Aug. 27, 1940. J. G. KERSHAW 2,212,691

CORD PREPARING MECHANISM

Filed Sept. 19, 1938 3 Sheets-Sheet 1

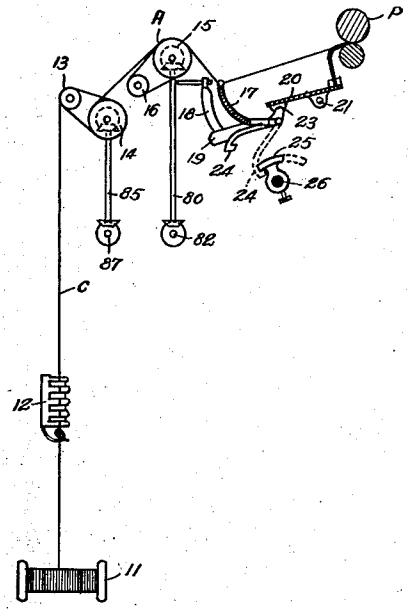


Fig. 1.

Fig. 2.

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CORD PREPARING MECHANISM

Filed Sept. 19, 1938 3 Sheets-Sheet 2

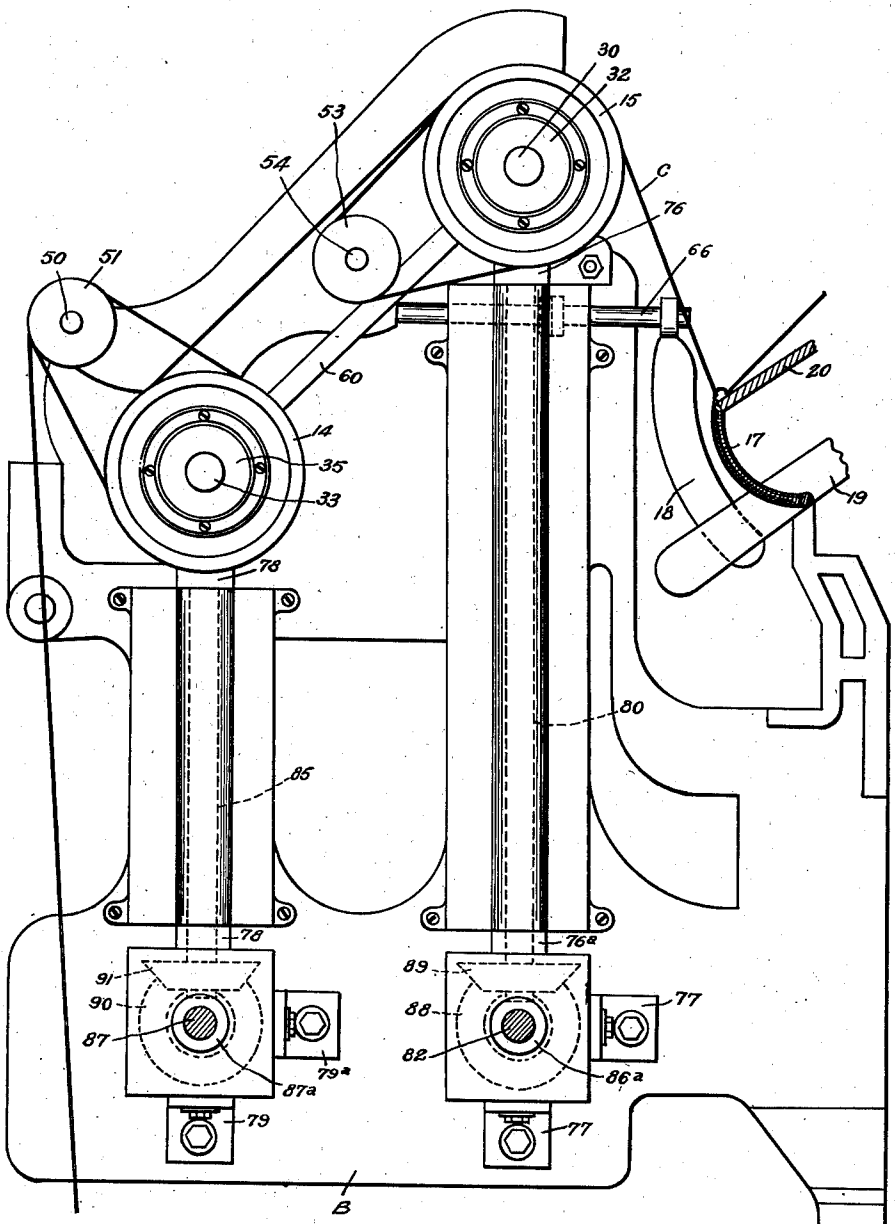


FIG. 3.

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CORD PREPARING MECHANISM

Filed Sept. 19, 1938 3 Sheets-Sheet 3

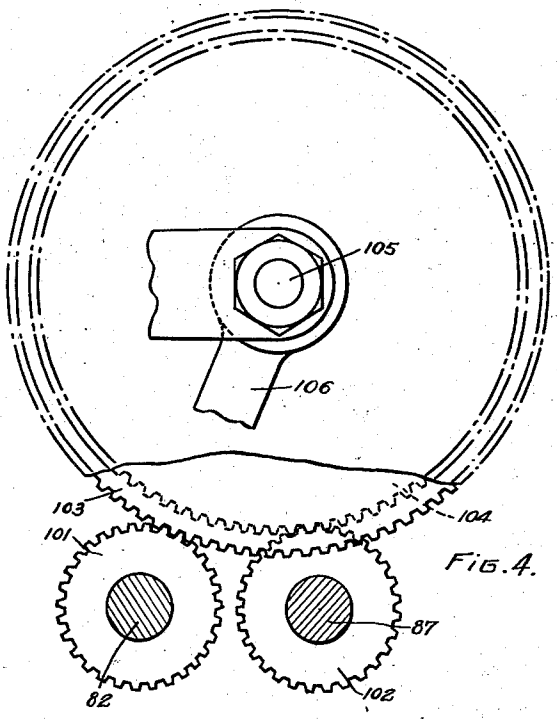


Fig. 4.

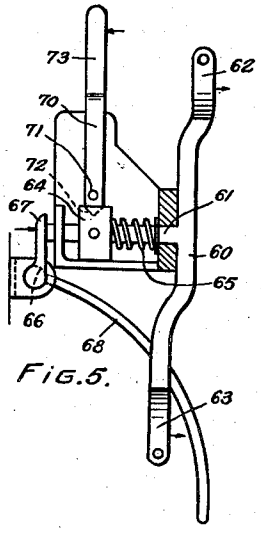


Fig. 5.

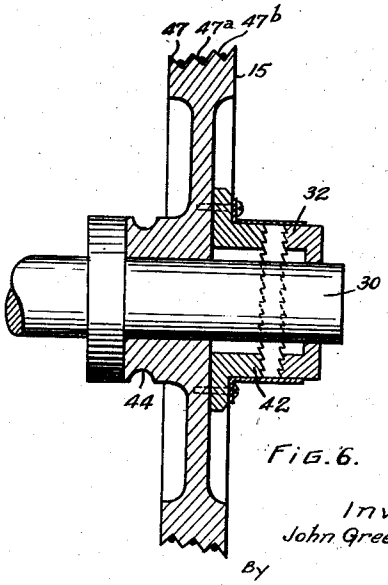


Fig. 6.

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2,212,691

CORD PREPARING MECHANISM

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3 Claims. (Cl. 28—57)

This invention relates to the preparing of cord, especially that for use in the manufacture of tires.

The requirements of tire cord production have become increasingly particular with developments in the manufacture of the pneumatic tire. Today, it is a generally accepted fact that, for embodiment into a tire, a cord must, during or after its formation, be suitably prepared to meet rigid specifications. Of prime importance among recently specified requirements is the embodiment in the cord of an accurately determined high twist factor coupled with a definite low stretch capacity, incidental to which are certain other desirable characteristics.

For the accomplishment of these requirements various methods and types of apparatus have been suggested. It is hardly necessary to deal with these methods or apparatus which are now well known to the trade. It is sufficient to stress the fact that, as in so many other mechanical developments in their early stages, the devices remain complicated and that they still leave much to be desired in efficiency. The present invention is founded on the thought that prior devices are in the main too complicated, that these devices fail to give the accuracy required in stretch control, that in many instances, they cannot be counted upon to produce a standard product, and that they are not sufficiently flexible for ready adaptation to the varying specifications of the different tire manufacturers. Additionally, the invention is chiefly concerned with the treatment of the cord after formation, preferably in conjunction with the winding operation as opposed to treatment during twisting.

With this thought in mind, it becomes a principal object of the present invention to provide improved cord treating means by the use of which cord may be suitably prepared for use in the manufacture of pneumatic tire carcasses. It is a further object of the invention to provide means of this nature whereby the cord may be controlled during treatment so that it is stretched to an accurately predetermined degree. It is a further object to provide an apparatus of this kind in which the treatment of the cord results in the reduction of imperfections, and by the use of which the yarn is not injured, resulting in a better product.

It is also an object of the invention to provide an apparatus for the accomplishment of the foregoing objects which is extremely simple in operation and convenient in structure, so that if desirable a number of units may be assembled adjacent one another for the purposes of mass production, and in which each unit may be counted upon to produce cord substantially identical to that produced on other units. These units may be used as attachments to cord handling mechanism of a type found in all textile mills.

The applicant has experimented with various types of apparatus of standard and radical types which seemingly, from a mechanical standpoint, should accomplish the desired result. Nevertheless, for one reason or another these apparatus have failed to give the qualities desired in the finished product. It is surprising how the present device, although resembling the others in certain respects and in itself very simple, achieves just these qualities. The main shortcomings of the previous devices are believed to be their lack of positive control over the highly twisted, elastic, and lively cord causing slippage and resulting in inaccuracies of degree of treatment.

With the cited objects and others in mind the invention is featured by means for subjecting a considerable length of the cord to a constant tension while positively gripped against slippage, so that substantially no variations in treatment occur. In this connection, it must be explained that the usual difficulty in cord stretching devices is that slippage occurs between the cord-engaging surfaces and the cord thus reducing the positive engagement between them. In some devices also, the stretch control is partially dependent on the condition of the cord. To eliminate this difficulty the present apparatus includes both a sufficiently long surface for engagement of a considerable length of cord, grooves of such inclination as to increase the frictional grip of this surface on the cord without injury to the cord, increasing effective diameter in successive grooves to increase the tension in the cord thereby to increase its cohesion to the gripping surfaces and increasing speeds between respective rotating members so that tension is further increased. Control of the degree of tension is obtained by a simple but extremely accurate adjustment to alter the respective speeds of the rotating members. The apparatus is rendered operative and inoperative by a special clutch arrangement actuated by the mechanism receiving the cord from the apparatus.

More specifically, the invention is featured by a pair of rotatable sheaves, each sheave associated with a guiding pulley for guiding successive laps of cord from one groove to the other of its respective sheave, driving mechanism for rotating the sheaves at definite different speeds so as

to impart tension to the cord passing between them, the grooves being of successively increasing effective diameters so as to impart additional tension to the cords passing about the sheaves, to increase the frictional grip between sheaves and cord and clutch means between the driving mechanism and the sheaves whereby the latter may be rendered operative or inoperative.

The advantages of such an apparatus, which will be referred to more particularly after a detailed description of a preferred form, will become apparent as the features, functions, and operations of the mechanism are dealt with.

Having thus generally described the nature of the invention, reference will now be made to the accompanying drawings in which is illustrated a preferred form thereof, and in which:

Figure 1 is a diagrammatic illustration of a unit according to this preferred embodiment, in use in conjunction with a winder of standard design.

Figure 2 is a front elevation of a preparing unit, such as that portrayed diagrammatically in Figure 1.

Figure 3 is a side elevation of the unit shown in Figure 2.

Figure 4 is a view taken in the direction of Figure 1 to show the clutch actuator mechanism.

Figure 5 is a fragmentary view partially in elevation and partially in section of the crown gear, change gear and respective pinions, which are operative to drive the sheaves.

Figure 6 is a cross section substantially through the top sheave with the clutch elements disengaged.

Referring more particularly to the drawings, Figure 1 illustrates the relationship of one unit A of the present apparatus to a winder of standard design. In this figure the cord C may be seen passing from a spool 11 through a spring tensioning device 12 to a leading guide pulley 13 of the unit. The cord then passes about portions of the periphery of the pulley 13 and portions of the peripheral cord-engaging grooves of gradually increasing circumference of an adjacent feeding sheave 14 and thence on to and about portions of a drafitg sheave 15 and an adjacent guiding pulley 16, the sheave 15 also having cord engaging grooves of gradually increasing circumference. The sheaves are conveniently arranged for threading and for continuous feed of the cord. The cord then passes from the sheave 15 through a spring tensioning device 17 to a rotating package P and is thus drawn on to the winder. The sheave 15 is driven at a speed greater than the sheave 14 whereby a tension is set up in the cord; the gradually increasing diameters of the grooves of each of the sheaves sets up an additional tension in the lappings of the cord, causing it to exert reaction forces on the sheave surfaces setting up a firm frictional grip between sheaves and cord.

The sheaves 14 and 15 are connected and disconnected from their respective drives through a clutch arrangement operated through a clutch actuator arm 18 which is held in clutch-operative position by an arm 19 extending from a drop plate 20 on the winder.

To cause the drop plate 20 to fall following the rupture of the cord C conventional mechanism is provided. For instance, the plate 20 is journalled on a shaft 21 and includes a package-supporting bracket 20*a* extending rearwardly to support the weight of the package P. The spring tension device 17 is pivotally mounted as at 23 on the end of the plate 20 and has a downwardly extending hook 24 adapted to engage a reciprocating catch 25 on a rocker shaft 26. When the cord C breaks, the tension device 17 is allowed to fall downwards and the hook 24 engages with the catch 25 as the latter reciprocates forward, thus pulling the plate 20 downward. As the plate is pulled downward the package P is lifted by the bracket 20*a* and the arm 19 releases the clutch actuator arm 18, thus simultaneously stopping the rotation of the package and that of the sheaves 14 and 15 by disconnecting them from their respective driving sources.

When the drop plate drops, the clutch actuator arm 18 is released by the drop plate arm 19 so that the sheave clutches become disengaged to disconnect the sheaves 14 and 15 from their respective drives.

While only one unit A is illustrated it will be understood that several are mounted in parallel, one to each package of the under frame.

Supporting structure

The structure of the unit A will now be described in further detail.

In the preferred form of the invention illustrated in the drawings, this unit includes an auxiliary frame B mounted on the frame of the winder in conjunction with which it is used. The frame B consists of a vertical base casting of conformation suitable for supporting the various working parts, and of additional elements secured to the casting for the further support or covering of these parts.

At the top of the frame B and towards the rear is a shaft 30, extending transversely of the frame B, that is to say, parallel to the winder rolls. This shaft is journalled in suitable bearings in the frame B carrying on one end a bevel gear 31 from which it receives its drive and, on the other end an inwardly disposed clutch element 32. Below the shaft 30 there is suitably journalled in a front portion of the frame B, offset from that journalling the shaft 30, another shaft 33. The shaft 33 carries on one end a bevel drive gear 34 and, on the other end, an inwardly disposed clutch element 35.

The cord-engaging sheaves

On the shafts 30 and 33 respectively there are mounted the upper and lower cord-engaging sheaves 15 and 14 specially constructed for the treatment of the cord in a manner to be described in detail. The sheave 15 is freely rotatable and axially slidable on the shaft 30 and includes a clutch element 42 adapted for engagement and positive drive by the clutch element 32. The sheave 14 is also freely rotatable and axially slideable on the shaft 33 and carries a similar clutch element 43 adapted for engagement with and retardation by the clutch element 35. Remote from its clutch face the sheave 15 is provided with a yoke-engaging portion 44 and the sheave 14 is similarly provided with a yoke-engaging portion 45.

The periphery of the sheave 14 is provided with a series of cord-engaging V-grooves 46, 46*a* and 46*b*, of respectively increasing effective diameters, and the sheave 15 is provided with similar grooves 47, 47*a* and 47*b*. The purpose of these grooves is to engage the cord positively and at increasing speeds so as to subject several lappings of the cord to a gradually increasing tension causing it to be frictionally gripped by

the surfaces of the grooves. All the grooves are of considerable effective diameter not being too acute in curvature to give the extensive cord engaging surface required for supporting purposes.

For guiding lappings of cord from one groove of the lower sheave 14 to the next, mounted on a freely rotatable shaft 50 journalled in the frame B, is a pulley 51 having a periphery provided with a series of cord-guiding grooves 52 of equal diameter. Another cord guiding pulley 53 is mounted on a freely rotatable shaft 54 adjacent the sheave 15. The pulley 53 has a grooved peripheral cord-guiding surface 55 and fulfills a similar purpose to the pulley 51 in guiding lappings of the cord from one groove to the next of the sheave 15.

Clutch actuator mechanism

Mechanism is provided for rendering operative or inoperative the clutch arrangement above described. This mechanism includes a clutch actuator arm 60 centrally supported on a transversely extending shaft 61 journalled in suitable bearings in the frame B. At one end of the actuator arm 60 is a yoke 62 engaging the sleeve 44 and at the other end of this arm is a yoke 63 engaging the sleeve 45 so that outward or inward movement of the arm 60 causes corresponding movement of both sheaves 15 and 14 to engage or disengage their respective clutches. On the shaft 61 at the side of the frame remote from the arm 60 is mounted a collar 64 and a compression spring 65 acting on the collar and against the frame B so as to urge the shaft 61 in an outward direction and the clutches out of engagement, in which position the sheaves disconnected from their drives are inoperative. Adjacent the rear end of the shaft 61 and extending transversely thereto, is a freely rotatable rod 66 including an upwardly extending finger 67 operative to engage the inner end of the shaft 61. On the end of the rod 66 remote from the finger 67 is a downwardly extending control arm 68, preferably of the conformation indicated, and adapted for engagement with the arm 19 on the drop plate 20 of the winder frame. Normally the arm 19 forces the control arm 68 in an outward direction causing the finger 67 to engage the shaft 61 and move it inwardly against the urge of the spring 65 so as to force the clutch faces into engagement and connect the sheaves 15 and 14 with their respective drive shafts. When the drop plate drops the clutch actuator arm 18 is released by the drop plate arm 19 so that the sheave clutches become disengaged under the urge of the spring 65 to disconnect the sheaves 14 and 15 from their respective drives. An auxiliary manual clutch actuator lever 70 is fulcrumed on a pin 71 and has a portion 72 engaging with the collar 64, and a handle portion 73. The clutches may be rendered operative or inoperative by manipulation of this lever.

The drive connections

Mechanism is provided for driving each of the sheave-supporting shafts 30 and 33 at a predetermined speed so as to govern the speed of the sheaves 15 and 14. This mechanism includes, journalled in suitable bearings 76 and 76*a*, and supported by brackets 77 mounted on the frame B, a vertical connecting shaft 80, carrying on its upper end a bevel gear 81 meshing with the bevel gear 31, and extending downwardly to adjacent a horizontal drive shaft 82. Similarly, journalled in bearings 78 supported in brackets 79, 79*a*, a vertical connecting shaft 85 extends downwardly from adjacent the shaft 33 and is provided at its upper end with a bevel gear 86 meshing with the bevel gear 34. The shaft 85 extends downwardly to adjacent a horizontal driven shaft 87. The shafts 82 and 87 are partially supported by bearings 86*a* and 87*a* carried by the brackets and extend the length of the machine, and are adapted to drive the vertical connecting shafts of several cord conditioning units similar to the unit described. On the shaft 82 is keyed a bevel gear 88 meshing with a bevel gear 89 on the shaft 80 and on the shaft 87 is keyed a bevel gear 90 meshing with a bevel gear 91 on the shaft 85.

The shaft 82 extends through to the end of the winder frame and carries adjacent this end a drive pulley 100 having a driven connection with the main drive of the winder. Inside the pulley 100 the shaft 86 carries a fixedly mounted pinion 101. The other horizontal drive shaft 87 extends through to adjacent the end of the winder frame and carries on its end a fixedly mounted pinion 102 spaced laterally from the pinion 101. To impart definitely different speeds to each of the shafts 82 and 87 the pinion 101 meshes with a crown gear 103 and the pinion 102 meshes with a change gear 104, the crown gear and the change gear being fixedly mounted on a common stub shaft 105 suitably borne by a radial bracket 106 mounted on a boss 107 so journalled on the shaft 82 that the change gear is controlled by the crown gear. The bracket 106 is adjusted radially through an arm 107 having a connection with it and with the frame B.

Through the mechanism described, the top sheave 15 receives its drive directly through a gear connection from the shaft 82 while the bottom sheave 14 receives its drive from the same shaft 82 through the crown and change gear arrangement just described. The change gear 104 is smaller than the crown gear 103, bearing a definite ratio thereto, whereby the sheave 14 is driven slower than the sheave 15.

Respective coverings 110 and 111 are provided for the shafts 80 and 85. Boxes 112 and 113 cover the gears 88 and 89, 90 and 91 respectively. These covers and boxes give the apparatus a finished appearance and serve to prevent undesirable access to the working parts.

Operation

In operating the apparatus, of which the structural features have been described, the cord is threaded in the manner already referred to and illustrated, about the respective sheaves and pulleys of the unit A and lead to the package P on the winder. The cord may, of course, be threaded in other ways, as for instance, in reverse curves from sheave to sheave but the presently illustrated manner has been found most practical for the purposes described. The cord first becomes gripped as it passes on to the first groove 46 of the feeding sheave 14 and is thus drawn into the apparatus, the various lappings of the cord being subjected to the action of surfaces of increasing speed as they pass about portions of the grooves 46*a* and 46*b*. Then the cord passes to the first groove 47 of the sheave 15 and is subjected to the action of surfaces of gradually increasing speeds as its various lappings pass about portions of the grooves 47*a* and 47*b*. It is finally drawn off on to the package P.

The resultant effect is that tension is set up in the cord from the time it becomes gripped by the

first groove 46 and until the time it leaves the last groove 47b. This tension is set up by the increasing speed between the sheaves and is accentuated by the increasing groove diameters. As a result, the cord reacts in exerting upon the sheave 15 a positive drive and on the sheave 14 a braking effect. The clutch faces on the sheaves and their respective shafts are oppositely arranged to grip accordingly.

It has been found that the cord is under positive control from the time it is engaged by the first groove until the time it leaves the last groove. This is apparently due to the particular V-shape of the grooves themselves, of the respectively increasing diameters and of the difference in speed between the respective sheaves. Positive regulation of the amount of tension exerted upon the cord is arrived at by adjustment of the respective sheave speeds through the change gear 104.

It is important to note that this degree of tension is unaffected by exterior conditions beyond control, such as for instance the state of the atmosphere, which has a very marked effect on weight-operated apparatus. The path of the cord is relatively simple, rendering the threading of the apparatus quite easy and thus eliminating time-consuming operations associated with the more complicated cord treating methods in vogue. The stopping and starting of the sheave is automatic for each preparing unit A without interference with any other unit.

Various modifications may be made in this invention without departing from the spirit thereof or the scope of the claims, and therefore the exact forms shown are to be taken as illustrative only and not in a limiting sense, and it is desired that only such limitations shall be placed thereon as are disclosed in the prior art or are set forth in the accompanying claims.

I claim:

1. A cord stretching apparatus, comprising in combination, a single driven cord advancing sheave and a single cord retarding sheave, both sheaves being of substantial circumference to provide a lengthy gripping surface, a series of parallel V-shaped grooves in the periphery of each sheave each for receiving a successive lap of cord, the sheaves being arranged in series with the groove of largest circumference of the retarding sheave being in a position to deliver cord to the groove of smallest circumference of the advancing sheave, idler means for guiding the cord in a plurality of parallel laps about the retarding sheave, separate idler means for guiding the cord in a plurality of parallel laps about the advancing sheave, means for causing rotation of the advancing sheave at a predetermined peripheral speed, a geared connection between the advancing sheave and the retarding sheave for causing the latter to rotate at a predetermined slower speed than the advancing sheave, said cord being delivered from said retarding sheave to said advancing sheave and being stretched during such delivery, the successive grooves of each sheave being of slightly increased effective diameter whereby sufficient tension is set up between the respective laps on each sheave to cause the cord to be forced against the surface of the grooves and to be gripped firmly thereby without stretching it additionally to any appreciable extent and means for feeding cord to the retarding sheave and for receiving cord from the advancing sheave.

2. A cord stretching apparatus, comprising in combination, a single driven cord advancing sheave and a single cord retarding sheave, both sheaves being of substantial circumference to provide a lengthy gripping surface, a series of parallel V-shaped grooves in the periphery of each sheave for receiving successive laps of cord, idler means for guiding the cord in a plurality of parallel laps about the retarding sheave, idler means for guiding the cord in a plurality of parallel laps about the advancing sheave, a drive connection for rotating the advancing sheave at a predetermined peripheral speed, a geared connection between the advancing sheave and the retarding sheave for causing the latter to rotate at a predetermined slower speed than the advancing sheave, said cord being delivered from said retarding sheave to said advancing sheave and being stretched during such delivery, the successive grooves of each sheave being of slightly increased effective diameter whereby tension is set up between the respective laps on each sheave causing the cord to be forced against the surface of the grooves and to be gripped firmly thereby, means for feeding cord to the retarding sheave and for receiving cord from the advancing sheave.

3. A cord stretching apparatus, comprising in combination, a frame, a pair of stub shafts mounted in said frame, a cord advancing sheave mounted on one of said shafts for free rotation, a cord retarding sheave mounted on the other shaft for free rotation and limited axial movement thereupon, a drive shaft, driving connections between the drive shaft and the advancing stub shaft, a speed reducing geared connection between the advancing stub shaft and the retarding stub shaft whereby the speed of rotation of the retarding shaft bears a predetermined ratio to that of the advancing shaft, clutch means including ratchet teeth faced in one direction to cause driving engagement between the advancing stub shaft and its sheave, clutch means including ratchet teeth faced in the opposite direction to cause a retarding engagement between the retarding stub shaft and its sheave, both sheaves being of substantial circumference to provide a lengthy gripping surface, a series of parallel V-shaped grooves in the periphery of each sheave for receiving successive laps of cord, idler means for guiding the cord in a plurality of parallel laps about the retarding sheave, separate idler means for guiding the cord in a plurality of parallel laps about the advancing sheave, said cord being delivered from said retarding sheave to said delivery sheave and being stretched in said delivery, the successive grooves of each sheave being of slightly increased effective diameter whereby sufficient tension is set up between the respective laps of each sheave to cause tension between the cord and sheave, means for feeding cord to the retarding sheave and for receiving cord from the advancing sheave, and clutch actuator means for causing simultaneous engagement or disengagement of said clutches.

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