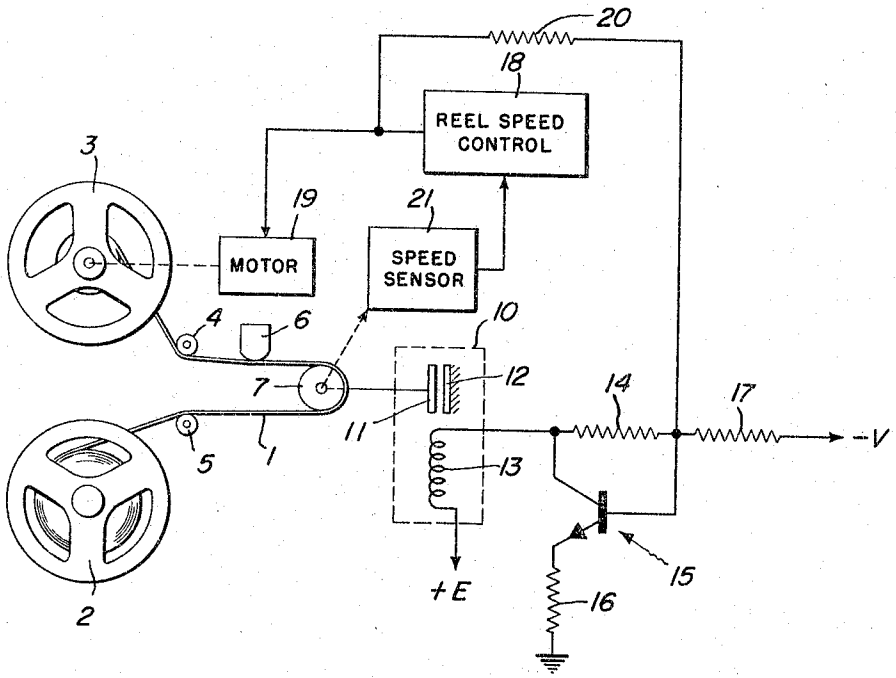
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WEB TENSION CONTROL APPARATUS

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WEB TENSION CONTROL APPARATUS

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This invention relates to web member transports. More specifically, the present invention relates to web tension control apparatus.

An object of the present invention is to provide an improved web tension control for web transports.

Another object of the present invention is to provide an improved web tension control for continuously controlling the tension of a moving web member.

A further object of the present invention is to provide an improved web tension control apparatus for continuously and progressively varying the tension of a web member as it is wound on a reel.

A still further object of the present invention is to provide an improved web tension control apparatus which is compatible with a concurrently operating web speed control device.

Another further object of the present invention is to provide an improved tape tension control for a tape transport.

Still another object of the present invention is to provide an improved web tension control, as set forth herein, having a simple operation and construction.

In accomplishing these and other objects, there has been provided, in accordance with the present invention, a tension control for a web member including a clutch means arranged to provide a variable torque coupling in response to a control signal. The clutch means is connected between a rotatable web support and a stationary member to supply a variable drag on a web member passing across the support. The control signal for the clutch means is derived from a reel motor energizing signal produced by a speed control apparatus. The speed control apparatus is arranged to control the speed of the moving web to maintain a constant web speed as the radius of the web wound on a reel is continuously increased. Thus, the drag on the web is progressively varied, as the web is wound on the reel, by the variation of the energizing signal from the speed control apparatus.

A better understanding of the present invention may be had when the following detailed description is read in connection with the accompanying drawing, in which the single figure is a schematic illustration of a tape tension control embodying the present invention.

Referring to the single figure drawing in more detail, there is shown an embodiment of the present invention as a tape tension control for a moving tape **1** being transported between a first reel **2** and a second reel **3**. In its path between the reels **2** and **3**, the tape **1** may be supported on tape idlers **4** and **5** and operatively associated with a recorded information sensing means **6**. Additionally, the tape **1** is passed over a third tape support device which in the illustrated embodiment is a turn-around drum **7**. The drum **7** is rotatably driven by the motion of the tape **1** and is coupled to one side of a magnetic clutch apparatus **10**. The clutch **10** may be any suitable apparatus for electrically varying the effective coupling between a pair of clutch torque transmitting members. One type of clutch suitable for this application may be a so-called eddy-current type which operates by having one clutch plate contain an energizing coil which produces, upon relative motion between the clutch plates, an electromagnetic force to couple the clutch plates in proportion to the energization of the coil. Another suitable clutch device may be a magnetic powder clutch having the space

between clutch plates substantially filled with a ferrous powder. This powder responds to an electromagnetic field established between the clutch plates by providing a coupling effect between the clutch plates depending on the strength of the field. Thus, the clutch **10** may be an electromagnetic clutch having a first clutch plate **11** coupled to the drum **7**, and a second clutch plate **12** coupled to a stationary member. A clutch winding **13** is effective to selectively produce the coupling effect between clutch plates **11** and **12**. In other words, the energization of the winding **13** is directly proportional to the drag exerted on the movable plate **11** by the fixed plate **12**. Thus, the clutch **10** is effective to provide a drag, or braking effect, on the drum **7** by having the second clutch plate **12** connected to a stationary member.

The winding **13** is energized by a transistor control circuit comprising a transistor **15** having its collector connected to one end of the winding **13**. The other end of the winding **13** is connected to an appropriate source of voltage E suitable for energizing the transistor **15**. The emitter of transistor **15** is connected through a resistor **16** to a ground connection. The base of the transistor **15** is connected to a source of a control signal, described hereinafter, and through a resistor **17** to a source of bias voltage V. Additionally, a feedback resistor **14** for stabilizing the operation of transistor **15** is connected between the collector and base thereof.

The control signal is derived from a reel speed control means **18**. The output signal from the control means **18** is applied through a resistor **20** to the base of transistor **15** and to a reel drive motor **19**. The motor **19** is arranged to drive the reel **3** to wind the tape **1** thereon. The speed control **18** is arranged to respond to the speed of the tape **1** by means of a speed sensor **21**. The sensor **21** may be arranged to sense the rotational speed of the drum **7** as a representative of the speed of the tape **1**. This sensing operation may be effected by any suitable means; such as, a tone wheel driven by the drum **7** to produce a signal having frequency proportional to the speed of the drum **7**.

In operation, the apparatus shown in the illustrated embodiment of the invention is effective to control the tension of the tape **1** while it is being wound on the reel **3** to proportion the tape tension between the inside of the reel and the outside of the reel. Specifically, in order to prevent damage to the tape, it is desirable to decrease the tension of the tape from the inside of the reel to the outside of the reel; e.g., a tape tension at reel hub of 20 oz. should be reduced to 5 oz. of the outside of the tape reel.

The speed control **18** is arranged to maintain a constant speed of the tape **1** during a winding operation on the reel **3**. Accordingly, as the radius of the wound tape is increased, the speed of the motor **19** and reel **3** is decreased to maintain the same tape speed. In other words, a larger circumference of the top tape layer will wind-up more tape at a lower rotational speed of the reel **3** than a smaller circumference. Thus, as the layers of tape increase on the reel **3**, the speed of the motor **19** will be decreased by the speed control **18** to maintain a constant tape speed. However, this decrease in the energizing signal to the motor **19** is also applied to the transistor **15** to decrease the current through the clutch winding **13**. This decrease in current is effective to decrease the torque drag between the clutch plates **11** and **12** to decrease the drag exerted on the tape **1** by the drum **7**. As the tape level on the reel **3** progresses from the inside to the outside of the reel **3**, the tape tension, consequently, is decreased to properly tension the layers of tape.

Accordingly, it may be seen that there has been provided, in accordance with the present invention, a ten-

sion control for progressively and continuously proportioning the tension in a moving web member during a winding operation without interfering with the speed control of the web member.

What is claimed is:

1. A tension control for a web member comprising a plurality of rotatable web carrying support means arranged to support a web member in a web transporting system, motor means operative to drive one of said support means, a clutch means arranged to concurrently rotate with a second one of said support means and operatively coupling said second support means to a stationary member, said clutch means including selectively actuatable means for varying the effective coupling of said clutch means to effect a drag on a web member passing over said second support means, sensing means operative to sense the speed of a web member and to provide a speed control signal, and control means for receiving said speed control signal connected to said motor means and said actuatable means to control said motor means and the coupling of said clutch means in response to said speed control signal.

2. A tape transport system comprising a pair of reels arranged to mutually store a length of tape, rotatably mounted tape support means operative to support a tape between said reels, a motor operative to drive one of said reels, speed control means operative to sense the speed of a tape moving between said reels and to supply an energizing signal to said motor to maintain a predetermined constant tape speed, and clutch means arranged to concurrently rotate with said support means and operative to selectively connect one of said support means to a stationary member in response to said energizing signal from said control means.

3. A tape transport system as set forth in claim 2 wherein said clutch means includes an electro-magnetic clutch having a clutch actuating winding and a transistor amplifier arranged to supply a variable current signal to said winding in response to said energizing signal.

4. A tension control for a web member transport system comprising a first and second web reeling means, a rotatable web carrying support, a clutch means arranged to concurrently rotate with said support and to selectively impose a drag effect on a web member passing over said support by coupling said support to a stationary member, said clutch means having an actuating winding, motor means operative to drive at least one of said web reeling means, sensing means operative to sense the speed of said web member passing over said rotatable web carrying support and provide a speed control signal output, speed control means for receiving said speed control signal from said sensing means connected to said motor means for providing an energizing signal to said motor means to maintain a predetermined constant web speed, and selectively actuatable means connected to said actuating winding and receiving said energizing signal from said speed control means operative to provide a signal to said winding and vary said imposed drag upon said web member in response to said energizing signal applied thereto for controlling the tension within said web member as said web is wound upon said web reeling means at a constant speed.

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