Sept. 23, 1952 E. KINSELLA 2,611,549

YARN WINDING MACHINERY

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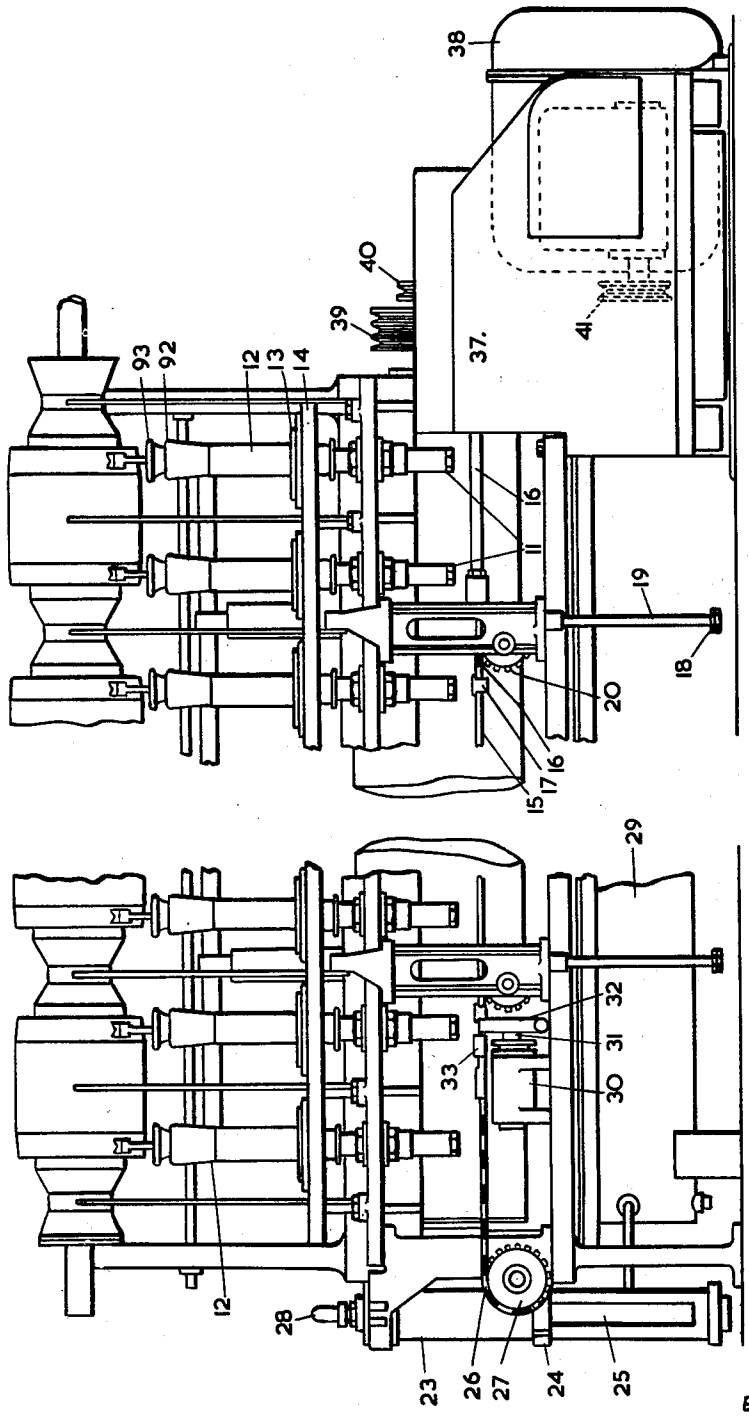


FIG. 1.

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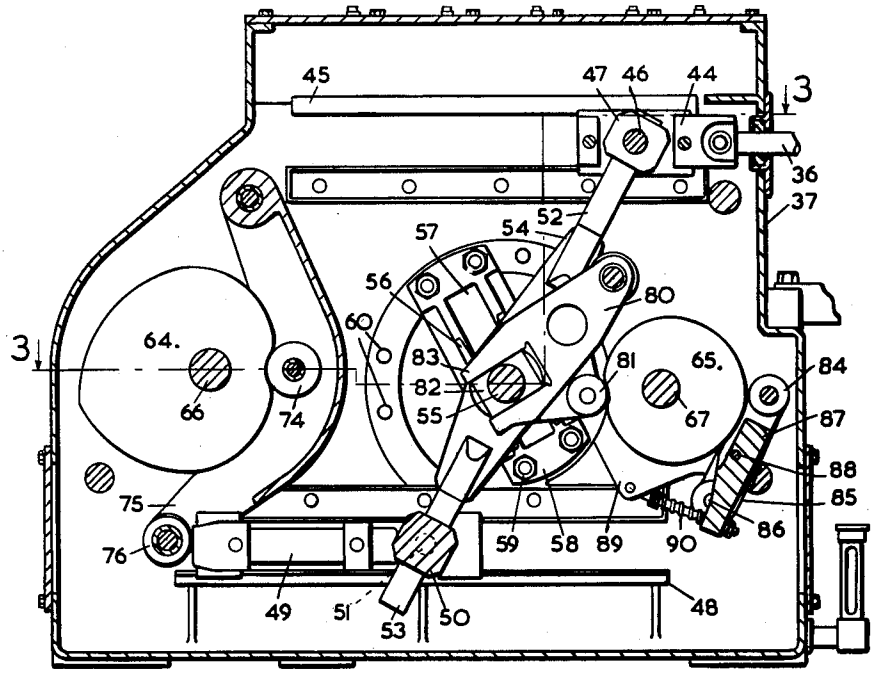


FIG. 2.

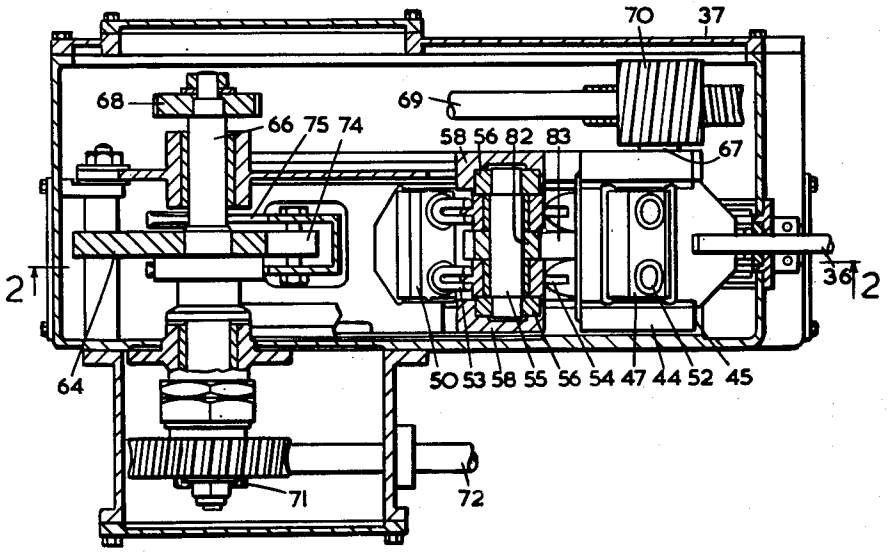


FIG. 3.

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FIG. 4.

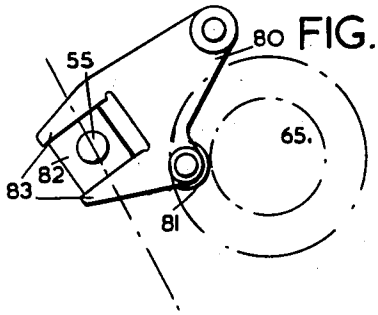


FIG. 5.

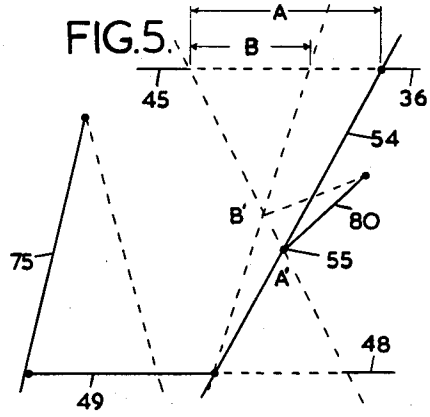


FIG. 6.

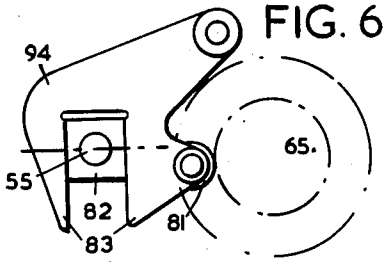


FIG. 7.

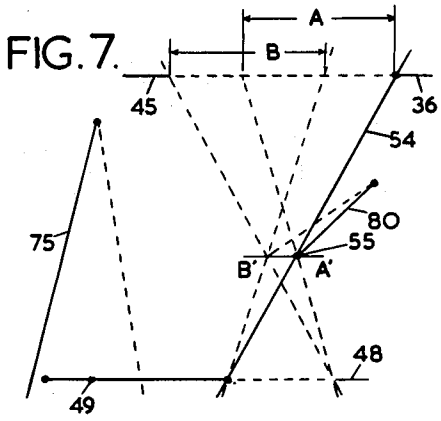


FIG. 8.

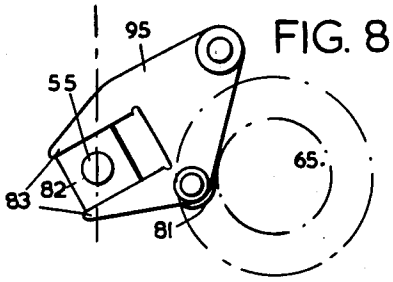


FIG. 9.

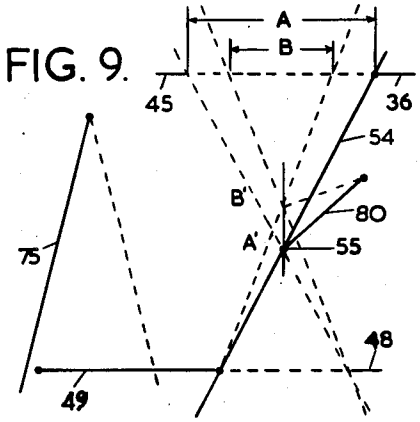
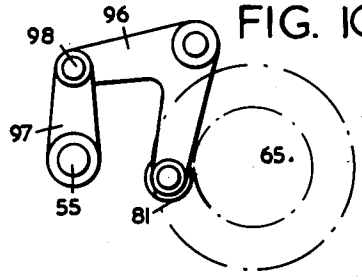


FIG. 10.



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YARN-WINDING MACHINERY

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Application October 25, 1946, Serial No. 705,704
In Great Britain October 31, 1945

6 Claims. (Cl. 242—43.7)

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This invention relates to yarn-winding machinery, and is especially concerned with yarn winding machines of the kind adapted to wind a package in which the total thickness of yarn on the package diminishes towards one or both ends of the package, and in which, in being traversed to and fro along the package during winding, the yarn reaches the two ends of the package alternately several times in the course of winding the package.

There are two broad principles that may be employed, separately or in combination, in machines for winding packages of this kind. In either case a yarn is traversed to and fro over a field of traverse extending over the major part of the length of the package; in one case the field of traverse is itself displaced slowly to and fro along the length of the package so that the ends of the field are brought alternately into coincidence with the ends of the package, and in the other case the length of the field of traverse is slowly and alternately increased and decreased. In the former case the thickness of yarn on the package diminishes towards each end of the package. The same is true in the latter case, provided that the length of the field of traverse is varied at both ends. By varying the length of traverse at one end only, however, and keeping the position of the other end constant, a package may be produced in which the total thickness of yarn tapers at one end only of the package while the body of yarn at the other end of the package is square, being conveniently supported by a flange provided on the package support. It is an object of the present invention to provide a yarn winding machine having a simple and robust traverse-actuating mechanism adapted to employ either of these principles, separately or in combination at will, and to produce packages of a wide variety of forms including each of those mentioned above.

According to the present invention a traverse mechanism for a yarn-winding machine comprises an intermediate lever, means for connecting one part of said lever to a part of the yarn-winding machine to be traversed, means connected to another part of said lever for rocking said lever to and fro about a pivot, and means for moving the said pivot slowly to and fro during winding so as to vary the field of the traverse effected through said lever. The mechanism preferably comprises also means for adjusting the direction of movement of said pivot so as to adjust the mode of variation of the field of traverse. By adjusting the movement of the pivot

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to a direction parallel to the general direction of the intermediate lever, the length of traverse is varied during winding. If in particular the direction of movement of the pivot is parallel to the lever in one of its end positions the length of traverse varies only at the other end thereof so as to build up a package that is tapered at one end and square at the other. If however the direction of movement of the pivot is parallel to the mean position of the lever the package is tapered equally at both ends. On the other hand by adjusting the pivot to move at right angles to the general direction of the length of the lever, it is the position of the field of traverse that is varied during winding. An oblique movement of the pivot, in a direction between the above extremes, causes both the position and the length of the traverse to vary. The path in which the pivot of the lever moves to and fro may, whether fixed or adjustable, be determined by any convenient constraining means, e. g. by mounting the pivot on a block constrained to move in rectilinear guideways which may be adjustable in direction or on the end of a lever whose pivot may be adjustable in position.

In order that the movement of the pivot point of the intermediate lever during winding should be effective in varying the length of field of the traverse, it is necessary that the movement of the pivot should have the effect of altering the mechanical advantage of the lever, i. e. the ratio of the distance between the pivot point and the driving and driven points respectively of the lever. These distances can be made to vary as a consequence of the movement of the pivot point by providing, at the driving and/or driven point of the lever a block through which the lever slidably passes and which is constrained, e. g. by guideways, to move in a path at an angle (preferably about a right-angle) to the length of the lever. The block at the driven end of the lever is operated by a suitable cam (the traverse cam) and the block at the driving end of the lever is connected through appropriate intermediate mechanism, to the traverse guide means. Alternatively one end of the lever may itself be constrained to a fixed path in this way and the pivot of the lever may be constituted by a pivoted block through which the lever slidably passes, the block being moved slowly to and fro in a fixed path, e. g. by means of a suitable pivot-actuating cam.

By way of example, one form of yarn-winding machine provided with traverse mechanism in accordance with the present invention, and suit-

able for use as the take-up device of a machine for the spinning of artificial yarn, will now be described in greater detail with reference to the accompanying drawings, in which:

Fig. 1 is the front elevation of the machine as a whole.

Fig. 2 is a sectional elevation of the traverse-gear box of the machine shown in Fig. 1.

Fig. 3 is a sectional plan of the gear box shown in Fig. 2.

Fig. 4 is a view of the pivot-actuating lever of Fig. 2.

Fig. 5 is a diagram showing the mode of traversing effected by the mechanism shown in Fig. 4.

Figs. 6 and 7 are views similar to Figs. 4 and 5 of an alternative form of lever.

Figs. 8 and 9 are views similar to Figs. 4 and 5 of a further alternative form of lever, and

Fig. 10 shows an alternative arrangement for producing the result achieved in accordance with Figs. 8 and 9.

Referring to Fig. 1, the machine shown therein comprises a long series of vertical spindles 11 adapted to carry tubular yarn supports 12, each of which is fed with yarn by means of a ring-and-traveller device. The rings 13 of the vertical spindles are mounted on a horizontal ring rail 14 arranged to reciprocate vertically and to be operated by means of a traverse bar 15 extending along the length of the machine and connected to the ring rail 14 by means of chains 16, secured at 17 to the traverse bar 15 and at the other end 18 to vertical rods 19 descending at intervals from the ring rail 14. The chains 16 extend horizontally from the point 17, pass over chain sprockets 20, which also serve to support the traverse bar 15, and extend vertically to the point 18. Thus the horizontal reciprocation of the traverse bar 15 results in a corresponding vertical reciprocation of the ring rail 14.

The weight of the ring rail 14 is balanced by means of an air cylinder 23 containing in its upper part a piston that is connected to the traverse bar 15. The connection is effected by means of a yoke 24 secured to the lower end of the piston rod and extending through slots 25 in the sides of the lower part of the cylinder 23. To the ends of the yoke 24 are attached chains 26 which pass over sprockets 27 and proceed horizontally to the end of the traverse bar 15. Compressed air is admitted to the top of the cylinder 23 through a pipe 28 connected to an air reservoir 29, the air in the reservoir 29 being at a pressure sufficient to force the traverse bar 15 along the length of the machine and to support the full weight of the ring rail 14. Traversing is effected by forcing the traverse bar 15 in one direction against the action of the compressed air in the cylinder 23, and allowing it to return, against the weight of the ring rail 14, under the influence of the compressed air. The reservoir 29 is connected through a non-return valve (not shown) to an air line.

The reversal of traverse when the ring rail 14 is in its lowest position is assisted by means of a spring contained in a spring cylinder 30, the spring being connected to an axial rod 31 acted upon by a lever 32, the upper end of which is engaged, when the ring rail 14 reaches its lowest position, by a yoke 33 to which the chains 26 are secured. By these means the descending ring rail is brought to rest and is assisted to acquire an upward velocity for its upward stroke.

At the end of the traverse bar 15 opposite to the cylinder 23 the traverse bar is connected to

a rod 36 entering a traverse-gear box generally indicated at 37. The gear box 37 is in the form of a distinct unit which can readily be applied to many types of twisting and winding machines. In the arrangement shown in Fig. 1, an electric motor 38 is employed to drive the spindles 11 through pulleys 39, and the drive is taken from the shaft carrying the pulleys 39 by way of a small pulley 40 back to a small pulley 41 through which the gear box 37 is driven.

The gear box 37 is shown in section in Figs. 2 and 3. The rod 36 entering the gear box is connected to a block 44 sliding in horizontal guides 45 and having pivoted therein on trunnions 46 a rotatable member 47. Below the guides 45 and near the floor of the gear box 37 is a further and similar set of guides 48 having a block 49 sliding therein and a member 50 pivoted on trunnions 51 within the block 49. Through the two members 47, 50 extend the opposite ends 52, 53 respectively of a pair of intermediate levers 54 connecting the members. As will be seen from Fig. 3, the levers 54 are identical in form and are duplicated to obtain symmetry and to avoid heavy twisting strains in the mechanism. The intermediate levers are pivoted about a pin 55, the ends of which enter into blocks 56 slidably mounted in grooves 57 in two guide members 58, one secured to each of the inner faces of the gear box 37. The guide members 58 are adjustable by rotation about an axis parallel to the pin 55 for a purpose described hereafter, and are secured in position by means of set screws 59 for which a number of tapped holes 60 are provided in the different positions corresponding to the different positions of the members 58.

The above system of blocks and levers is operated by means of two cams 64, 65 mounted on separate cam shafts 66, 67 which are geared together through skew gears 68 and shaft 69 and a non-reversible worm gear 70 so that the shaft 66 rotates several times as fast as the shaft 67. The shaft 66 is driven by a worm 71 mounted on the shaft 72 which carries the driving pulley 41 indicated in Fig. 1. The skew gears 68 are exchangeable with other gears to enable the relative speeds of the cams 64, 65 to be readily altered, e. g. to increase the speed of the shaft 67, for the winding of yarns of greater denier and to reduce it for yarns of less denier. The cam 64 is the traverse cam; it engages with a cam follower 74 on a lever 75, the lower end of which carries a roller 76 engaging with the end of the block 49. The cam 64 thus acts, through the lever 75, block 49, intermediate levers 54, block 44 and rod 36, to reciprocate the traverse bar 15 and consequently to raise and lower the ring rail 14 at a rate appropriate for the purpose of traversing yarn on the tubes 12.

The more slowly rotating cam 65 is the pivot-actuating cam. It is connected by means of a lever 80 bearing a cam follower 81 to a block 82 through which the pin 55 passes. The block 82 is engaged between jaws 83 on the end of the lever 80 and is capable of sliding between the jaws 83 so as to accommodate the arcuate motion of the lever 80 to the rectilinear motion of the pin 55, controlled by the blocks 56 and guide grooves 57. In order to maintain the cam follower 81 in constant engagement with the cam 65 a second cam follower 84 is provided, mounted between the upper ends of a pair of levers 85 which are pivoted at their lower ends at 86. A forked lever 87 lies between the levers

85, and is pivoted thereto at their upper ends, the middle of the lever 87 being pivoted at 88 to a bent lever 89, the other end of which is pivoted to the lever 80 on the pin of the cam follower 81. Between the lower end of the forked lever 87 and the angle of the bent lever 89 is a strong compression spring 90 which acts so as to nip the cam 65 firmly between the cam followers 81, 84 and keeps the cam follower 81 in constant engagement with the cam so that the lever 80 is moved steadily to and fro. The pivot of the levers 54, i. e. the pin 55 is thus moved slowly backwards and forwards along a straight line, under the constraint of the blocks 56 sliding in the grooves 57 in the guide members 58.

The motion of the pivot pin 55 has the effect of moving the intermediate levers 54 as a whole, the ends of which, accordingly, slide through the rotatable members 47, 50 through which the levers pass at each end thereof. By these means the pivot 55 of the intermediate levers 54 is moved either in a direction parallel to both sets of guides 45, 48, or away from one set of guides and towards the other, or as shown in Fig. 2 with a resultant motion having components in each of these directions, on account of the angular position of the grooved guide members 57. The arrangement of Fig. 2 is also shown in Figs. 4 and 5, but the alternative arrangements mentioned above are shown in Figs. 6 and 7 and in Figs. 8 and 9, respectively.

For the purpose of moving the pivot 55 in accordance with the different positions of the guide members 58, it is convenient to employ pivot-actuating levers of different shapes, and Figs. 4, 6 and 8 show three shapes of lever for moving the pivot obliquely (as in Fig. 2), horizontally, and vertically, respectively, while Figs. 5, 7 and 9 are diagrams showing the effect upon the yarn traverse of these three arrangements. Fig. 4, as stated above, shows a lever of the same form as Fig. 2. As will be seen from Fig. 5 the resulting traverse varies from a long traverse marked A at the top of the figure, which occurs when the pivot pin 55 is in the lowest position marked A' in the middle of the figure. When the pivot pin 55 moves to the position B' the resulting traverse is a short traverse as indicated at B. The left-hand ends of the traverse A and B coincide with one another, which is due to the fact that the pivot positions A' and B' are in line with one extreme position of the intermediate levers 54. In the resulting yarn package the thickness of yarn tapers towards the top of the package but not towards the bottom, the package being built up upon cylindrical tubes 12 provided with a wide flange at the base to support the yarn, while at the upper end of the package the tube is slightly flared at 92 and is provided with an extension at 93 for handling the package.

In Fig. 6 the guide members 58 are assumed to be in a horizontal position and a lever 94 is employed of different form from the lever 80 of Figs. 2 and 4. In this case, as shown in Fig. 7, the traverse is of constant length but varies from a position A, when the pivot 55 is in position A', to a position B when the pivot is in the position B'. The resulting package is tapered at each end and may be built either on a plain cylindrical tube or upon one that is conically flared at the base at such as angle that the outer surface of the package is cylindrical at the base and is tapered only at the tip. Such an arrangement greatly facilitates the over-end unwinding of the package since at no time is the yarn drawn past a portion of the partly unwound package that is of greater diameter than the part from which the yarn is being withdrawn.

In Fig. 8 is shown a form of lever 95 for use when the guide members 58 are in a vertical position. In this case, as indicated in Fig. 9, the mid-position of the traverse is constant, but the length of traverse varies from a maximum length A, when the pivot 55 is in the position A', to a minimum length B, when the pivot is in the position B'.

Instead of using a single lever 95 to produce the effect indicated in Fig. 9, a bell crank lever 96 as shown in Fig. 10 may be employed, connected to the pivot 55 by means of a link 97. In this case the block 82 may be dispensed with, the lower end of the link 97 acting in the place thereof. The freedom allowed by the provision of the pivot 98 between the bell crank lever 96 and the link 97 is an adequate substitute for the freedom allowed between the block 82 and the jaws 83 in Figs. 4, 6 and 8.

In each of the forms of package described above the layers of yarn, whether of uniform or of varying length, fall into successive groups each of which corresponds to one to and fro movement of the pivot 55 of the lever 54, and covers the whole length of the package although the individual layers, or almost all of them, do not. The whole of the yarn on the package is constituted by a number of such groups of layers. An advantage of this arrangement is that, if yarns on the outside of the package should be soiled, the soiling is confined to the yarn of the outer group of layers, which may readily be stripped off leaving a clean package, and does not recur along the whole length of the yarn on the package.

Another advantage of the arrangement is that there is no long traverse cycle having a beginning and end coinciding with the beginning and end of a package. Consequently, the doffing of a package and its replacement by an empty package support 12 can take place indiscriminately at any time in the course of operation of the machine and not at a particular time only, when all the packages of the machine must be doffed simultaneously. This feature makes the machine particularly well adapted for the winding of artificial yarns continuously with their production in which, since the production of the yarn cannot be conveniently interrupted for the doffing of all the packages on the machine, it is necessary to doff the packages successively. Accordingly the machine according to the invention is particularly well adapted for use as the take-up device of a machine for the production of artificial continuous filament yarns, e. g. yarns of cellulose acetate spun by the dry or evaporative method.

Other means may be employed in conjunction with those of the present invention for controlling the external shape and other characteristics of the yarn packages produced. Thus, by the use of a traverse cam 64 whose profile gives an acceleration of the traverse movement towards one or both ends of the field of traverse and a deceleration of the traverse movement away therefrom, a tapering of the thickness of yarn on the package at one or both ends may be brought about irrespective of any variation of the field of traverse and superposed on any taper-

ing produced by such variation. Thus, by the use of exchangeable traverse cams 64 of various different forms yarn packages having various different degrees of additional taper may be produced. Similarly exchangeable cams of different forms may be employed as the pivot-actuating cam 65 so as to control the degree, and to some extent the character of the variation of the field of traverse, the character of the variation being mainly controlled by the direction in which the pivot 55 of the intermediate lever 54 is arranged to move during winding. Moreover, the different cams 64, 65 used in either case may have different total throws, so as to give packages of different overall lengths in the case of the traverse cam 64, and packages of different lengths of taper in the case of the pivot-actuating cam 65. By removing one or both skew gears 68 and locking the shaft 69 the pivot 55 may be fixed in any desired position (equivalent to providing a cam 65 of zero throw) so as to produce a parallel sided package, or one whose taper depends wholly on the form of the traverse cam.

Having described my invention, what I desire to secure by Letters Patent is:

1. A yarn winding machine comprising a series of winding spindles, a series of yarn guide means, one for each spindle, a traverse rail movable to-and-fro parallel to said spindles for effecting relative movement between the said guide means and said spindles, a traverse lever having one part connected to said traverse rail, a block to which said lever is pivoted, guides for said block, means connected to another part of said lever for rocking said lever to and fro about its pivot to effect the traverse, and means for moving said block to and fro at a lower frequency, so as to vary the field of traverse, said guides being angularly adjustable so as to adjust the direction of the motion of said pivot and consequently the mode of variation of the field of traverse.

2. A yarn winding machine comprising a series of winding spindles, a series of yarn guide means, one for each spindle, a traverse rail movable to-and-fro parallel to said spindles for effecting relative movement between the said guide means and said spindles, a traverse lever, a block at each end of said lever through which the lever slidably passes, the first of said blocks being connected to said traverse rail, rectilinear guides for said blocks, a third block to which said lever is pivoted, further guides for said third block, means connected to the second block for rocking said lever to and fro about its pivot to effect the traverse, and means for moving said third block to and fro at a lower frequency, so as to vary the field of traverse, said further guides being angularly adjustable so as to adjust the direction of the motion of said pivot and consequently the mode of variation of the field of traverse.

3. A yarn winding machine having a traverse mechanism comprising a lever, means for connecting one part of said lever to a part of the yarn winding machine to be traversed, a cam adapted to act on another part of said lever for rocking said lever to and fro about a pivot to effect the traverse, and a further cam geared to the first cam for moving said pivot to and fro at a lower frequency, so as to vary the field of traverse.

4. A yarn winding machine having a traverse mechanism comprising a lever, a block at each end of said lever through which the lever slidably passes, rectilinear guides for said blocks, means for connecting one of said blocks to a part of the yarn winding machine to be traversed, a third block to which said lever is pivoted, further guides for said third block, a cam adapted to act on the second block for rocking said lever to and fro about its pivot to effect the traverse, and a further cam geared to the first cam for moving said third block to and fro at a lower frequency, so as to vary the field of traverse, said further guides being angularly adjustable so as to adjust the direction of the motion of said pivot and consequently the mode of variation of the field of traverse.

5. A yarn winding machine having a traverse mechanism comprising a lever, means for connecting one part of said lever to a part of the yarn winding machine to be traversed, a cam adapted to act on another part of said lever for rocking said lever to and fro about a pivot to effect the traverse, and a further cam geared to the first cam for moving said pivot to and fro at a lower frequency, so as to vary the field of traverse, the gearing between the two cams being exchangeable for varying the relative frequencies of the traverse and the variation of the field of traverse.

6. A yarn winding machine having a traverse mechanism comprising a lever, a block at each end of said lever through which the lever slidably passes, rectilinear guides for said blocks, means for connecting one of said blocks to a part of the yarn winding machine to be traversed, a third block to which said lever is pivoted, further guides for said third block, a cam adapted to act on the second block for rocking said lever to and fro about its pivot to effect the traverse, and a further cam geared to the first cam for moving said third block to and fro at a lower frequency, so as to vary the field of traverse, said further guides being angularly adjustable so as to adjust the direction of the motion of said pivot and consequently the mode of variation of the field of traverse, the gearing between the two cams being exchangeable for varying the relative frequencies of the traverse and the variation of the field of traverse.

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