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WINDING APPARATUS

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This invention relates to winding apparatus and more particularly to improved apparatus of this kind in which the speed of a rotatable take-up member is automatically varied in response to the building-up of wound material on such take-up member.

Another object of my invention is to provide improved winding apparatus adapted to be used with a wire drawing machine or other device for taking up material being delivered or payed-out and in which the driving means for the rotatable take-up member includes a magnetic clutch adapted to be adjusted in response to the building-up of wound material for automatically varying the winding speed.

Still another object of my invention is to provide improved winding apparatus for taking up wire or other material to be wound and in which the rotatable take-up member is driven by an electromagnetic clutch adapted to operate with controlled slippage for driving the take-up member at different winding speeds and in which the magnetization of the clutch can be automatically varied for controlling the slippage thereof.

The invention may be further briefly summarized as consisting in certain novel combinations and arrangements of parts hereinafter described and particularly set out in the appended claims.

In the accompanying sheet of drawings illustrating one embodiment of the invention,

Fig. 1 is a side elevation of my winding apparatus showing the same applied to a wire drawing machine or the like;

Fig. 2 is a partial sectional plan view taken through the winding apparatus, and

Fig. 3 is a wiring diagram.

More detailed reference will now be made to the accompanying drawing for the purpose of describing the particular embodiment of the invention here illustrated, but it will be understood, of course, that the present illustration of the invention is by way of example and that my improved winding apparatus may be embodied in various other constructions and arrangements and can be applied to wire drawing machines, or to numerous other machines from which material to be wound is delivered or payed-out.

In Fig. 1 of the drawing I show my improved winding apparatus 10 applied to a wire drawing machine 11, and show a strand of wire 12 passing from the capstan 13 of the drawing machine to the spool or rotatable take-up member 14 upon which the material is to be wound.

My improved winding apparatus includes a

frame or housing 15 having a rotatable shaft 16 mounted therein. One end of this shaft may project from the housing 15 and may carry an arbor or rotatable take-up member, such as the spool 14 shown in this instance, and upon which the material may be wound after passing through the guide device 14a. Power for driving the shaft 16 may be supplied by an independent driving motor, or as shown in this instance, may be supplied from the machine 11 through the shafts 17 and 18 and the coupling 19 connecting the same. For transmitting power from the shaft 17 to the shaft 16, I employ an electromagnetic or eddy current clutch 20 which, as will be presently explained, forms a part of a control means whereby the winding speed at which the spool 14 is driven can be automatically varied in response to the building-up of the material on the spool. Such variation of the winding speed is desirable, as is well known to those skilled in this art, because as the material builds up on the spool the winding speed should be progressively decreased to prevent breakage of the strand or other material being wound.

The clutch 20 may comprise a frame 21 having a pair of coaxial rotors 22 and 23 arranged for rotation therein and adapted to be magnetically coupled with a controlled amount of slippage or relative rotation therebetween for transmitting driving torque through the clutch. The outer rotor 22 which may also be referred to as the driving rotor is keyed or otherwise connected to the shaft 17, and the inner or driven rotor 23 may be keyed or otherwise connected to a rotatably mounted sleeve or hollow shaft 24 which surrounds the shaft 17. The sleeve 24 may be drivingly connected with the shaft 16 by any suitable means, such as the bevel gears 25 and 26 shown in this instance.

The driving rotor 22 may be of any appropriate form or construction, for example, it may comprise a wheel-like member or spider 27 and an axially projecting rim portion 29 surrounding the driven rotor 23 with an air gap 28 therebetween. This rim portion 29 may be formed integral with the member 27, or as here shown, may comprise a separate annular member having circumferentially spaced fins 30 on the outside thereof and which is connected with the member 27, either directly or with the ring 31 disposed therebetween. The members 27, 29 and 31 constituting the outer or driving rotor 22 may be connected by welding or by any other suitable connecting means.

The inner rotor 23 may comprise a disk por-

tion or spider 32 and rings 33 and 34 mounted on opposite sides of such disk portion adjacent the rim thereof so as to provide an annular groove or recess 35 adapted to receive an energizing winding 36. The rings 33 and 34 may be welded or otherwise connected with the disk member 32 and the latter may be keyed or otherwise connected with the sleeve 24. The terminals of the energizing winding 36 may be suitably connected with a pair of slip rings 37 and 38 which are mounted on but insulated from the sleeve 24 and with which brushes 39 and 40 cooperate for supplying energizing current to the winding.

In the operation of my winding apparatus, the rotor 22 is driven by torque applied to the shaft 17. By energizing the winding 36 the rotor 23 can be magnetically coupled with the rotor 22 to be driven thereby and thus driving torque can be transmitted through the sleeve 24 and the gears 25 and 26 to the shaft 16 carrying the winding arbor or spool 14. By varying the energization or excitation of the winding 36, the magnetic coupling between the rotors 22 and 23 can be varied to thereby vary the slippage between these members. In other words, by reducing the energization of the winding 36, the slippage between the rotors can be increased and the winding speed of the spool thereby reduced.

To secure automatic variation or adjustment of the winding speed of the spool 14, I may provide a rheostat 41 or the like in circuit with the winding 36 and may vary the setting of the rheostat in accordance with the building up of wound material on the spool. For this purpose I may provide a pivoted lever 42 which is connected with the actuating arm 43 of the rheostat by a link 44 and which cooperates with the wound material either directly or by means of a roller 45 carried thereby. As the material builds up on the spool 14, the arm or lever 42 will be swung on its pivot and the setting of the rheostat 41 will be correspondingly changed and will reduce the energization of the winding 36 of the magnetic clutch 20. Thus as the material builds up on the spool, the slippage of the clutch will be permitted to increase and the winding speed of the spool will be correspondingly decreased.

The position or setting of the rheostat arm 43 with respect to the roller-carrying arm 42 can be varied or adjusted as desired by shortening or lengthening the link 44 which can be in the form of a turnbuckle so as to permit of this adjustment. I may also provide a means for varying or controlling the effectiveness of the automatically operated rheostat 41. This means may be in the form of a second rheostat 46 which is preferably arranged in parallel with the rheostat 41, as shown in Fig. 3, although it may be connected in series with the rheostat 41 if desired. The rheostat 45 is set or adjusted manually at the beginning of the winding operation, or at times during the winding operation if this is necessary or desirable to thereby vary or determine the effectiveness which the rheostat 41 is to have. It may be desirable to provide a further adjustment of the winding speed whereby the tension on the strand 12 can be controlled or varied. This latter adjustment may be in the form of a third rheostat 47 provided in the energizing circuit of the winding 36.

When the spool becomes full, the winding 36 may be completely deenergized, as by opening the switch 48, so that the spool can be brought to a stop preparatory to being dismantled from the shaft 16. The switch 48 can be actuated manu-

ally or can be incorporated in the rheostat 41 so that it will be opened automatically when the roller 45 is moved to a position corresponding with the filled condition of the spool 14.

To expedite the stopping of the spool when the magnetic clutch is deenergized, I may provide a magnetic brake so that the spool will not continue to coast and cause breakage or tangling of the material. In this instance I show such a magnetic brake embodied in the clutch 20 and comprising a rotor 50 carried by the disk 32 of the inner rotor 23 and arranged to operate in a stator 51 which is carried by the frame 21 and provided with a magnetizing winding 52. This winding can be energized at substantially the same time that the winding 36 is deenergized, as by manual actuation of a rheostat or switch 53 contained in an appropriate energizing circuit, to thereby apply magnetic braking action to the rotor 50 as the result of which the spool 14 may be quickly brought to a stop.

From the foregoing description and the accompanying drawing it will now be readily understood that I have provided improved winding apparatus which may be used with a wire drawing machine or with various other devices for taking up the wire or other material being payed-out or delivered therefrom. It will be seen further that by embodying in the driving means for the spool or take-up member an electromagnetic or eddy current clutch adapted to operate with controlled slippage, I am able to vary the winding speed in response to the progressive building up of the wound material. It will be understood further that the use of such a magnetic clutch in the driving means of my winding apparatus provides a simple and efficient means for automatically securing a smooth and positive variation in the winding speed in response to the building-up of the material on the spool or arbor.

While I have illustrated and described my improved winding apparatus in a somewhat detailed manner, it will be understood, of course, that I do not wish to be limited to the particular construction and arrangement of parts herein disclosed but regard my invention as including such changes and modifications as do not constitute a departure from the spirit of the invention and the scope of the appended claims.

Having thus described my invention, I claim:

1. In winding apparatus of the character described, the combination of rotatable means upon which material is adapted to be wound, means for driving said rotatable means including an electromagnetic clutch, a member engaging the wound material and adapted to be moved thereby as the material builds up on said rotatable means, and means actuated by movement of said member for varying the magnetization of said clutch.

2. In winding apparatus of the character described, the combination of a frame, a shaft rotatable in said frame and carrying winding means upon which material is adapted to be wound, driving means including an electromagnetic clutch adapted to operate with controlled slippage for driving said shaft at different winding speeds, a member cooperating with the wound material and adapted to be moved as the material builds up on said winding means, means actuated by movement of said member for controlling the slippage of said clutch, a magnetic brake comprising cooperating brake elements connected respectively with said frame and shaft,

and means for energizing said brake for stopping said shaft.

3. In winding apparatus of the character described, the combination of rotatable means upon which material is adapted to be wound, driving means including an electromagnetic clutch adapted to operate with controlled slippage for driving said rotatable means at different winding speeds, a rheostat for varying the magnetization of said clutch to control the slippage thereof, and an arm engageable with the wound material and connected with said rheostat to actuate the latter as the material builds up on the rotatable means.

4. In winding apparatus of the character de-

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scribed, the combination of rotatable means upon which material is adapted to be wound, driving means including an electromagnetic clutch adapted to operate with controlled slippage for driving said rotatable means at different winding speeds, an energizing circuit for said clutch, a variable resistance device in said circuit, means actuated in response to the building up of wound material for automatically varying the resistance of said device, and other control means in said circuit comprising a series resistance and a resistance in parallel with said variable resistance and manual means for individually varying such series and parallel resistances.

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