Aug. 1, 1933. L. L. WEAVER 1,920,224

ROTATING MECHANISM

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Fig. 1.

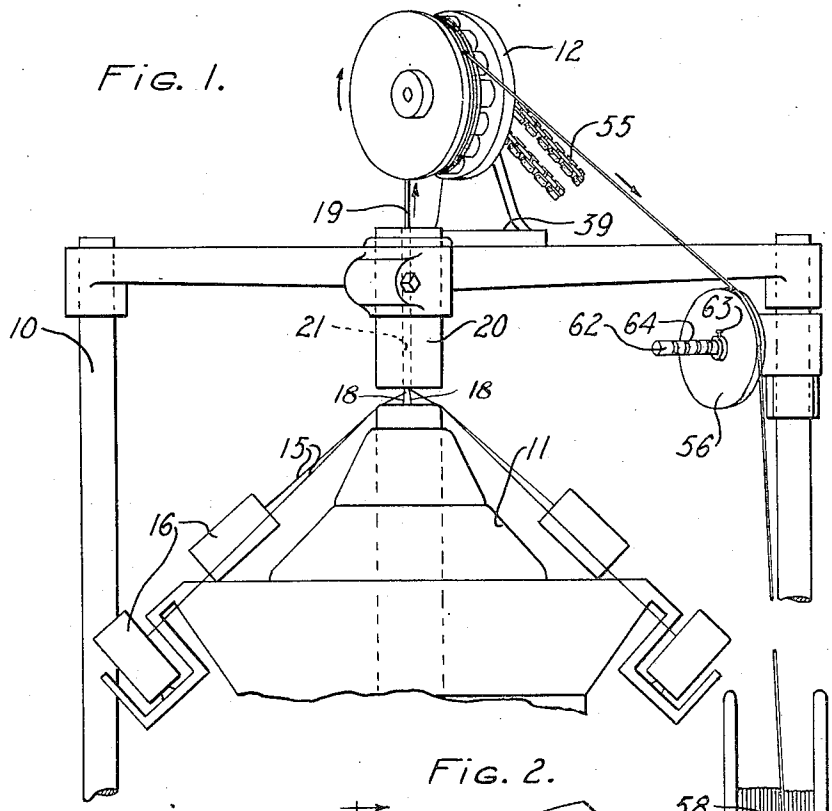


Fig. 2.

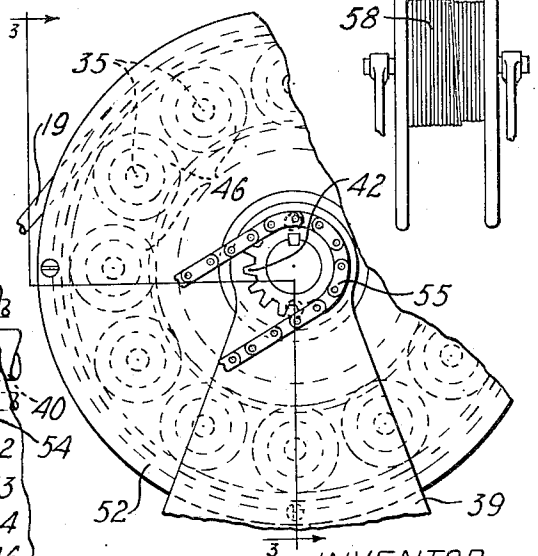
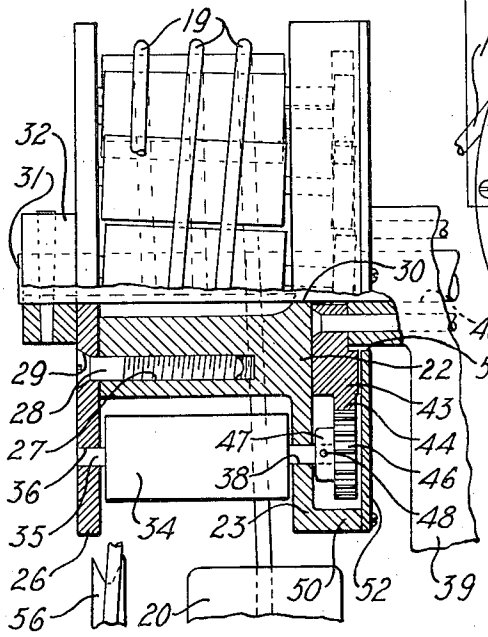


Fig. 3.



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Fig. 5.

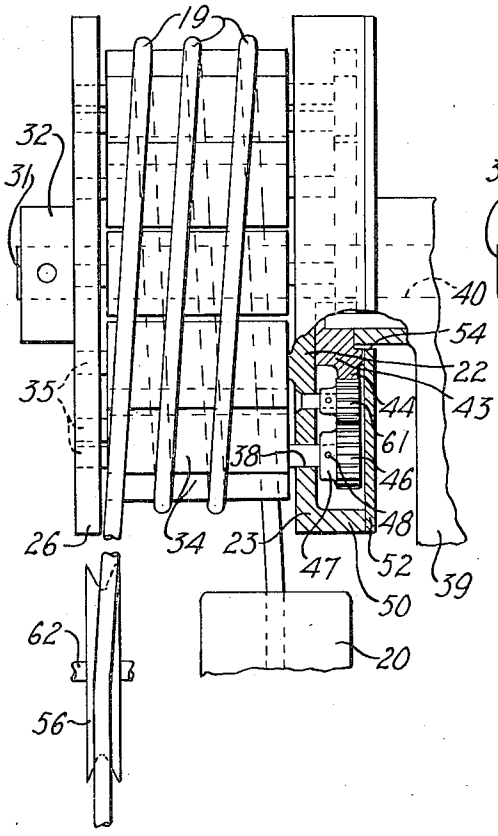


Fig. 6.

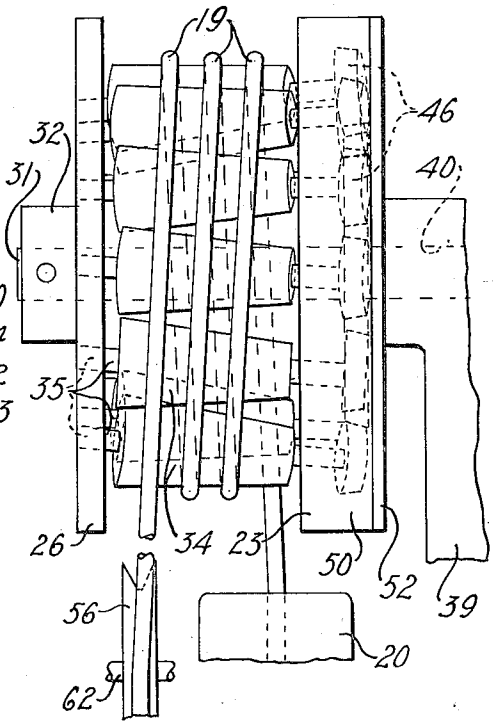
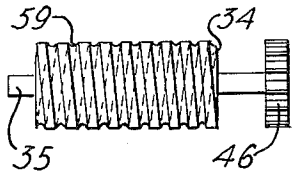


Fig. 4.



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ROTATING MECHANISM

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19 Claims. (Cl. 254—176.)

This invention relates to rotating mechanisms and more partcularly to rotating mechanisms of the strand handling type, such as capstans.

An object of the present invention is to provide a simple and efficient mechanism for handling a length of material.

The invention contemplates the provision of a rotating capstan, a material or strand-bearing surface of which is composed of a number of transverse individually driven rollers disposed peripherally around the capstan. Essentially, the rollers are so disposed with respect to the axis of the strand that the latter is thereby passed across the face of the rollers and discharged from the capstan at the opposite side thereof from that on which the strand is received, without chafing or otherwise deleteriously affecting the strand or its movement.

In a preferred embodiment, the axis of the strand is caused to be inclined with respect to the element of a cylindrical roller, that is, the generatrix of the strand-engaging surface of the roller, by advancing the strand to the capstan in such manner that the axis of the strand extends substantially at a right angle with the axis of the capstan, and so positioning each of a plurality of cylindrical rollers in the capstan that the elements thereof are inclined with respect to the axis of the strand. In a modification, the individual rollers are peripherally grooved so that a strand being advanced by the capstan will be accommodated in the grooves of the rollers and passed across the capstan without deleterious frictional effects. In another form the axes and elements of the cylindrical rollers and the capstan are parallel, and the strand is so guided that it approaches the rollers with the necessary angular inclination with respect to the elements thereof. In a fourth form, the rollers are conical in shape, and the strand is so guided thereto that the axis of the strand makes an angle with the element of the roller so as to pass the strand across the face of the roller, and in so passing the strand is stretched or permitted to shrink, as the case may be, while being carried by the capstan by introducing the strand to the smaller or larger ends, respectively, of the conical rollers.

A better understanding of the invention may be had from a consideration of the following detailed description, read in connection with the accompanying drawings forming a part thereof, in which

Fig. 1 is a fragmentary schematic view in elevation of a braiding machine employing a capstan embodying the invention;

Fig. 2 is a fragmentary enlarged side elevation of the capstan shown in Fig. 1;

Fig. 3 is a fragmentary sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is an elevation of an alternative form of roller which may be employed;

Fig. 5 is a view corresponding to Fig. 3 showing a modified form of capstan embodying the invention, and

Fig. 6 is a view corresponding to Fig. 3 and showing another form of capstan embodying the invention.

Referring to the drawings, wherein similar parts are indicated by identical reference numerals, a frame 10 and braiding head 11 of a conventional braiding machine are surmounted by a capstan 12. Braid threads 15, 15 are drawn from supply spools 16, 16 carried by the head to provide a covering for a pair of conductors 18—18, to form a conductor cord 19. An adjustable sleeve 20, having an eccentrically located bore 21, is formed in the frame 10 above the head, the cord 19 passing axially through the bore as the cord is drawn from the head by the capstan 12 when the latter rotates in a clockwise direction, as indicated by the arrow in Fig. 1. The adjustable sleeve 20 serves as a control means or guide for the braided cord and serves, as by turning the bore 21 with respect to the braiding head and the capstan, to insure that the cord contacts with the surface of the capstan at a proper angle of approach.

The capstan comprises (Fig. 3) a rotative internal core or base member 22 having at one end thereof a relatively enlarged disc portion 23 which forms one side of the capstan 12. A disc 26, of substantially the same circumference as the disc 23, forms the other side of the capstan. The base member 22 is provided with a recess 27, which is internally threaded to receive a threaded bolt 28 which extends through a suitable aperture 29 in the disc 26, thereby rigidly securing the latter to the rotative base member 22. The base member 22 is provided with an axially disposed aperture 30 through which extends a driving shaft 31. It will be understood that the base member is keyed to the shaft 31 so as to insure its rotation therewith, and in order to secure the base member in proper position on the shaft 31 any suitable locking collar 32 is secured to the outer end of the shaft 31 beyond the disc 26.

The bearing surface of the capstan consists of a plurality of rollers 34, 34 (in the present

embodiments 12 of such being shown) which are disposed peripherally around the capstan at suitable spaced points to permit their individual and positive rotation without interfering one with the other. Any greater or lesser number of such rollers may be used, depending upon the size of the capstan employed, it being only desirable that a sufficient number be employed that their surfaces might combine to present a substantially circular capstan surface for the strand 19 passing thereover. Each roller 34 is suitably secured upon an axially extending projecting shaft 35 which is journalled at one end in spaced apertures 36, 36 in the disc 26, and in the disc portion 23 in suitable spaced apertures 38, 38. In the preferred embodiment, as may be observed in Fig. 3, the rollers 34 are cylindrical and the elements and axes thereof are skewed or angularly disposed with respect to the axis of the group as assembled in the capstan to the extent that one end of each roller, namely, that adjacent the disc 23, is advanced slightly, in terms of the direction of rotation of the capstan, beyond the other end which is journalled in the disc 26; both ends of the roller, however, being equidistant from the axis of the capstan. The reason for thus skewing or inclining the rollers is to insure that the axis of the strand 19, in engaging therewith, shall make an angular intersection or angle of approach of other than 90° with the elements of each roller. Under such circumstances, when the rollers are positively and individually driven, the strand will be passed across the face of the capstan in the direction of the acute angle of approach between the strand and the elements of the roller.

A bracket 39 secured upon the top of the frame 10 supports the capstan 12 and is provided with an aperture 40 in which the shaft 31 extends. The inner end of the shaft 31 projects beyond the bracket and at its extremity is provided with a sprocket 42 (Fig. 2). A stationary gear 43 on the bracket projects upon the base member 22, the peripheral teeth 44 thereof meshing with a plurality of gears 46, one such gear being secured to the inner end of each of the roller shafts 35. In order to properly maintain said gears in position with respect to the stationary gear 43, each gear 43 is provided with a collar 47 and a suitable set screw or pin 48 which engages the shaft 35. The disc portion 23 is provided with an external peripheral annular flange 50 which projects over the gears 46, 46 to form a housing therefor and is provided with a circular guard disc 52 suitably secured thereto. The guard disc 52 is provided with a central aperture 54 for accommodating the bracket 39.

The sprocket 42 of the capstan shaft is engaged by a chain 55 operated from any suitable source of power (not shown) to rotate the capstan, and the strand thereby discharged from the capstan passes to a guide pulley 56. The guide pulley carries a collar 63 and is revolvably mounted on a shaft 62 which is secured on the frame 10 and provided with a number of spaced peripheral grooves 64 with one of which the collar 63 engages to position the pulley 56 with respect to the rollers 34. From the pulley 56, the strand passes to a conventional take-up reel 58 which receives the cord 19 for storage, pending further disposition thereof.

In operation the braided cord 19 is drawn upwardly through the sleeve 20 by the capstan 12. The strand is wrapped any desired number of times around the capstan, in the present instance three turns thereof being made. The braided covering of telephone cords, while substantial enough to withstand service conditions, is usually composed of light weight thread and liable to injury if it should be drawn tightly around the ordinary conical type of capstan, wherein preceding turns of the strand may be forced sidewise across the surface of the capstan by succeeding turns, resulting at times in a tendency to side chafing between adjacent strands, scraping of the strand on the surface of the conductor and other deleterious effects of such frictional contact. It is therefore desirable that a type of capstan be employed which is of such a construction as to afford the necessary snubbing action between the strand and the capstan surface to cause the strand to be pulled steadily and without jerking, while at the same time moving the strand across the face of the capstan without frictional wear. For sundry reasons, it is also frequently desirable to control the spacing between adjacent turns of the strand on the capstan in order that strands may or may not as desired abut with adjacent strands.

By causing the roller-supporting apertures in the disc portion 23 to be advanced slightly beyond the corresponding apertures in the disc 26, the axes and elements of the cylindrical rollers 34 are inclined with respect to the axis of the shaft 31, thus causing the strand, upon first engaging the capstan, to meet the peripheral surface of one of the rollers 34 adjacent the right-hand end thereof at an angle other than a right angle with the axis and element of the roller, as shown in Fig. 3, and to be continually carried across the face of the rotating capstan due to the positive rotation of the individual rollers.

In considering the project of separating adjacent turns of the strand while they are being advanced across the face of the capstan, it should be borne in mind that the pitch or inclination of an element of the roller with respect to the axis of the strand must, at all times, be sufficient to advance the strand across the roller a distance equivalent at least to the diameter of the strand for one revolution of the group. This is done in order to prevent the strand piling upon the capstan at the point of initial engagement therewith. The space produced between adjacent strands depends on the rate of travel of the strand across the rollers of the capstan, and this rate is determined by the angle between the axis of the strand and the element or axis of the roller, as the case may be, and the speed of the strand over the roller. In order, therefore, to insure that adjacent turns of the strand shall not contact during their passage across the capstan and to entirely eliminate side pressure between the strands, the roller should be tilted the more in order to move the strand across the roller a distance in excess of the diameter of the strand for each revolution of the group. In this connection it will be observed (Fig. 3) that the inclination of the rollers 34 is such as to advance the strand across the roller a distance equivalent to at least twice the diameter of the strand for each revolution of the group.

In the handling of extremely fine strands having more or less delicate surfaces, strands having viscous coatings, or otherwise where conditions warrant it, each roller 34 of the capstan may be provided with a helical groove 59, as shown in Fig. 4, in which the strand rests during its advancement by the capstan. Since the effect of the grooved roller is, like the plain roller

described above, to obviate relative movement or frictional contact between the strand and the rollers, the inclination of the groove 59 must be determined in advance, taking into consideration the diameter of the strand, the angle between the element or axis of the roller and the axis of the strand, etc. in order that the path of the strand in passing over a capstan the surface of which is composed of a number of grooved rollers, might correspond with the path which a strand of the same diameter would follow in passing across a similar capstan having an equal number of plain rollers, except that allowance must be made for the fact that in travelling in the groove, the path of the strand around the capstan is relatively shortened.

When the rotation of the rollers 34 is, as indicated by the gearing arrangement as shown in Fig. 3, in the same direction (clockwise) as is the rotation of the capstan, it will be obvious that the strand, since it is advanced both by the capstan and the individual rollers, will travel at a linear speed greater than the surface speed of the capstan, the speed forward of the strand being the algebraic sum of the surface speed of the group and the surface speed of a roller 34 with respect to the group. Where it may be desirable to forward the strand at a speed less than that of the capstan, a modified apparatus, as shown in Fig. 5, may be employed. An additional gear 61 is interposed between the stationary gear 43 and the individual roller gears 46, thus causing the individual rotation of the rollers to be in a direction opposite to that travelled by the group, the surface speed of the roller 34 being thus rendered a minus quantity instead of a plus quantity in the algebraic sum above referred to, and the forward speed of the conductor correspondingly slow. When this arrangement is used the rollers 34 need not be inclined with respect to the axis of the capstan to avoid frictional wear between the strand and the capstan. Instead, the apertures 38 in the disc portion 23 may be diametrically opposite the apertures 36 of the disc 26, and the rollers mounted therein to be parallel with the axis of the capstan. When this is done, the correct angle of approach between the strand and the roller element may be secured by adjusting the guide pulley 56 on the shaft 62.

In the treatment of certain types of strand material, it is desired to stretch the strand as it is being advanced by the capstan; or conversely, to advance the strand by the capstan as the strand is undergoing elongation due to some inherent or extraneous agency. A modified capstan suitable for such a purpose is shown in Fig. 6, wherein it will be noted that the rollers 34 are frustro-conical in shape. As in the arrangement in Fig. 3 the rollers are rotated in the same direction as the capstan, the inner ends of the shafts 35 being advanced beyond the outer ends thereof carried in the disc 26. By thus inclining the shafts so that the elements of the rollers are inclined with respect to the axis of the strand, the strand is passed across the rollers from the inner to the outer sides of the capstan. Due, however, to the fact that the strand is constantly urged in an opposite direction by reason of the inclination of the conical surface of the roller, the strand would tend to constantly slip backwardly toward the small end of the rollers if the ends of each roller shaft were equidistant from the axis of the capstan. In order to overcome this tendency and permit the passing of the strand across the rollers due to the inclination of the shafts 35 pointed out above, the shafts are also inclined in the other plane so that the ends of each roller are no longer equidistant from the axis of the capstan as in Fig. 3, but the end in the disc 26 is disposed nearer to the axis than the opposite end. It is noteworthy that since the outer ends of the shafts are thus nearer to the axis of the capstan, the surface speed of the group at that end is no faster than the surface speed of the group at the end where the shafts 35 are further removed from the capstan axis. Due, however, to the frustro-conical shape of the rollers, the end of each roller nearest the disc 26 has a substantially greater individual surface speed than the small end of the rollers. It will be apparent then, that a strand first engaging the smaller end of the rollers and being passed across the capstan to the larger end of the rollers due to the advancement of the smaller end of the rollers beyond the larger end of the rollers, continually is advanced upon a surface the speed of which is increasing so that the speed of the strand is constantly increased as it approaches the larger end of the rollers. Consequently, the strand is discharged from the capstan at a substantially higher rate of speed than it is received thereon at the smaller end of the rollers, thus causing a substantial elongation or stretching in the strand as it is being advanced by the capstan. By reversing the condition in the capstan shown in Fig. 6, it is possible to advance the stand by the capstan while permitting its shrinkage.

What is claimed is:

1. In a strand handling apparatus, a rotative member, a roller mounted therein, the axis of the roller being angularly disposed with respect to the axis of the strand.

2. In an apparatus for handling a strand, a rotative carrier, an unbroken roller mounted in the carrier for bearing the strand, an element of the strand engaging the surface of the roller being disposed at an angle other than a right angle with the axis of the roller, and means for predetermining the angle of engagement between the roller and the strand.

3. The combination of a rotative member, a grooved roller mounted therein, the axis of the roller being angularly disposed with respect to the axis of the member, and means for rotating the roller and the member.

4. A capstan, including an axial rotative member, and a rotative strand bearing roller having a helically grooved surface mounted therein and inclined with respect to the strand so that the latter, upon engaging the roller at one side of the capstan, will be advanced along its longitudinal axis and carried axially of the capstan without sliding friction between the strand and the roller.

5. The combination of a rotative member, a roller mounted therein, the roller being angularly disposed with respect to the axis of the member, and means for rotating the roller and the member with respect to each other.

6. The combination of a rotative member, a plurality of rotatable rollers mounted therein longitudinally of the member, the ends of each roller being equidistant from the axis of the member and the axes of the rollers being angularly disposed with respect to the axis of the member, and means for rotating the member and the rollers.

7. The combination of a rotative member, a plurality of rotatable rollers mounted therein longitudinally of the member, the axes of the

rollers being angularly disposed with respect to the axis of the member, a shaft secured to the member, driving means thereon for rotating the member, and means for rotating the rollers individually.

8. The combination of a rotative member, a plurality of rotatable rollers mounted therein longitudinally of the member, the axes of the rollers being angularly disposed with respect to the axis of the member, a supporting bracket for the member, a shaft secured to the member, driving means thereon for rotating the member, and a stationary gear on the supporting bracket for rotating the rollers individually.

9. The combination of a rotative member, a plurality of rotatable rollers mounted therein longitudinally of the member, the axes of the rollers being angularly disposed with respect to the axis of the member, a supporting bracket for the member, a shaft secured to the member, driving means thereon for rotating the member, a stationary gear on the supporting bracket, and a gear carried by each of the rollers and meshing with the stationary gear for rotating the rollers with respect to the member.

10. In a strand handling apparatus. a capstan for the strand, a rotative base member for the capstan, a disc at each end thereof and rotatable therewith, means for supporting the capstan, a stationary gear on the supporting means, a roller mounted in the disc, and a gear meshing with the stationary gear for rotating the roller individually with respect to the capstan during the capstan's rotation to provide a substantially frictionless bearing surface for the strand.

11. In a strand handling apparatus, a rotative member, a roller mounted therein, the axis of the roller being angularly disposed with respect to the axis of the strand, means for driving the rotative member, and means for simultaneously rotating the roller in a direction opposite to that in which the member is driven.

12. In a strand handling apparatus, a rotative member, guide means for the strand, a roller mounted in the rotative member, the axis of the roller being angularly disposed with respect to the axis of the strand, guide means for receiving the strand discharged from the roller, and means for rotating the member and the roller individually.

13. In a strand handling apparatus, a rotative member, a conical roller mounted therein, and means for rotating the member and the roller individually.

14. In a strand handling apparatus, a capstan for advancing the strand, a conical strand bearing roller mounted in the capstan, means for driving the capstan and the roller individually, and means for controlling the angle of engagement between the strand and the roller.

15. The combination of a rotative member, a conical roller mounted therein, the axis of the conical roller being angularly disposed with respect to the axis of the member, and means for rotating the roller and the member.

16. In a strand advancing capstan, a plurality of rollers mounted in the periphery of the capstan, a shaft secured to the capstan, driving means affixed to the shaft for rotating the capstan, and driving means fastened to the rotative shaft for rotating the rollers.

17. In a strand handling apparatus, a rotative member, a roller mounted therein, the axis of the roller being parallel to the axis of the member, a supporting bracket, a stationary gear on the bracket, a gear carried by each of the rollers, and a gear intermediate the stationary gear and the gear of each roller for rotating the rollers in a direction opposite to that in which the member is driven.

18. In a strand handling apparatus, a rotatable member, a roller mounted therein, the axis of the roller being angularly disposed with respect to the axis of the member.

19. In a strand handling apparatus, a rotatable member, an actuator therefor, a roller mounted in the member, the axis of the roller being angularly disposed with respect to the axis of the member for advancing the strand along its longitudinal axis and simultaneously moving it axially thereof, and means actuated by the member for rotating the roller.

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