April 13, 1965 H. BUDDECKE 3,178,123

METHOD AND APPARATUS FOR PULLING YARN FROM A YARN PACK

Filed March 20, 1961 2 Sheets-Sheet 1

Fig. 1

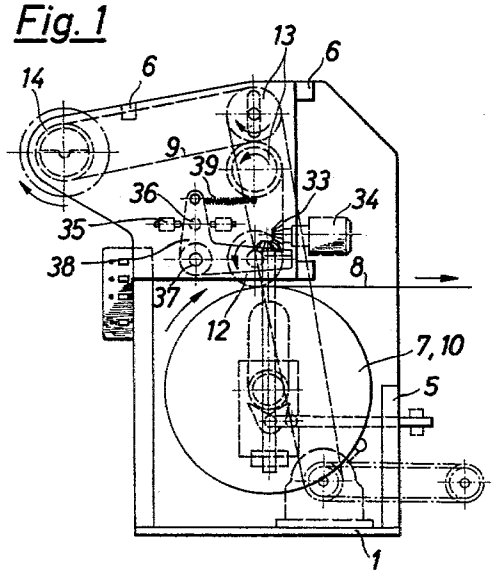

Fig. 2

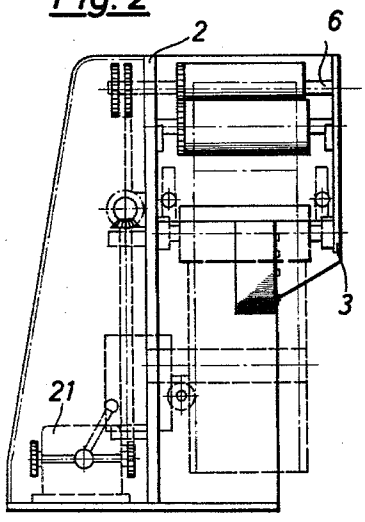

Fig. 3

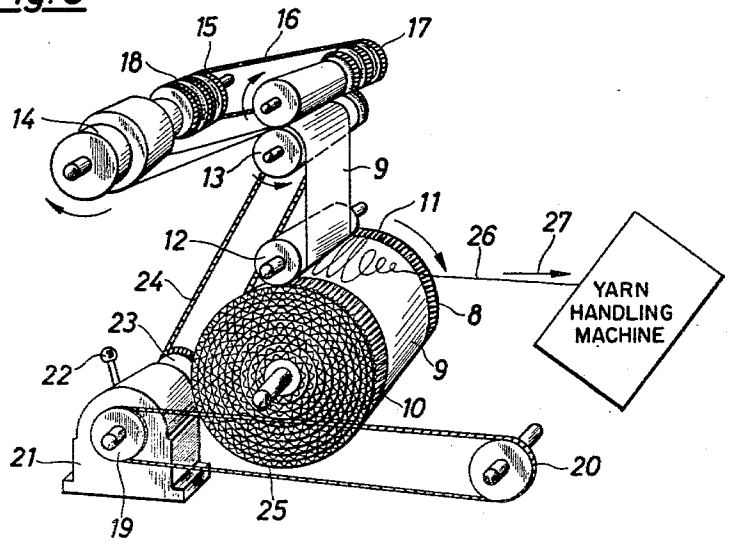

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Fig. 5

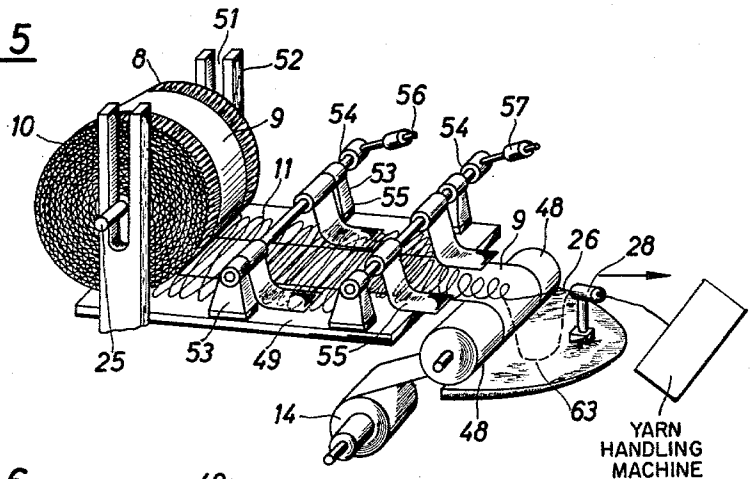


Fig. 6

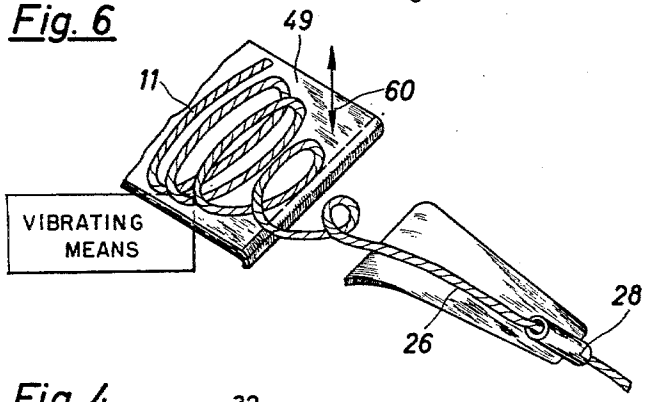


Fig. 4

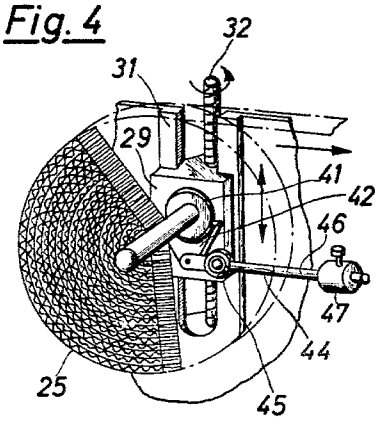
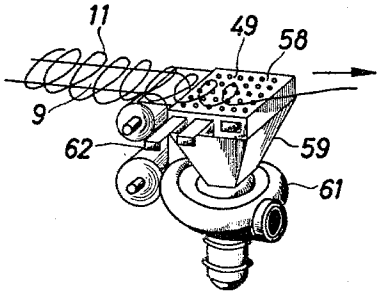


Fig. 7



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METHOD AND APPARATUS FOR PULLING YARN FROM A YARN PACK

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12 Claims. (Cl. 242—54)

The invention relates to a method of and a device for effecting the quick drawing-off with low resistance and free from loops or kinks of yarns from a yarn pack placed before or in a yarn-processing machine, e.g., a weaving machine, a loom or knitting frame or any other appliance for treating yarns in order to handle the greatest possible quantity of yarn in the shortest time, uninterruptedly, without impediment, and free from knots. These requirements which become continually more pressing with increasing automation of all yarn handling and working processes, are not fulfilled in any of the known yarn reeling or drawing appliances.

When the yarn is to be drawn sideways off a rotatably-mounted spool or bobbin, the yarn being drawn off must rotate the spool so that with varying drawing speed high inertia forces have to be overcome by the thread, which may lead to breaking or excessive stretching of the thread, as well as to irregularities in the handling or working of the yarn. In the case of large spools or bobbins carrying a correspondingly large weight of yarn, such an arrangement is impracticable.

When the yarn is drawn off over the head of the spool, whether it is in the form of a cylinder, a cop or a cheese, while the yarn carrier is not rotated, the yarn tends to ball while being drawn off, this ball varying in size with the drawing-off speed and the varying spool diameter, thus causing considerable differences in the yarn tension, which likewise give rise to irregularities in the handling or working of the yarn.

In all cross-spool types of yarn pack, irregular yarn tension is further caused by the fact that the draw-off points on the spool travel up and down the spool. This is also the case with cylindrically-wound spools used in combing frames or needle banks, which are driven circumferentially between two rollers running in the same direction.

Drawing out of spinning cans in which the yarn is laid loose in regular or irregular coils can only be done slowly, if balling, or the drawing of bunched coils not running out in a smooth thread is to be avoided. The quantity of yarn which can be put in a spinning can is also in practice relatively small.

It is already known, in yarn devices, to provide means between the yarn pack and the yarn-processing machines, whereby the yarn is itself coiled in serpentine form in a particular manner by a separately acting arrangement, in particular, transversely moving pins or by damming the thread. The resulting serpentine turns or loops are intended to serve as a reserve to take up any brief variations in the rate of travel or speed of the yarn through the yarn-processing machine, running out or accumulating more or less rapidly while the yarn is being drawn out.

This arrangement does not reduce the tension of the yarn in the part next to the yarn-processing machine, but, on the contrary, preceptibly increases it, unless a special, additional feed motion is imparted to the yarn. Further, with the yarn packs as hitherto used, only a limited length of yarn can be accommodated since with increasing size and weight of the yarn pack, the difficulty of drawing off becomes greater. This is particularly disadvantageous if the yarn pack must be carried in some moving part of the yarn-processing machine; as a consequence of this, such

machines must be stopped at correspondingly short time intervals. In addition, no advantage can be gained by increasing the speed of drawing the yarn through the yarn-processing machine, since that speed cannot be greater than the drawing-off speed of the preceding spool or bobbin or the like, which is greatly restricted by the resistances arising in the yarn pack itself.

The above mentioned disadvantages will be eliminated or reduced if, according to the present invention the yarn pack is of a known form in which a plain strip of yarn formed of transversely extending, elongated loops of yarn is spirally wound up together with a plain separating strip into a roll. The yarn being drawn off in the longitudinal direction of the strips, after the loop of the yarn to be next withdrawn has been brought to a spatially fixed point by the motion of the yarn pack and has been exposed by or released from the separating strip.

By this means, the use of a spool or bobbin is unnecessary, so that the resistance offered to the drawing off of the yarn by the processing machine is only the vanishingly-small resistance of the exposed turns of the yarn to motion over a smooth surface and withdrawal as a smooth thread. No impediment in drawing off; no variation in the resistance of the yarn to drawing off need be feared; no special means for laying the yarn in coils or the like are necessary; and no additional feed devices for the yarn are required.

Owing to the greatly reduced tension required for drawing off the yarn, the attainable drawing speed of the yarn is much increased, since the breaking strain of the yarn depends on the rate at which it is drawn, and the resistance which it offers thereto.

In the device used for operating the method the roll-shaped yarn pack formed of a layer of yarn coils or windings and a separating strip is rotatably mounted and means is provided for drawing off the separating strip at a fixed point and simultaneously rotating the yarn pack.

Especially suitable yarn packs for this purpose are those in which the yarn coils consist of elongated, helically wound turns over-lapping each other. Such yarn packs are quickly and easily wound by machinery. Their weight is not increased by separate spool or bobbin elements and they can be made to contain a very large quantity of yarn which can be drawn off to the very end without tangling.

To eliminate the fluctuations in the drawing tension which might be caused by the changing diameter of the yarn roll or pack, the axis of the yarn pack is shifted as its diameter decreases so that the yarn is drawn off always at the same level.

For this purpose, the rolled yarn pack is either supported circumferentially on a drawing-off table which simultaneously supports the freed yarn coils or the axis of the roll is raised or lowered by a control element making contact with its circumference, driven by a reversing motor, as its diameter decreases.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation of the drawing off device with a separating strip moving vertically upwards,

FIG. 2 is an end view corresponding to FIG. 1,

FIG. 3 is a perspective view of the yarn pack for the device with the separating strip being drawn off vertically, and the yarn thread being drawn off horizontally;

FIG. 4 is a perspective view of a control element for the shaft of the yarn roll or pack,

FIG. 5 is a perspective view of a second embodiment; and

FIGS. 6 and 7 show further embodiments of the braking and separating element.

In the embodiment shown in FIGS. 1 to 4, the body of the device consists of a base 1 (FIG. 1), a central sup-

porting partition 2 (FIG. 2), a front plate 3 parallel thereto, and side plates or braces 5, 6 (FIG. 1).

The yarn pack 7 is carried in the lower part of the device and consists of a strip of coiled yarn 8 and a separating or parting strip 9; which, as will be seen in FIG. 3, are rolled up together to form a yarn roll 10.

The layer of coiled yarn consists of yarn coils 11 (FIG. 5) of elongated, helical shape, running transversely to the direction of the strip, and overlapping each other. Yarn coils of this type, their preparation and assembly in a yarn pack, are more fully described in the German patent specifications 869,932, 877,592, 891,984 and 929,123. Such yarn packs can be very rapidly wound to any size required and enable the completely untangled drawing off of the yarn to the very end to be achieved, while the yarn cannot be drawn without a certain amount of tension. In accordance with the fundamental feature of the invention, the yarn coils 11 enclosed by the separating strip 9 are freed by the said separating strip 9 always in the same place, where the yarn is taken off by the yarn-handling or processing machine following. While this latter machine when drawing off the yarn merely has to exert the slight force necessary to straighten the exposed coils without applying tension to the yarn, the drive for exposing the coiled yarn is supplied by a separate driving motor so that the yarn being drawn off is itself free from all forces required for its exposure, the motion of the yarn pack, and overcomes the friction between the thread being drawn and the rest of the yarn in the pack. The handling and processing of the yarn can, therefore, be conducted with a completely uniform, but also very low yarn tension; in fact, so low, as to be exactly sufficient to keep the yarn approximately straight.

As shown in the perspective view in FIG. 3, the separating strip 9 is led over a guide roller 12 upwards. This strip runs between two, gear-meshed, counter-rotating driving rollers 13, by which it is drawn off the yarn pack roll 10, and finally wound on the stock reel 14. This reel 14 is driven through a chain sprocket 15 by a chain 16, running on a sprocket 17. The stock reel 14 is connected with the sprocket 15 by means of a slipping clutch 18.

In order to ensure that the quantity of yarn released or exposed by the separating strip 9 shall always correspond to the quantity of yarn required by the processing machine, the following arrangement is used:

A chain sprocket 20 on the yarn-processing machine is continuously driven by the latter at a speed corresponding to the instantaneous rate of yarn consumption by the said machine. It is connected by a chain with the chain sprocket 19 of a chain drive 21, controlled or driven by the sprocket 20. This gear transmits the drive, through a reducing train controlled by the handle 22, and a drive sprocket 23 actuating a chain 24 to the chain sprocket 17, which is connected with the upperdriving roller 13. By this means, the separating strip 9 is drawn off the roll 10 according to the rate of consumption of the yarn by the processing machine and correspondingly frees or exposes the yarn coils 11.

The hand crank 22 regulates the rate of release of the yarn coils 11, which is necessary when the distance between the coils changes.

The drive to the roller 13 simultaneously through the sprocket 17 and the slipping clutch 18, actuates the separating strip stock reel 14, the diameters of the sprockets 15 and 17 are equal and the diameter of the stock reel is somewhat larger than that of the upper roller 13 so that the part of the strip 9 between the stock reel 14 and the rollers 13 is permanently tensioned. However, as the driving force of the slipping clutch is set at such a low value that the separating strip 9 cannot be drawn through the rollers 13 force of the slipping clutch 18 will be overcome and the strip 9 always be reeled up under tension.

While the separating strip 9 is being drawn off between the rollers 13, the entire yarn pack roll 10 is being rotated on its axis 25, the coils 11 hitherto held fast by the separating strip 9 being thus, successively released or exposed by the latter and caused to move forward together with the pack roll. The yarn thread is drawn off in the direction of the arrow 27 (FIG. 3) by a diagrammatically indicated yarn handling machine, the exposed coils 11 being successively stretched or straightened.

The yarn consumption of the processing machine may fluctuate over short or long periods, regularly or irregularly. The longer fluctuations are taken up by controlling the chain sprocket 20, while for dealing with the short-term fluctuations, it is advisable to accumulate in front of the fixed yarn-guiding means 28 (FIGS. 5, 6) which forms a part of the processing machine, a sufficient number of exposed or freed yarn coils or loops 11, by which means the small and medium, periodic fluctuations of the rate of consumption of the yarn in the processing machine can be compensated.

As the separating strip 9 and the yarn strip 8 are drawn off, the diameter of the yarn pack roll 10 continuously decreases, so that the point of release of the yarn coils or loops descends. To ensure that these yarn coils are always released at the same level as well as to ensure that when a new yarn pack is inserted this level is maintained, the axis 25 (FIG. 3) of the pack is correspondingly raised or lowered.

For this purpose, in the exemplary embodiment according to FIGS. 1–4, the axis 25 is rotatably supported in a slide 29 (FIG. 4) which can be moved up and down in vertical guides 31 by means of a screw spindle 32. This screw spindle is linked through a pair of bevel gears 33 (FIG. 1) to a small, reversing motor 34, which, through a two-way switch 35, can be set to run in either direction. The two-way switch coacts with a stop 36 on a bell-crank lever 38 pivoted in the body, and carrying the previously mentioned guide roller 12. A spring 39 acting on the upper, vertical arm of the bell-crank lever 38, presses the guide roller 12 against the circumference of the yarn roll, in such manner that the stop 36 is moved to the left when the roll diameter increases, and to the right when it decreases, and correspondingly operates the two-way switch 35. In this manner, as the yarn roll diameter decreases, its axis 25 is raised by the spindle 32, and the motor 34 is stopped as soon as the release point has reached the prescribed height. If the diameter of the yarn roll is greater than the corresponding position of the axis 25, the other contact of the two-way switch is brought into action and the spindle 32 rotated by the motor 34 in the opposite direction until the yarn-release point is again in the prescribed position.

To prevent the coiled yarn roll 10 from becoming loosened by the withdrawal of the separating strip, the axis 25 (FIG. 4) carries a brake disc 41 (FIG. 4), coacting with a brake block 42 which is attached on a lever 44 pivoted at 45 on the slide 29 having a right-handed arm 46 carrying a slidably-held weight 47. By adjusting this weight 47 a braking force can be set up between the parts 41 and 42 of a magnitude to apply a slight but sufficient tension to the withdrawal part of the parting strip 9, preventing any loosening of the coiled-yarn roll.

In the form of embodiment according to FIG. 5, the separating strip 9 is withdrawn horizontally over a guide roller 48 and wound on a stock reel 14.

The controlling and tensioning means for the withdrawal of the separating strip, not shown in this figure, are the same as those represented in FIG. 1. The coiled-yarn 10 lies with its circumference on a run-off table 49. This table 49 also carries the withdrawn portion of the separating strip 9 and the exposed portion of the yarn coils 11 not yet withdrawn by the yarn processing machine. This arrangement automatically ensures that the release point for the yarn coils is always at the same meight, viz., at the level of the upper surface of the element 49. It is here, therefore, unnecessary to provide special means for controlling the height of the axis 25 of the yarn roll; it being sufficient to make it guidable in

vertical slots 51 of guide plates 52 attached laterally to the run off table 49.

In order to prevent the released yarn coils or loops 11, lying between the thread guide 28 and the release point, from balling or tangling for any reason, and to ensure that they are drawn off steadily in a continuous, straight thread, in particular that they should uniformly become narrower in the drawing direction, the following means are used.

In the arrangement of these braking and straightening elements according to FIG. 5, small spindles 54 are supported between pairs of brackets 53 on the run-off table 49, carrying light braking elements 55, which are by means of small weights 57 slidably carried on arms 56 attached on the spindles 54, controllably pressed against the exposed or released yarn coils or loops 11. These braking elements 55 are thin strips of metal or plastic foil, flexibly curved and highly polished on the underside, which have the purpose of lightly pressing the yarn coils against the polished surface of the run-off table. The two braking elements of each pair are reciprocally spaced at a distance continuously diminishing in the direction of run-off, whereby it is attained that the drawing tension on the threads is greater on the coils nearest the yarn guide 28 and the thread is straight when it reaches the said guide 28.

The same braking and straightening arrangements can operate in various other ways. For instance, in the form of embodiment according to FIG. 6, the run-off table 49 can be made to vibrate vertically as indicated by the arrow 60, by means of a suitable vibrator element as diagrammatically indicated at the left portion of the figure. As a result the vibrations transmitted by the released yarn loops or coils will facilitate loosening of the coils from the loop shape into a straight thread.

In the form of embodiment according to FIG. 7, the released yarn loops 11 are guided over perforations 58 in a part of the run-off table 49, opening into a funnel 59 from which air is extracted by the fan 61. The holes 58 can be opened or closed by lateral slides 62, in such manner that particular parts of the yarn coils 11 are drawn against the perforated top plate of the funnel representing in FIGURE 7 the run off table 49 by the sucking action of the air, obtaining the same effect as with the braking elements according to FIG. 5.

Between the yarn guiding eye 28 the end of the run-off table 49 (FIG. 6), or the guide roller 48 for the parting strip (FIG. 5), a gap is left into which the last, already nearly circular turn of the withdrawn thread can drop and hang in the manner indicated by the broken lines 63 in FIG. 5.

What I claim is:

1. A method for drawing off the yarn thread from a substantially cylindrical yarn pack composed of continuous spiral yarn layers separated by spiral layers formed by a spirally wound flat leaf strip, said yarn layers comprising a succession of elongated helicoidal yarn thread coils extending in directions of their lengths transversely to the direction of length of said strip, said method comprising the following steps: drawing off said flat leaf strip in a tangential direction from said cylindrical yarn pack thereby rotating the latter about its axis, and freeing successive ones of said elongated helicoidal yarn thread coils from coverage by said flat leaf strip at the lay-open line in which successive portions of the radially outer ones of said yarn layers and one of the sides of said separating strip are detached from each other, said lay-open line being disposed on the circumference of said cylindrical yarn pack; maintaining said lay-open line in a constant horizontal position; drawing off said freed successive ones of said elongated helicoidal yarn coils in a direction perpendicular to said lay-open line; whereby the coiled disposition of the yarn thread of successive ones of said yarn thread coils is changed to a substantially straight line disposition.

2. A method according to claim 1, further comprising the step of applying a braking force to opposite end portions of said elongated helicoidal thread coils after freeing said coils from said coverage by said flat leaf strip to prevent entanglement of said coils.

3. A device adapted to cooperate with mechanical means in drawing-off a yarn thread from a substantially cylindrical yarn pack rotatable about its axis and composed of continuous spiral yarn layers separated by spiral layers formed by a spirally wound leaf strip, said yarn layers comprising a succession of elongated helicoidal yarn thread coils extending in direction of their lengths transversely to the direction of length of said strip, said device comprising further mechanical means for causing a drawing-off movement of said leaf strip from said yarn pack and thereby imparting rotation to said yarn pack about said axis, said drawing-off movement being effective to free successive ones of said elongated helicoidal yarn thread coils from coverage by said flat leaf strip at the lay-open line in which successive portions of the radially outer ones of said yarn layers and one of the sides of said separating strip are detached from each other, said drawing off movement of said leaf strip being in a direction away from the circumference of said cylindrical yarn pack, means for maintaining said lay-open line in constant horizontal position comprising means for compensating for the decrease of the radius of said cylindrical yarn pack caused by said drawing off movement, said compensating means comprising means for vertically shifting said axis of said cylindrical yarn pack, said first-named mechanical means being operatively connected to said yarn thread and imparting a force to the outermost coil of said freed successive ones of said elongated yarn coils for drawing-off the yarn thread from said outermost coil.

4. A device according to claim 3, further comprising means for constraining the action of said force to a line longitudinally median of said leaf strip, and means preventing the entangling of said freed yarn coils.

5. A device according to claim 3, wherein said mechanical means for causing said drawing off movement of said leaf strip comprises a pair of drive rollers for gripping and driving said strip, and means for driving said drive rollers including reduction gear means and control means for said reduction gear means effective to control the speed of said rollers for controlling said movement.

6. A device according to claim 4, further comprising means engaging and supporting end portions of said freed elongated yarn coils, said means preventing the entangling of said freed yarn coils comprising means for braking a plurality of said freed successive ones of said elongated yarn coils, said means for braking comprising a plurality of flat, resilient tongue members engaging said end portions of said elongated yarn coils and pressing said end portions downwardly against said means engaging and supporting said end portions, the lengths of said freed elongated yarn coils diminishing in the direction of said drawing-off movement.

7. A device according to claim 3, wherein said mechanical means for causing a drawing-off movement of said leaf strip is effective to effect said movement from the topmost line of said cylindrical yarn pack in a direction tangential of said pack, said topmost line being co-incidental with said lay-open line, a guide roller for guiding said separating strip upwardly from said yarn pack, said yarn pack having an axle, said means for vertically shifting said axis of said pack including vertically extending guide means for said axle, and said means for vertically shifting said axis of said pack moving said axle upwardly in correspondence with the decrease of radius of said yarn pack effected by the said drawing-off movement of said leaf strip.

8. A device according to claim 3, wherein said mechanical means for causing said drawing-off movement of said leaf strip is effective to draw-off said strip in a

direction upwardly of said yarn pack, said freed successive ones of said yarn coils being drawn-off in a horizontal direction by said first-named mechanical means, said means for vertically shifting the axis of said pack moving the axis of said cylindrical yarn pack upwardly in accordance with the decrease, of the radius of said yarn pack in consequence of said drawing-off movement of said leaf strip, said means for vertically shifting said axis comprising a vertically shiftable slide member rotatably mounting said yarn pack, means including a reversing motor for moving said slide member, and control means sensing the topmost line of said cylindrical yarn pack, switch means for said motor, said control means being effective to operate said switch means for energizing said motor.

9. A device according to claim 3, wherein said mechanical means for causing a drawing-off movement of said leaf strip is effective to draw said strip from the lowermost line of said cylindrical yarn pack in a horizontal direction, a horizontally disposed run-off table supporting said leaf strip, said freed successive ones of said coils and said cylindrical yarn pack, said yarn pack having an axle, means for vertically guiding said axle, means for deflecting the movement of said leaf strip in a downward direction below said run-off table, and means for guiding the yarn thread from said freed coils in a horizontal direction.

10. A device according to claim 3, wherein said further mechanical means is effective to cause said drawing-off movement to take place in a horizontal direction, a horizontally extending run-off table supporting said freed successive ones of said coils, a yarn guiding eye stationarily located in front of said run-off table receiving and guiding the yarn thread from said outermost coil, said first-named mechanical means being effective to draw-off said yarn thread from said coils and through said guiding eye, said table and said guiding eye being in spaced relationship.

11. A device according to claim 4, wherein said means for preventing the entangling of said freed yarn coils comprises means for braking a plurality of said freed yarn coils including a run-off table supporting said freed yarn coils, said run-off table being vibratable in a vertical direction for effectively preventing said freed coils from adhering to said table.

12. A device according to claim 4, wherein said means preventing the entangling of said freed yarn coils comprises means for braking a plurality of said freed coils including a run-off table supporting said freed coils, passages in said table, a fan for drawing air through said passages inwardly of said table, and means for selectively opening and closing said passages.

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