by reason of the engagement of finger 36 in the notch 34 of the latch arm 23.

When it is desired to open the pole-top switch the solenoid 32 is only momentarily energized, which may be accomplished from a remote point by any suitable electrical system. Upon energization of the solenoid 32 the plunger 31 is retracted, which swings the latch arm 23 about its pivot 24 in a direction to release the finger 36 from notch 34. When this occurs the one stop pin 42 that is engaged in the notch 41 of head 40, acting under the tendency of the connected drums 11 and 12 to rotate, then part-turns said head 40 until said stop pin escapes therefrom; the latch shaft 38 being correspondingly part-turned so that the finger 36 occupies the dotted line position as in FIG. 1. As soon as said one stop pin 42 escapes the head 40, the spring 39 back-turns the latch shaft 38 and head 40 to their normal positions, and reengages finger 36 in notch 34 of latch arm 23; the latter having also been returned to its normal or latching position by spring 28 upon deenergization of the solenoid 32.

Upon actuation of the latch unit 22, with escape of said one stop pin 42 from the head 40, as above described, the connected drums 11 and 12 rotate under the influence of the weight 21; such rotation being in the direction indicated by the arrow in FIG. 5. With such rotation continuing through 180 degrees the crank 9 swings through a corresponding arc, pulling down on the rod 3 and opening the pole-top switch.

The hub 13 of the outer drum 12 is radially offset within such drum in a direction such that the leverage imparted by said outer drum 12 to the inner drum 11

is greater on the initial and switch opening half-turn of the drum assembly (see FIG. 5); this for the reason that it requires a greater force on the rod 3 to open the switch than to close it.

After a switch opening half-turn of the drum assembly, and which comprises one-half the cycle of the device, the other stop pin 42 is received in the notch 41 in the head 40; the latch unit 22, in all of its parts, having previously returned to normal position, as already described. When said other stop pin 42 so engages in the notch 41, the drum assembly is latched against further rotation.

However, upon the next or following energization of the solenoid 32, and which is controlled from the remote point, the latch unit 22 is again released so that said other stop pin 42 escapes the head 40, whereupon the second half of the cycle takes place; i.e., the drum assembly, under the influence of the weight 21, makes a further half-turn, swinging the crank 9 back to its upstanding and starting position. This thrusts the rod 3 upwardly to close the switch. On completion of the cycle, with the switch closed, the related stop pin 42 is received in the notch 41 of head 40 and the device again becomes inoperative; the weight 21 then being to substantially its limit of downward movement in the well 20.

Before the device can again function through a cycle of opening and closing the switch, the cable 18 must be rewound on the drum 12, and this is accomplished in the following manner:

The outer drum 12 is fitted on one end thereof with an annular sprocket wheel 43 about which is trained an endless chain 44 which extends to and passes about a sprocket 45 on a cross shaft 46 journaled in the beam 4; such cross shaft 46 extending at one end out of the front of the housing 6 and there being provided with a removable hand crank 47.

When it is desired to rewind the cable 18 on the outer drum 12, the spring-pressed detent 14 is first released; this being accomplished by inward pressure applied to the free end of the fulcrum lever 17 by a normally out-of-the-way radial, spring-returned finger 48 fixed on a cross shaft 49 journaled in the beam 4 and projecting out of the housing 6 at the front thereof; such cross shaft 49 being formed at its outer end, as at 50, for reception of a wrench.

Upon engagement of said cross shaft end 50 by a wrench, as indicated in FIG. 7, the finger 48 may be swung inwardly to engage and depress the free end of the fulcrum lever 17 whereby to retract the detent 14.

The fulcrum lever 17 and finger 48 are in the proper relationship to each other, for the accomplishment of the above described detent releasing action, at the end of a complete 360 degree cycle of the device.

Upon retraction of the detent 14 the outer drum 12 is released from the inner drum 11, whereupon the hand crank 47 is rotated in a direction to rewind the cable 18 onto said outer drum 12 with a full turn—i.e. 360 degrees of rotation of the latter—whereupon said detent 14 automatically re-engages, locking the drum 12 to the drum 11. Of course the finger 48, as soon as the rewinding operation begins, is released and returns to its clearance position in order to permit the detent 14 to automatically re-engage after the cable is rewound on the outer drum 12, and at which time the device is reset for a subsequent cycle of operation.

It is to be recognized that by deepening the well 20, and lengthening the cable 18 with more turns on the outer drum 12, the device can be made to function through more than one cycle of operations before rewinding is necessary.

In order to prevent any undesirable counter-rotation of the shaft 7, and the drum assembly thereon, a spring-pressed pawl and ratchet unit 51 is mounted between said shaft 7 and the beam 4.

With the described device a pole-top switch can be

positively and effectively opened, and closed, at selective times, yet from a remote point; the structure of the device being such that it is relatively fool-proof, and requires little maintenance or servicing other than resetting or rewinding after each cycle of operations.

While the device has been described herein as adapted, in each cycle of operations, to open and then close a normally closed switch, such device can also be employed —with minor modifications—to close and then open a normally open switch; the crank 9 then being reset to an initially downwardly extending position, and the detent 14 being arranged to be worked in a diametrally opposite position to that here shown.

From the foregoing description it will be readily seen that there has been produced such a device as will substantially fulfill the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations therefrom may be resorted to as do not form a departure from the spirit of the invention as defined by the appended claims.

Having thus described the invention the following is claimed as new and useful, and upon which Letters Patent are desired:

1. A device, for operating a pole-top switch having a rod depending in vertically reciprocable relation alongside the pole, comprising a support secured to and projecting laterally from the pole adjacent the lower end of the rod, a horizontal shaft journaled on the support, a crank fixed on the shaft, means connecting the crank to the rod, an inner drum fixed on the shaft, an outer drum journaled on the inner drum, releasable means locking the drums together, a cable anchored to, wound about, and thence depending from the outer drum, an element engaging and pulling down on the depending portion of the cable whereby to tend to cause rotation of the locked-together drums and the shaft, a latch unit between the support and inner drum normally preventing such rotation but being releasable to permit of successive half-turns, such latch unit being re-engaged upon completion of each half-turn, and means between the support and outer drum adapted to rotate the latter in a cable winding direction upon release of said locking means.

2. A device, as in claim 1, in which the outer drum includes a hub journaled on the inner drum; said locking means comprising a spring-pressed detent normally but releasably engaged between said hub and inner drum.

3. A device, as in claim 2, including means to release said detent without obstructing rotation of the outer drum.

4. A device, as in claim 1, in which said latch unit includes circumferentially spaced stop elements projecting from the inner drum on the end adjacent the support, a movable member mounted on the support and including a portion against which one of the stop elements is normally engaged, the engaged stop element escaping from said member upon predetermined movement of the latter, and means to free said member for such predetermined movement thereof; said member being automatically returned to its position to receive the following stop element.

5. A device, as in claim 4, in which said last named means includes a solenoid.

6. A device, as in claim 1, in which said outer drum is eccentric to the shaft at the side from which the cable depends when said drum is in an initial position with the crank extending upwardly.

7. A device, as in claim 1, in which the latch unit comprises an arm disposed in a plane at right angles to the shaft, means pivoting the arm on the support, normally inactive means connected to the arm to swing the same in one direction, a latch shaft journaled on the support and extending parallel to the first named shaft in spaced relation to the arm, a pin projecting radially from one end of the latch shaft and normally engaged in a notch in one side of the arm, said notch being positioned to withdraw from the pin upon swinging of the arm in said one direction, spring means tending to rotate the latch shaft when the pin is clear of the notch, and another pin projecting from the inner drum parallel to and adjacent the other end of the latch shaft, the latter having a notch in one side and open to said other end thereof and normally receiving said other pin therein, said shaft notch being shaped to cause the other pin to tend to turn the latch shaft and release the last named pin from the shaft notch and allow the inner drum to rotate upon the first named pin being released from the arm notch.

8. A device, as in claim 1, in which said latch unit includes a latch shaft journaled on the support and extending parallel to the drum shaft with one end adjacent but clear of the inner drum, a pin on and projecting from said inner drum parallel to said shafts in position to normally engage in a notch in one side of the latch shaft and open to said one end thereof, said notch being shaped to cause the pin to tend to turn the latch shaft and leave the notch and then allow the inner drum to rotate, and releasable means normally preventing such turning of the latch shaft.

9. A device, as in claim 1, in which the outer drum includes a hub journaled on the inner drum; said locking means comprising a spring-pressed detent disposed radially of the inner drum and slidably mounted in the hub for movement into and out of a socket in the inner drum, a lever pivoted intermediate its ends on the outer drum and engaged at one end with the detent in pull-out relation, and a finger turnably mounted at one end on the support and arranged, upon turning of said finger from an initial out-of-the-way position, to be engaged with the other end of the lever in pressing relation when the drums occupy a predetermined position in locked relation with each other.

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