

Description

This invention relates to drive apparatus e.g., tape drives for magnetic tape of the kind mentioned in the first part of claim 1 such as those utilized with computers and other data processing equipment, which are adapted to utilize large tape reels which must be rewound after each use.

Magnetic tape drives which utilize large reels of magnetic tape, e.g. 1,27 cm (0.5 inch) wide tape having a length of 732 m or 1097 m (2400 or 3600 feet) typically include DC motors for powering the supply reel and the take-up reel. Such DC motors require a voltage which is proportional to the linear velocity of the magnetic tape in addition to the voltage required to drive current through the armature of the motor. As a result, for a fixed rewind tape velocity, the DC motors require a changing voltage as the tape rewinds from the end of the tape to the beginning of the tape. The change of voltage during rewinding of a 0.5 inch tape drive is roughly 2:1 since this is the total radius change.

Thus, in conventional tape drive systems, the voltage to each of the reel motors changes as tape is wound from one reel to the other (e.g., during rewinding operation) when the tape velocity remains fixed.

The rewind time for a magnetic tape which is 732 m (2400 feet) long is two minutes in conventional tape drive apparatus. The rewind time for a magnetic tape which is 1097 m (3600 feet) long is three minutes in such apparatus.

The problem underlying the invention is to provide a driving apparatus having reduced winding times. In accordance with the present invention this problem is accomplished by claim 1.

The drive apparatus of this invention significantly reduces the time required to wind the tape from one reel to the other (e.g., either during rewind from the take-up reel to the supply reel, or in winding the tape forwardly from the supply reel to the take-up reel). For example, the rewind time for a 732m (2400 foot) reel of magnetic tape may be shortened to 90 seconds using the system of this invention as compared to 120 seconds in conventional apparatus.

The system of the invention significantly shortens the winding time of roll goods from one reel to the other by varying the velocity while utilizing all of the available voltage.

The system of this invention is adaptable to other types of winding apparatus also. For example, it may be useful in conjunction with winding apparatus for roll goods such as wire, paper, sheet metal, cloth, plastic, ribbon, etc. where both the supply reel and the take-up reel are driven by electrical motors. The various types of roll goods may be generally referred to as either webs or

filaments.

Brief Description of the Drawings

The invention is described in more detail hereinafter with reference to the accompanying drawings, wherein like reference characters refer to the same parts throughout the several views and in which:

FIGURE 1 is a block diagram of a preferred embodiment of a tape drive system of this invention; and

FIGURE 2 is a flow chart illustrating the logic of a microprocessor used in the system of this invention.

In Figure 1 there is shown a block diagram of a preferred embodiment for a tape drive apparatus which includes the rewind system of this invention. Thus, there is illustrated a tape drive apparatus which includes a supply reel 10 and a take-up reel 12. Each reel is driven by an electrical motor (typically a DC motor). Magnetic tape 14 extends from the supply reel 10, over a tension sensor 16, past magnetic head 18, over a tape incremental position encoder 20 and then onto take-up reel 12. The magnetic tape 14 may be wound from the supply reel 10 onto the take-up reel 12 or, alternatively, from the take-up reel 12 to supply reel 10.

For purposes of discussion of the system of the invention hereafter, all voltages are referred to as being positive voltages.

When it is desired to wind the tape from one reel to the other reel as rapidly as possible (e.g., during a rewind operation), the voltages to the respective motors driving reel 10 and reel 12 are monitored (e.g., by analog-to-digital converters 22 and 24, respectively). These voltage signals are communicated to microprocessor 26. The velocity of the moving tape 14, as measured or monitored by incremental position encoder 20, is also communicated to microprocessor 26. The larger of the voltages at the electrical motors driving the supply reel and take-up reel is compared to a supply voltage reference (e.g., 45 volts or any predetermined voltage value which is available to the drive system). The supply voltage reference represents the motor voltage supply (e.g., 48 volts) less enough voltage to overcome noise in the system (e.g., 3 volts).

If the voltage of either motor exceeds this supply voltage reference, then the microprocessor reduces or decreases the velocity command which is communicated to the servo means controlling the motor. This velocity command is first converted to an analog signal via digital-to-analog converter 28, after which it proceeds to a velocity compensator 30. The signal from the position encoder 20 is communicated to a tachometer 32 which converts

the signal from encoder 20 to a voltage signal. This value is combined with the signal from the converter 28 at velocity compensator 30.

In effect the velocity command from the microprocessor results in a minor adjustment to the voltage driving the electrical motors for the take-up reel and supply reel. The new voltage signal is amplified by amplifier 34, after which it is received by the servo for the motor driving reel 12. Preferably (although not required) the new voltage signal is also added to the voltage to the motor driving supply reel 10 via summer 36 and amplifier 38, as illustrated.

If the voltage at either motor exceeds the supply reference voltage, then the velocity command to the motor is reduced. Conversely, if less than all the available voltage is being utilized, then the velocity command is increased. Another way of stating this is that if the velocity of the tape is increased then the voltage requirement at the motors is increased. If the velocity of the tape is decreased, then the voltage requirement at the motors is decreased.

The tension sensor 16 operates in conventional fashion and communicates with tension compensator 40 which is capable of adjusting the voltage driving reel 10 to maintain the desired tension in tape 14 between reel 10 and reel 12.

The adaptive rewind system of this invention may be used in conjunction with reel-to-reel tapes and with tape cartridges, if desired.

Figure 2 is a flow chart illustrating the logic of the microprocessor used in the system of this invention. The timer interrupt refers to periodic sampling of the voltages at the first and second electrical motors driving the supply reel and the take-up reel. The voltage at each such motor is determined at short intervals (e.g., every few milliseconds). The processor then compares the voltage at each motor to the "limit" which is the predetermined supply reference voltage for the system.

If the voltage at both of the motors is less than the supply reference voltage, then the velocity command is increased by a small increment. If the voltage at one of the motors exceeds the supply reference voltage, then the velocity command is decreased by a small increment. In this manner the processor assures that the velocity of the tape while being wound from one reel to the other is maximized by driving at least one of the motors with a voltage essentially equal to the supply reference voltage, while neither motor exceeds the reference voltage.

In another embodiment of the system of the invention a processor may be used to perform all of the functions of processor 26 plus those contained within the boundaries of dotted line 42 in

Figure 1.

Claims

- 5 1. Drive apparatus of the type having a supply reel (10) for roll goods (14) driven by a first DC-motor and a take-up reel (12) driven by a second DC-motor, wherein a supply reference voltage is available,
 - 10 characterized in that
 - a) a comparison means (20: 22, 24, 26, 32) is provided to compare the voltage at said first DC-motor to said supply reference voltage, and to compare the voltage at said second DC-motor to said supply reference voltage, and
 - 15 b) a control means (26, 28, 30), which is responsive to said comparison means, includes a processor (26) operative for generating a velocity command which is increased when the voltage at both of said first and second DC-motors is less than said supply reference voltage and which is decreased when the voltage at either of said DC-motors exceeds said supply reference voltage, said velocity command being operative for correspondingly adjusting said voltages at said first and second DC-motors.
- 20 2. Drive apparatus in accordance with claim 1, wherein said roll goods (14) is a magnetic tape.
- 25 3. Drive apparatus in accordance with claim 1 or 2, wherein said voltages at said first and second electrical motors are monitored through analog-to-digital converters (22, 24) by said processor (26).
- 30 4. Drive apparatus in accordance with claim 1, wherein said roll goods comprise a filament.
- 35 5. Drive apparatus in accordance with claim 1, wherein said roll goods comprise a web.

Patentansprüche

- 40 1. Antriebsvorrichtung der Bauart mit einer Speiserolle (10) für Wickelgut (14), die von einem ersten Gleichstrommotor getrieben ist, und einer Rückspulrolle (12), die von einem zweiten Gleichstrommotor getrieben ist, wobei eine Referenz-Speisespannung verfügbar ist, dadurch gekennzeichnet, daß
 - 45 a) eine Vergleichsvorrichtung (20, 22, 24, 26, 32) zum Vergleichen der Spannung am ersten Gleichstrommotor mit der Referenz-Speisespannung und zum Vergleichen der
 - 50
 - 55

the signal from encoder 20 to a voltage signal. This value is combined with the signal from the converter 28 at velocity compensator 30.

In effect the velocity command from the microprocessor results in a minor adjustment to the voltage driving the electrical motors for the take-up reel and supply reel. The new voltage signal is amplified by amplifier 34, after which it is received by the servo for the motor driving reel 12. Preferably (although not required) the new voltage signal is also added to the voltage to the motor driving supply reel 10 via summer 36 and amplifier 38, as illustrated.

If the voltage at either motor exceeds the supply reference voltage, then the velocity command to the motor is reduced. Conversely, if less than all the available voltage is being utilized, then the velocity command is increased. Another way of stating this is that if the velocity of the tape is increased then the voltage requirement at the motors is increased. If the velocity of the tape is decreased, then the voltage requirement at the motors is decreased.

The tension sensor 16 operates in conventional fashion and communicates with tension compensator 40 which is capable of adjusting the voltage driving reel 10 to maintain the desired tension in tape 14 between reel 10 and reel 12.

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If the voltage at both of the motors is less than the supply reference voltage, then the velocity command is increased by a small increment. If the voltage at one of the motors exceeds the supply reference voltage, then the velocity command is decreased by a small increment. In this manner the processor assures that the velocity of the tape while being wound from one reel to the other is maximized by driving at least one of the motors with a voltage essentially equal to the supply reference voltage, while neither motor exceeds the reference voltage.

In another embodiment of the system of the invention a processor may be used to perform all of the functions of processor 26 plus those contained within the boundaries of dotted line 42 in

Figure 1.

Claims

1. Drive apparatus of the type having a supply reel (10) for roll goods (14) driven by a first DC-motor and a take-up reel (12) driven by a second DC-motor, wherein a supply reference voltage is available, characterized in that
 - a) a comparison means (20: 22, 24, 26, 32) is provided to compare the voltage at said first DC-motor to said supply reference voltage, and to compare the voltage at said second DC-motor to said supply reference voltage, and
 - b) a control means (26, 28, 30), which is responsive to said comparison means, includes a processor (26) operative for generating a velocity command which is increased when the voltage at both of said first and second DC-motors is less than said supply reference voltage and which is decreased when the voltage at either of said DC-motors exceeds said supply reference voltage, said velocity command being operative for correspondingly adjusting said voltages at said first and second DC-motors.
2. Drive apparatus in accordance with claim 1, wherein said roll goods (14) is a magnetic tape.
3. Drive apparatus in accordance with claim 1 or 2, wherein said voltages at said first and second electrical motors are monitored through analog-to-digital converters (22, 24) by said processor (26).
4. Drive apparatus in accordance with claim 1, wherein said roll goods comprise a filament.
5. Drive apparatus in accordance with claim 1, wherein said roll goods comprise a web.

Patentansprüche

1. Antriebsvorrichtung der Bauart mit einer Speiserolle (10) für Wickelgut (14), die von einem ersten Gleichstrommotor getrieben ist, und einer Rückspulrolle (12), die von einem zweiten Gleichstrommotor getrieben ist, wobei eine Referenz-Speisespannung verfügbar ist, dadurch gekennzeichnet, daß
 - a) eine Vergleichsvorrichtung (20, 22, 24, 26, 32) zum Vergleichen der Spannung am ersten Gleichstrommotor mit der Referenz-Speisespannung und zum Vergleichen der



Spannung am zweiten Gleichstrommotor mit der Referenz-Speisespannung vorgesehen ist und

b) daß eine Regelvorrichtung (26, 28, 30), welche auf die Vergleichsvorrichtung reagiert, einen Prozessor (26) aufweist, der zum Erzeugen eines Geschwindigkeitsbefehls betreibbar ist, welcher erhöht wird, wenn die Spannung an beiden Gleichstrommotoren kleiner als diejenige der Referenz-Speisespannung ist, und welche vermindert wird, wenn die Spannung an einem der beiden Gleichstrommotoren die Referenz-Speisespannung übersteigt, wobei der Geschwindigkeitsbefehl die Spannungen am ersten und am zweiten Gleichstrommotor entsprechend einstellt.

Antriebsvorrichtungen nach Anspruch 1, bei welchem das Wickelgut (14) ein Magnetband ist.

3. Antriebsvorrichtungen nach Anspruch 1 oder 2, bei dem die Spannungen an den beiden Elektromotoren über Analog-Digital-Umsetzer (22, 24) von dem Prozessor (26) überwacht werden.

4. Antriebsvorrichtung nach Anspruch 1, bei dem das Wickelgut ein fadenförmiges Element umfaßt;

5. Antriebsvorrichtung nach Anspruch 1, bei dem das Wickelgut einen Streifen umfaßt.

Revendications

Appareil d'entraînement du type comprenant une bobine débitrice (10) pour produits enroulables (14), commandée par un premier moteur à courant continu, ainsi qu'une bobine réceptrice (12) commandée par un second moteur à courant continu, appareil dans lequel une tension d'alimentation de référence est disponible, caractérisé en ce que

a) un moyen de comparaison (20, 22, 24, 26, 32) est prévu pour comparer la tension aux bornes du premier moteur à courant continu avec la tension d'alimentation de référence et pour comparer la tension aux bornes du second moteur à courant continu avec la tension d'alimentation de référence et

b) un moyen de commande (26, 28, 30) sensible à ce moyen de comparaison est prévu, ce moyen de commande comportant un processeur (26) générant une commande de vitesse qui est augmentée lorsque la

tension aux bornes des deux moteurs à courant continu, du premier et du second moteur, est inférieure à la tension d'alimentation de référence, et qui est diminuée lorsque la tension aux bornes de l'un ou l'autre de ces moteurs à courant continu dépasse la tension d'alimentation de référence, la commande de vitesse servant à ajuster de façon correspondante les tensions aux bornes des premier et second moteurs à courant continu.

2. Appareil d'entraînement selon la revendication 1, dans lequel le produit enroulable (14) est une bande magnétique.

3. Appareil d'entraînement selon la revendication 1 ou 2, dans lequel les tensions aux bornes des premier et second moteurs électriques sont surveillées par le processeur (26) par l'intermédiaire de convertisseurs analogique-numérique (22, 24).

4. Appareil d'entraînement selon la revendication 1, dans lequel le produit enroulable est un produit filamentaire.

5. Appareil d'entraînement selon la revendication 1, dans lequel le produit enroulable est une bande.

