June 8, 1943. H. H. MERWIN 2,321,096

STRAND HANDLING APPARATUS

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FIG. 1

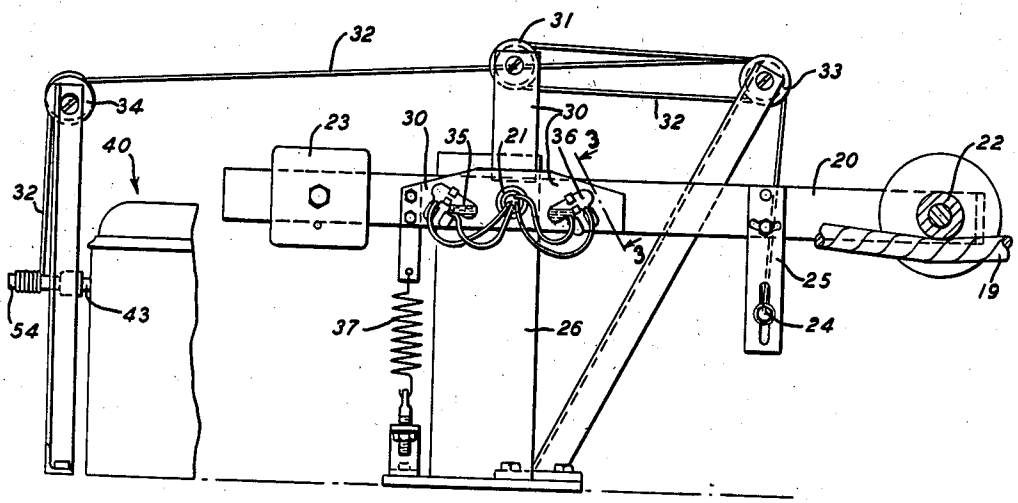


FIG. 2

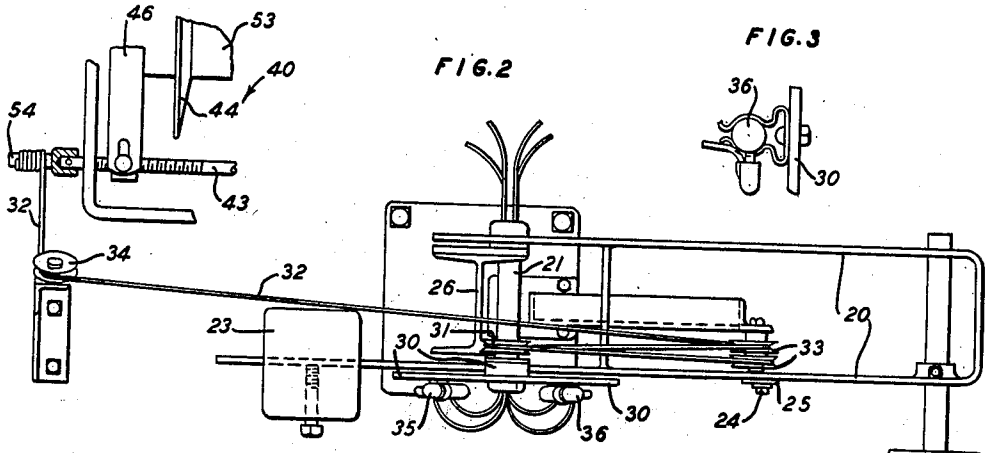


FIG. 3

FIG. 4

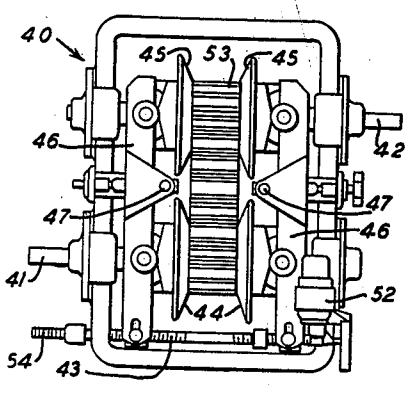
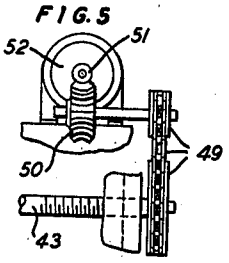


FIG. 5



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STRAND HANDLING APPARATUS

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FIG. 6

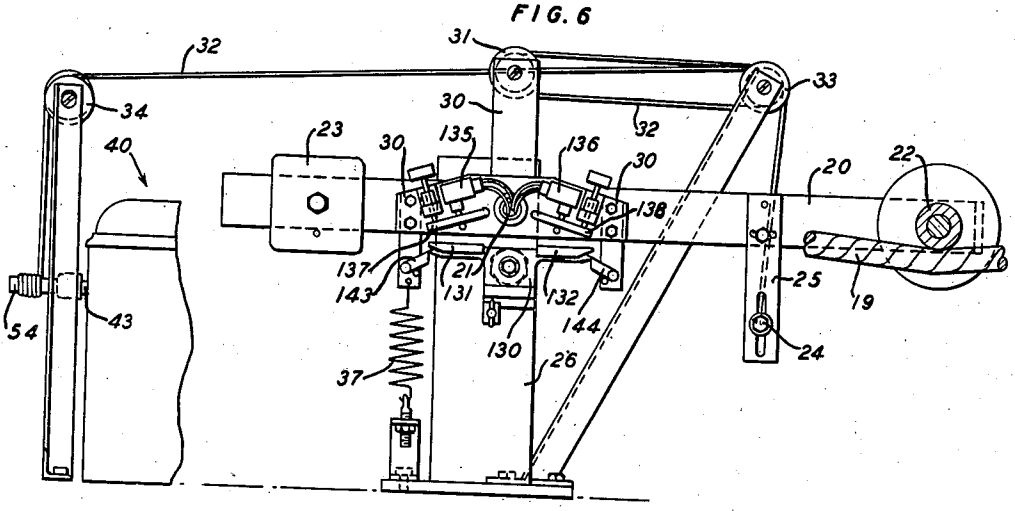


FIG. 7

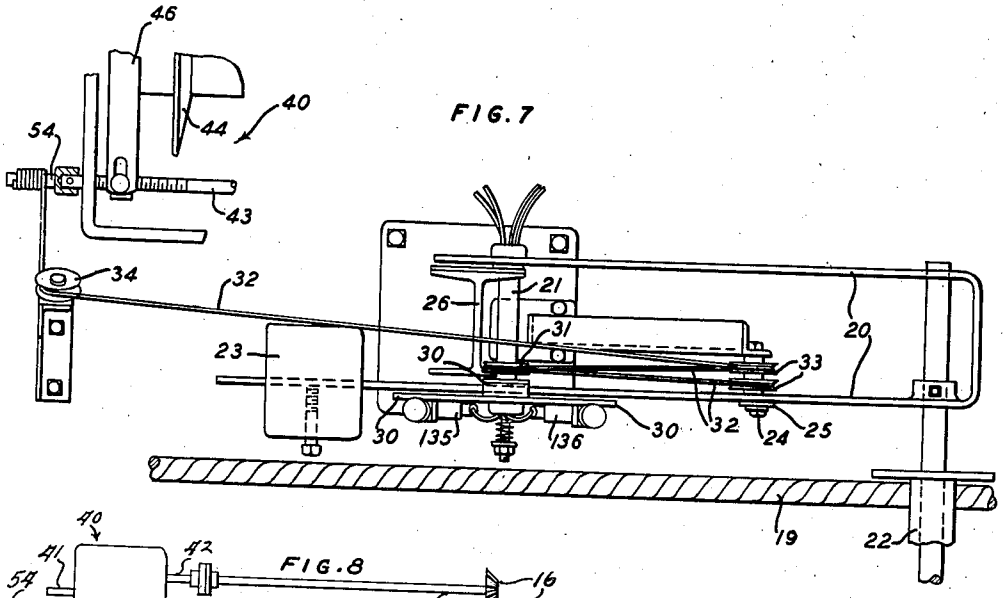
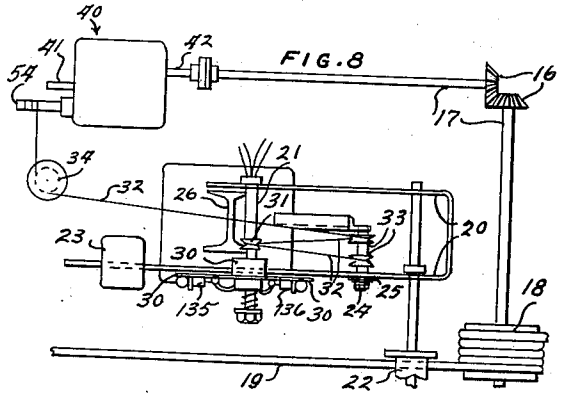


FIG. 8



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UNITED STATES PATENT OFFICE

2,321,096

STRAND HANDLING APPARATUS

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Application August 14, 1941, Serial No. 406,856

6 Claims. (Cl. 242—45)

This invention relates to strand handling apparatus, and more particularly to apparatus for controlling the longitudinal speed of electrical cable while in process of manufacture.

In the manufacture of cable, especially of the somewhat complexly organized multi-conductor cables employed in telephony, a plurality of constituent strands may be rotated to intertwist the strands while the intertwisted strands are propelled longitudinally. The pitch, or degree of twist, of the cable thus produced depends upon the ratio between the rotary speed of twisting and the linear speed of advance of the cable. The cable is usually advanced by being wound up on a take-up reel or drum, with or without the aid of some form of capstan; or, if the cable is to undergo further treatment, may be advanced by a capstan. Being thus pulled along against resistance offered by the twisting means and by tensioning devices applied to the supply reels or to the strands being supplied, tension is maintained in the cable by the advancing or pulling means. If the resistance rises or drops for any reason, the tension will rise or drop, and the pulling means will pull the cable along too slowly or too rapidly. Hence the speed of advance of the cable tends to vary more or less inversely as the tension; and uniformity of pitch of the cable depends upon uniformity of tension.

An object of the present invention is to provide an improved apparatus actuable by and in response to a change in tension in an advancing cable or other strand to correspondingly alter the speed of advance, which apparatus shall be sensitive and quick to respond, shall be effective in proportion to the magnitude and swiftness of the change in tension, and shall operate to control over compensation and consequent hunting.

With the above and other objects in view, the invention may be embodied in a strand handling apparatus having means to advance a strand longitudinally and means adjustable to control the speed of advance of the strand, means responsive to variations of tension in the strand to adjust the speed control means, and means actuable by the control means to annul the actuation of the means to adjust the control means.

Other objects and features of the invention will appear from the following detailed description of one embodiment thereof taken in connection with the accompanying drawings in which the same reference numerals are applied to identical parts in the several figures and in which

Fig. 1 is a view in front elevation of an apparatus constructed in accordance with the invention;

Fig. 2 is a plan view of the showing of Fig. 1;

Fig. 3 is a fragmentary view on the line 3—3 of Fig. 1;

Fig. 4 is a plan view on a smaller scale of the transmission device;

Fig. 5 is an enlarged detached view of the transmission control drive;

Fig. 6 is a view similar to Fig. 1 of a modified form;

Fig. 7 is a plan view of the showing of Fig. 5; and

Fig. 8 is a diagrammatic view of the apparatus of Fig. 1 showing one form of driving means for the strand.

As herein disclosed, the invention is illustrated as applied in connection with the spooling or taking up of a cable or other like strand, only so much of the related apparatus being shown as is necessary for an understanding of the invention.

Let it be assumed that a cable 19 is being advanced longitudinally of itself from left to right in Figs. 1 and 2 by being wound upon a spool, reel, drum or other analogous rotatable take-up means or by being drawn along by a capstan 18 or other advancing means, at the right, against some resistance afforded by means at the left (not shown), e. g., cable forming means of some kind. Let it be further assumed that the cable advancing means 18 be driven by mechanical or other interconnections, e. g., shafts 17 and gears 16, from the output shaft 42 of a suitable variable speed transmission device such as that generally indicated at 40. The particular device 40 here shown is that commercially known as a Reeves variable speed transmission and is described in detail hereinafter, but any analogous suitable device may be used instead.

The weight of the cable, which is unsupported during its passage through the distance shown, causes it to hang in a downwardly convex catenary curve whose depth will depend on the tension existent in the cable. Should the tension diminish, the cable will sag, deepening the curve; and should the tension increase, the curve will become shallower. This fact is the primary factor in causing the cable to control the tension in the cable by means of the apparatus embodying the invention.

A horizontal lever 20, pivotably mounted on a hollow, transverse, horizontal shaft 21 supported in a pedestal 26, carries a sheave or roller 22,

which rides on the downwardly curved free hanging portion of the cable, preferably near the bottom thereof, and is counterpoised by a weight 23 to follow changes in sag of the cable sensitively without causing any undue additional strain on the cable.

A three-armed lever 30 is also pivotably mounted on the shaft 21 and carries an idler sheave 31 on the upper end of its vertical arm. A substantially inextensible and flexible cord 32 is attached at one end to a vertically adjustable pin 24 mounted in a vertically depending member 25 pivotably adjustably secured on the lever 20 between its fulcrum and the roller 22. From the pin 24, the cord 32 passes over a double guide sheave 33 rotatably supported in a fixed position about over the pin 24 and about on a level with the sheave 31. The cord passes from the sheave 33 around the sheave 31 and back to and around the sheave 33 again and thence to a fixed position sheave 34 located to lead the cord to an extension 54 secured on the outer end of the control shaft 43 of the device 40, to be wound thereon or unwound therefrom by the action thereof.

On the outer or front face of each horizontal arm of the lever 30 is mounted one of a pair of tiltingly operating mercury switches 35 and 36 in such fashion that when one arm of the lever turns down the switch on that arm is closed while the other is open, but also so that both switches are open when the lever 30 is in the normal position shown in Fig. 1. The lever 30 is yieldably maintained in normal position, under normal conditions, by a spring 37 which also serves at all times to keep the cord 32 operatively taut. The switches 35 and 36 are adjustable as to angular position on the lever 30 as indicated in Fig. 3.

As before stated, the cable advancing means (not shown) is assumed to be driven from the output shaft 42 of the device 40, while the input shaft 41 is driven by any suitable constant speed driving means (not shown). A pair of mutually opposed cones 44, 44 is mounted on the shaft 41 and keyed thereto to be freely slidable thereon but enforcedly rotatable therewith. A similar pair of cones 45, 45 is mounted in like fashion on the shaft 42. A pair of levers 46, 46 is mounted on fixed pivots 47, 47. The upper end (Fig. 3) of each lever 46 is pivotally secured to one of the cones 45 while its lower part is similarly attached to one of the cones 44 at an equal distance from its fulcrum. The lower end of each lever 46 carries a nut engaging with respectively oppositely threaded portions of the control shaft 43. The shaft 43 is drivable through sprocket and chain drive 49 and a wheel and worm drive 50, 51 by a reversible electric motor 52. Connections to a suitable source of electric current (not shown) to run the motor in one direction or the other, are controlled by the switches 35 and 36 respectively.

To describe the operation, let it be assumed that the cable 19 is being drawn along toward the right under the predetermined optimum tension, and that the apparatus is therefore in its normal, idle state as shown in Fig. 1, with both switches 35 and 36 open and hence with the motor 52 idle. If now for any reason the tension in the cable should diminish, the part of the cable supporting the sheave 22 will sag or drop down. The right side of the lever 20 moves down, pulling the right hand end of the cord 32 and thus moving the sheave 31 and therefore the lever 30 clockwise about its axis. The switch 36 is closed and the motor 52 starts to run in such direction as to drive the shaft 43 to cause the nuts on the levers 46, 46 to move together. The consequent movement of the levers 46, 46 causes the cones 44, 44 to approach each other and the cones 45, 45 to recede from each other. The effective diameter of the pulley formed by the cones 44, 44 is increased and that of the pulley 45, 45 is diminished in equal measure so that the V-belt 53 running on these two pulleys remains taut and the speed of the output shaft 42 is increased until the growing tension in the cable lifts the lever 20 and allows the spring 37 to return the lever 30 to normal and open the switch 36.

The apparatus as thus far described will work fairly well, but it tends to overcorrect because the motor 52 continues to run after the lever 20 begins to rise. Hence there is a tendency to hunt. To obviate this, the cord 32 is carried on over the sheave 34 and wound on a suitably dimensioned coaxial extension 54 on the shaft 43 in such a way that when the lever 20 moves down and pulls the cord to move the lever 30 clockwise, the motor 52 when it drives the shaft 43 will unwind cord from the extension 54 and thus open the switch 36 by releasing the lever 30 from the pull of the cord at about the time when the lever 20 begins to respond to the increasing tension of the cable. Thus the further correction of tension effected by the motor 52 may be arranged to be annulled when the desired tension is attained, by suitably proportioning the diameter of the extension 54, and by adjusting the tilt of the switches 35 and 36 on the lever 30. In this manner, since overcorrection is annulled, there is no tendency of the apparatus to hunt and thus keep the tension alternating more or less rapidly between too much and too little.

The operation of the device, when for some reason the tension in the cable becomes too great, is believed to be obvious from the above description of the opposite case, and so is not described in detail.

In the modified form shown in Figs. 6 and 7, the mechanical parts are substantially the same except as noted in the following. The liquid contact switches 35 and 36 of Fig. 1 are replaced by solid contact switches 135 and 136 respectively, operable respectively by levers 137 and 138 pivoted on the lever 30 and movable between fixed stop pins below and adjustable stops above respectively. A lever 130 is mounted below the lever 30 and normally horizontal, to be pivotable under frictional resistance. On the upper faces of the arms of the lever 130 are serrated contact shoes 131 and 132 respectively positioned to actuate the levers 137 or 138 when the lever 30 moves clockwise or counterclockwise. Pawls 143 and 144 are mounted on depending extensions of the lever 30 to pass the ends of the lever 130 freely when moving down relatively thereto and to catch thereunder when moving upward under the same. When the lever 20 turns, say clockwise, and thus turns the lever 30 also clockwise via the cord 32, the lever 138 coming down on the shoe 132 actuates the switch 136 and also forces the lever 130 to turn clockwise. Since the pivot of the lever 30 is above that of the lever 130, the outer end of the lever 138 slides inwardly along the surface of the shoe 132, and the pawl 144 is moved inwardly under the falling arm of the lever 130 while the pawl 143 moves outwardly and up away from the rising arm. Since there is some lost motion between the lever 138 and the member 132 (much less, however, than is shown for clarity in the drawings) as also between the pawl 144 and

the lever 30, the switch 136 is opened almost immediately when the lever 20 begins to turn back toward normal instead of not until normal position is reached. Hence with the arrangement of levers and switches shown the tendency to hunt is still further guarded against. Because of the serrations of the shoes, the action of the levers 137 and 138 to close and open the switches 135 and 136 respectively is intermittent, so that, in effect, the lever 138, for example, acting on the switch 136, will effect a small increment of speed of the shaft 42 by starting and stopping the motor 52 while riding over one serration of the shoe. The arrangement will then pause as if to see if the correction is sufficient, and if not will make another, and so on. In theory, the arrangement of Fig. 1 will not hunt; in practise it does not prevent hunting to a slight extent, but does damp out the hunting in short order. Such action is completely satisfactory in most instances. However, where extreme conditions require as complete prevention of hunting as possible, as contrasted with suppression, the arrangement of Figs. 6 and 7 substantially ensures this.

The combination of the lever 130 with the lever 30 and of the elements associated directly with both levers is not per se a part of the present invention, being more fully disclosed and being claimed in copending application Serial No. 406,855, filed of even date herewith by Waldemar C. Ewaldson and assigned to the same assignee as the present invention, to which application reference may be had as to details not herein sufficiently described.

The embodiments herein disclosed are illustrative and may be modified and departed from variously without departing from the spirit and scope of the invention as pointed out in and limited only by the appended claims.

What is claimed is:

1. In a strand handling apparatus having means to advance a strand longitudinally and means adjustable to control the speed of advance of the strand, means responsive to variations of tension in the strand to adjust the speed control means, and means actuable by the control means to annul the actuation of the means to adjust the control means.

2. In a strand handling apparatus having means to advance a strand longitudinally and means adjustable to control the speed of advance of the strand, a member movable in response to variations of tension in the strand, means actuable by the member to adjust the speed control means, and means actuable by the control means to annul the actuation of the means to adjust the control means.

3. In a strand handling apparatus having means to advance a strand longitudinally in a free hanging catenary and including adjustable variable speed transmission means to control the speed of advance of the strand and thereby the tension in the strand, a member supported on the catenary of the strand and movable thereby in response to variations in the tension of the strand, means actuable by the member to adjust the transmission means, and means actuable by the transmission means to annul the actuation of the means to adjust the transmission means.

4. In a strand handling apparatus having means to advance a strand longitudinally in a free hanging catenary and including electrically actuated adjustable variable speed transmission means to control the speed of advance of the strand and thereby the tension in the strand, a member supported on the catenary of the strand and movable thereby in response to variations in the tension of the strand, electric switch means actuable by the member to adjust the transmission means, and means actuable by the transmission means to annul the actuation of the means to adjust the transmission means.

5. In a strand handling apparatus having means to advance a strand longitudinally in a free hanging catenary and including adjustable variable speed transmission means adjusted by an electric motor to control the speed of advance of the strand and thereby the tension in the strand, a member supported on the catenary of the strand and movable thereby in response to variations in the tension of the strand, a support tiltable against a restoring force, electrical switch means on the support and actuated by the tilting thereof to start, stop or reverse the motor to adjustably vary the speed of advance of the strand, means to connect the member to the support to tilt the same, and means actuated by the motor to render the connecting means ineffective to tilt the support.

6. In a strand handling apparatus having means to advance a strand longitudinally in a free hanging catenary and including adjustable variable speed transmission means adjusted by an electric motor to control the speed of advance of the strand and thereby the tension in the strand, a member supported on the catenary of the strand and movable thereby in response to variations in the tension of the strand, a support tiltable against a restoring force, electrical switch means on the support and actuated by the tilting thereof to start, stop or reverse the motor to adjustably vary the speed of advance of the strand, a shaft driven by the motor, a sheave on the support, and a cord having one end secured to the member and the other end wound upon the shaft and a loop passing over the sheave to tilt the support by motion of the member on the cord and to be rendered unable to tilt the support by rotation of the shaft.

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