

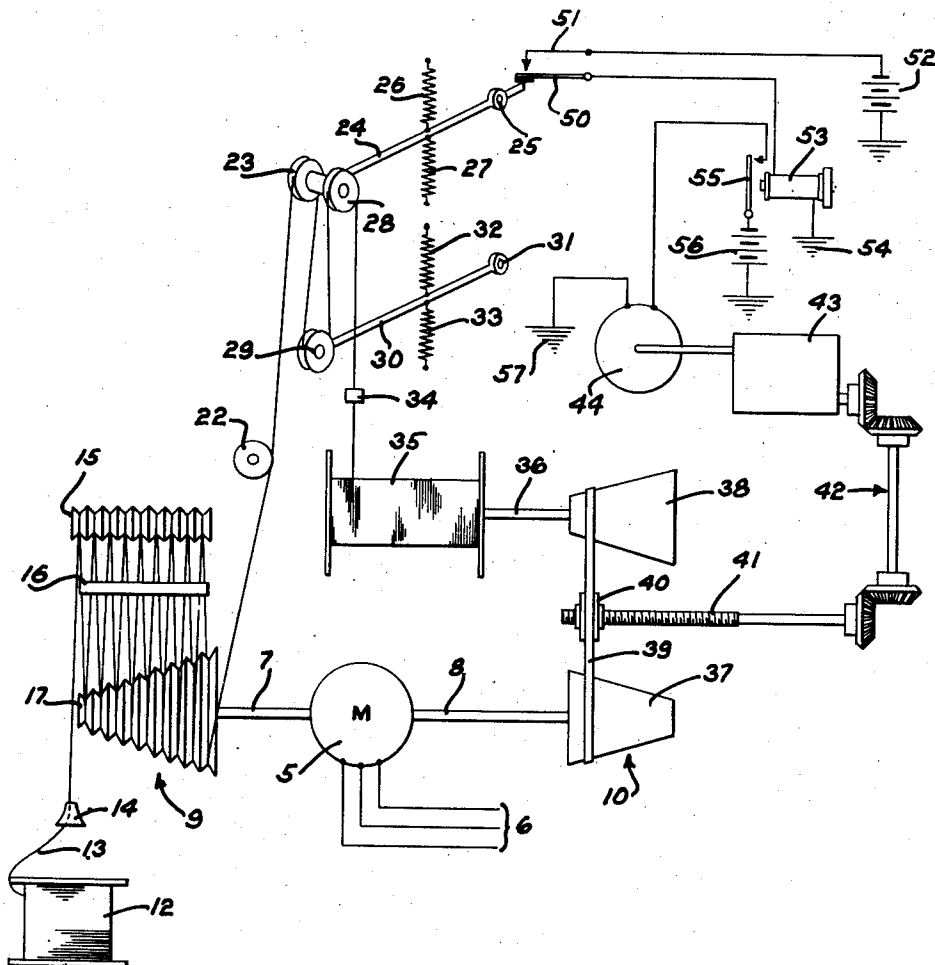
Aug. 31, 1943.

W. BERTHOLD

2,328,322

TENSION CONTROLLING APPARATUS

Filed Jan. 13, 1942



INVENTOR
W. BERTHOLD
BY: *Harry L. Suft*
ATTORNEY

UNITED STATES PATENT OFFICE

2,328,322

TENSION CONTROLLING APPARATUS

Wolf Berthold, Weehawken, N. J., assignor to
Western Electric Company, Incorporated, New
York, N. Y., a corporation of New York

Application January 13, 1942, Serial No. 426,549

13 Claims. (Cl. 242—45)

This invention relates to tension controlling apparatus and more particularly to apparatus for controlling the tension in a strand being fed from a processing apparatus and taken up on a takeup reel.

It is an object of the present invention to provide a simple and efficient apparatus for maintaining substantially constant the tension in a strand being taken up from a strand processing apparatus.

In accordance with one embodiment of the invention as applied to a takeup apparatus for a wire drawing machine, the motor which drives the wire drawing machine is interconnected through a variable speed transmission to the takeup reel which receives the wire directly from the drawing machine and power is supplied to vary the transmission at intervals when the tension in the wire between the drawing machine and the reel reaches a predetermined value. A time delay circuit is provided for holding power on the motor, which varies the transmission, for a definite interval each time the power is supplied thereto whereby the tension in the wire will be maintained substantially constant.

A better understanding of the invention may be had by reference to the accompanying drawing, wherein the single figure represents, diagrammatically, a wire drawing apparatus and its associated takeup mechanism, together with means for controlling the speed of the takeup mechanism to maintain the tension between the drawing machine and the takeup spool within a definite range.

In the drawing, there is shown a wire drawing apparatus adapted to be driven by a motor 5 connected through conductors 6 to any suitable source of power. The motor 5 is provided with shafting 7—8 for driving the drawing apparatus, designated generally by the numeral 9, and the takeup apparatus, designated generally by the numeral 10. A supply spool 12, having wound thereon a supply of relatively coarse wire 13, is positioned beneath a bell-shaped guide 14 so that wire may be withdrawn from the spool 12 through the guide 14 for direction to one of a series of guide rollers 15 in the wire drawing apparatus, from whence the wire may be directed through the first die on a die shelf 16 and thence to a drawing capstan 17. The capstan 17 is driven by the shaft 7 and after the wire has been passed through the dies in the die shelf 16, wrapped a predetermined number of times around various passes of the capstan and passed over the guide rollers 15, it is directed from the last pass of the

capstan 17 to a guide roller 22. Cooperating with the guide roller 22 is a movable guide roller 23, mounted upon a tension or upper cushioning arm 24, which is, in turn, pivoted at 25. The arm 24 which supports the guide roller 23 is normally held in a predetermined position by cooperating springs 26 and 27, carries a second guide roller 28 and is damped to prevent slight increases in tension of short duration from moving it.

The wire, after being passed around one of the idler guide rollers on the cushioning arm 24, is directed to an idler roller 29 and back to the other roller on cushioning arm 24 and down to a distributor 34. The idler roller 29 is mounted on a cushioning arm 30, similar to the arm 24, the arm 30 being pivoted at 31 and being held in its normal position by cooperating springs 32 and 33. With this arrangement, the cushioning arms may be moved relatively close together, at which time there will be a relatively short length of wire between the fixed idler 22 and the distributor 34, or, when the tension on the wire is released somewhat, a relatively large amount of wire may be held under a definite tension between the roller 22 and the distributor 34 due to the displacement of the cushioning arms 24 and 30 and the guide roller carried by them away from each other. The distributor 34, which is shown diagrammatically, serves to distribute the wire over the face of a takeup spool 35 mounted upon a shaft 36. The shaft 36 is adapted to be driven through a variable speed transmission, which may be of any suitable form, such as a "Reeves" drive, as shown in the patent to E. Eger, No. 1,916,467, or the form as illustrated diagrammatically in the drawing, wherein tapered driving and driven members 37 and 38 have a belt 39 interconnecting them and wherein the belt is guided by a movable idler 40 mounted on and displaceable by a motor driven screw member 41, which is interconnected by suitable gearing and shafting 42 to a speed reducer 43 driven by a motor 44.

The lower cushioning arm 30 is relatively freely movable, whereas the upper cushioning arm 24 is suitably damped whereby slight variations in tension in the wire which may be caused by the usual slight irregularities in the winding on the takeup spool 35 or in the distribution of the wire on the takeup spool may be compensated for by the lower arm 30, whereas the upper arm 24 will only be moved under the tension of the wire when there is a sustained increase in tension between the idler 22 and the takeup spool 35.

The end of the arm 24 away from the rollers 23 and 28 has associated therewith a movable

contact member 50, which, when the tension in the wire reaches a predetermined value, will be moved into engagement with a fixed contact member 51 to complete a circuit from grounded battery at 52 to one side of the winding of a slow to release relay 53, the other side of the winding of which is connected to ground at 54. This slow to release relay 53 may be replaced by any other time delay device which will, upon energization, maintain a circuit for a definite length of time. The relay 53 is supplied with a contact making armature 55 connected to grounded battery at 56 and adapted, upon energization of the relay 53, to complete a circuit through the winding of the motor 44 to ground, at 57. It is believed to be thus apparent that when the switch comprising contacts 50 and 51 is closed momentarily, the relay 53 will be energized and will stay energized for a predetermined length of time, depending upon its time delay characteristic and will complete a circuit to the motor 44.

In the operation of this apparatus, it is possible to maintain a very small average slip on the capstan since the wire coming from the last pass of the capstan 17 runs over the idlers 23, 29 and 28 on the cushioning arms 24 and 30. Since the cushioning arm 30 is relatively free to swing about its pivot 31 for variations in tension of short duration and the arm 24 being suitably damped, will follow these changes in tension slowly, the cushioning arm 30 will take up any slight variation in tension, whereas the arm 24 will complete the circuit to the relay 53 only when the slip on the last pass of the capstan 17 has been taken up due to the increased diameter of application of the wire to takeup spool 35. As soon as the slip on the last pass of the capstan 17 has been completely taken up, the spool or reel 35 will tend to wind the wire faster than the wire drawing apparatus can deliver it and, therefore, the arm 24 will be pulled downwardly to close the circuit between the contacts 50 and 51 to supply power from battery 56 to motor 44. The motor 44 will drive the screw member 41, thereby to shift belt 39 to the right and vary the transmission to reduce the speed or rotation of the takeup reel 35. Since the relay 53, upon operation, will stay operated for a definite amount of time, the motor 44 will drive for a definite length of time and change the transmission of power from the motor 5 to the reel 35 a definite amount.

After a reel 35 has been completely filled with wire and the reel has been removed from the drive shaft 36, the connections to the motor 44 may be reversed while the drawing motor 5 is being operated at slow speed to reset the belt 39 with respect to the driving and driven members 37 and 38. Furthermore, it may be necessary to render the contacts 50 and 51 inoperative during the starting period of acceleration of the apparatus, but since the circuits for performing this function do not form a part of the present invention and the present apparatus will function satisfactorily if the acceleration is relatively slow, they are not disclosed herein.

Although a specific embodiment of the invention has been described hereinbefore, it will be understood that modifications thereof may be made without departing from the invention.

What is claimed is:

1. Apparatus for controlling the tension in a strand comprising a takeup reel, a capstan for delivering material to the takeup reel, a driving

motor for driving said reel and capstan, a variable speed transmission between said reel and motor, and means for changing the speed ratio of said transmission in response to tension in the strand.

2. Apparatus for controlling the tension in a strand comprising a takeup reel, a driving motor therefor, a variable speed transmission between said reel and motor, and means for changing the speed ratio of said transmission by a predetermined fixed increment in response to a predetermined tension in the strand.

3. Apparatus for controlling the tension in a strand comprising a takeup reel, a driving motor therefor, a variable speed transmission between said reel and motor, and means for changing the speed ratio of said transmission at a predetermined rate for a uniform interval of time each time the tension in the strand reaches a predetermined value.

4. An apparatus for controlling the tension in a strand between the material working apparatus and a takeup spool comprising means for connecting the takeup spool to the working apparatus to drive the takeup spool, said means comprising a variable speed transmission and a motor for varying the output speed of said variable speed transmission, and means responsive to tension the strand for driving said varying motor for a definite fixed time each time the tension in the strand reaches a predetermined value.

5. An apparatus for controlling the tension in material between a material processing apparatus and a reel for supporting a supply of said material comprising a variable speed transmission mechanism for transmitting power to the reel, means driven by the processing apparatus for supplying power to drive said transmission mechanism, means for varying the rate of transmission of the transmission mechanism, and means responsive to a predetermined tension in the material for actuating the means for varying the ratio of transmission for a predetermined fixed time interval.

6. An apparatus for controlling the tension in a strand between a strand working apparatus and a takeup reel comprising a variable speed transmission for transmitting power to the takeup reel, means driven by the strand working apparatus for supplying power to drive said transmission, a pilot motor for changing the transmission rate of said variable speed transmission, and means responsive to the tension in the strand for supplying power to said pilot motor for a predetermined fixed time interval.

7. An apparatus for controlling the tension in a strand between a strand processing apparatus and a reel for supporting a supply of said strand comprising a variable speed transmission, means for changing the output speed of the variable speed transmission with respect to its input speed, means driven by the strand processing apparatus for supplying power to drive the transmission, and means responsive to tension in the strand for driving the means to change the output speed of the transmission with respect to its input speed for a predetermined fixed time interval.

8. A tension controlling apparatus for a processing machine which feeds material at a constant rate comprising means driven at a constant rate proportional to the rate of feed of material, said means being driven by the processing machine, a variable speed transmission driven by said means driven at a constant rate, means for

varying the rate of transmission of the variable speed transmission, and means responsive to tension in material being processed for driving said last mentioned means to effect a predetermined amount of change in the transmission rate of said transmission means.

9. In a tension controlling apparatus for use in connection with a material processing machine, a takeup reel associated with said processing machine, a variable speed transmission driven by the processing machine for transmitting power to drive the takeup reel, a pilot motor for said transmission means to vary the rate at which the transmission means transmits power to the reel, means responsive to a predetermined tension in the material being processed for initiating operation of said pilot motor, and means for maintaining said pilot motor operative for a fixed length of time each time its operation is initiated.

10. A tension controlling apparatus for strand being delivered at a constant rate from a processing machine to a takeup reel comprising means interconnecting the processing machine and the takeup reel to drive the takeup reel, means for controlling said interconnecting means to decrease the rate at which it transmits power to the takeup reel, and means responsive to tension in the material for operating said last mentioned means for a fixed interval of time.

11. An apparatus for controlling the tension in material being fed at a constant rate from a processing machine to a takeup reel comprising means responsive to tension in the material for

closing an electrical circuit, means in said electrical circuit for closing a second circuit and maintaining it closed for a definite time interval, a variable speed transmission interconnecting the processing machine and the takeup reel, and a motor for varying the rate of transmission of said variable speed transmission means, said motor being in the circuit maintained for a definite time interval whereby each time the tension in the strand reaches a predetermined value, the rate of speed of the takeup reel is reduced by a predetermined amount.

12. Apparatus for controlling the tension in a strand comprising a takeup reel, a driving motor therefor, a variable speed transmission between said reel and motor, and means for changing the speed ratio of said transmission by a predetermined increment in response to a predetermined tension in the strand, said last mentioned means including a time delay circuit operable under control of the material.

13. Apparatus for controlling the tension in a strand comprising a takeup reel, a driving motor therefor, a variable speed transmission between said reel and motor, and means for changing the speed ratio of said transmission at a predetermined rate for a predetermined fixed time each time the tension in the strand reaches a predetermined value, said last mentioned means including a circuit closing device actuated by the strand when the tension in the strand reaches a predetermined value.

WOLF BERTHOLD.