Nov. 18, 1952 B. MARCELLUS 2,618,441

CONE WINDER TENSION COMPENSATOR

Filed Aug. 7, 1951 2 SHEETS—SHEET 1

Fig. 1.

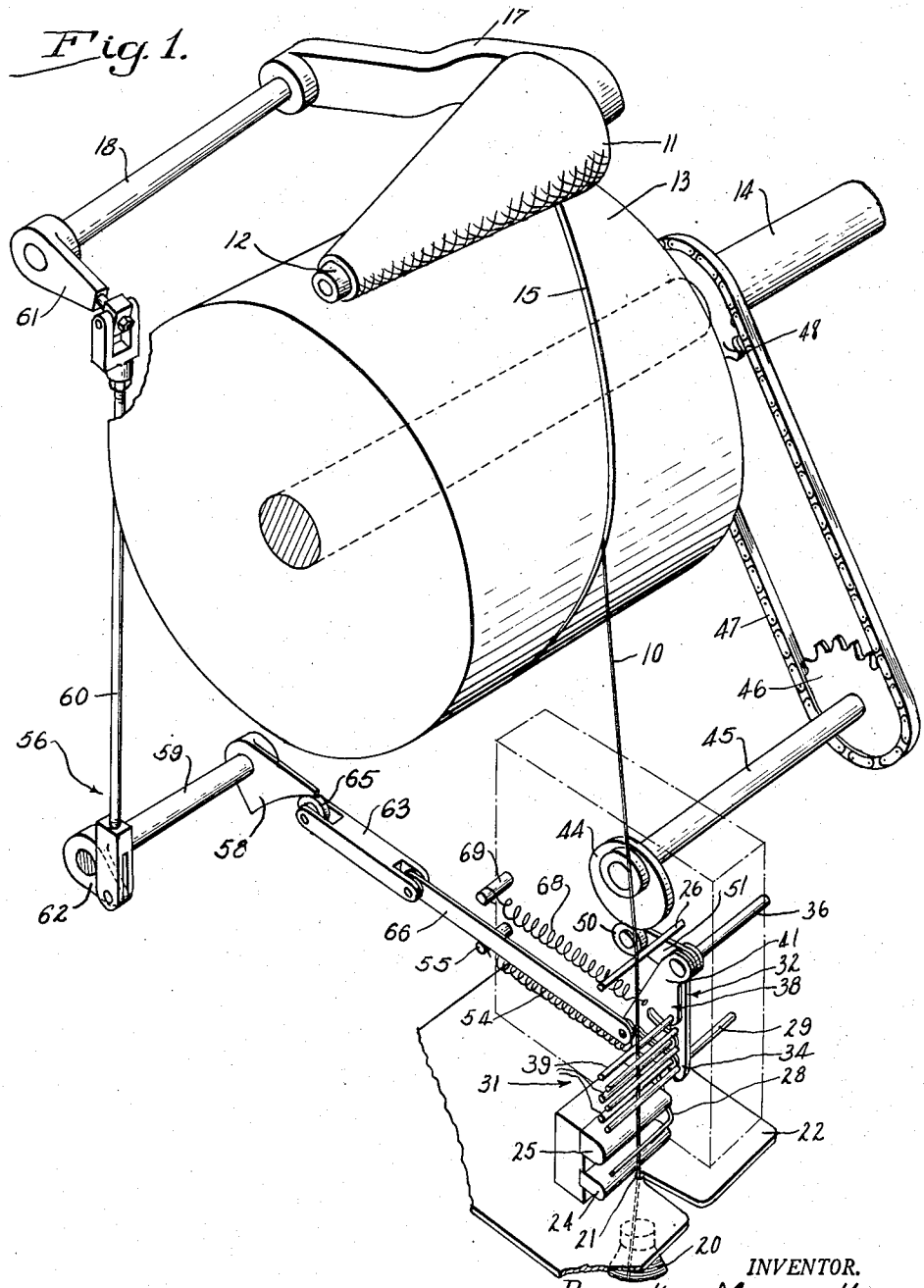

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Fig. 2.

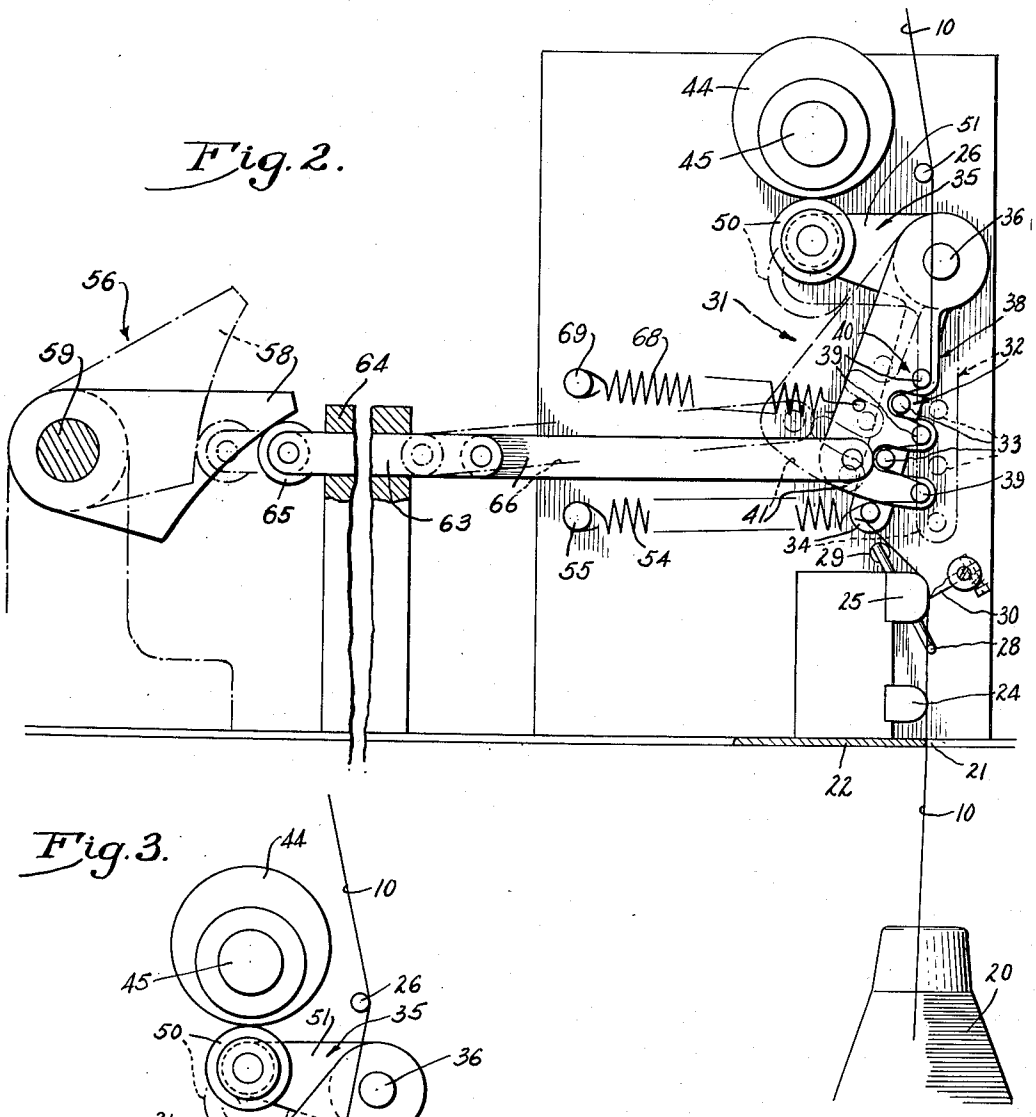
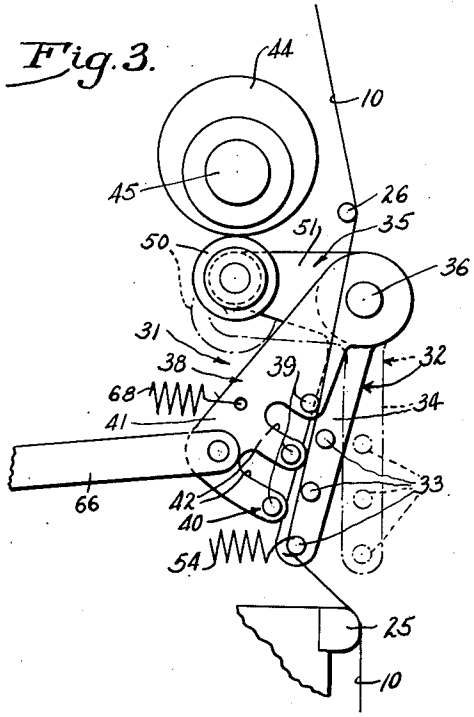


Fig. 3.



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CONE WINDER TENSION COMPENSATOR

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16 Claims. (Cl. 242—45)

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This invention pertains to machines for winding conical packages or "cones" of yarn. When a conical package of yarn is wound at constant rotary speed, the linear speed of the yarn varies as the yarn is traversed back and forth between the large end of the cone and the small end, the linear speed being greatest at the large end and smallest at the small end. As a result there is a tendency for the yarn to be wound with less tension at the small end than at the large end so that an unsatisfactory cone having non-uniform density is produced.

It is an object of this invention to provide a cone winder having improved means for producing variable frictional tensioning on the yarn in order to wind cones with substantially uniform tension. This invention provides means to compensate for the fact that there is a decrease in the proportional variation in the linear winding speed between the large and small ends of the cone as the yarn accumulates on the cone. Thus it is a further object of the invention to provide a cone winder having a tensioning device which varies the winding tension as the yarn is traversed between the large and small ends of the cone, the variation in the tension being gradually reduced as the yarn builds up on the cone.

This invention is particularly applicable to winding machines in which the yarn is traversed by means of a grooved drum which is held in frictional driving engagement with the cone.

The objects of the invention thus generally set forth, together with other objects and ancillary advantages, are attained by the construction and arrangement shown by way of illustration in the accompanying drawings, in which:

Figure 1 is a somewhat diagrammatic perspective view of a yarn winding machine constructed in accordance with the invention.

Fig. 2 is a partly sectional elevational view of a portion of the machine including the yarn tensioning device, and

Fig. 3 is a fragmentary view similar to Fig. 2 showing a change of position of the tensioning device.

While the invention is susceptible of various modifications and alternative constructions, there is shown in the drawings and will herein be described in detail the preferred embodiment, but it is to be understood that it is not thereby intended to limit the invention to the form disclosed, but it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

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In Fig. 1 a yarn strand 10 is being wound into a conical package or "cone" 11 on a conical winding form 12. The winding machine includes means adjacent the cone 11 to traverse the yarn back and forth along the cone between the large and small ends thereof. In this instance, the traversing means includes a yarn traversing drum 13 carried for rotation by a shaft 14. The drum has a single traversing groove 15 which in this instance runs in spiral fashion from one end of the drum to the other and back again in one revolution of the drum.

The yarn strand 10 is wound on the conical package 11 by rotating the cone as the yarn is traversed from one end to the other. In this instance the cone 11 is frictionally driven by the winding drum 13, the winding drum being rotated by means of a source of motive power (not shown) connected to the shaft 14. In order to hold the cone 11 in frictional driving engagement with the drum 13, the conical winding form 12 is rotatably carried on the end of an arm 17 supported by a rock shaft 18. The cone 11 is held against the drum 13 in any suitable way, as by the weight of the cone 11, the winding form 12, and the arm 17.

The yarn strand 10 is fed to the traversing drum 13 along a predetermined path from a source of supply in the form of a bobbin 20. In traveling along its path, the yarn 10 is guided by means of an eye 21 in a plate 22 positioned above the bobbin 20. The yarn passes over a pair of adjacent elongated guide members in the form of abutments 24 and 25 positioned transverse to the yarn path above the eye 21. A further elongated guide member in the form of a rod 26 is positioned transverse to the yarn path above the abutment 25 on the same side of the yarn as the abutments. A thread detector 28 may be held in contact with the yarn between the abutments 24 and 25 and on the opposite side of the yarn therefrom. The thread detector 28 may be rockably carried by means of a shaft 29. A rockable yarn cleaning snick plate 30 (Fig. 2) is disposed opposite the upper abutment 25.

In accordance with this invention, a tensioning device 31 acts upon the yarn 10 at a point along its path from the bobbin 20 to the drum 13. The tensioning device preferably acts upon the yarn between the guiding abutment 25 and the guiding rod 26. In this instance the tensioning device includes yarn deflecting means 32 in the form of a plurality of parallel grid rods 33 movably carried by a depending arm 34 of a bell crank 35 which is rotatably mounted on a shaft 36. A

second yarn deflecting means 38 is provided, which in this instance includes a plurality of parallel rods 39 arranged to form a second grid 40. The grid rods 39 are carried on an arm 41 pivoted on the shaft 36, the rods being staggered with respect to the grid rods 33 so that one set of rods can mesh with the other. In this particular machine, three rods are employed on each deflecting means. The arm 41 has two notches 42 to provide for meshing of the sets of grid rods.

The yarn deflecting devices 32 and 38 are positioned on opposite sides of the yarn strand 10. In this instance the deflecting device 32 is movable to deflect the yarn toward the guiding members 25 and 26 while the other deflecting device 38 is movable toward the first deflecting device 32 to deflect the yarn in the opposite direction. Thus the grid rods 33 and 39 may be advanced in opposite directions to increase the frictional tension on the yarn strand 10. When the grid rods 33 and 39 are fully advanced, the yarn strand is deflected around the rods in serpentine fashion as clearly shown in Fig. 2.

Means is provided to oscillate one of the deflecting means 32 or 38 back and forth in order to change the frictional resistance to yarn movement as the yarn is traversed back and forth along the cone 11. In this instance the deflecting means 32 is moved back and forth by means of a cam 44 mounted on a shaft 45 which carries a sprocket wheel 46 driven by a chain 47 running on a sprocket wheel 48 carried by the drum shaft 14. The cam 44 may be driven at the same rotative speed as the drum 13. In order to move the yarn deflecting means 32, the cam 44 may act upon a cam riding roller 50 carried on the end of a generally horizontal arm 51 of the bell crank 35. In this instance the cam 44 is positioned so that the high portion of the cam is acting on the bell crank 35 when the drum 13 is feeding the yarn 10 to the large end of the cone 11. The cam 44 rotates to permit the grid rods 33 to advance against the yarn 10 as the yarn is traversed toward the small end of the cone 11. The follower roller 50 may be held against the cam 44 by means of a coil spring 54 tensioned between the arm 34 and a stationary pin 55.

At the beginning of the winding operation the yarn deflecting means 38 is fully advanced so that the back and forth oscillation of the other yarn deflecting means 32 produces a maximum variation in the frictional tensioning provided by the yarn tensioning device 31. Means is provided to reduce the variation in tensioning as the yarn builds up on the cone 11. As the diameter of the cone increases, there is a decrease in the percentage variation in the linear speed of the yarn as the yarn is traversed from one end of the cone to the other. Consequently, there is need for less variation in the frictional tensioning of the yarn as the yarn accumulates on the cone 11. In order to reduce the variation in the tensioning, means is provided to withdraw the yarn deflecting means 38 in response to accumulation of wound yarn on the cone 11. In this instance the deflecting means 38 is withdrawn by operating means 56 which produces withdrawing movement of the deflecting means as the winding form 12 moves away from the winding drum 13. The form 12 is moved away from the drum by wound yarn which accumulates thereon. In the illustrated embodiment, the operating means 56 includes a cam 58 which is driven by the rock shaft 18 supporting the arm 17 which carries the form 12. The cam 58 is mounted on a shaft 59 which is connected with the rock shaft 18 by means of a link rod 60 pivotally connected to arms 61 and 62 carried by the shafts 18 and 59. The cam 58 operates the deflecting means 38 by means of a cam follower 63 slidably carried in a stationary bearing 64 (Fig. 2). The cam follower 63 has a roller 65 which rides on the cam 58. The follower 63 is connected with the arm 41 by means of a link 66 having its opposite ends pivoted to the slider and the arm 41. In this instance the follower roller 65 is held against the cam 58 by means of a coil spring 68 tensioned between the arm 41 and a stationary pin 69.

In the operation of the machine, the conical winding form 12 is initially held in frictional driving engagement with the drum 13 by means of the movable supporting arm 17. Yarn is threaded from the bobbin 20 through the eye 21 over the abutments 24 and 25, between the deflecting means 32 and 38, over the guiding rod 26, and along the traversing groove 15 to the conical winding form 12. When winding begins, the winding form 12 is rotated by the drum 13 and the yarn is traversed along the form 12 from end to end by the traversing groove 15 in the drum. When the yarn is being wound on the small end of the form 12, the linear speed of the yarn is relatively small. As the yarn is traversed toward the large end of the form 12, the linear speed increases in proportion to the increasing diameter of the form. The increasing linear speed of the yarn tends to increase the tension on the yarn and produce denser winding at the large end of the form than at the small end.

However, by means of this invention, the frictional resistance to movement of the yarn is decreased as the yarn is traversed toward the large end of the form 12. This is accomplished by withdrawing the yarn deflecting means 32 as the yarn is traversed toward the large end of the conical package 11. As the traversing of the yarn reaches the large end and begins to proceed toward the small end of the cone 11, the cam 44 is rotated so that the roller 50 rides down the cam by virtue of the tension provided by the spring 54. The grid rods 33 on the deflecting means 32 are thereby moved toward the guiding members 25 and 26 and the grid rods 39 so that the yarn 10 is given an increasingly serpentine path around the rods and the guiding members. The point of maximum advance of the deflecting means 32 is reached when the yarn is being fed to the small end of the cone 11 by the traversing drum 13. At this point the tensioning device 31 provides a maximum tension. The maximum tension position of the deflecting means 32 is illustrated in full lines in Figs. 2 and 3. As the yarn is traversed toward the large end of the cone 11, the arm 34 and the grid rods 33 are moved toward their minimum tension position, shown in dotted lines in Figs. 2 and 3.

When the winding of the cone 11 is begun, the deflecting means 38 is fully advanced into its maximum tension position illustrated in full lines in Fig. 2. As the winding of the cone 11 proceeds, the diameter of the cone is increased by accumulation of wound yarn on the cone. The percentage variation in the linear speed of the yarn, caused by traversing the yarn between the large and small ends of the cone, gradually decreases as the yarn builds up on the cone. To compensate for this reduction in the speed variation, the deflecting means 38 is gradually withdrawn to its minimum tension position illustrated in full lines in Fig. 3. As the winding proceeds,

the deflecting means 38 is withdrawn by means of the cam 58. The winding form 12 is moved away from the winding drum 13 as the diameter of the cone 11 increases, and the rock shaft 18 is thereby turned counterclockwise. The link 60 gradually turns the cam 58 counterclockwise toward its minimum tension position illustrated in dotted lines in Fig. 2. The follower roller 65 rides down the cam by virtue of the force of the spring 68. When the winding of the cone is nearly complete, the grid rods 39 are withdrawn to such an extent that the yarn no longer follows a serpentine path around the rods 33 and 39 when the rods 33 occupy their maximum tension position. However, the rods 33 continue to deflect the yarn around the guide members 25 and 26, as shown in Fig. 3.

By means of this invention, satisfactory cones may be wound for use in situations, such as in the knitting industry, where substantially uniform density is required.

I claim as my invention:

1. In a machine for winding yarn on cones, a rotatable conical winding form, traversing means adjacent the form for traversing the yarn back and forth along the form, means to guide the yarn along a path to the traversing means, a first movable tensioning member to deflect the yarn from its path in one direction to provide frictional tensioning, means operated by the traversing means to move the first tensioning member back and forth to increase the frictional tensioning as the yarn is traversed toward the small end of the conical winding form, a second member movable adjacent the first member to deflect the yarn in the opposite direction for changing the amount of variation in the tensioning caused by the back and forth movement of the first member, and means to move the second member in a direction to reduce the variation in tensioning in response to accumulation of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

2. In a machine for winding yarn on cones, a winding drum having a continuous yarn traversing groove running from one end of the drum to the other and back again in one revolution, a conical winding form, movable means rotatably holding the form in frictional driving engagement with the drum, means to guide the yarn along a path to the drum, a first movable tensioning member to deflect the yarn from its path in one direction to provide frictional tensioning, means operated by the winding drum to move the first member back and forth to increase the frictional tensioning as the yarn is traversed toward the small end of the conical winding form, a second tensioning member movable adjacent the first member for deflecting the yarn in the opposite direction to change the amount of variation in the tension caused by the back and forth movement of the first member, and means operated by the movable means to move the second member in a direction to reduce the variation in tensioning as the winding form moves away from the drum due to accumulation of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

3. In a machine for winding yarn on cones, a rotatable conical winding form, traversing means adjacent the form for traversing the yarn back and forth along the form, means to guide the yarn along a path to the traversing means, a tensioning device to maintain substantially constant winding tension on the yarn including first and second deflecting means on opposite sides of the yarn path, means operated by the traversing means to move the first deflecting means toward and away from the second as the yarn is respectively traversed toward and away from the small end of the conical form, and means to withdraw the second deflecting means from the first in response to accumulation of wound yarn on the form in order to reduce the variation in tension produced by the back and forth movement of the first deflecting means.

4. In a machine for winding yarn on cones, a conical winding form, a grooved winding drum to traverse the yarn back and forth along the form, movable means holding the form for rotation in frictional driving engagement with the drum, means to guide the yarn along a path to the drum, a tensioning device to maintain substantially constant winding tension on the yarn including first and second deflecting means on opposite sides of the yarn path, means operated by the winding drum to move the first deflecting means toward and away from the second as the drum respectively traverses the yarn toward and away from the small end of the conical form, and means operated by the movable means to withdraw the second deflecting means from the first in response to building up of wound yarn on the form in order to reduce the variation in tension produced by the back and forth movement of the first deflecting means.

5. In a machine for winding yarn on cones, a conical winding form, a grooved winding drum to traverse the yarn back and forth along the form, a rockable arm holding the form for rotation in frictional driving engagement with the drum, means to guide the yarn along a path to the drum, a tensioning device to maintain substantially constant winding tension on the yarn including first and second deflecting means on opposite sides of the yarn path, means including a cam driven by the winding drum to move the first deflecting means toward and away from the second as the drum respectively traverses the yarn toward and away from the small end of the conical form, and means including a cam driven by the rockable arm to withdraw the second deflecting means from the first in response to building up of wound yarn on the form in order to reduce the variation in tension produced by the back and forth movement of the first deflecting means.

6. In a machine for winding yarn on cones, a winding drum having a continuous yarn traversing groove running from one end of the drum to the other and back again in one revolution, a conical winding form, movable means holding the form for rotation in frictional driving engagement with the drum, means to guide the yarn along a path to the drum, a tensioning device to maintain substantially constant winding tension on the yarn including first and second deflecting means on opposite sides of the yarn path, means operated by the winding drum to move the first deflecting means toward and away from the second as the drum respectively traverses the yarn toward and away from the small end of the conical form, and means operated by the movable means to move the second deflecting means away from the first as the movable means is moved away from the drum due to building up of wound yarn on the form, in order to reduce the variation in tension produced by the back and forth movement of the first deflecting means.

7. In a machine for winding yarn on cones, a winding drum having a continuous yarn groove traversing the drum from one end to the other and back again in one revolution, a conical winding form, movable means rotatably holding the form in frictional driving engagement with the drum, means to guide the yarn along a path to the drum, first and second movable meshing grids for tensioning the yarn by deflecting it in an opposite direction from its path, means operated by the winding drum to move the first grid in a tension increasing direction as the drum traverses the yarn toward the small end of the conical form, and means operated by the movable means to move the second grid in a tension reducing direction as the winding form moves away from the drum due to building up of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

8. In a machine for winding yarn on cones, a conical winding form, a grooved winding drum to traverse the yarn along the form, movable means rotatably holding the form in frictional driving engagement with the drum, means to guide the yarn along a path to the drum, first and second movable meshing grids for tensioning the yarn by deflecting it in opposite directions from its path, means operated by the winding drum to move the first grid in a tension increasing direction as the drum traverses the yarn toward the small end of the form, and means operated by the movable means to move the second grid in a tension reducing direction as the winding form moves away from the drum due to building up of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

9. In a machine for winding yarn on cones, a winding drum having a continuous yarn groove traversing the drum from one end to the other and back again in one revolution, a conical winding form, movable means rotatably holding the form in frictional driving engagement with the drum, means to guide the yarn along a path to the drum, first and second movable meshing grids for tensioning the yarn by deflecting it in opposite directions from its path, means including a cam driven by the winding drum to move the first grid in a tension increasing direction as the drum traverses the yarn toward the small end of the conical form, and means operated by the movable means to move the second grid in a tension reducing direction as the winding form moves away from the drum due to building up of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

10. In a machine for winding yarn on cones, a winding drum having a continuous yarn groove traversing the drum from one end to the other and back again in one revolution, a conical winding form, a rockable arm holding the form for rotation in frictional driving engagement with the drum, means to guide the yarn along a path to the drum, first and second movable meshing grids for tensioning the yarn by deflecting it in opposite directions from its path, means operated by the winding drum to move the first grid in a tension increasing direction as the drum traverses the yarn toward the small end of the conical form, and means including a cam operated by the rockable arm to move the second grid in a tension reducing direction as the winding form moves away from the drum due to building up of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

11. In a machine for winding yarn on cones, a rotatable conical winding form, a winding drum adjacent the form to traverse the yarn along the form, means to guide the yarn along a path to the drum, first and second movable meshing grids for tensioning the yarn by deflecting it in opposite directions from its path, means operated by the winding drum to move the first grid in a tension increasing direction as the drum traverses the yarn toward the small end of the form, and means to move the second grid in a tension reducing direction in response to accumulation of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

12. In a machine for winding yarn on cones, a rotatable conical winding form, a winding drum adjacent the form to traverse the yarn along the form, means to guide the yarn along a path to the drum, first and second rotatable arms, first and second sets of meshing grid rods on the respective arms, the rods being positioned to tension the yarn by deflecting it from its path in serpentine fashion by movement of the sets of rods in opposite directions, means operated by the winding drum to move the first set of rods back and forth for increasing the winding tension as the drum traverses the yarn toward the small end of the conical form, and means responsive to building up of wound yarn on the form to move the second set of rods in a direction to reduce the variation in tension produced by the back and forth movement of the first set, in order to maintain substantially constant winding tension on the yarn.

13. In a machine for winding yarn on cones, a rotatable conical winding form, traversing means adjacent the form for traversing the yarn back and forth along the form, means to guide the yarn along a path to the traversing means including two guiding members spaced along the path on the same side thereof and extending transversely thereto, a first rotatable arm carrying a first set of grid rods adjacent the yarn path between the guiding members on the opposite side of the path from the members for movement to deflect the yarn toward the members for tensioning the yarn, means operated by the traversing means to move the first set of rods back and forth to provide increased tensioning as the yarn is traversed toward the small end of the conical winding form, a second rotatable arm carrying a second set of grid rods movable into meshing relation with the first set to deflect the yarn in serpentine fashion around the rods of the two sets for changing the amount of variation in tensioning produced by the back and forth movement of the first set of rods, and means to move the second set of rods in a direction to reduce the variation in tensioning in response to building up of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

14. In a machine for winding yarn on cones, a rotatable conical winding form, traversing means adjacent the form for traversing the yarn back and forth along the form, means to guide the yarn along a path to the traversing means, a first movable grid for deflecting the yarn from its path in one direction to provide frictional tensioning of the yarn, means operated by the traversing means to move the grid back and forth for increasing the frictional tensioning as the

yarn is traversed toward the small end of the conical winding form, a second grid movable into meshing relation with the first grid to change the amount of variation in the tensioning caused by the back and forth movement of the first grid, and means to move the second grid in a direction to reduce the variation in tensioning in response to accumulation of wound yarn on the form, in order to maintain substantially constant winding tension on the yarn.

15. In a yarn winding machine, a winding form, a traversing drum, movable supporting means holding the form for rotation in frictional driving engagement with the drum, means to feed yarn along a path to the drum, a yarn tensioning device acting on the yarn along its path, the device having a movable member for changing the tensioning, and means operated by the movable supporting means for moving the movable member to reduce the tensioning as the form moves away from the drum due to building up of wound yarn on the form.

16. In a machine for winding yarn packages, a rotatable winding form, traversing means to traverse the yarn along the form, two tensioning elements cooperating to vary the tension on the yarn, means to position one of the elements in response to traverse of the yarn, and means to position the other element in response to varying size of the yarn package.

BROOKS MARCELLUS.

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