Feb. 4, 1936. E. CANNITY 2,029,854

AUTOMATIC VARIABLE SPEED DRIVE FOR TEXTILE MACHINES

Filed Aug. 3, 1932 2 Sheets-Sheet 1

Fig. 1.

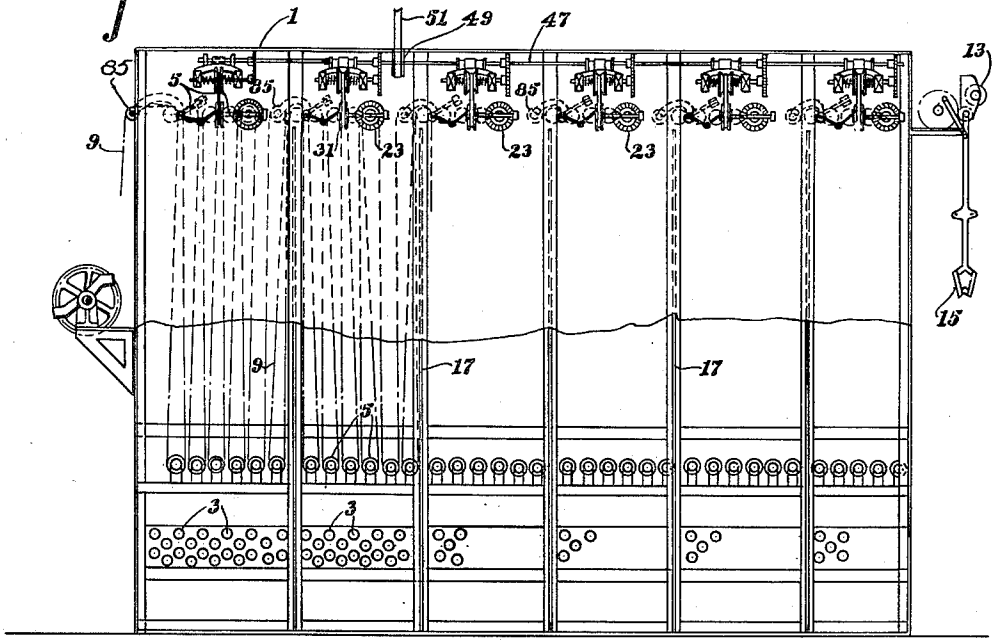
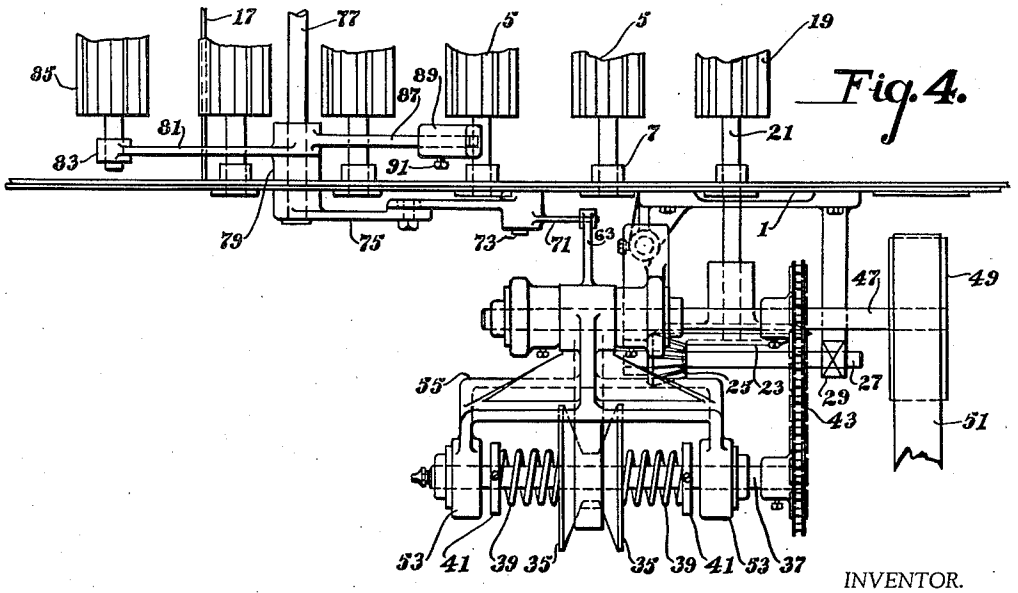


Fig. 4.



INVENTOR.
Ernest Cannity,
BY
Robert K. Randall,
ATTORNEY.

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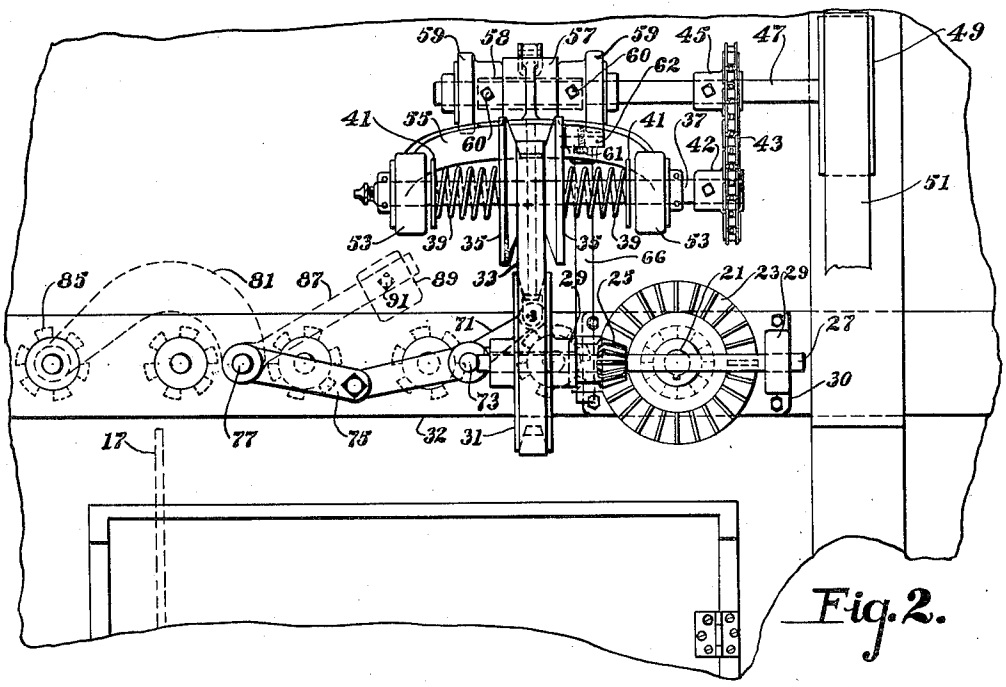
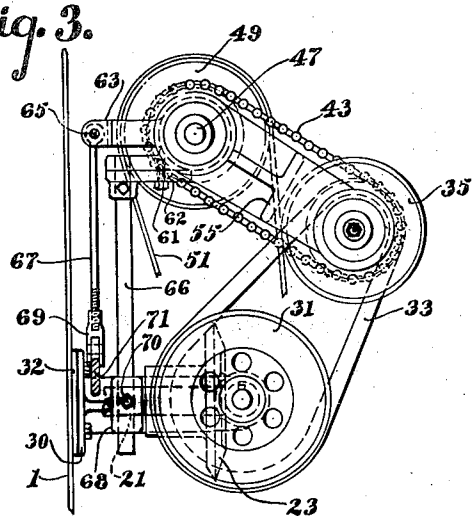


Fig. 2.

Fig. 3.



INVENTOR.
Ernest Cannity,
BY
Robert K. Randall,
ATTORNEY.

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UNITED STATES PATENT OFFICE

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AUTOMATIC VARIABLE SPEED DRIVE FOR TEXTILE MACHINES

Ernest Cannity, North Adams, Mass., assignor to The James Hunter Machine Company, North Adams, Mass., a corporation of Massachusetts

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10 Claims. (Cl. 271—2.3)

The invention has relation to variable speed driving devices which are used in the textile industry and in other arts for correlating the rate of operation or of delivery of one machine, with the rate of feed or operation of a succeeding machine, or for thus correlating the working rates of two or more working elements in the same machine. The need for thus adjusting the operating speeds of successive machines or sub-organizations of a single machine arises frequently in the textile industry and other arts especially where continuous material such as cloth is passed from one machine to another, each of which includes means for propelling the continuous material, or where a single machine performing successive or repeated operations on the continuous material has to propel the material through engagement therewith at a plurality of points.

This coordination of the speeds of operation of successive machines or parts of machines is known as range driving, and has assumed great importance under modern continuous methods of processing textile fabrics.

In dealing with cloth, the situation is greatly complicated by the changes in the length of fabric incident to variations in its moisture content, and many of the most important steps in cloth finishing comprise the putting in or the taking out of this moisture content.

In particular, this change in the length of fabrics has been especially troublesome in putting cloth through dryers in which a high temperature is maintained, and in which for economy of space the cloth is caused to follow a lengthy zigzag course to prolong its exposure to the heated air confined in the dryer. The length of the cloth within the dryer enclosure is too great to permit of propelling the cloth entirely therethrough by pulling it onward at a single point, and owing to its marked changes in length within the machine it has been almost impossible to propel it through engagement at a number of points in exact accordance with its needs.

Carbonizing dryers have been especially characterized by faulty operation, because the woolen and worsted fabrics treated therein, by nature prone to shrink excessively, are subjected to temperatures around 260° F. while wet in order to burn and char all particles of vegetable matter which may be present, the moisture being likewise removed from the fabric in the course of its passage through the machine. In these machines, the cloth passes back and forth around a great number of rolls defining the ends of the numerous passes, certain of such rolls being power driven in unison to propel the cloth, while the rest merely guide the cloth. When the cloth shrinks it tightens and puts such a strain on the rolls as often to make it very hard to turn them in their bearings, and sometimes the cloth is even torn apart; additionally, the excessive tension stretches the cloth to an extent which often produces an uncontrolled and harmful variation in its weight. Also, other factors may cause undesired changes in tension, such as a driving roll which is warped or slightly larger or smaller in diameter than the other driving rolls; if a single driving roll be a trifle larger than the others it will put the cloth going to it under a tension, and create a slack in the cloth which has passed it. This tension gradually builds up cumulatively in the course of several hours' running, putting an extra load on the bearings of the rolls which in turn increases their resistance to rotation and their tendency to hold back on the cloth, thus increasing the tension in a vicious circle, until it is very often necessary for four or five men to have to go inside the hot dryer and pull and coax the material past the drive rolls, to gain enough slack to ease up the strain on the bearings and permit the machine to turn.

If the driving roll be a trifle too small or if the drying of the fabric causes the fabric to lengthen as the moisture leaves it, the fabric will run slack, always causing it to wrinkle and to fold over at the selvage, especially where air is blown transversely across the fabric to expedite the drying, in which case the blast works the goods over sidewise across the machine so that they very often come out incompletely dried in a rope or snarl, while the varying uniformity of the drying resulting from folding produces streaky cloth.

With the aim of overcoming these drawbacks and to provide accurately correlated driving speeds for successive elements which operate on traveling material to effect and govern the feed, the invention comprises the combination with the means governing the forward feed of the material and operating at spaced points in the length thereof, of variable speed power transmitting devices including a cone or cones and a belt which is automatically shifted by the tension or weight of the traveling material to vary the driving ratio of the feed governing devices operating at one of the said spaced points so as to keep the tension or weight of the intermediate stretch of traveling material within the desired limits. Preferably, the invention includes a pair of opposed cones

yieldingly pressed toward each other with the belt wedging between them and arranged to have its tension increased or decreased in accordance with variations in the tension or weight of the traveling material, so that the belt will automatically seek the proper effective diameter of the cones to proportion the driving speed to the needs of the traveling material.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which,—

Fig. 1 is a side elevation of a carbonizing dryer, showing a number of the automatic variable speed devices of the invention applied thereto.

Fig. 2 is a side elevation of one of the automatic variable speed drive units of Fig. 1.

Fig. 3 is an end elevation of the parts of Fig. 2.

Fig. 4 is a plan view of one of the said units showing its relationship to the driving and other rolls of the carbonizing dryer of Fig. 1.

The invention is applicable to a great variety of uses, in general wherever two machines operating in succession on the same traveling material need to be correlated in their speeds of operation, and in the textile industry is of particular use in connection with carbonizing dryers, crabbing machines, back washers, continuous cloth washers, loop dryers, vacuum extractors, acid and wetting-out tanks, and other machines commonly employed in cloth finishing and processing. Its use is illustrated in the drawings in connection with a carbonizing dryer of typical construction, comprising a housing 1 in which are heating coils 3, and a great number of idler rolls 5, usually formed of slats, and mounted for free rotation in bearings 7 in connection with the housing 1. The cloth 9 enters the housing over a shiftable feeler- or dance-roll 85, described hereinafter, and through a slot in the housing, and then passes alternately over the rolls at top and bottom in runs which extend substantially vertically of the machine. The cloth emerges at the top of the opposite end of the machine, passing over rolls 13 and through a folder 15. Baffles 17 extend across the full width of the machine and up to the upper rolls at intervals, to divide the interior of the dryer into sections in which different conditions of heat and moisture may be maintained.

In accordance with the invention, each section is provided with a roll 19 which is power driven so as to propel the cloth through frictional engagement as the cloth passes around it. Thus, as shown in Fig. 4, this roll 19 is fixed on a shaft 21 which is extended outward beyond the side of the housing 1 and has fixed thereon a bevel gear 23 which engages with a bevel pinion 25 fixed to a shaft 27 mounted in spaced and parallel relation to the side of the housing 1 by bearings 29 at the extremities of arms formed on a plate 30 bolted to the panel 32 on the housing. Also fixed on this shaft 27 is a pulley 31, preferably though not necessarily of inverted V-face, around which engages a V-section belt 33.

The V-belt 33 passes around and between two obtuse conical sheaves 35 which are splined to a shaft 37 so as to turn in unison therewith, and to slide axially thereon, these cones 35 being arranged with their small ends in confronting relation and being yieldingly pressed toward each other by expanding coil springs 39 or their equivalent surrounding the shaft 37 and confined between their respective sheaves 35 and collars 41 fixed to the shaft by set screws which permit shifting of the collars to adjust the tension of the springs and hence the force with which the cones 35 are pressed toward each other.

The shaft 37 is driven, by a sprocket 42 fixed thereon and a chain 43, from a sprocket 45 fixed on the power shaft 47 of the machine, which shaft may be driven in any suitable or preferred manner as by the pulley 49 fixed thereon and belt 51 connecting the shaft with any suitable source of power.

The shaft 37 with its cones and springs is carried in bearings 53 in the ends of a yoke 55 which swings freely about the axis of the main drive shaft 47, the yoke 55 having a bearing 57 fitting a sleeve 58 extending along the shaft 47 between two ball bearings 59 one of which is attached by screw 61 to a plate 62 fixed to the top end of a rod 66 fixed in a sleeve 68 formed in the left-hand arm on the plate 30, the set screw 70 providing for adjustment of the whole up or down to locate the shaft 47 to suit the length of the belts 33. Clamping screws 60 combine the bearings 59 rigidly with the sleeve.

The yoke 55 has an arm 63 which extends beyond the bearing 57 in the yoke and stands inward toward the side of the housing 1. A link 67 is attached to this arm 63 at its upper end by a pin 65, and its lower end is joined by a screw threaded clevis 69 (providing for length-adjustment) with one arm of a lever 71 pivoted on a stud 73 standing out from the side of the housing 1. The other end of this lever is joined by bolt-and-slot connection to an arm 75 fixed on a rockshaft 77 extending across the width of the machine and mounted for free rocking movement in bearings 79 in each side of the housing 1.

On rockshaft 77, just inside the housing, are fixed levers having in their left-hand arms 81 bearings 83 in which are carried the pintles of a feeler- or dance-roll 85. The other ends 87 of these levers are provided with slidable weights 89 held in adjusted position by set screws 91. The pintles of the feeler-roll 85 are short enough to permit free swinging movement of the roll up and down within the housing 1 without striking the inward sides thereof. The feeler-roll is thus mounted with capacity to rise and fall in accordance with the reduction or increase in the tension of the cloth, which passes around it as shown in Fig. 1, the arms 81 being curved upward to clear the pintles of the idler roll located between the feeler-roll and the rockshaft 77.

By this arrangement a state of equilibrium is established between the tendency of the coil springs 39 to increase the effective diameter of the bearing circle on their surfaces engaged by the V-belt, which must necessarily involve a lowering of the cones and the end of the yoke 55 bearing them, and the tendency of the cloth to pull and press down on the feeler-roll 85, abetted by the weight of the roll, with resultant elevation of the outward end of the yoke 55 which necessarily forces the belt to spread the cones and assume a smaller effective driving diameter thereon. The cones are always driven at a constant speed of rotation; if the tension of the cloth passing over the feeler-roll 85 decreases, this roll rises, and through the intermediate linkage permits the descent of the free end of the yoke, which in turn permits the cones to move closer together and to engage the V-belt on larger circles which are nearer to the bases of the cones, thereby increasing the rate at which the pulley 31 is driven, and thus in turn causing the feed-roll 19 driven by this pulley to be rotated faster, with the result that the cloth is pulled ahead faster with accompanying increase in its tension and the desired prevention of slack running. However, when the

tension surpasses that for which the device is set, the feeler-roll 85 is pulled downward by the tension of the cloth itself, and causes the yoke 55 to be swung upwardly, increasing the spaced relation between the center of the pulley 31, and the common center of the two cones 35. Since the belt is of fixed length, the increased tension on the belt forces it to wedge the cones apart against the resistance of their springs 39, so that the belt engages the cones on a circle of smaller effective pitch or driving diameter, thus causing the pulley 31 and hence the feed-roll 19 to be rotated more slowly and thus diminishing the rate at which the cloth is pulled forward by the feed-roll, with resulting reduction in the tension on the cloth preceding the feed-roll.

Obviously, the feeler-roll can be located at any point, and either in advance of or following the feed-roll whose rate of rotation it controls. In the present instance, where the dryer is divided up into sections definitely separated from each other by the baffles 17, and with each section equipped with its own feed-roll and a separate automatic variable speed drive controlling such feed-roll, the location of the feeler-roll just after the preceding feed-roll (where the slack or tension will be most pronounced) and substantially at the beginning of the passage of the cloth through the following section is of advantage, because thus each section may be handled as an independent unit and run at any desired tension, regardless of the other sections, if desired, and hence of course can be adjusted to match or to contrast with other sections. The speed at which the cloth is fed through any section is controlled by the tension on the feeler-roll 85 associated with the feed-roll propelling the cloth through that section, and the resistance of the feeler-roll to displacement can be easily governed by adjusting the position of the sliding weights or counterbalances 89 on arms 87 to attain any desired condition of tension in the length of cloth extending between each feeler-roll and its associated feed-roll.

In the illustrated arrangement of a plurality of automatic variable speed driving devices each applied to successive sections of the dryer, while it is possible to create and maintain totally different conditions of tension in different sections, yet all the sections are so interrelated that an accidental change in the tension in one section will cause a corresponding and compensating change in all of the other sections controlled by variable speed drives. For instance, if the feed-roll should swell in the third section reached by the cloth, and try to feed the cloth faster than the feed-rolls preceding it, the succeeding driving units, noting the slack in the cloth coming to them, would speed up to feed the cloth forward at the same rate as it entered their respective sections; in the meantime, the feeler-roll associated with the swollen feed-roll would be pulled down by the increased tension in that section with resulting reduction in the rate of rotation of the defective feed-roll, and after such feed-roll had settled down to its corrected rate the two successive driving units would correspondingly resume their relative rate; and the dryer will operate to maintain a definite ratio of tensions between all the sections even though the tensions be purposely different in the different sections. The tension can never accidentally build up to any appreciable extent, nor can any notable degree of slack develop. The dryer thus equipped with the devices of the invention hence can be used to effect elongation of the cloth under full control, so as to get any desired degree of tension, and thus errors resulting from excessive fulling of the cloth may be corrected. Each section of the dryer equipped with the improved drive devices becomes in effect independent of all the other sections so far as conditions of tension are concerned, even though it keeps in exact step with all the other sections and handles the cloth at exactly the same rate as all the other sections.

The devices of the invention are applicable equally well to the handling of cloth or other continuous traveling material whether in open and flat relation or in rope formation and of circular section.

While I have illustrated and described a certain form in which the invention may be embodied, I am aware that many modifications may be made therein by any person skilled in the art, without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to the particular form shown, or to the details of construction thereof, but

What I do claim is:—

1. In apparatus for operating on continuous material, in combination, means governing the forward feed of the material operating at spaced points in the length of the material, power-transmitting devices for such governing means including a drive-shaft, a pair of opposed cones yieldingly pressed toward each other and having their axis disposed so as to swing about the axis of the drive-shaft, a pulley actuating the governing means, a belt between the cones and the pulley, means controlled by the material between the said spaced points to swing the cones about the axis of the drive-shaft to change the spacing of the axis of the cones from that of the pulley, and means for driving the opposed cones from the drive-shaft.

2. Tension-controlling devices for traveling continuous material having in combination means engaging the material to make it travel, power-transmitting devices for such means including a drive-shaft, a pulley of fixed diameter and a pulley of variable effective diameter, and a belt encircling both pulleys, one of such pulleys rotating about a shifting axis apart from that of the drive-shaft, and means governed by the tension of the material to shift such axis to vary the effective diameter of the second-named pulley.

3. Tension-controlling devices for traveling continuous material having in combination means engaging the material to make it travel, power-transmitting devices for such means including a drive-shaft, a pulley of fixed diameter and a pulley comprising opposed cones yieldingly pressed toward each other, one of such pulleys being disposed so that its axis is apart from that of the drive-shaft, a belt engaging the first pulley and the cones of the second pulley, and means governed by the tension of the material to vary the tension of the belt.

4. In apparatus for operating on continuous material, in combination, means operating at spaced points in the length of the material governing its forward feed, power-transmitting devices including a pulley, and opposed cones yieldingly pressed toward each other, a drive-shaft out of line with the pulley and the cones, means for transmitting driving power from the drive-shaft to one of these latter elements, a belt wedging between the cones and also engaging the pulley, and means controlled by the tension of the material between the said spaced points for

causing a change in the relative spacing of the axes of the cones and of the pulley, so as through varying the tension on the belt to vary the effective diameter of the cones where engaged by the belt.

5. Tension-controlling devices for traveling continuous material having in combination a feeler movable under changes in the tension of the material, a drive-shaft, opposed cones yieldingly pressed toward each other, means causing the feeler to produce shift of the axis of the cones about the axis of the drive-shaft, and a wheel in a driving relation with the cones which varies in ratio in accordance with the said shift of the cones.

6. Tension-controlling devices for traveling continuous material having in combination a material-feeding element, a driving pulley connected therewith, a drive-shaft, opposed sheaves yieldingly pressed toward each other, means providing for swinging of the opposed sheaves toward and from the pulley about the axis of the drive-shaft, a V-belt engaging the pulley and both sheaves, means for driving the sheaves, and means governed by the tension of the traveling material for changing the spaced relation between the pulley and the opposed sheaves.

7. In apparatus for operating on continuous material, in combination, a feeler movable under changes in the tension of the material, a driving belt, a cone engaged by the belt, and intervening linkage causing the pull of the belt on the cone to be counteracted by the pull of the material on the feeler, whereby an increase in the latter pull changes the effective diameter of the cone engaged by the belt.

8. In a range drive, in combination, feed-rolls engaging continuous material at a plurality of spaced points in its length intermediate idler rolls disposing the material in a plurality of runs, feeler-rolls displaceable under changes of tension in the material and engaging the latter at points in the material's length relatively close to the preceding and remote from the following feed-roll; and means for varying the rate of feed of the feed-roll next following a feeler-roll in response to the displacement of the feeler-roll.

9. In apparatus for operating on continuous material, in combination, a feed-roll feeding the material, a pulley driving the feed-roll, a belt encircling the pulley, a drive-shaft, opposed cones yieldingly pressed toward each other and having their small ends confronting each other within the circuit of the belt, means for rotating the cones, from the drive shaft, a lever carrying the cones, with their axis eccentric to the axis of the drive-shaft, and a feeler-roll displaceable by the pressure of the material thereagainst and thereby shifting the lever.

10. A variable speed drive comprising, in combination, an element to be driven, a pulley actuating such element, a source of power, a drive-shaft transmitting such power, a pair of opposed cones yieldingly pressed toward each other and having their axis disposed so as to swing about the axis of the drive-shaft, a belt between the cones and the pulley, means to swing the cones about the axis of the drive-shaft to change the spacing of the axis of the cones from that of the pulley and thus cause the belt to travel on a larger or smaller circuit of the cones, and means to drive the opposed cones from the drive-shaft.

ERNEST CANNITY.