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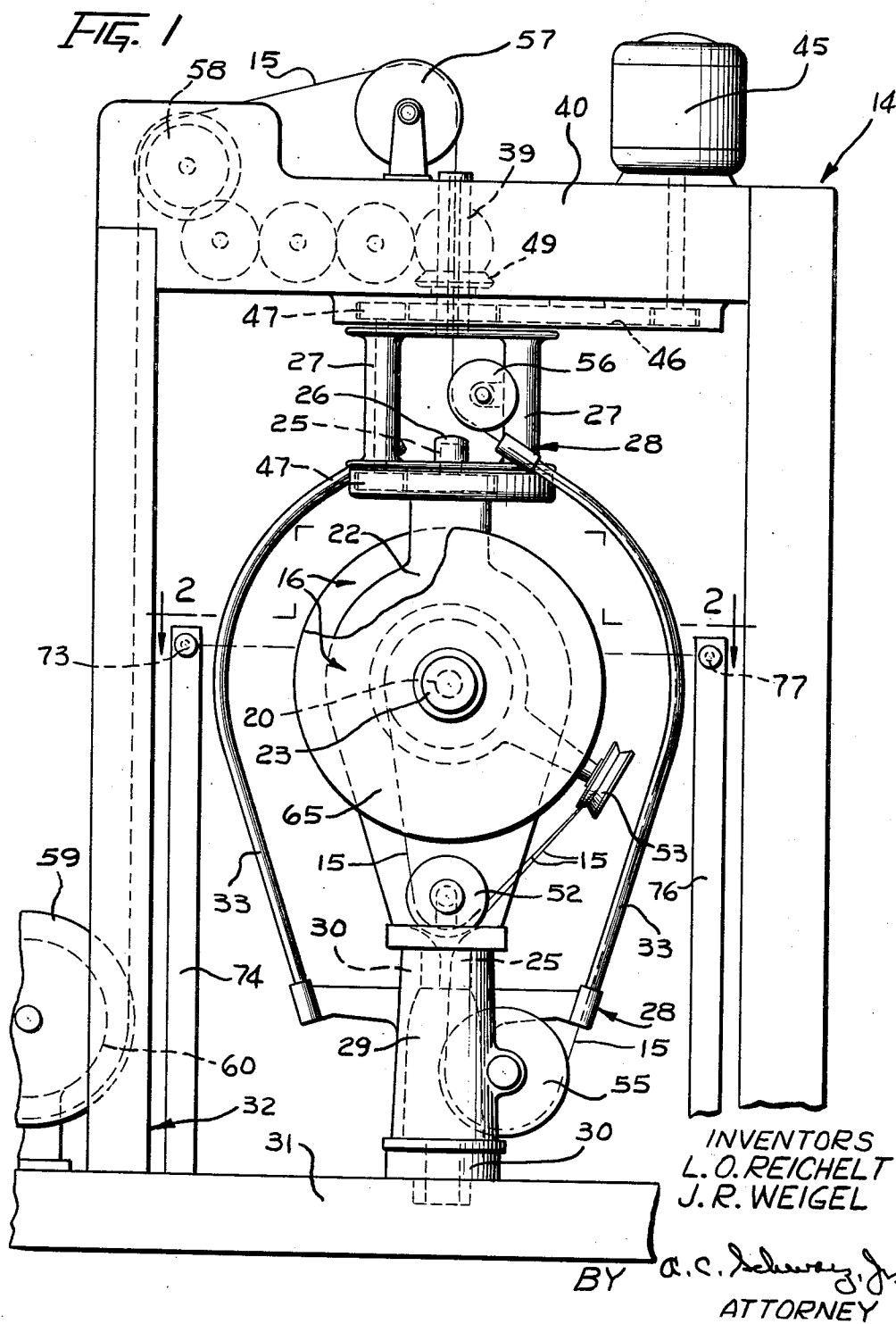
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END OF STRAND CONTROL MECHANISM

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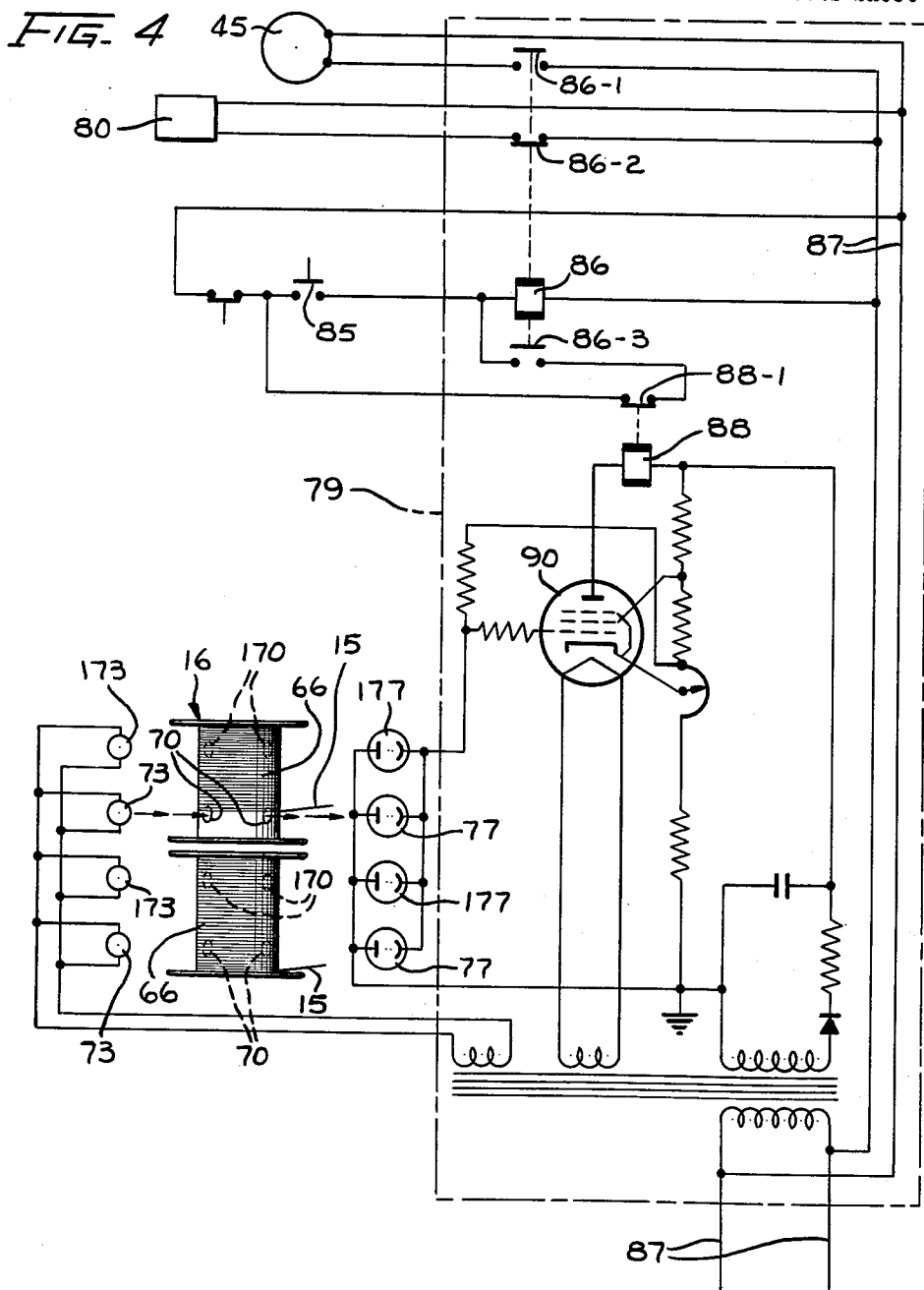
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## END OF STRAND CONTROL MECHANISM

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5 Claims. (Cl. 242—37)

This invention relates to end of strand control mechanism, and more particularly to mechanism for indicating when a supply of strand being unwound from a reel is nearly exhausted and for effecting the automatic stopping of the unwinding of the strand from the reel prior to exhaustion of the supply.

An object of the present invention is to provide a new and improved end of strand control mechanism.

Another object of the invention is to provide a new and improved mechanism for indicating when a supply of strand being withdrawn from a reel is nearly exhausted and for effecting the stopping of the withdrawal of the strand from the reel prior to the exhaustion of the strand supply.

With these and other objects in view, the present invention contemplates the provision of a reel having a drum which supports a supply of strand wound thereon and which is provided with a pair of circumferentially spaced apertures for permitting the passage of a beam of light therethrough from a light source when a sufficient portion of the last layer of strand has been unwound from the drum to uncover the apertures. A light sensitive control element mounted in the path of and responsive to the beam of light through the aligned apertures is connected with and effects the actuation of control mechanism for indicating the condition of the strand supply and for effecting the stopping of the unwinding of the strand from the reel.

Other objects, advantages and novel aspects of the invention will become apparent upon consideration of the following detailed description, in conjunction with the accompanying drawings, in which:

FIG. 1 is a side view of a wire twisting apparatus embodying the present invention;

FIG. 2 is a plan sectional view of the apparatus taken on line 2—2 of FIG. 1;

FIG. 3 is a fragmentary vertical sectional view of the apparatus taken on line 3—3 of FIG. 2; and

FIG. 4 is a diagrammatic view of the electrical control system.

Referring to the drawings, the invention is illustrated in connection with a conventional wire twisting apparatus 14 for withdrawing a pair of wires 15 from a pair of supply reels 16 and twisting the wires together for use in telephone communication and the like. The supply reels 16 are rotatably supported on a pair of spindles 20 extending horizontally from opposite sides of a stationary support 22 and the reels are locked onto the spindles 20 by removable locking collars 23.

At its upper end, the support 22 is provided with a trunnion 25 that is journaled in a bearing 26 on the upper head 27 of a rotatable flyer 28 and at its lower end, the support 22 is provided with a hollow trunnion that is supported in a hollow lower head 29 of the flyer. The lower end of the lower head 29 of the flyer is supported in a bearing 30 on a base 31 of a frame 32 of the apparatus. A pair of tubular wire guides 33 secured to the lower head 29 of the flyer extend upwardly around the reels 16 and the frame member 22 and are secured to the upper head 27 of the flyer.

Extending upwardly from the head 27 of the flyer is a hollow trunnion 39 which is rotatably supported in suitable bearings in an upper member 40 of the frame

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32. Rotation is imparted to the flyer 28 by a motor 45 through a suitable gearing 46 interconnecting the motor and the hollow trunnion 39 of the flyer. Suitable gearing 47 is provided for holding the support 22 against rotation while the flyer is rotating.

The wires 15 are withdrawn individually from the supply reels 16 and are guided over fixed pulleys 52 and 53 individual to each reel 16 and are directed downward through the hollow trunnion 25 and twisted together as they advance onto and around a pulley 55 on the lower head 29 of the rotating flyer. The pair of twisted wires 15 are then directed upwardly through one of the tubular guides 33 onto a guide pulley 56 on the head 27 and are further twisted as they advance upwardly through the hollow trunnion 39 onto and around a pulley 57 supported on the upper frame member 40. The twisted pair of wires 15 is wrapped around and advanced by a capstan 58 and is found onto a take-up reel 59. The capstan 58 and the take-up reel 59 are driven by suitable drive means from the motor 45.

Each of the reels 16 comprises a pair of heads 65 secured in spaced relation to each other by a cylindrical drum 66 on which the supply of wire 15 is wound in successive layers. The heads 65 are apertured to receive the spindles 20 and may be provided with a bearing sleeve 68 interconnecting the heads 65 for engaging the spindle. The drum 66 is provided with a pair of apertures 70 which are arranged in circumferentially spaced relation to each other for the passage therethrough of a beam of light 72. The beams of light 72 are projected along a predetermined path onto the drums along relatively narrow zones thereof from light sources 73 and suitable lenses supported in a fixed position on a standard 74 on one side of the reels 16 and on the outside of the rotating flyer 28.

Supported on a standard 76 on the opposite side of the reels and in the paths of the beams of light 72 are light responsive elements 77 in the form of photoelectric cells. The light responsive elements 77 are electrically connected to operating circuits of a control device 79 for actuating an indicating device 80 and for rendering the wire twisting apparatus unoperative. In response to the projection of a beam of light onto either of the light responsive elements 77, the control device 79 is rendered operative to actuate the indicating device 80 for indicating the condition of the strand supply and for rendering the motor drive unoperative thus stopping the unwinding of the wires 15 from the reels. The indicating device 80 may be of various types and include either a visual or audible signal.

It will be understood that the apertures 70 are normally covered by the layers of strand 15 on the reel so that it is only when the greater part of the strand supply has been used up and when a sufficient portion of the last layer of strand has been unwound from the drum of the reel to uncover the aligned aperture 70 sufficiently so that as the reel rotates and the apertures are moved into alignment with the projected path of the beam, the light beam 72 from the light source 73 may pass through the aligned apertures 70 to effect the actuation of the light responsive element 77.

To insure that under all conditions the strand will not be withdrawn entirely from the reel when the wire twisting apparatus has been stopped by the control mechanism in response to the passage of a beam of light through the apertures 70 in the drum of one of the reels and that a substantial portion of the last layer of a strand will remain on the drum after the apparatus has been stopped, the drum of each of the reels is provided with a second pair of apertures 170 in spaced relation to the apertures 70 longitudinally of the drum. Preferably, the pairs of apertures 70 and 170 are disposed adjacent to opposite ends

of the drums respectively as indicated in FIG. 2. Light sources 173 and suitable lenses are supported on the standard 74 for projecting light beams along predetermined paths onto the reels along relatively narrow zones thereon and for passage through the apertures 170 when such apertures are uncovered and in alignment with the path of the light beams. To provide for counterbalancing of the reels 16, the apertures 70 and 170 are disposed on opposite sides of the drums 66 thereof (FIG. 3).

Light responsive control elements 177 in the form of photoelectric cells which are supported on the standard 76 in positions for receiving the beams of light from the light sources 73 through the apertures 170 of the drums 66 are electrically connected to operative circuits of the control device 79 for effecting the actuation of the indicating device 80 and the stopping of the wire twisting device in response to actuation of the light responsive elements 177.

With the provision of two sets of apertures 70 and 170 in spaced relation to each other longitudinally of a drum it does not matter at what portion of the drum the winding of the wire has been started. When the wire 15 uncovers one pair of apertures 70 or 170 to permit the passage of a beam of light therethrough to effect the operation of the indicating device 80 and the stopping of the wire twisting apparatus a substantial portion of the last layer of wire remains on the drum which is sufficient to extend from the uncovered pair of apertures to and over the other pair of apertures.

#### Operation

In the operation of the wire twisting apparatus and the wire depletion control mechanism therefor, with the apparatus set up for operation, the normally open start button 85 (FIG. 4) is depressed to connect a relay 86 to a power source 87 to effect the energization of the relay. With the energization of the relay 86, normally open relay contacts 86-1 are closed to connect the motor 45 to the power source 87 and start the wire twisting apparatus, normally closed contacts 86-2 are opened to disconnect the indicating device 80 from the power source, and the normally open relay contacts 86-3 are closed to lock in the relay 86 to the power source 87 in series with normally closed contacts 88-1 of a relay 88. The relay 88 is connected in the plate circuit of an electronic tube 90 of the control device 79, and the photoelectric cells 77 and 177 are connected to the control grid of the electronic tube 90. As the wire twisting apparatus operates, the pair of wires 15 are withdrawn from the supply reels 16 and twisted about each other at a relatively high velocity and are wound onto the take-up reel 59.

As the supply of wire 15 on a reel approaches depletion, wire from the last layer of wire on the drum of the reel will be unwound from the drum and uncover a pair of aligned apertures 70 or 170 and permit a beam of light from the light source to pass through the aligned apertures and strike the photoelectric cell in its path. The voltage developed thereby is impressed on the control grid of the tube 90 and changes its bias to effect the conduction of the tube resulting in the energization of the relay 88 and the opening of the relay contacts 88-1. This in turn effects the deenergization of the relay 86 and the opening of the contacts 86-1 to disconnect the motor 45 from the power source, and to effect the closing of the contacts 86-2 and the connection of the indicating device 80 to the power source.

Because of the arrangement of the two sets of apertures 70 and 170 in longitudinally spaced relation to each other on the drum of the reel, an ample supply of wire 15 is assured on the drum when the first pair of apertures is uncovered and the control mechanism is actuated by a passage of a beam of light therethrough, so that, even though there is a predetermined lapse of time before the apparatus stops, a portion of the wire remains on the drum of the reel when the reel comes to rest and thus permits the operator to effect the removal of the trailing

end of the wire from the empty reel and the connection thereof to a full reel of wire.

From the above description, it will be apparent that an effective control mechanism is provided which indicates when the wire supply is about to run out and which stops the wire twisting apparatus when such condition occurs so that the trailing end of the wire remaining on the reel may be readily unwound from the reel and connected to the leading end of another supply of wire.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of this invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. A device for indicating the condition of a supply of strand comprising:

a reel mounted for rotation about its axis and having a cylindrical drum on which the supply of strand is wound, said drum having a first pair of apertures in circumferentially spaced relation to each other and having a second pair of apertures in circumferentially spaced relation to each other and in longitudinally spaced relation to said first pair of apertures;

means for projecting light beams along predetermined paths for passage through said first pair of apertures and through said second pair of apertures when said apertures are uncovered;

a pair of light responsive elements mounted in the paths of the light beams passing through said first and said second pairs of apertures respectively; and indicating means connected to said light responsive elements and operable in response to the projection of a light beam onto either of said light responsive elements.

2. In an apparatus for handling strand and having means for withdrawing the strand from a supply thereof, the combination therewith of:

a reel mounted for rotation about its axis and having a cylindrical drum on which the supply of strand is wound, said drum having a first pair of apertures disposed adjacent one end thereof in circumferentially spaced relation to each other and having a second pair of apertures disposed adjacent the other end thereof in circumferentially spaced relation to each other, said apertures being normally covered by the strand;

means for projecting a beam of light along a predetermined path for passage through said first pairs of apertures when said apertures are uncovered and for projecting a beam of light along a predetermined path for passage through said second pair of apertures when said apertures are uncovered;

a pair of light responsive elements mounted in the paths of said beams of light; and means connected to said light responsive elements and operable in response to the projection of a light beam onto one of said light responsive elements for rendering said strand withdrawing means inoperative.

3. In an apparatus of the type described having means for withdrawing strand from a supply thereof, the combination therewith of:

a reel mounted for rotation about its axis and having a cylindrical drum on which the supply of strand is wound, said drum having a first pair of apertures in circumferentially spaced relation to each other and on one side of a plane passing through the axis of said reel and having a second pair of apertures disposed in circumferentially spaced relation to each other and on the other side of said plane and in axially spaced relation to said first pair of apertures;

means for projecting a beam of light along a predetermined path for passage through said first pair of

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- apertures when said apertures are uncovered and for projecting a beam of light along a predetermined path for passage through said second pair of apertures when said apertures are uncovered;
- a light sensitive element mounted in the path of each of the beams of light projected through said pairs of apertures for actuation by a beam of light; indicating means; and
- means responsive to the actuation of either one of said light sensitive elements for rendering said indicating means operative and said strand withdrawing means inoperative.
4. In an apparatus of the type described:
- a reel mounted for rotation and having a cylindrical drum on which the supply of strand is wound;
- means for projecting a first beam of light along a predetermined path onto a first zone of said drum and for projecting a second beam of light along a predetermined path onto a second zone of said drum in axially spaced relation to said first zone, said first and said second beams of light being intercepted respectively by strand wound on said first and said second zones of said drum;
- a first light responsive element mounted for receiving the first beam of light;
- a first means on said drum in said first zone for effecting the passage of the first beam of light to said first light responsive element when the strand is unwound from said first zone of the drum;
- a second light responsive means mounted for receiving the second beam of light;
- a second means on said drum in said second zone for effecting the passage of the second beam of light to said second light responsive element when the strand is unwound from said second zone of the drum; and
- means connected to said light responsive elements for indicating the projection of a light beam onto one of said light responsive elements.
5. In an apparatus of the type described having means for withdrawing strand from a supply thereof, the combination therewith of:

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- a reel mounted for rotation about its axis and having a cylindrical drum on which the supply of strand is wound;
- a first light source for projecting a first beam of light along a predetermined path onto a first zone of said drum, said first beam of light being intercepted by strand wound on said first zone of the drum;
- a first light responsive element mounted for receiving the first beam of light;
- a first means on said drum in said first zone for effecting the passage of the first beam of light to said first light responsive element when the strand is unwound from said first zone of said drum;
- a second light source for projecting a second beam of light along a predetermined path onto a second zone on said drum in a predetermined axially spaced relation to said first zone, said second light beam being intercepted by strand wound on said second zone of the drum;
- a second light responsive means mounted for receiving the second beam of light;
- a second means on said drum in said second zone for effecting the passage of the second beam of light to said second light responsive element when the strand is unwound from said second zone of said drum; and
- means connected to said light responsive elements and operable in response to the projection of a light beam onto one of said light responsive elements for rendering said strand withdrawing means inoperative.

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