

Lighting Winches

This invention relates to lighting winches for use in, for example, television and film studios.

Conventionally, an array of lighting winches is
5 installed in the roof of a studio and each winch can be operated independently of the others to raise or lower a so-called "lighting barrel" on which lights are mounted to achieve a desired lighting effect. The lighting barrel is suspended by cables and each winch has its own
10 motor which is operated to wind or unwind the cables and so raise or lower the barrel. In some winches, this motor is mounted together with the cable drums in the studio roof: in others (so-called "self-climbing winches") the motor and cable drums move up and down with
15 the lighting barrel.

Most winches are capable of carrying much greater loads than those to which they are likely to be subjected in normal use. Even so, it is important to ensure that individual winches cannot be overloaded, to
20 avoid any possibility of overloading the roof structure on which the array of winches is supported.

The present invention provides a lighting winch having a lighting barrel suspended from a cradle, and a motor operable to raise and lower the barrel relative to
25 the cradle, the cradle being pivotally movable when the suspended weight thereon exceeds a predetermined amount to actuate a switch to prevent operation of the motor.

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In embodiments of the invention described herein, it is arranged that all the suspended weight on the cradle acts in one vertical plane.

The motor may be mounted on the cradle for pivotal movement therewith; alternatively, the winch may be of the self-climbing type in which the motor is mounted for movement with the barrel.

Preferably, each cable by which the lighting barrel is suspended from the cradle has a respective device responsive to slackness in the cable to terminate operation of the motor.

The winch may include means responsive to the height of the lighting barrel to terminate operation of the motor when a predetermined height is reached.

By way of example, lighting winches constructed in accordance with the invention will be described with reference to the accompanying drawings in which:

- Fig. 1 is a general view of a lighting winch;
- Fig. 2 is a cross-section of a lighting winch of the type shown in Fig. 1;
- Fig. 3 is a front elevation of a lighting winch;
- Fig. 4 is a detailed view of part of Fig. 3, with some components broken away and some components shown in cross-section;
- Figs. 5 to 8 are enlarged views on the lines V-V to VIII-VIII respectively of Fig. 4, with some components omitted for clarity;

Fig. 9 is a front elevation of another lighting winch;

Fig. 10 is an end enlarged view of the winch shown in Fig. 9;

5 Fig. 11 is an enlarged view of part of Fig. 9;

Fig. 12 is an enlarged view on the line XII-XII of Fig. 11;

Fig. 13 is an enlarged view of another part of Fig. 9;

10 Fig. 14 is a view on the line XIV-XIV of Fig. 13;

Fig. 15 is an enlarged view of another part of Fig. 9, and

Fig. 16 is an enlarged view of part of Fig. 10.

15 Fig. 1 is a general view of a lighting winch of the type in which the motor and cable drums are mounted in the roof structure. Most of the roof structure has been omitted from Fig. 1, only parts of two beams 1 being shown, on which the winch is mounted.

20 The lighting barrel of the winch is shown at 2, mounted at each end in a support 3 suspended by a respective cable 4. Above the lighting barrel 2 and also mounted in the supports 3 is a hanger 5 for an electricity supply cable 6 which, in the winch shown in Fig. 1, is supported in a collapsible zig-zag carrier 7
25 mounted at its lower end on the hanger 5.

At its upper end, the carrier 7 is suspended from a cradle indicated generally at 8 and located in

the roof structure. The cradle 8 comprises a cable drum shaft 9 having two helically grooved cable drums 10, one at each end, on which the support cables 4 are wound and from which the cables fall away at an angle true to the helix angle of the drums. The cradle 8 further comprises a bar 11 parallel to shaft 9, and end supports 12 in which the shaft 9 is rotatably mounted and to which the bar 11 is rigidly secured. The bar 11 carries brackets 11a in which are mounted cable control rollers 17 for each drum 10. At one end, the cradle carries a braked drive motor and gear unit 13 for rotating the drum shaft. The whole cradle 8 is pivotally-mounted at its ends in blocks 14 standing on the beams 1 of the roof structure.

By operating the motor 13 to rotate the drum shaft 9 the support cables 4 are wound on or off the drums 10 to raise or lower the lighting barrel 2 and, during this movement, the carrier 7 for the electricity supply cable 6 collapses or expands as required. Lights (not shown) are mounted on the lighting barrel 2 and connected to electric sockets 15 in the hanger 5, supplied by the cable 6. Additional equipment may, if required, be suspended from auxiliary lifting eyes 18 in the supports 3.

An array of winches of the type shown in Fig. 1 would normally be installed in the roof structure of a television or film studio. Each winch can be operated

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independently of the others, through its motor 13, to raise or lower the lights carried on the lighting barrel 2 and so enable a desired lighting effect to be achieved. For identification purposes, each winch in the array carries its own identification number 16.

To prevent overloading of the winch, a cut-out switch (not shown in Fig. 1) is connected in circuit with the "up" contactor for the motor 13. This cut-out switch is associated with the cradle 8 to be actuated thereby in the event of pivotal movement of the cradle caused by excessive weight on the lighting barrel 2. To ensure that this pivotal movement is an accurate representation of the suspended weight on the winch, it is arranged that all the suspended weight (including that of the carrier 7) acts on the cradle in one vertical plane. Actuation of the cut-out switch during normal loading of the lighting barrel 2 is prevented by arranging the motor 13 with its associated gear unit to act as an effective counterweight under these circumstances, the counterweight effect being augmented by an adjustable spring (also not shown in the drawing).

To illustrate the arrangement further, Fig. 2 shows a cross-section through a winch of the type shown in Fig. 1, taken at the attachment of the carrier 7 to the cradle 8 and looking towards the motor end of the winch. Corresponding components carry the same reference numerals as in Fig. 1. It will be apparent

that the support cables 4 (part of one of which is visible in Fig. 2) both lie in the same vertical plane since they pass around respective drums of the shaft 9 and Fig. 2 illustrates that the weight of the carrier 7 acts in this vertical plane also. This is achieved by suspending the carrier 7 from a suitably-shaped bracket structure 7a which is rigid with the bar 11. Fig. 2 also illustrates that the motor 13 is positioned to act as a counterweight to the suspended weight on the cradle while the angle X shown by the broken lines indicates the pivotal movement of the cradle under overload conditions.

An overload cut-out arrangement of the type used in the winch of Fig. 1 will be described in greater detail with reference to Figs. 3 to 8. Fig. 3 shows the winch in which the cut-out arrangement is incorporated. The winch is of the same general type as that shown in Fig. 1 and corresponding components, where possible, have been given the same reference numerals. The winch of Fig. 3 differs from that of Fig. 1 in that the electricity supply cable 6 is of the self-coiling type supplied from a drum 20 on the hanger 5 and having a central guide cord 21 wound on an additional helically-grooved drum 22 on the cable drum shaft 9. It also differs in the form of guides 23 provided at the drums 10 for the support cables; in the provision of slack cable detector arrangements 24 (one for each

support cable 4), and top and bottom limit switches 25, 26. These various features will be described below.

The cut-out arrangement which functions to prevent operation of the winch in the event of the lighting barrel being overloaded is indicated generally at 29 in Fig. 3 adjacent an oil drip tray 13a for the motor and is shown in greater detail in Fig. 4 (partly cut-away) and in Fig. 5. The cut-out arrangement includes a limit switch 27 electrically-connected in the controlling circuit of motor 13. The switch 27 is mounted in a bracket assembly, indicated generally at 28, and thereby attached to the motor housing 30 for movement with the cradle 8. For operating the switch 27, an arm 31 is provided which extends from and is fast with the roof structure. Anchored in a groove 31a (Fig. 4) on the arm 31 is one end of a spring 32 (omitted from Fig. 4) which augments the counterweight effect of motor 13 as previously described and the other end of which is secured in the bracket assembly 28 and provided with a tension-adjusting arrangement 33.

In the event of the lighting barrel 2 being overloaded, the cradle 8 pivots as described above with reference to Fig. 1. This pivotal movement, which is against the weight of the motor 13 and the action of the spring 32 brings the operating member 34 of the limit switch 27 into engagement with the arm 31, so actuating the switch to inhibit operation of the motor 13. When

the excess weight on the lighting barrel 2 is removed, the cradle pivots back, under the action of spring 32 assisted by the weight of the motor, to move the switch operating member 34 away from the arm 31 and allow the motor to be re-started. Cushioning 35 is provided on the bracket assembly 28 to prevent damage due to any contact between the bracket assembly and the arm 31 during this return movement. In addition, a damping arrangement 36 is associated with the anchored end of the spring 32 to eliminate oscillations during movement of the bracket assembly 28.

It was mentioned with reference to Fig. 1 that all the suspended weight acts on the cradle 8 in one vertical plane. For the winch of Fig. 3, this can best be seen with reference to Figs. 6 to 8 which show cross-sections through the cradle at various locations along its length. In each of those Figures the cable drum shaft 9 and the bar 11 appear, with Fig. 6 showing one of the support cables 4; Fig. 7 showing the lighting cable 6 and Fig. 8 showing the guide cord 21. It will be apparent that the two support cables 4 and the guide cord 21, which pass round respective drums on the shaft 9, all lie in the same vertical plane and it can be seen from Fig. 7 that the weight of the lighting cable 6 acts on the cradle in this plane also. This is achieved by suspending the lighting cable (held in a clamp 40) via a pivoted hanger 41 from a suitably-shaped bracket

structure 42 which is rigid with the bar 11.

The slack cable detector arrangement 24 at the left-hand end of the cradle (as seen in Fig. 3) will now be described. The purpose of this detector is to respond to slackness in the associated support cable 4 when the winch is being lowered, indicating that the lighting barrel has been caught on an obstruction, to prevent further downwards movement until the obstruction has been removed. It will be appreciated that the detector arrangement 24 at the other end of the cradle 8 responds in a similar manner so that slackness in either of the support cables 4 will result in disconnection of the motor.

The detector arrangement comprises an elongated roller 50 (shown in Figs. 3 to 6) mounted at each end in brackets 51 one of which is pivotally-mounted at 51a on the end plate 12 and the other of which is pivotally-mounted at 51b on the bracket structure 42. The roller 50 can thus pivot relative to the cradle structure 8 as a whole and is biased by a spring 52 anchored at 53 to the end plate 12. Normally, the roller 50 rests against the taut support cable 4 (Fig 6) but, if the support cable goes slack when the lighting barrel 2 is being lowered, the roller 50 is moved by the spring 52 into engagement with a cut-out switch 54 mounted on the bracket structure 42. The cut-out switch 54 is connected in circuit with the "down" contactor of

the motor 13 and, when operated, prevents further downwards movement of the lighting barrel. A stop 55 is mounted on the end plate 12 to limit the pivotal movement of the roller 50.

5 A slack cable detector arrangement of this type could, of course, be incorporated in the winch shown in Fig. 1.

In the winch shown in Fig. 1, simple pressure rollers 17 control the run of the support cables 4 on to
10 and from the drums 10 and, in the winch of Fig. 3 a similar roller 56 (see also Figs. 4 and 8) is used with the drum 22 carrying the guide cord 21 for the electricity supply cable 6. This roller 56 is mounted on the bracket structure 42 and is associated with a guide
15 57 through which the cord 21 (not shown in Fig. 4) passes. Each of the support cables 4, on the other hand, is guided by a respective jockey assembly 23, the left-hand one of these (as seen in Figs. 3 and 4) is associated with an arrangement defining the upper and
20 lower limit positions of the lighting barrel as will be described below.

Each jockey assembly 23 comprises two annular members 60 (Figs. 4 and 6) surrounding the drum shaft 9 and held apart by spacers 61. Between the members 60 are
25 mounted control rollers 62 which guide the support cable 4 (not shown in Fig. 4). Each of the rollers 62 is shaped to run in the helical groove formed in the

drum 10 so that, as the drum rotates, the jockey assembly 23 moves along the drum shaft 9. To this end, the jockey assembly 23 is constrained against rotational movement by a guide assembly (not shown in Fig. 3) comprising a
 5 bracket 63 extending downwardly from one of the annular members 60 and carrying rollers 64 which contact the bar 11 of the cradle at diametrically-opposed points. As the drum shaft 9 rotates to raise the lighting barrel, so the jockey assembly moves to the left as seen in Fig. 4 and
 10 vice versa.

Secured to the left-hand jockey assembly for movement therewith is a guide rod 70 supported for axial movement within a guide tube 71 which forms part of the bracket structure 42 and over which the pivoted hanger 41
 15 of the lighting cable passes. The guide rod 70 carries the guide 57 for the guide cord 21 of the lighting cable and, on either side of this, switch actuating cones 72, 73 associated with the top and bottom limit switches 25, 26 respectively. As the winch is raised, moving the
 20 guide rod 70 to the left as already described, so the cone 72 will come into engagement with the switch 25 as shown in Fig. 4 to disconnect the motor and define the upper limit position of the lighting barrel. The lower limit position is defined in a similar manner by
 25 engagement between cone 73 and the bottom limit switch 26.

An upper and lower limit arrangement of this type could, if required, be incorporated in the winch shown in Fig. 1.

Figs. 9 to 16 show a winch which is of the so-called "self-climbing" type, that is a winch in which the motor and cable drums move up and down with the lighting barrel. However, many of the components are similar to those of the winches already described and, where possible, corresponding components carry the same reference numerals.

In this case, as shown in Figs. 9 and 10, the drum shaft 9 is mounted above the cable hanger 5 in the supports 3, and the braked motor 13 with its gear unit is mounted on the hanger. Each support cable 4 is wound around a respective helically-grooved drum 10 on the shaft 9, being guided by a respective jockey assembly 23 similar to those already described except that, in this case, the jockey assembly is constrained to move axially by a guide roller 80 which engages the cable hanger 5 (see also Fig. 12).

The drum 20 for the self-coiling supply cable 6 (not shown in Fig. 10) is mounted above the left-hand drum 10, as seen in Fig. 9, with the guide cord 21 for the supply cable being wound on to an extension of the drum 10 through a further jockey assembly 81. The drum 20 for the self-coiling cable and the jockey assembly 81 for the guide cord are both coupled by a channel-shaped

member 23a to the left-hand jockey assembly 23 for movement therewith along the drum.

The support cables 4 and the electricity supply cable 6 with its guide cord 21 are all suspended from a cradle 8 supported from beams of the roof structure by cleats at 1. As in the Fig. 3 arrangement, the cables fall at an angle true to the helix angle of the drums 10. The cradle 8 incorporates an overload protection arrangement indicated at 82 and a respective slack cable 10 detection arrangement 83 for each support cable 4, and will be described below.

By operating the motor 13 to rotate the drum shaft 9, the support cables 4 are wound on or off the drums 10 to raise or lower the winch. At the same time, the guide cord 21 is also wound on or off the left-hand drum 10 (Fig. 9) and the supply cable 6 is fed into or out of the drum 20. It will be appreciated that, in this arrangement, the supply cable 6 carries not only the lighting supply but also the power supply for the motor 13. An operating lever controlling the motor is carried by the winch and indicated at 84 and, in addition, top and bottom limit switches (not shown in Figs. 9 and 10) are associated with the left-hand jockey assembly 23 to define the upper and lower limit positions of the lighting barrel 2 as will be described below.

5 The cradle 8 comprises a bar 87
 rotatably-mounted in rigid end supports 86 extending from
 a supporting beam 85 rigidly secured to the roof
 structure. Each support cable 4 is suspended from an arm
 92 which normally rests on a stop 94 rigidly attached to
 the end of the bar 87, while the guide cord 21 is
 suspended from a pair of parallel arms 88 also rigidly
 attached to the bar 87. The points of suspension are so
 arranged that all the suspended weight on the cradle acts
 10 in one vertical plane.

The overload protection arrangement 82 will now
 be described with reference to Figs. 13 and 14. It
 comprises the two parallel arms 88 which, in addition to
 the guide cord 21, carry a stop 89 with cushioning 89a
 15 which co-operates with the actuating member of a limit
 switch 90 mounted on arms 85a rigid with the roof
 structure. The limit switch 90 is connected in circuit
 with the "up" contactor of the motor 13. A tensioning
 spring 91 extends between the roof structure and the arms
 20 88 and, under normal loading of the winch, ensures that
 the limit switch is not operated to disconnect the motor.
 Associated with the spring 91 are a tension adjusting
 arrangement 91a and a damper unit 91b.

In the event of the lighting barrel being
 25 overloaded, the bar 87 is caused to pivot against the
 action of the tensioning arrangement 91, moving the stop
 89 away from the limit switch 90 which operates to

disconnect the motor 13.

The slack cable detector arrangement 83 associated with one of the support cables 4 will now be described with reference to Figs. 15 and 16, it being understood that the arrangement associated with the other support cable is similar. The arm 92 to which the support cable 4 is attached carries a plate 92a on which is mounted a cut-out switch 93 connected in circuit with the "down" contactor of the motor 13. The arm 92 can pivot relative to the remainder of the cradle 8 and, if the cable 4 should go slack, the arm will move away from the stop 94 under the action of a spring 95 (not shown in Fig. 15) connected between it and the end support 86: this brings the switch 93 into engagement with the stop 94 and operates the switch to disconnect the motor. Movement of the arm 92 is limited by engagement of the upper end of plate 92a with end support 86. Provided the cable 4 remains taut, however, the arm 92 is held in a position in which the switch 93 is out of engagement with the stop 94.

This form of slack cable detector arrangement is, however, not essential and could be replaced by one of the type shown in Fig. 3 in which a resiliently-biased roller bears against the cable.

It was mentioned above that the winch of Fig. 9 incorporates top and bottom limit switches to define the upper and lower limit positions of the lighting barrel

2. These switches are similar to those shown at 25 and 26 in the winch of Fig. 3 and are associated with the left-hand jockey assembly 23 of Fig. 9. The general arrangement of the switches is shown in Fig. 11, in which (as in Fig. 3) the top limit switch is referenced 25 and the bottom limit switch is referenced 26. The support cable 4 and guide cord 21 have been omitted from this Figure.

Associated with each limit switch 25, 26 is a respective actuating member 72, 73 and relative movement between the switches and the actuating members is caused by movement of the jockey assembly 23 transmitted via the jockey assembly 81 of the guide cord 21. As the winch is raised or lowered, movement of the jockey assemblies 23, 81 along the drum 10 results in actuation of the appropriate one of the switches 25, 26 to terminate operation of the motor 13 and thereby define the upper and lower limit positions of the lighting barrel 2.

Fig. 11 also shows the location of switches 84a through which the lever 84 controls operation of the motor 13.

The self-climbing type of winch shown in Figs. 9 to 16 offers the advantage that less roof space is required since the motor and cable drums are accommodated on the lighting barrel. In addition, access to the motor can be gained simply by lowering the winch.



Claims

1. A lighting winch having a lighting barrel suspended from a cradle, and a motor operable to raise and lower the barrel relative to the cradle, the cradle
5 being pivotally movable when the suspended weight therein exceeds a predetermined amount to actuate a switch to prevent operation of the motor.
2. A lighting winch as claimed in claim 1, in which all the suspended weight on the cradle acts in one
10 vertical plane.
3. A lighting winch as claimed in claim 1 or claim 2, in which an electricity supply arrangement for the lighting barrel is also suspended from the cradle.
4. A lighting winch as claimed in any one of
15 the preceding claims, in which the motor is mounted on the cradle for pivotal movement therewith.
5. A lighting winch as claimed in claim 4, in which the motor is arranged as a counterweight to the suspended weight on the winch.
- 20 6. A lighting winch as claimed in any one of the claims 1 to 3, in which the motor is mounted for movement with the barrel.
7. A lighting winch as claimed in any one of the preceding claims, in which the switch is mounted on
25 the cradle for movement into engagement with a switch-actuating member during pivotal movement of the cradle.

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8. A lighting winch as claimed in any one of the preceding claims, including a tensioning device acting on the cradle in opposition to the suspended weight.

5 9. A lighting winch as claimed in any one of the preceding claims, in which the lighting barrel is suspended from the cradle by cables, each cable having a respective device responsive to slackness in the cable to terminate operation of the motor.

10 10. A lighting winch as claimed in claim 9, in which the slack cable-responsive device comprises a member resiliently-biased into engagement with the cable whereby slackness in the cable permits movement of the member to actuate a switch to terminate operation of the
15 motor.

11. A lighting winch as claimed in claim 9, in which the slack cable-responsive device comprises a resiliently-biased member which forms part of the cradle and to which the cable is attached whereby slackness in
20 the cable permits movement of the member relative to the remainder of the cradle to actuate a switch to terminate operation of the motor.

12. A lighting winch as claimed in any one of claims 1 to 8, in which the lighting barrel is suspended
25 from the cradle by cables each wound around a respective drum on a shaft which is rotatable by the motor.



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13. A lighting winch as claimed in claim 12,
when appendant to claim 3, in which the electricity
supply arrangement comprises a self-coiling cable around
a guide cord, the guide cord also being wound around a
5 drum on the shaft.

14. A lighting winch as claimed in any one of
the preceding claims, including means responsive to the
height of the lighting barrel to terminate operation of
the motor when a predetermined height is reached.

10 15. A lighting winch as claimed in claim 14, in
which the height-responsive means is operable to define
upper and lower limit positions for the lighting barrel.

16. A lighting winch as claimed in claim 14 or
claim 15, when appendant to claim 12, in which the
15 height-responsive means is responsive to rotation of the
drum shaft.

17. A lighting winch as claimed in claim 16, in
which the height-responsive means is movable axially
along t shaft in response to rotation of the shaft, and
20 including at least one switch positioned to be actuated
by the height-responsive means in a predetermined axial
position to terminate operation of the motor.

18. A lighting winch substantially as described
with reference to, and as shown in, Fig. 1 and 2 or Figs.
25 3 to 8 or Figs. 9 to 16 of the accompanying drawings.
