Sept. 22, 1942. F. A. DANIELS 2,296,339

AUTOMATIC DOFFING APPARATUS

Filed May 9, 1941 3 Sheets-Sheet 1

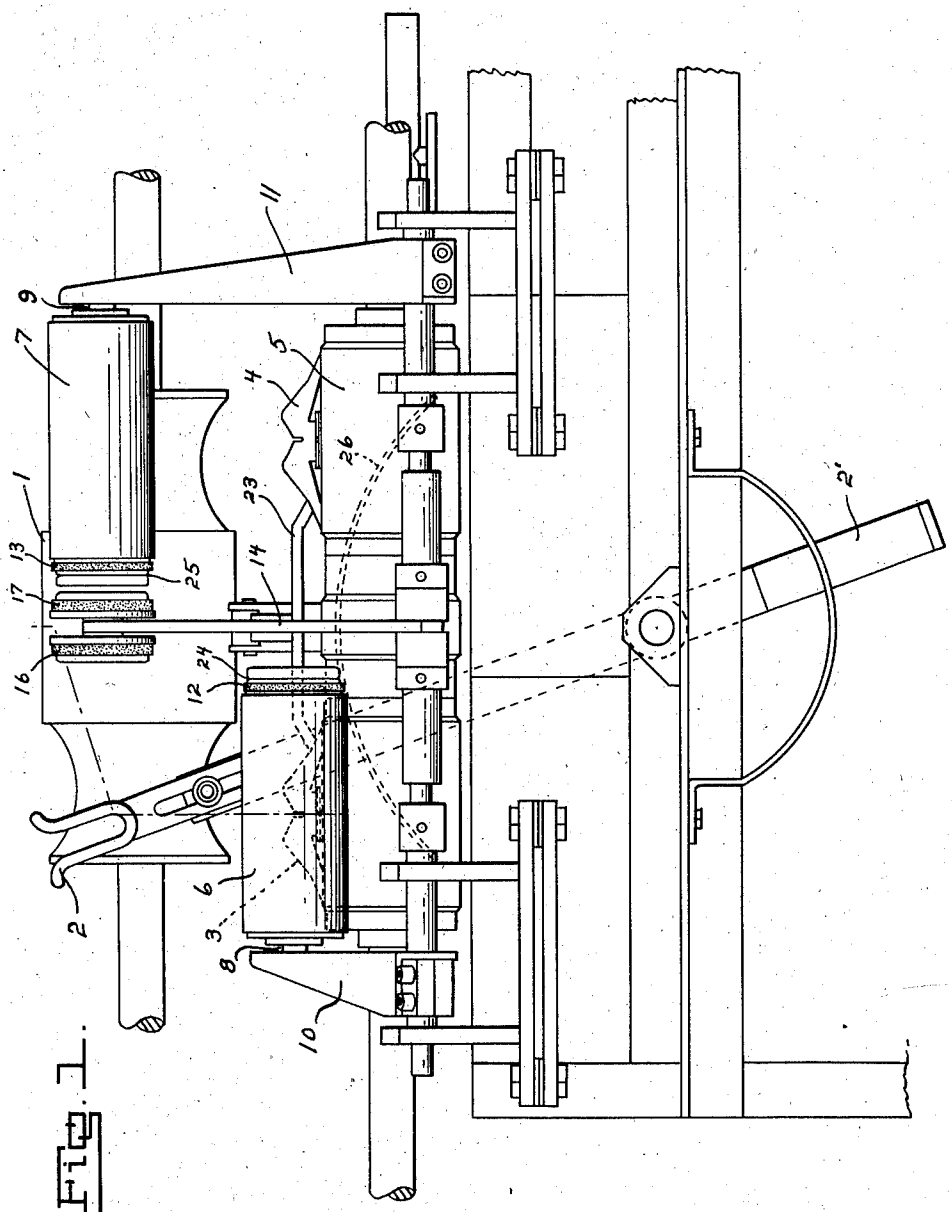


Fig. 1.

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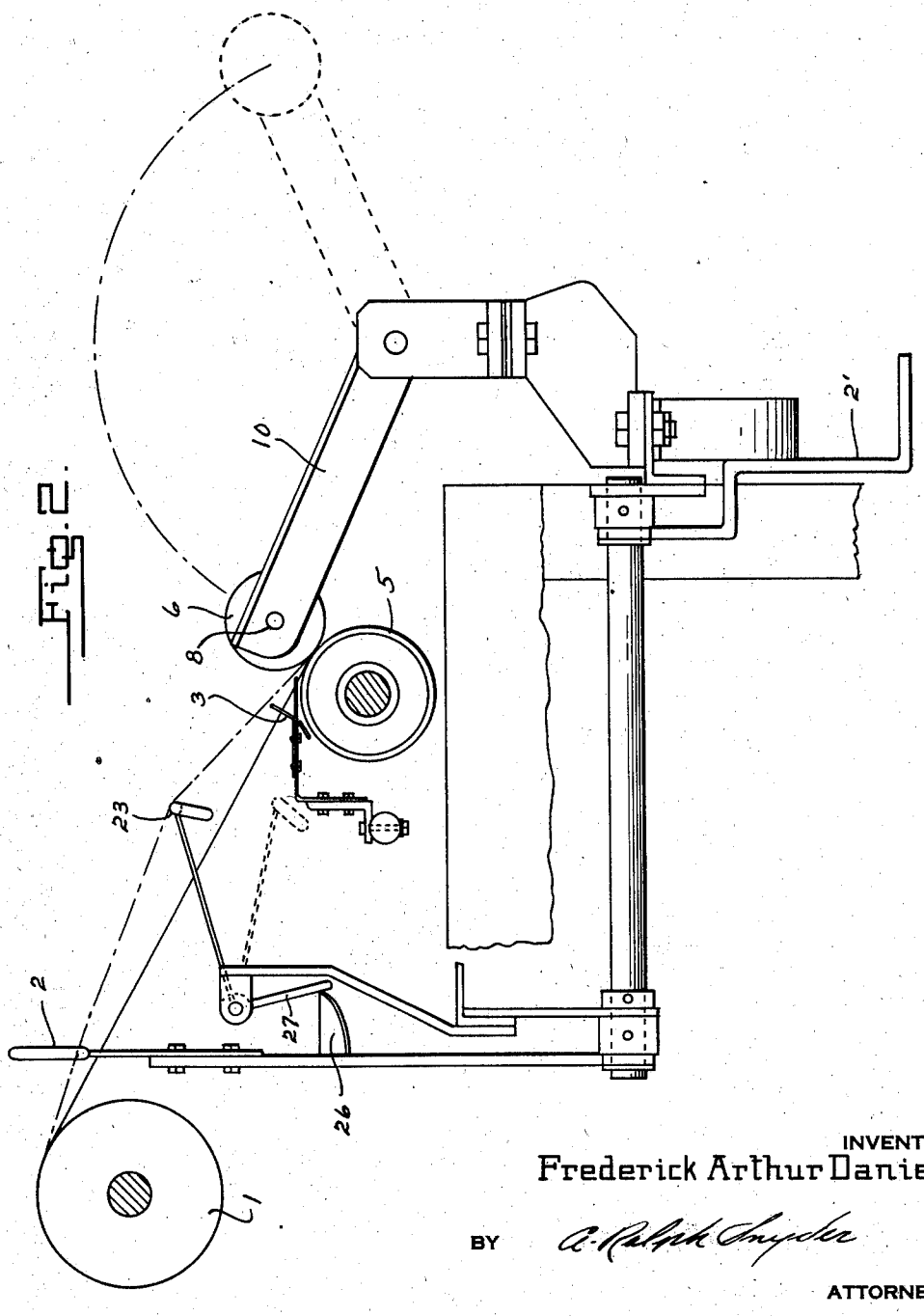
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Fig. 2.



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Fig. 3.

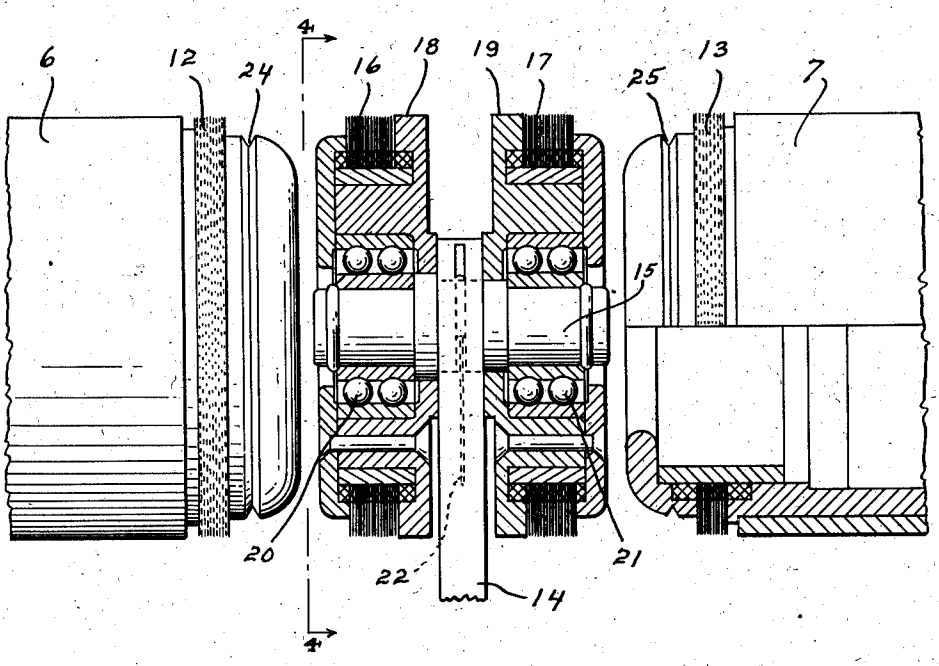
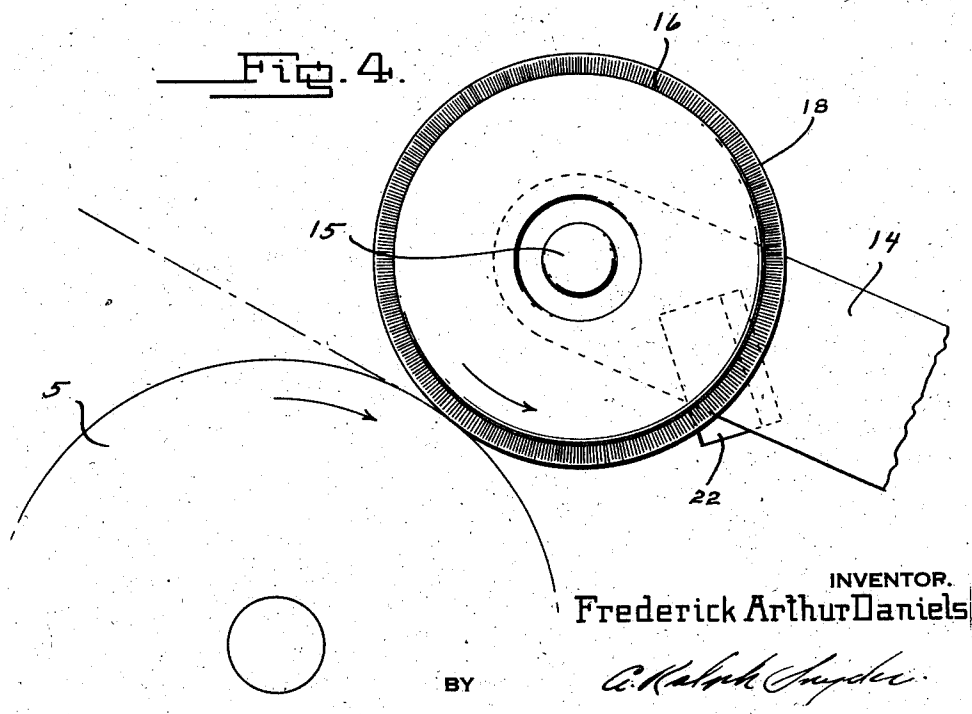


Fig. 4.



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UNITED STATES PATENT OFFICE

2,296,339

AUTOMATIC DOFFING APPARATUS

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Application May 9, 1941, Serial No. 392,804

8 Claims. (Cl. 242—19)

This invention relates to apparatus for doffing yarn. More particularly it relates to apparatus for automatically transferring continuously produced yarn from a filled package to an empty yarn support without interrupting the continuity of the process, and without damaging and/or wasting yarn.

In many textile treating operations involving the collection of yarn in wound packages, it is usually the practice when a package is completed to momentarily interrupt the operation by stopping the spindle on which the filled yarn support, e. g. a bobbin, is carried. This stoppage must be long enough to permit the yarn to be cut, the full package removed, an empty yarn support inserted, and the yarn manually wound around it sufficiently to remain in place when the spindle is restarted.

Such a stoppage, however, cannot be tolerated in a continuous process, as for example, in the dry spinning of cellulose acetate yarn. To preserve the continuity of the process, means have heretofore been devised whereby the yarn can be temporarily transferred to a rotating waste roll while the package is being doffed, following which the yarn is returned to the empty bobbin and the wrap removed from the waste roll. This operation is not satisfactory because (1) it contains an element of risk, particularly if the yarn is of ultra-heavy denier or if spun at high speed; (2) it is apt to cause considerable waste; and (3) it is usually necessary to dampen the face of the empty bobbin to cause the yarn to adhere to it, and this has a deleterious effect on the yarn itself since it tends to remove the finishes that have previously been applied and, under certain circumstances, causes nonuniformity of dyeing.

Various expedients have been proposed to overcome the latter defect, i. e., to cause an empty bobbin to automatically engage the yarn so that doffing can be carried out without the necessity of moistening the bobbin. One expedient has been to provide on the end of the bobbin a spring appropriately shaped to engage the yarn and to securely grip it afterwards. Devices of this type have not proved entirely satisfactory except where comparatively fine denier yarn is involved. In the case of very heavy multi-filament rope (which may be collected for subsequent cutting into staple), as for example, a continuous-filament rope of 30,000 denier, a pick-up spring or, as is also used, a tapered notch on the end of the bobbin, is not satisfactory since it grips only a portion of the filaments, leaving the remainder to slip out of engagement and to lose tension. This loss of tension effectively prevents adherence to the bobbin and makes automatic doffing impossible. No satisfactory means for eliminating the element of risk or for preventing considerable waste during doffing in a continuous process have been disclosed heretofore.

An object of this invention, therefore, is to provide apparatus for automatically transferring yarn from a full package to an empty yarn support without stoppage, and without danger of personal injury to the operator.

A further object resides in the provision of apparatus for automatically transferring yarn in a continuous process without waste of, or damage to, the yarn.

A still further object is to provide an automatic doffing device particularly effective in the handling of ultra-heavy denier yarn.

Another object is to furnish a yarn support provided with improved means for engaging the yarn.

These and other objects will more clearly appear hereinafter.

I have found that both wet and dry ropes of parallel multi-filament yarns of any commercial size will readily cling to wire card cloth of the type used in combing machines for removing tangles and parallelizing individual fibers in the manufacture of cotton and other types of batting. If the wire card cloth moves in the same direction and at substantially the same velocity as the yarn, as for example, when a feed roll is covered with wire card cloth, the yarn clings so readily that there appears to be no loss of tension.

Wire card cloth usually consists of a belt pierced with sharp pointed, closely spaced metal staples in such a way that the points or teeth all project from one face of the belt. The ends of the teeth are usually bent to a definite angle to improve their tendency to engage and parallellize tangled fibers. The use of such a material on a rotating cylinder in its usual manner, wherein the teeth are bent against the direction of rotation would probably entail a sufficiently serious operating hazard to prohibit its use in any application wherein an operator's hand could contact it while in motion. I have found further, however, that surprisingly enough, the direction of inclination of the teeth has relatively little bearing on the effectiveness with which they will seize a parallel-filament rope. Parallel-filament ropes as large as 32,400 denier, for example, can be positively gripped while in motion without any apparent

loss of tension, irrespective of the angle of inclination of the teeth.

These findings have made possible the development of the apparatus of my invention, a preferred form of which is hereinafter described in connection with the drawings wherein:

Fig. 1 is a front elevation of the apparatus;

Fig 2 is an end view with parts broken away to show the means of mounting the bobbins and means for shifting the yarn;

Fig. 3 in a detail view of the portions of the bobbins and of the doffing wheel incorporating the yarn engaging means of this invention; and

Fig. 4 is an end view on the line 4—4 of Fig. 3.

Referring to Figs. 1 and 2, feed roll 1, shifter fork 2, and self-threading traverse guides 3 and 4, all of conventional design, are provided to conduct the yarn to the yarn collection means which comprises a drive roll 5, positively driven about a fixed axis, and tubular bobbins 6 and 7 removably mounted and freely rotatable on spindles 8 and 9, respectively, which project from swing-arms 10 and 11, respectively. The swing-arms are independently mounted in such manner that the bobbins can be moved into contact with, or away from, drive roll 5 which is common to both bobbins, and still maintain axial parallelism with the drive roll.

The adjacent ends of each bobbin carry a narrow band 12 and 13 of radially projecting pins or teeth (Fig. 3) which form substantially the same curved surface as formed by projecting or extending the curved surface of the bobbin, and which therefore move at substantially the same velocity as the cylindrical surface of the empty bobbin. Conveniently these bands are made from conventional card cloth. Scored in the bobbins alongside the outer side of each of these bands is a shallow groove 24 and 25 to permit a knife to be safely held against the rotating bobbin should it become necessary to remove loose ends of the yarn.

Sufficient space is left between the adjacent ends of the bobbins to permit an auxiliary swing-arm 14 to be lowered into place against the central part of drive roll 5 when doffing. This auxiliary swing-arm has a spindle 15 projecting from each side, each projection carrying a doffing wheel consisting of a narrow band 16 and 17 of radially extending pins or teeth attached respectively to a driving disc 18 and 19. The doffing wheels rotate on ball bearings 20 and 21, and since the outside diameter of the bands 16 and 17 is substantially the same as that of the driving discs, the teeth move practically at yarn speed when the discs are brought into contact with the drive roll.

The auxiliary swing-arm contains a removable razor-edged blade 22 (see Fig. 4) equipped with suitably shaped guides and so located that it will sever the yarn when it is gripped simultaneously by wire cards 16 and 17 and by their rotation carried against the cutting edge the blade.

As previously stated, the reciprocating traverse guides 3 and 4 are self-threading, being so shaped that they run under the yarn and automatically steer it into the guide slot, but it is necessary to lift the yarn from one traverse guide before it can be picked up by the other. This is accomplished by lifter bar 23 which normally lies just below the path of the yarn and is mechanically connected by cam 26 and bell-crank lever 27 to the shifter mechanism so that when shifter fork 2 is moved by lever 2' to guide the yarn from one bobbin to the other, the lifter bar immediately rises and lifts the yarn out of the traverse guide slot. The yarn is held out of engagement until the shifter bar has moved it almost in line with the other bobbin. Completing the movement of the shifter fork 2 causes the lifter bar to drop and the yarn then returns to its normal path and is automatically picked up by the traverse guide as it passes beneath it.

The operation of a typical transfer cycle is as follows. Shifter fork 2 is assumed to be in the position shown on Fig. 1 with the yarn passing through traverse guide 3 and being wound on bobbin 6 carried by the swing-arm 10. When this bobbin fills and it becomes necessary to transfer the rope to empty bobbin 7, swing-arm 11 is lowered into place until the bobbin is in contact with and rotating at the same surface speed as drive roll 5. Simultaneously, auxiliary swing-arm 14 is also lowered and sufficient pressure applied to cause driving discs 18 and 19 to acquire the same velocity as the face of the drive roll. Lever 2' is then rapidly pushed over to its opposite position and in doing so causes shifter fork 2 to line up with the center of empty bobbin 7. During this operation a cam 26 actuates lifter bar 23 and causes it to lift the yarn out of the guide slot of traverse guide 3 and to hold it out of engagement with both traverse guides until it is almost in line with bobbin 7, at which point lifter bar 23 begins to drop. When the movement of lever 2' is complete, the yarn falls to its normal path with relation to bobbin 7 and is then in position to be picked up by self-threading traverse guide 4.

During this procedure, the yarn has moved over the end of bobbin 6 and has become gripped successively by the teeth of bands 12, 16, 17, and 13. The angularity of the yarn path with respect to bobbin 7 (caused by the new location of shifter fork 2) causes the yarn to move to the center of bobbin 7 and, since at this point it is lowered by shifter 23, is automatically picked up by the reciprocating traverse guide 4 and continues to wind up on bobbin 7.

The yarn bridging the gap between 16 and 17 has been carried by their rotation into contact with blade 22 and consequently the full package on bobbin 6 continues to rotate but with its severed end of the rope gripped by the teeth of bands 12 and 16. Bobbin 7 is now rotating but with its severed end of the rope held by the teeth of rotating bands 17 and 13. A sharp knife is now held in the guide groove 24 at the end of bobbin 6 and the rope severed between bands 12 and 16 to permit swing-arm 10 and full package to be swung away from the roll and the package to be removed. The knife is then held in the guide groove 25 in the end of bobbin 7 and the rope further severed between wire cards 17 and 13. Bobbin 7 is thus in a condition to permit it to continue to build up to full size, and the cycle is completed by swinging out arm 14, removing the waste yarn entangled on wire cards 16 and 17, examining the condition of blade 22, removing the full package, and inserting an empty bobbin on swing-arm spindle 8 in readiness for the next transfer operation.

It is understood, of course, that the above description is by way of illustration and is not limitative, for it is obvious that the invention is subject to a wide variation from the preferred specific embodiment. Thus in place of the swing-arm type of bobbin holder, other types of bobbin holders intended for use with a constant speed surface drive, may be used, as for example, slotted

guides engaging the ends of a spindle passing through the bobbin in such a manner that the bobbin can rise or move along the guides as the package builds up in size. Also this invention may be used for transferring from a package, which is not being wound at a constant yarn speed providing the toothed bands are rotating at the peripheral speed of the empty bobbin. Likewise, obvious mechanical equivalents could be substituted for the specific bobbin, drive roll, shifter arm, and thread guide and other structures, herein disclosed, and modification particularly suited to the handling of yarn deniers within a restricted range, either extremely high or extremely low, could also be made without departing from either the spirit or terms of my invention.

It is, however, essential that the rope be delivered to the bobbin at approximately its line of contact with the drive roll in the manner usually known as "reverse rotation." Unless the rope is fed to the bobbin in this fashion, it is usually not possible to transfer it from a full package to an adjacent empty core since it loses tension and in consequence tends to become entangled in the yarn traverse mechanism.

I claim:

1. A device for continuously winding textile filaments, yarns, and threads comprising two freely rotatable yarn supports, a positively-driven drive roll, means to position said yarn supports in horizontal alignment against the cylindrical surface of said rolls, two horizontally aligned and freely rotatable doffing wheels positioned between the adjacent ends of said yarn supports, said yarn supports being provided at their adjacent ends with a band comprised of a plurality of radially projecting pins adapted to engage the yarn, said doffing wheels each being provided with a band of pins substantially identical with those of the yarn supports, and means positioned between the doffing wheels to sever yarn therebetween.

2. A device for continuously winding textile filaments, yarns, and threads comprising two freely rotatable bobbins, a positively-driven drive roll, means to bring said bobbins into driving contact with the drive roll in axial alignment, two freely rotatable doffing wheels mounted to contact said drive roll between the adjacent ends of the bobbins and in axial alignment with said bobbins, said doffing wheels and the adjacent ends of said bobbins each being provided with a band comprising a plurality of radially extending pins adapted to engage the yarn without substantially modifying its speed of travel, and means mounted between the doffing wheels for severing yarn.

3. A device for continuously winding textile filaments, yarns, and threads comprising two freely rotatable bobbins, a positively-driven drive roll, means to bring said bobbins into driving contact with the drive roll in axial alignment, two freely rotatable doffing wheels mounted to contact said drive roll between the adjacent ends of the bobbins and in axial alignment with said bobbins, said doffing wheels and the adjacent ends of said bobbins each being provided with a band comprising a plurality of radially extending pins adapted to engage the yarn without substantially modifying its speed of travel, means mounted between the doffing wheels for severing yarn, and traversing thread guide means associated with each bobbin and positioned to feed yarn into the bobbin at substantially its line of contact with the drive roll.

4. A device for continuously winding textile filaments, yarns, and threads comprising two freely rotatable bobbins, a positively-driven drive roll, means to bring said bobbins into driving contact with the drive roll in axial alignment, two freely rotatable doffing wheels mounted to contact said drive roll between the adjacent ends of the bobbins and in axial alignment with said bobbins, said doffing wheels and the adjacent ends of said bobbins each being provided with a band comprising a plurality of radially extending pins adapted to engage the yarn without substantially modifying its speed of travel, means mounted between the doffing wheels for severing yarn, traversing thread guide means associated with each bobbin and positioned to feed yarn into the bobbin at substantially its line of contact with the drive roll, and means for shifting the yarn from one thread guide to the other.

5. A device for continuously winding yarn comprising two freely rotatable yarn supports disposed end to end and in spaced relationship, a drive roll, means for independently positioning said yarn supports in driving contact with said drive roll, the line of contact of one support with the roll being a straight line extension of the line of contact of the other support with the roll, each of said yarn supports being provided with a plurality of radially extending pins disposed in a band closely adjacent the contiguous ends of said supports, the outer extremities of said pins being in substantially the same plane with the outer surface of said yarn supports, two axially aligned freely rotatable doffing wheels each provided with a band of radially projecting pins, means to drive said doffing wheel at substantially the peripheral velocity of the drive roll, and means to bring said doffing wheel into contact with the drive roll between the ends of said yarn supports and on substantially the line of contact of the drive roll and the yarn supports, means to sever the yarn located between said doffing wheels, and reciprocable thread guides associated with each yarn support and positioned to feed yarn on the supports at substantially the line of contact between the drive roll and yarn support.

6. In apparatus for continuously winding yarn wherein doffing wheels are provided for transferring the continuously traveling yarn from a filled yarn support to an empty yarn support, the improvement which comprises providing the doffing wheels and one end of each yarn support with yarn pick-up means comprising a narrow band of radially projecting pins the outer extremities of which lie in substantially the curved plane of the doffing wheel, and yarn support surfaces.

7. In apparatus for continuously collecting yarn in wound packages wherein freely rotatable bobbins are driven by a positively-driven drive roll and doffing wheels also driven by the drive roll are used to transfer continuously running yarns from the filled bobbin to the empty bobbin, the improvement which comprises providing the doffing wheels and the end of the bobbin which initially engages the yarn, with a yarn pick-up device comprising a plurality of pins which are confined within a narrow circumferential band about the doffing wheels and bobbin, and which project out radially from the axis of the doffing wheels and bobbins to such an extent that their extremities travel at substantially the same linear

speed as does a point on the surface of the drive roll.

8. A bobbin for yarn comprising a cylindrical body member provided with a portion of reduced diameter at one end, means to mount said body member freely rotatable on a spindle, a plurality of pins radially projecting from the portion of reduced diameter to substantially the maximum diameter of the cylindrical body member and a circumferential groove immediately adjacent the outer end of said portion of reduced diameter, said groove being shaped to receive the cutting edge of a knife.

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