

Nov. 14, 1944.

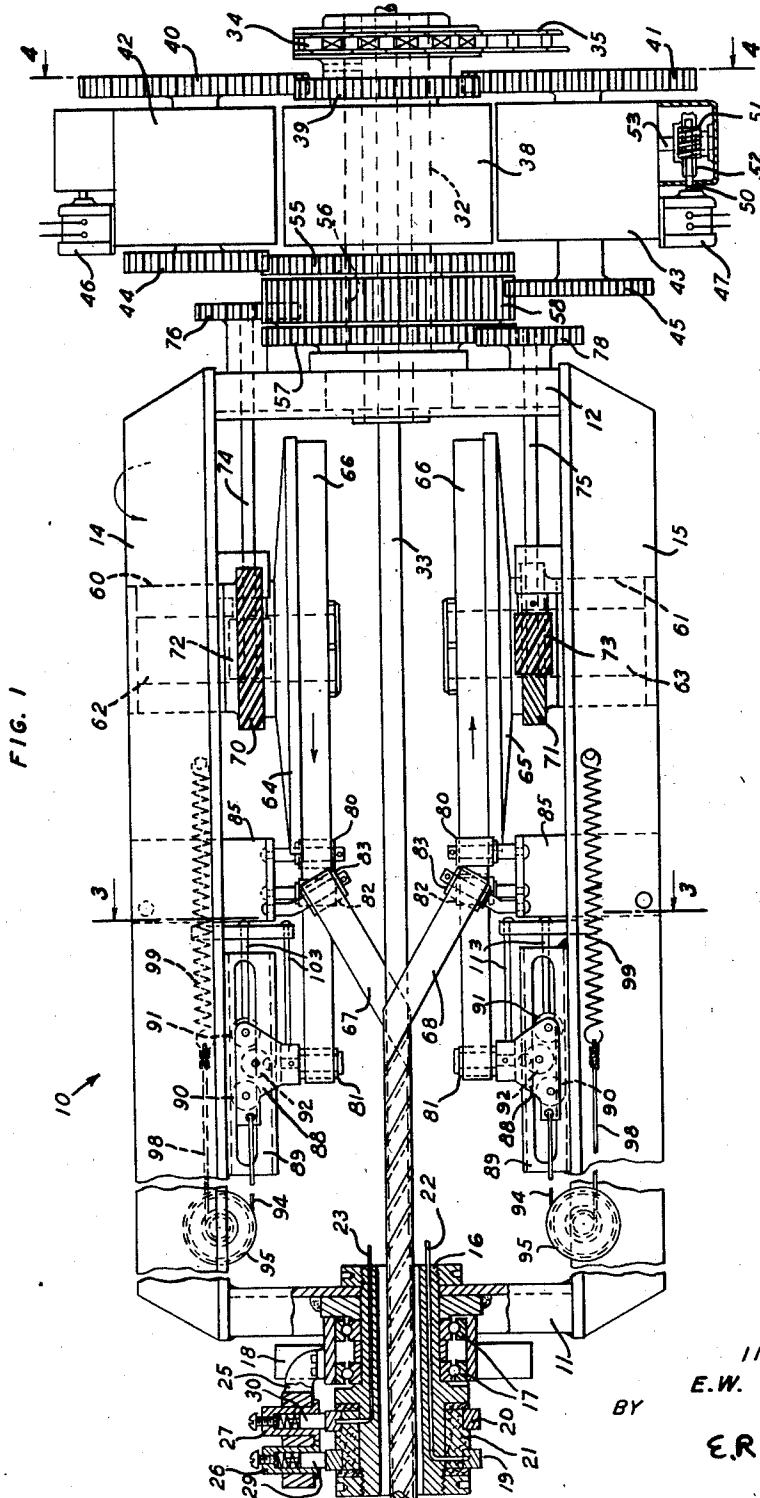
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2,362,665

UNWINDING CONTROL DEVICE

Filed Oct. 7, 1942

2 Sheets-Sheet 1



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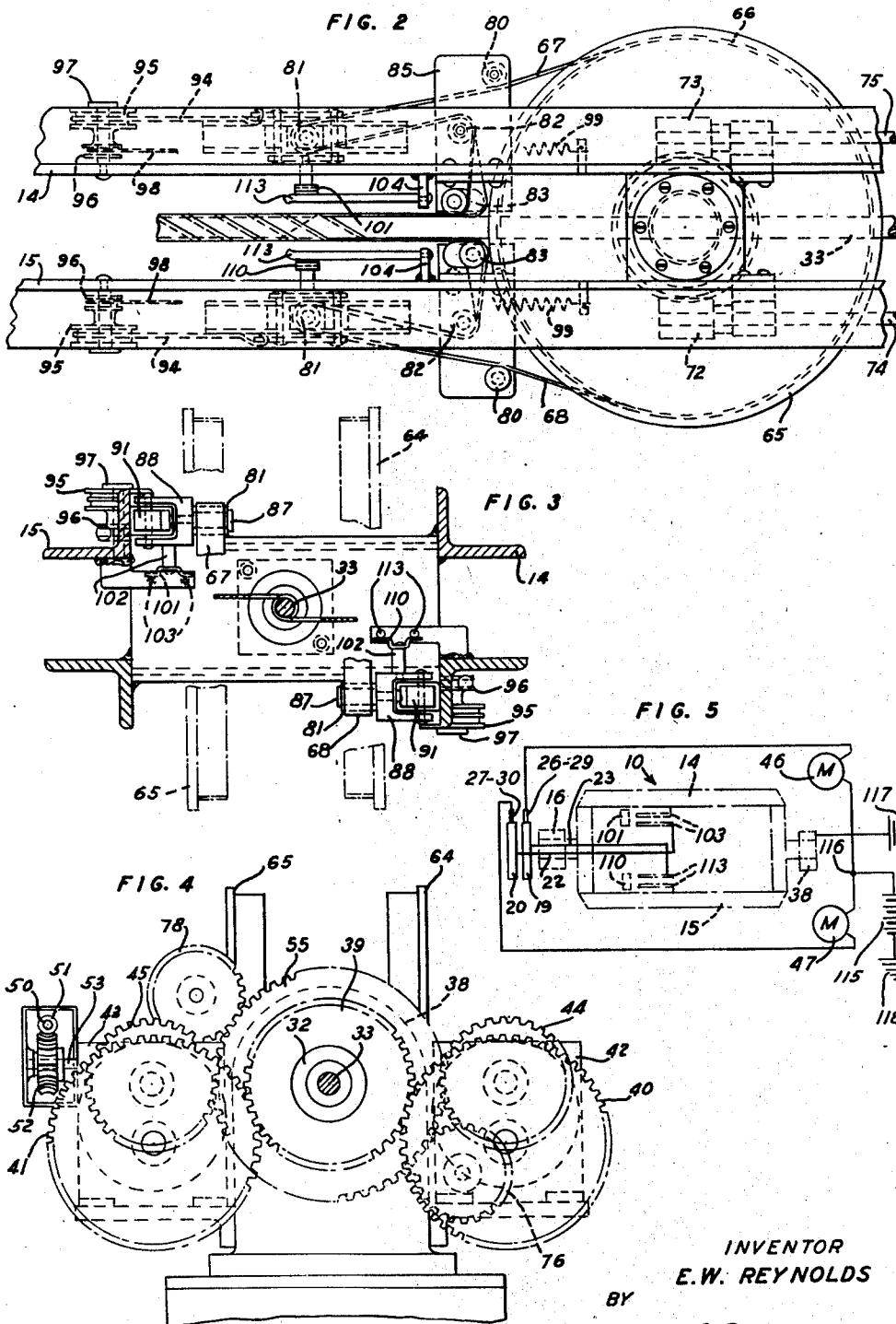
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UNITED STATES PATENT OFFICE

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UNWINDING CONTROL DEVICE

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Application October 7, 1942, Serial No. 461,223

7 Claims. (Cl. 57—15)

This invention relates to unwinding control devices, and more particularly to devices for controlling the unwinding of material in serving heads.

In stepping up the speeds of operations of material serving heads, for example those wherein tapes are served to an advancing core, numerous problems arise. The major problem is possibly the overcoming of the heavy frictional resistance of the material supply spindle bearings, which is due to the large centrifugal loads on these bearings. Other problems include the elimination of tape breakage, uneven tension thereon and overlapping thereof resulting from irregular surges of the supply pads and their holders. These surges may be caused by unbalanced pads with a heavy axis or out of round pads. All of these effects are greatly magnified by the large centrifugal multiplier inherent in high speed operations. Thus with the solution to these problems, the cancellation of the effect of all such difficulties makes possible the increasing of the speed of the serving heads to produce maximum output.

An object of the invention is to provide an unwinding control device which is efficient in operation and adapted for high speed operation.

With this and other objects in view, the invention comprises an unwinding control device particularly adapted for serving a material from a supply onto an advancing core, and including means through a variable unit under the control of the material to drive the supply to apply a given tension on the material and remove the strain of rotating the supply from the material being served.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a top plan view of the device;

Fig. 2 is a fragmentary front elevational view of a portion of the serving head;

Fig. 3 is a fragmentary sectional view taken along the line 3—3 of Fig. 1;

Fig. 4 is an end sectional view taken along the line 4—4 of Fig. 1, and

Fig. 5 is a wiring diagram illustrating a portion of the control means.

Referring now to the drawings, attention is first directed to Fig. 1, which illustrates a serving head, indicated generally at 10, and formed of end members 11 and 12 having pairs of intermediate angle members 14 and 15 with their ends secured thereto. Considering first the end

member 11, it will be observed that this member is centrally apertured to receive a hollow shaft 16 which is rigidly secured thereto. The shaft 16 is supported by bearings 17 mounted in a suitable bracket 18. An outer portion of the shaft 16 has conductor rings 19 and 20 mounted for rotation therewith on an insulating member 21. Insulated electrical conductors 22 and 23 extend through apertures in the shaft 16 to their respective rings 19 and 20. A bracket 25, mounted upon the bracket 18, serves to support terminals 26 and 27 which are electrically connected to their respective rings 19 and 20 through brushes 29 and 30. The terminals 26 and 27 are included with their brushes in the electrical circuit hereinafter described.

Referring now to the end member 12, this member is similarly centrally apertured for mounting upon a drive shaft 32, which is hollow, for the passage of a core or cable 33 therethrough. The shaft 32 is driven by a sprocket 34 operatively connected through a chain 35 to any suitable power means (not shown). A main bearing 38 is provided to support the mechanism at this, the right, end of the serving head. The main bearing may include suitable frictionless bearings (not shown), to rotatably support the hollow shaft 32. A gear 39 is fixed to the shaft 32 and caused to drive gears 40 and 41 of the input ends of variable speed transmission units 42 and 43, respectively. The transmission units may be of commercially known types having constant speed driven inputs and variable speed outputs through adjustable means controlled externally thereof. Gears 44 and 45 are mounted at the output ends of their respective transmission units 42 and 43. The speed ratio of these units may be varied by their respective motors 46 and 47. The mechanisms linking the motors with the transmission units are identical and the illustration of one is believed sufficient for both units.

Attention is, therefore, directed to the lower unit in Fig. 1, wherein the motor 47 is shown provided with a shaft 50 for driving a worm 51, the latter driving a worm gear 52 which in turn drives its respective shaft 53. The mechanism associated with the shaft 53 is not illustrated in detail, it being understood that this structure may be of the conventional type to bring about changes in the transmission unit to vary the speed ratio of the gears 41 and 45. The gear 41 being driven at a constant speed, this change will bring about a change in the speed of rotation of the gear 45. The same change

will take place in the unit 42 through the control of its motor and connecting mechanism.

The gear 44 interengages a gear 55, the latter being rotatably mounted upon the hollow shaft 32 and including a connecting bearing portion 56 which connects the gear 55 with a like gear 57. Thus, rotation of the gear 55 by its gear 44 will impart rotation to the gear 57. The gear 45 drives a gear 58 which is rotatably mounted upon the connecting bearing 56 disposed between the gears 55 and 57. It will be noted that the gears 40 and 41 are of the same size and, when driven by the common gear 39, the input of both transmission units 42 and 43 will be driven at the same speed. The output gears 44 and 45 are also identical, as are the gears 55, 57 and 58.

Attention is now directed to the material supply units in the serving head. These units are identical in structure, the only difference being that they are mounted upon opposite sides of the head. Between the pairs of angle members 14 and 15 are mounted bearings 60 and 61 for their respective shafts 62 and 63. These shafts support holders 64 and 65 respectively for pads 66 of material which in the present instance is tape and identified by reference numerals 67 and 68 respectively. Worm gears 70 and 71 are fixedly mounted upon their respective shafts and are adapted to be driven by worms 72 and 73 respectively. The worms 72 and 73 are mounted upon shafts 74 and 75 respectively, which are journaled in suitable bearings and have gears 76 and 78, respectively, mounted upon the outer ends thereof. These gears, as illustrated in Fig. 1, are positioned to be driven by gears 58 and 57 respectively. Thus far it is apparent that separate means is provided to drive the material supplies at variable speeds.

The means to control the motors 46 and 47 to bring about variations in the speeds of rotation of the supplies, will now be described. This means is under the control of the tapes 67 and 68. First consider the travel of the tape from each supply. Referring first to the supply or pad on the holder 64, attention is now directed to Fig. 2, where the tape 67 from this pad travels beneath a roller 80, around a roller 81, back around a roller 82, and finally around a roller 83 to the core 33. The rollers 80, 82 and 83 are mounted upon suitable spindles supported by a bracket 85, the latter being fixedly mounted between the pairs of angle members 14. The material, in passing from the roller 80 around the roller 81 and back to the roller 82, forms a loop several inches in length which may be varied due to variations in tension on the material, to cause lateral movement of the roller 81 and its supporting means. This roller (Figs. 1 and 3) is supported by a spindle 87 carried by a cradle 88, the latter straddling a housing 89 and being of the general contour shown in Fig. 1. The housing 89 is hollow and rectangular in general contour, to receive a set of three rollers or bearings 90, 91 and 92 which are rotatably mounted upon shafts carried by the leg portions of the cradle 88. The rollers 90 and 91 have their axes lying in a common plane, whereas the axis of the roller 92 is spaced therefrom and parallel therewith, the purpose being to cause the rollers 90 and 91 to ride along one wall of the housing 89 and the roller 92 to ride along the opposite wall thereof. The rollers, therefore, provide a support for the cradle and for the roller 81, but hold the roller in a definite plane with respect to the other

rollers 80, 82 and 83 but to allow movement of the roller 81 with respect to its associated rollers in the given plane.

Means is provided to normally urge the roller 81 in a direction away from its supply, to maintain a given tension on the material yet be affected by any increase in tension on the material to allow the roller to move toward the supply. This means consists of a cable or other suitable means 94, having one end connected to the cradle 88 while the other end is given a desired number of turns about a large pulley portion 95 to which the cable is secured. A small pulley portion 96 of the same unit is fixed to the portion 95, this unit being rotatably supported on a spindle 97, the latter being mounted upon a suitable angle member of the pair 14. A cable or other suitable means 98 has one end secured to the pulley portion 96 and given a desired number of turns thereon, the opposite end of the cable being secured to one end of a spring 99 which has sufficient force to apply a desired tension on the material through the cable and pulley connections with the roller 81 or its cradle 88.

An electrical contact 101 is supported by the cradle 88 and insulated therefrom, by suitable means such as a member 102, to move with the cradle and the roller 81 during any variations in the loop of the material passing about the roller. Contact strips 103, disposed in parallel spaced positions (Figs. 2 and 3), are supported by a suitable bracket 104 mounted upon one of the angle members 14, and are positioned to be engaged by the contact 101 during the travel of the cradle 88. One of the contact strips 103 is electrically connected to one of the angle members 14 as shown in Fig. 5. The contact strips 103 are positioned, however, so that the contact 101 will not engage them until the cradle reaches approximately the mid point of its complete, possible, travel toward the supply. The contact strips are of sufficient length, however, to maintain electrical connection with the contact should the cradle be caused to travel a greater distance toward its supply. Through this structure, as will hereinafter be described, the circuit to the motor 47 will be controlled.

In view of the fact that the tension control means for the material 68 is identical to that just described for the material 67, it is thought unnecessary to repeat this description and for this reason like reference numerals are given to all of the parts of the control for the material 68 as were given for the control of the material 67 except for a contact 110 and contact strips 113, as these are shown in the wiring diagram and need to be separately distinguishable from the contact 101 and contact strips 103.

Attention is now directed to Fig. 5, wherein the various features previously described are given like reference numerals in the wiring diagram. A source of electrical energy is indicated at 115. It will be apparent that at all times the controls of the motors 46 and 47 are placed at their respective contacts and contact strips 110—113 and 101—103, respectively. Thus, upon movement of the contact 110 into electrical engagement with its strips 113, a circuit, completed through the motor 46, may be traced from the source 115, through connection 116, motor 46, terminal and brush connections 25—29, ring 19 through the contacts 110—113, through the frame of the head 10, to ground 117 and back to the source 115 through ground 118. The circuit for the motor 47 may be traced in a similar manner from the

source 115, through connection 116, motor 47, terminal and brush unit 27—30, ring 20, through contacts 101—103, through the frame of the head 10, to ground 117 and back to the source 115 through the ground 118.

Considering now the operation of the device, let it be assumed that the tapes or materials 67 and 68 are secured in a conventional manner to the core 33, that the core is advanced by suitable means (not shown), and that the serving head is rotating in the direction of the arrow (Fig. 1). If desired, the advancing means for the core and the driving means for the device may be one and the same or so linked together that they operate in synchronism one with the other. During rotation of the serving head 10, the tapes are wound spirally upon the core. At the beginning of the operation with full supply pads 66, the holders 64 and 65 will be rotated at their minimum speeds, the variable transmission units 42 and 43 having been previously adjusted for this purpose. With the springs 99, through their associated connecting means, linking them with their cradles 88, constant and like tensions are created in the tapes. However, as the materials or tapes are withdrawn from their supplies at constant linear speed due to the constant speed of travel of the core, the reduction in the circumferential measurements of the supplies necessitates an increase in the rotary speed of the holders 64 and 65. The pull on the tapes as they are served to the core will not increase this rotary speed of the holders, and as a result portions of the loops at the rollers 81 are used, causing movement to the right of the cradles 88 to eventually move the contacts 101 and 110 into electrical engagement with their contact strips 103 and 113. When this occurs, the electrical circuits through the motors 46 and 47 are completed, causing variation in the transmission units 42 and 43 and causing an increase in the rotary speed of the holders 64 and 65. This operation continues at intervals during the rotation of the serving head so as to increase the rotary speed of the supplies with the decrease in the diameters or circumferential measurements thereof. As a result, the cradles 88 remain within approximately the centers of their housings, alternately causing closure of the electrical circuits when their respective loops in their tapes are shortened, and opening the circuits through the forces of their springs 99 when the rotary speeds of the supplies have been increased desirably. During this operation it will be apparent that the cradles 88 move in paths parallel with the core and the axis of rotation of the serving head, the purpose for this being to cancel the effect of centrifugal force. Furthermore, the cradles are supported by and move on the roller bearings 90, 91 and 92, minimizing any frictional resistance.

From the previous description it may have been understood that the supplies 66 and their holders 64 are under the direct influence of the gears 44 and 45. It is true that the speeds of rotation of the supplies and their holders are completely governed through the trains of gears linked to the main power means or gear 39 with their intermediate variable speed transmission units 42 and 43. However, the fact remains that the gears 57 and 58 are in effect sun gears about which planet gears 76 and 78 travel during the rotation of the serving head. The sun gears, however, if held stationary would cause rotation of the planet gears at constant speeds to impart constant rotary movements to the holders and their sup-

plies. This result, however, is not desired in the present instance and it is through the other gear trains that the sun gears 57 and 58 may at times be rotated with the serving head so that there will be no rotary movement of the supplies, while at other times the sun gears may be rotated together or independently at like or different speeds, to bring about rotation of their supplies in the desired directions. As a result, the supplies are kept in pace with the linear speed of the material to the core as they decrease in size, and their control means operate independently of each other. For example, the supplies 66 may be identical when originally mounted on their holders. Due to the fact that one tape, for example, tape 68, is wound upon the tape 67 while the latter is wound directly upon the core, it may be said that the supply for the tape 68 may decrease in size faster than that for the tape 67. In this instance the advantage of controlling each supply separately is apparent.

After the supplies of tape have been exhausted, the device may be stopped and new supplies inserted in place. At this time it is necessary for the operator, through suitable means not shown, to return the controls for the variable speed transmission units 42 and 43 to their starting positions. After this has been accomplished and the new tapes secured to the core, the device may again be set in operation. The device may be stopped prior to the exhausting of the tape, which in most instances is desirable, and in this case there are two intervals, at the beginning and at the end of the operations, when the device is operating at ascending and descending speeds. During these intervals, it should be understood that through the direct connection at the gear 39 with the driving means, the speed of rotation of the holders is in direct proportion to the speed of rotation of the serving head. By this means the speed of the serving head may be greatly increased as the effect of centrifugal force, regardless of the speed of the head, is eliminated through the driving of the supplies.

Although specific improvements of the invention have been shown and described, it will be understood that they are but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined by the appended claims.

What is claimed is:

1. An unwinding control device comprising a rotatable supply of material whose circumferential dimension varies with the unwinding of the material therefrom, means to move the supply in a circular path about an advancing core to cause wrapping of the material on the core and unwinding of the material from the supply, means to create a given tension in the material, and means responsive to any variations in the tension in the material to rotate the supply at varied speeds.

2. An unwinding control device comprising a rotatable supply of material whose circumferential dimension varies with the unwinding of the material therefrom, means to move the supply in a circular path about an advancing core to cause wrapping of the material on the core and unwinding of the material from the supply, means to create a given tension in the material, and means responsive to any variations in the tension in the material to rotate the supply at speeds variable with the said dimensions.

3. An unwinding control device comprising a rotatable supply of material whose circumferen-

tial dimension varies with the unwinding of the material therefrom, means to move the supply in a circular path about a core to cause wrapping of the material on the core, a unit mounted for movement in a path parallel with the core and adapted to create a given tension in the material, and means under the control of the unit to rotate the supply at varied speeds.

4. An unwinding control device comprising a serving head rotatable about an advancing core, a supply of material whose circumferential dimension varies with the unwinding of the material therefrom mounted for rotation in the head, means to feed the material to the core, and means including a planetary gear train to rotate the supply at speeds variable with the said dimensions.

5. An unwinding control device comprising a serving head rotatable about an advancing core, a supply of material whose circumferential dimension varies with the unwinding of the material therefrom mounted for rotation in the head, means to feed the material to the core, means including a planet gear supported by the head and adapted to travel with the head and about a sun gear to cause rotation of the supply, and means to cause rotation of the sun gear to cause variation in the speed of rotation of the supply with variations in the said dimension thereof.

6. An unwinding control device comprising a serving head rotatable about an advancing core, a supply of material whose circumferential dimension varies with the unwinding of the material therefrom mounted for rotation in the head, means to feed the material to the core, means including a planet gear supported by the head and adapted to travel with the head and about a sun gear to cause rotation of the supply, and a variable speed unit adapted to cause rotation of the sun gear at varying speeds to cause rotation of the supply at increasing speeds with the decreasing dimensions thereof.

7. An unwinding control device comprising a serving head rotatable about an advancing core, a supply of material whose circumferential dimension varies with the unwinding of the material therefrom mounted for rotation in the head, means to feed the material to the core, means including a planet gear supported by the head and adapted to travel with the head and about a sun gear to cause rotation of the supply, a variable speed unit adapted to cause rotation of the sun gear at varying speeds to cause rotation of the supply at increasing speeds with the decreasing dimensions thereof, and means under the control of the material to control the variable speed unit.

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