United States Patent [19]

Tannert

[11] **3,709,444**

[45] **Jan. 9, 1973**

[54] **POSITIVE THREAD FEEDER FOR CIRCULAR KNITTING MACHINES WITH A PLURALITY OF KNITTING POINTS**

[76] Inventor: **Karl Tannert**, Birkenstrasse 1, Eggenfelden, Germany

[22] Filed: **Aug. 19, 1970**

[21] Appl. No.: **65,189**

[30] **Foreign Application Priority Data**

Aug. 19, 1969 Germany.....P 19 42 062.3

[52] **U.S. Cl.**.....**242/47.04,** 242/47.12

[51] **Int. Cl.**.....**B65h 51/02,** B65h 51/20

[58] **Field of Search**..242/47.01, 47.04, 47.05, 47.06, 242/47.07, 47.12, 47.13; 66/132

[56] **References Cited**

UNITED STATES PATENTS

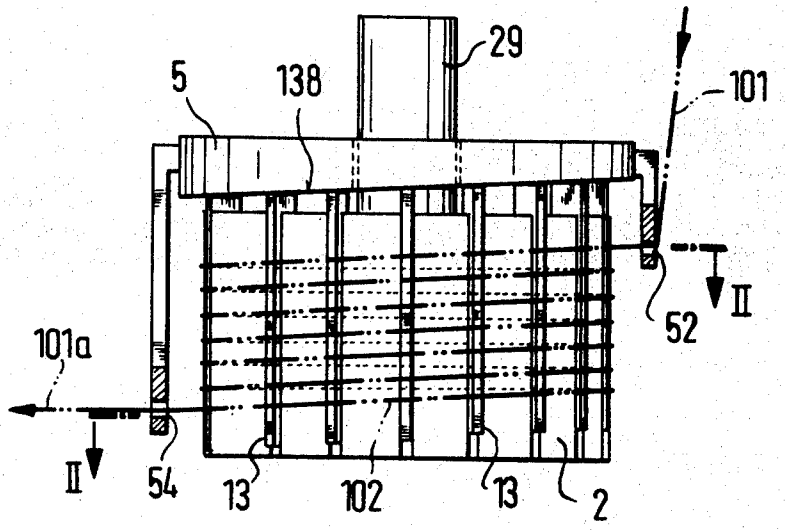
1,052,212	2/1913	Boos	242/47.07
2,435,430	2/1948	Ewing	242/47.13
2,512,645	6/1950	Hellbach	242/47.07 X
2,614,313	10/1952	Reitsma	242/47.04
2,628,407	2/1953	Lowe et al.	242/47.04 X
3,490,710	1/1970	Muhlhausler	66/132 X

Primary Examiner—Werner H. Schroeder
Attorney—Silverman & Cass

[57] **ABSTRACT**

A thread feeder for circular knitting machines having several knitting points, each comprising a rotary winding body. A storage coil is formed on each winding body by an axial feeding device, the storage coil embracing the winding body with several turns in a slip-free manner.

9 Claims, 14 Drawing Figures



PATENTED JAN 9 1973

3,709,444

SHEET 1 OF 5

Fig.1

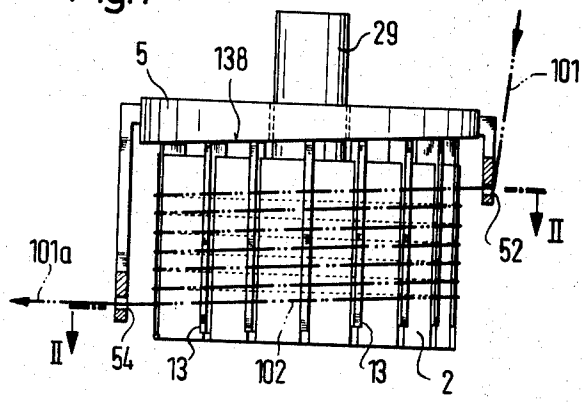


Fig.2

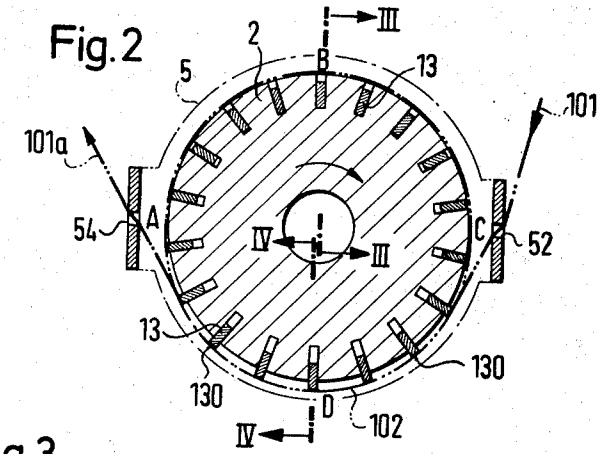


Fig.3

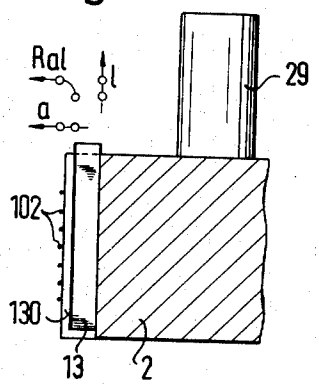
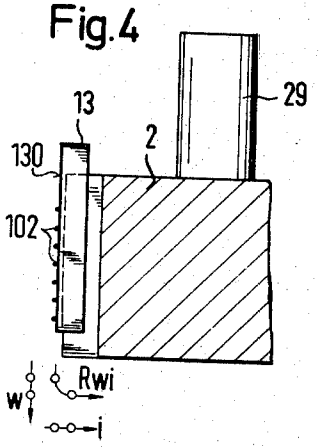


Fig.4



INVENTOR:
KARL TANNERT
BY: Silverman & Cass
ATTORNEYS

Fig.5

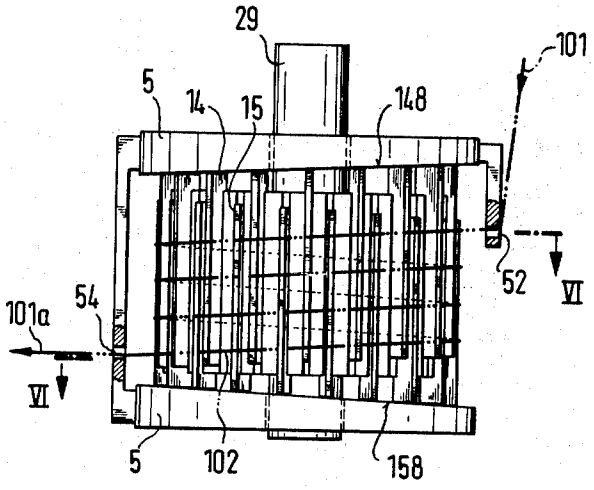
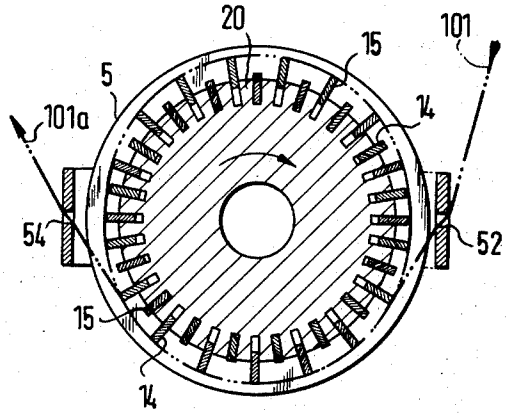


Fig.6



INVENTOR:
KARL TANNERT
BY: Silverman & Cass
ATTORNEYS

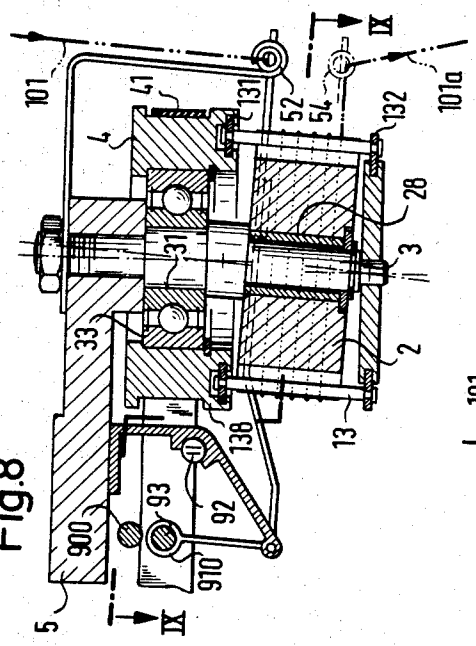


Fig.8

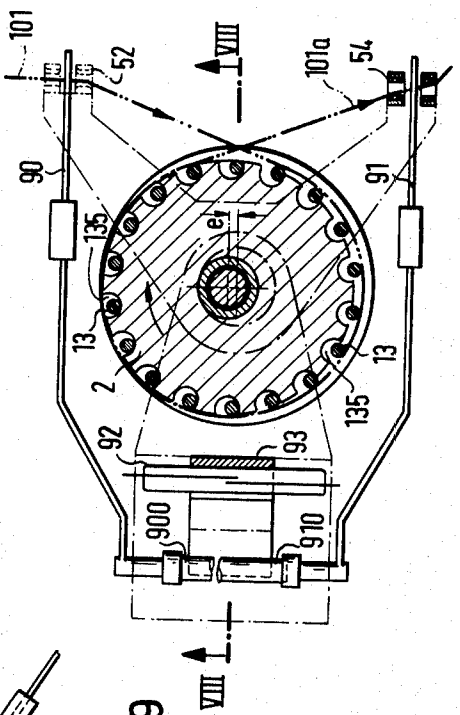


Fig.9

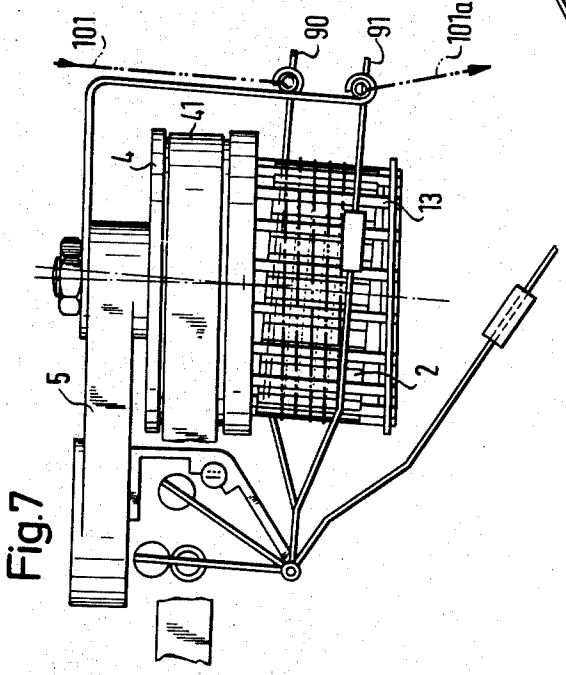


Fig.7

INVENTOR:
KARL TANNERT
BY: Silberman & Cass
ATTORNEYS

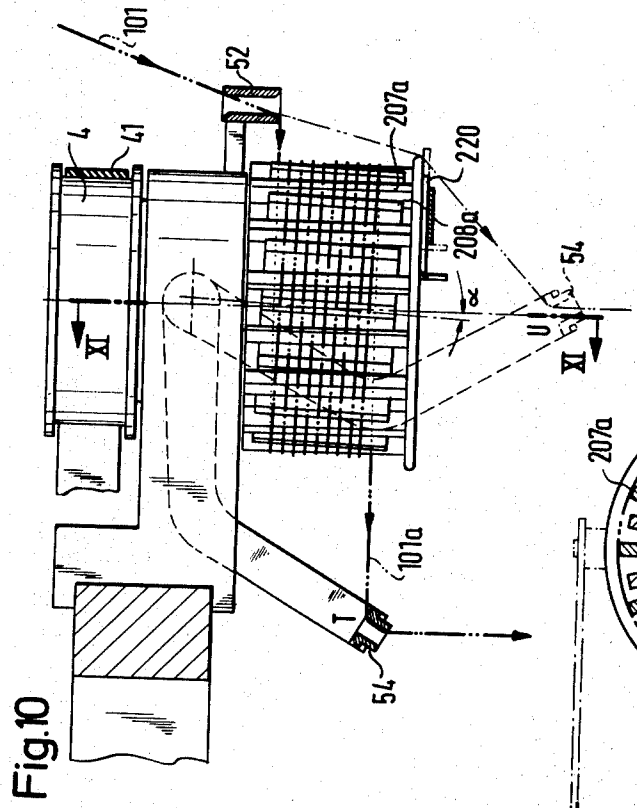


Fig.10

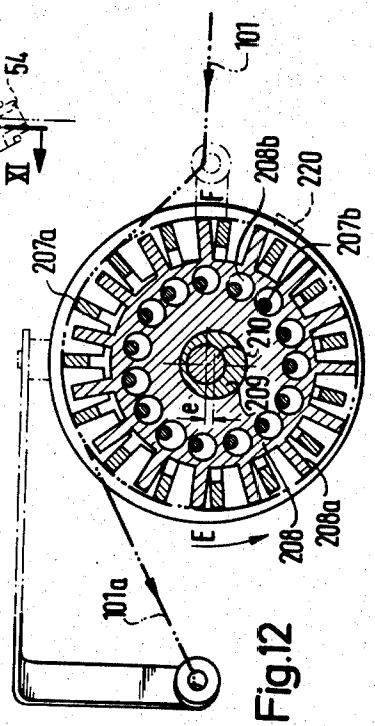


Fig.12

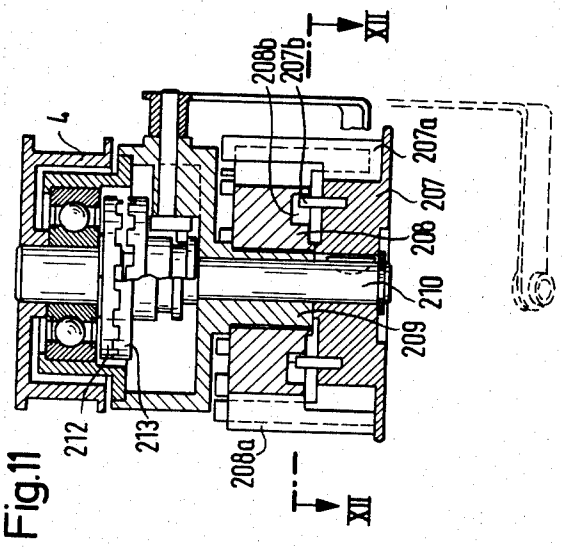


Fig.11

INVENTOR:
KARL TANNERT
BY: Silverman & Cass
ATTORNEYS

Fig.13

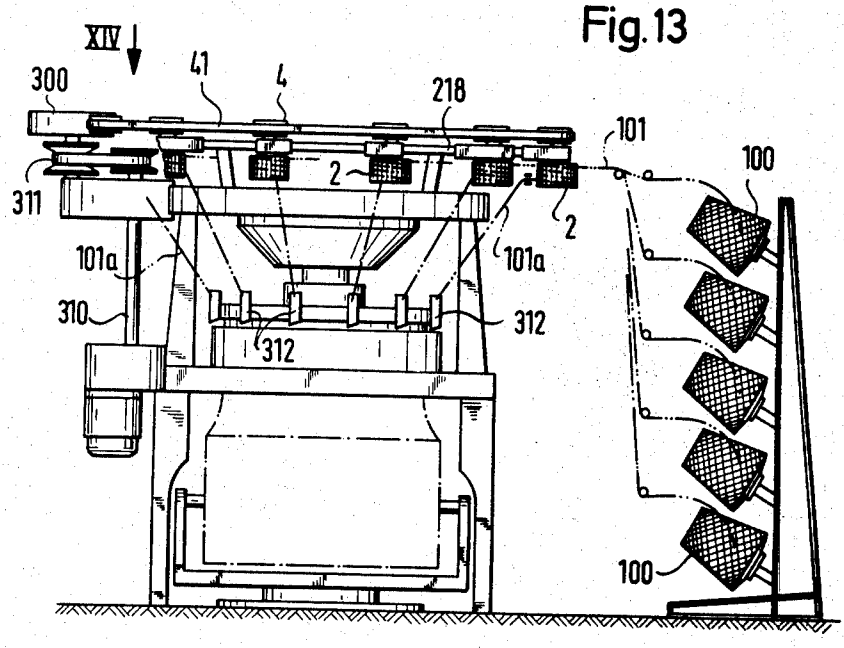
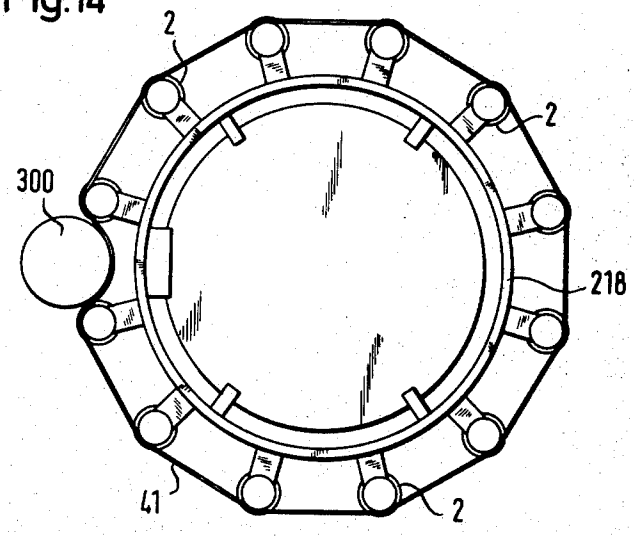


Fig.14



INVENTOR:
KARL TANNERT
BY: Silverman & Cass
ATTORNEYS

POSITIVE THREAD FEEDER FOR CIRCULAR KNITTING MACHINES WITH A PLURALITY OF KNITTING POINTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a positive thread feeder for circular knitting machines with a plurality of knitting points comprising one rotary winding body each, whereupon a storage coil embracing the winding body slip-free in several windings is formed by an axial feeding device.

This storage coil between thread supply body and the knitting point of the machine in each case is used as intermediate storage from which the operating point can consume thread even if no additional thread is fed from the thread supply body due to tearing of the thread or because the reel is empty. Such tread supply devices furthermore eliminate in an advantageous manner the differences in tension and plucking caused by the unwinding of the thread from the thread supply body. Furthermore, the use of such thread supply means eliminates the long thread reversals which were necessary according to prior art on knitting and weaving machines in order to form the necessary thread reserves between reel and thread supplier.

The supply coil is continuously applied to the winding body, moved progressively in axial direction and removed in tangential direction by the operating point of the circular knitting machine. The unwinding of the thread from the coil body is synchronized with the winding. The winding speed is harmonized with the consumption at the knitting point in question. Consequently, such a thread feeder operates as a so-called positive thread supply system.

In multisystem circular knitting machines positive thread supply causes the formation of uniformly sized stitches of desired size. Moreover, positive thread feeders decisively facilitate the adjustment of the knitting points, precisely in accordance with the desired thread consumption.

2. Description of the Prior Art and Departures Therefrom

Thread feeders of prior art of the initially mentioned kind are unusually large in their technical cost for multisystem circular knitting machines so that they could make no inroads for general application in circular knitting machines. Others are appropriate only for threads having a certain elasticity. This elasticity is required because the effective circumference of the winding body changes due to the oblique position of the inserted feeder body from one to the other end of the position of the winding. This may lead at the winding to excessive stress of the material or cause an unreliable transportation of the winding layer. The thread layer then starts to flutter in the medium range of the winding body and the distance from winding to winding may be lost. Unwinding disturbances due to superposition from one winding to the immediately subsequent one result disadvantageously from this operation.

Accordingly, it is an object of the invention to provide a positive thread feeder of the initially mentioned type which at low construction cost, with storage effect, assures a perfectly safe operation and improves altogether the positive thread supply for circular knitting machines with a plurality of knitting points.

It is a further object of the invention to provide a feeding system that comprises a plurality of individual lamellae arranged at the circumference of the winding body which, individually guided execute in each case oscillating superposed axial and radial movements, whereby the operative edges of the individual lamellae transport the storage coil over part of the circumference of the winding body during their feed movement in each case.

Another object of the invention is to provide a rolling body co-rotating with a winding body, the winding body and the rolling body engaging cammingly by a pin serration, and a thread discharge member being movable from a tangential unwinding operating position to an overhead discharge position.

Still a further object of the invention is to provide a positive thread feeder which satisfactorily eliminates the deficiencies which heretofore have been experienced in practice.

A still further object of the invention is to provide a thread feeder which delivers positively, facilitates the adjustment of the knitting points according to the intended consumption of thread and creates a large thread reserve in the form of its storage coils eliminating the bulky and complicated thread reversals, the use of which was heretofore necessary for safety reasons in circular knitting machines. The threading of many threads of a circular knitting machine no longer requires to be performed several meters above the head of the operator but can be done on body level within the reach of his hands.

Other objects and advantages not specifically enumerated will become apparent to those skilled in this art as a description of the preferred embodiments of the invention is set forth in detail. The drawings which accompany this specification illustrate several embodiments of the structure of the invention.

SUMMARY OF THE INVENTION

A thread feeder for a circular knitting machine having a number of knitting points, each including a rotary winding body and a storage coil which is formed on the winding body by a feeding device. The feeding device comprises a series of lamellae disposed on the circumference of the winding body which are individually guided such as to perform oscillating axial and radial motions superimposed on one another, whereby the storage coil is moved over part of the circumference of the winding body.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a schematic view of the thread feeder according to the invention;

FIG. 2 shows a section along line II—II in FIG. 1;

FIG. 3 shows a section along line III—III in FIG. 2;

FIG. 4 shows a section along line IV—IV in FIG. 2;

FIG. 5 shows another embodiment of the positive thread feeder according to the invention;

FIG. 6 shows a section along line VI—VI of FIG. 5;

FIG. 7 shows an additional embodiment of the thread feeder according to the invention;

FIG. 8 shows a center section through the embodiment according to FIG. 7;

FIG. 9 shows a section along line IX—IX of FIG. 8;

FIG. 10 shows a further embodiment of the thread feeder according to the invention;

FIG. 11 shows a central section along line XI—XI through the embodiment according to FIG. 10;

FIG. 12 shows a section along line XII—XII in FIG. 11;

FIG. 13 shows the thread feeder according to the invention in an arrangement on a circular knitting machine; and

FIG. 14 shows a plan view in the direction of arrow XIV in FIG. 13.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The feed system of the thread feeder according to the invention is represented schematically in an embodiment in FIGS. 1 to 4. A stationary carrier 5 supports the winding body 2 with its axle stump 29 rotarily in its center. A winding eye 52 and an unwinding eye 54, are fixedly connected to the carrier 5. The winding body 2 is equipped with radial slots into which axis parallel individual lamellae 13 are inserted such as to be movable therein. The lamellae move periodically with each rotation of the winding body in both axial and radial direction. A guiding curve 138 is provided for the axial movement of the individual lamellae. The radial drive of the individual lamellae is not shown. It can be accomplished with means known from prior art, for example curve bodies and eccentrics.

FIG. 2 shows that the individual lamellae in sectors A, B, C are located with their external operating edges 130 within the periphery of the winding body, while in sectors C, D. A they protrude beyond its circumference and carry thereby the storage coil.

FIGS. 3 and 4 represent the motion diagram of the individual lamellae within the winding body. Each individual lamellae 13 carries out an axis parallel longitudinal oscillation 1–*w* and a radial oscillation *a-i*. Both oscillations are superposed so that an active resulant movement Rwi (FIG. 4) alternates with the resultant return movement Ral (FIG. 3).

In order to simplify the propulsion such movement of the individual lamellae is coordinated with each revolution of the winding body.

The incoming thread 101 passes the winding eye 52 and encounters near C (FIG. 2) the enveloping circle of the lamellae. During the revolution of the winding body in the direction of the arrow the thread progressively winds upon the lamellae and progresses in sector C-D-A with the individual lamellae commensurate with the incline guide curve 138. In sector A-B-C the individual lamellae pass below the storage coil and, without influencing it they move back in their starting position in area C. The thread layer remains in axial reposing position in sector A-B-C. This cycle is repeated with each revolution of the winding body and a storage coil is created with regular distance from winding to winding, until the unwinding thread 101*a* leaves the thread feeder through the thread eye 54 toward the knitting point of the circular knitting machine.

FIGS. 5 and 6 represent another embodiment of the positive thread feeder, schematically. There the entire periphery of the winding body is formed by individual lamellae. Thus two groups of equivalent lamellae are created. One lamella group forms the winding body with the individual lamellae 15, while another group represents the feed means with the individual lamellae 14. Both groups of individual lamellae 14 and 15 are inserted into the core 20 of the winding body in relation to each other on a gap. Each group of lamellae is moved by its own guide curve 148 and/or 158. The oscillation of one lamella unit is thereby so coordinated in relation to the oscillation of the other lamella unit that the storage coil undergoes on its entire circumference an axial feed, alternatingly by the individual lamellae 14 and 15. In the returning upward phase of their oscillation the individual lamellae pass below the storage coil 102. within the winding circumference determined in each case by the adjacent individual lamellae in feed action, without influencing said circumference.

In the embodiment according to FIGS. 7,8 and 9 the winding eye 52 and the unwinding eye 54 are fixedly connected to the stationary carrier 5 and stand still. The winding body 2 is positioned on the stationary shaft 3 loosely operating with its bearing bushing 28. Its outer circumference is designed as sprocket wheel, whose tooth gaps are identified by 135. The individual lamellae 13 connected by frontal disks 131 and 132 into a longitudinally deformable feed unit engage with this serration ofthe winding body. The connections between the disks 131, 132 with the lamellae 13 are made by means of permanently elastic material. Also the individual disks 131, 132 may be made of permanently elastic material. The radial oscillation of the individual lamellae is produced in this thread feeder (FIG. 9) by the axis parallel eccentric positioning e of the feed unit against the winding body 2. By its seat 31 of a roller bearing 33 inclined under an acute angle against the axis of the winding body, the drive pulley 4 becomes the guiding plane for the frontal pulley 31 inserted in its edge 138.

With each rotation of the drive pulley 4 the individual lamellae undergo a longitudinal oscillation which superposes in proper function with the radial oscillation of the individual lamellae relative to the winding body forced by the eccentricity.

In FIGS. 7 to 9 the thread feeder according to the invention is combined in this embodiment with thread guards 90 and 91 for the incoming and unwinding thread. These thread guards are used in a manner known from prior art for shutting down the circular knitting machine and to generate a signal in case of a thread break ahead of and behind the thread feeder, and when the reel is empty. In the embodiment shown each thread guard is connected to a permanent magnet 900 and/or 910.

If there is a thread break, the scanner of the thread guard drops down and approaches its permanent magnet toward a magnetic switch located at the stationary holding device 93.

During the rigging or preparing the machine for a change of function, that is when the circular knitting machine is changed to another type of knitting or to other stitch sizes, it is advantageous to discontinue the positive thread supply. This is accomplished most simply by a clutch in the drive of the individual winding bodies. Such a clutch also is represented in connection with another solution of the invention in FIG. 11.

According to this other solution of the invention, the positive thread feeder according to FIGS. 10,11 and 12 is provided with two roll bodies 207 and 208. On their circumference these roll bodies are provided with

bridges **207***a* and **208***a* which protrude the roll body itself in longitudinal direction. Thereby the bridges of the one roll body enter the gaps between the bridges of the other roll body. The roll body **207** is rotated by the drive belt **41** via the drive pulley **4** and the clutch parts **212** and **213** along with its shaft **210**. The roll body **208** is positioned on the bearing pin **209** for loose rotation. The axis of the bearing pin **209** intersects the axis of the drive pin **210** at the acute angle (FIG. **10**) and at a distance e (FIG. **12**). The roll bodies **207** and **208** are in combining engagement with each other by their pins **207***b* and their circular tooth flanks **208***b*. The incoming, slightly braked thread **101** passes the infeed eye **52** and impacts tangentially on the bridges **207***a* rotating with their roll bodies in the direction of the arrow (FIG. **12**). In the area E the bridges **208***a* of the inclined roll body **208** then take over the thread and convey it downward by one pace commensurate with the sloping position and the diameter. In the area F the thread again reaches the roll body **207** positioned on the main axis. This operation is repeated with each rotation of the winding body. A step-by-step axial feed of the entire winding layer is produced until the thread **101***a* finally leaves the roll body **207**, tangentially and through the discharge eye **54**, possibly under interposition of a thread guard known from prior art, and in the direction toward the knitting point.

The positive thread feeders according to the invention are operated in their entirety or in groups by a joint drive means, for example a drive belt **41**. At identical dimensions thus all jointly operated thread feeders deliver the same amount of yarn or thread to the knitting points of the circular knitting machine corresponding to them, thus producing a very uniform knitting even when the stitch-forming components of the circular knitting machine already have undergone a certain wear.

Because the wear at the stitch-forming members of the individual knitting points does not always take place uniformly, it is impossible in practice to adjust the outlet locking parts (looping lock parts) of the knitting machine only in accordance with their scale. Consequently, it is better to adjust the sliding lock parts in accordance with the desired thread consumption.

In a circular knitting machine containing a plurality of knitting points this adjustment of the looping lock parts is accomplished in connection with the positive thread feeder in the following manner:

Each thread feeder is uncoupled against the joint drive belt **41**. The winding body thus no longer deliver positively but are only corotated loosely by the unwinding thread. The speed ofthe drive means **41** is now adjusted in accordance with the new quantity of thread to be delivered. The looping lock parts of the individual knitting points then are adjusted in relation to each other and engaged for the control of the correct thread consumption of the corresponding thread feeders, and it is checked whether the knitting point precisely consumes the quantity of thread delivered.

The winding bodies of the disengaged thread feeders rotate easily but then a thread tension occurs in the unwinding area which becomes inadmissibly high in case of very thin threads. Consequently, according to an additional embodiment of the subject of the invention the discharge eye **54** (FIGS. **10**, **11**, **12**) is placed at a pivotable arm, by which it can be placed into a central position U by a simple manual motion from its tangential unwinding position T, the operating position, when the machine is to be reset in the above described manner or if troubles should occur at individual knitting points. In addition the invention also provides that simultaneously with this shifting toward position U, the coupling or clutch **212/213** is disengaged (FIG. **11**). That way the knitting point from that moment on takes its thread by overhead unwinding from the now stopped winding body until it is emptied and then, bypassing the thread feeder, directly from the thread supply body via the infeed eye **52**, passing directly through the discharge eye **54**.

However, prior to renewed engaging ofthe thread feeder a new thread reel must be placed on the winding body. The entrainment means adjustable (**220**) and located at the winding body helps in its outer position (FIG. **12**). Prior to the engaging the operator shifts this entrainment means again radially inwardly into its dead center position, for during normal thread feed by the winding body, this entrainment means remains inoperative.

FIG. **13** is the lateral view of a multi-system rotary knitting machine with a juxtaposed reel gate. The drive shaft **310** be causes via sprocket wheels in the usual manner the rotation drive for needle cylinders and the dial. Moreover, via an adjustable intermittent gear **311** it propels the main drive pulley **300** for the entire thread feeder. FIG. **14** shows a plan view of the thread feeding system connected by a carrier ring **218** to the machine. The individual thread feeders are identified by **2**, **41** is the joint drive belt. Each thread **101** progresses from the thread supply body **100** toward its thread feeder **2** and leaves it, identified by **101***a* in the direction toward the thread guide **312** of the individual knitting points.

Other constructural details should be obvious from the drawings and, likewise, it is obvious that variations of a wide range may be made without departing from the spirit or scope of the invention as defined by the appended claims.

What is desired to secure by Letters Patent of the United States is:

I claim:

1. A positive thread feeder for a circular knitting machine comprising:

a. means for entering and discharging the thread,

b. a plurality of knitting points each including a rotary winding body,

c. a storage coil embracing the winding body slip-free with a plurality of turns,

d. axial feeding means for forming the storage coil on the winding body,

e. said feeding means including a plurality of lamellae having operating edges,

f. means for mounting said lamellae in longitudinal gaps of the winding body at the circumference thereof,

g. means for guiding said lamellae individually to perform oscillating axial and radial motions superimposed upon one another,

h. the operating edges of the lamella being constructed and arranged to transport during said motions the storage coil over part of the circumference of the winding body,

i. the individual lamellae of the feeding means being interconnected by a pair of frontal discs into a longitudinally deformable unit, and

j. at least one of the discs being associated with a wobbling member having a bearing seat disposed at an acute angle with regard to the axis of the winding body, whereby a wobbling motion of the disc in relation to the winding body is produced.

2. A thread feeder according to claim 1, wherein the wobbling member is fixedly connected with a roller bearing.

3. A thread feeder according to claim 1, wherein the rotary winding body is designed as a gear wheel and the lamellae are configurated as pins, the tooth flanks of the gear wheel forming, with the individual lamellae of the feeding means, a pin teeth system.

4. A positive thread feeder for a circular knitting machine comprising:

a. means for entering and discharging the thread,

b. a plurality of knitting points each including a rotary winding body,

c. a storage coil embracing the winding body slip-free with a plurality of turns,

d. axial feeding means for forming the storage coil on the winding body,

e. said feeding means including a plurality of lamellae having operating edges,

f. means for mounting said lamellae in longitudinal gaps of the winding body at the circumference thereof,

g. means for guiding said lamellae individually to perform oscillating axial and radial motions superimposed upon one another,

h. the operating edges of the lamella being constructed and arranged to transport during said motions the storage coil over part of the circumference of the winding body,

i. the individual lamellae of the feeding means being interconnected by a pair of frontal discs into a longitudinally deformable unit, and

j. the connections of the discs with the individual lamellae being made of permanently elastic material.

5. A positive thread feeder for a circular knitting machine comprising:

a. means for entering and discharging the thread,

b. a plurality of knitting points each including a rotary winding body,

c. a storage coil embracing the winding body slip-free with a plurality of turns,

d. axial feeding means for forming the storage coil on the winding body,

e. said feeding means including a plurality of lamellae having operating edges,

f. means for mounting said lamellae in longitudinal gaps of the winding body at the circumference thereof,

g. means for guiding said lamellae individually to perform oscillating axial and radial motions superimposed upon one another,

h. the operating edges of the lamella being constructed and arranged to transport during said motions the storage coil over part of the circumference of the winding body,

i. the individual lamellae of the feeding means being interconnected by a pair of frontal discs into a longitudinally deformable unit, and

j. the discs being made of permanently elastic material.

6. A positive thread feeder for a circular knitting machine comprising:

a. means for entering and discharging the thread,

b. a plurality of knitting points each including a rotary winding body,

c. a storage coil embracing the winding body slip-free with a plurality of turns,

d. axial feeding means for forming the storage coil on the winding body,

e. said feeding means including a plurality of lamellae having operating edges,

f. means for mounting said lamellae in longitudinal gaps of the winding body at the circumference thereof,

g. means for guiding said lamellae individually to perform oscillating axial and radial motions superimposed upon one another,

h. the operating edges of the lamella being constructed and arranged to transport during said motions the storage coil over part of the circumference of the winding body,

i. the individual lamellae of the feeding means being interconnected by a pair of frontal discs into a longitudinally deformable unit, and

j. one of the frontal discs of the feeding means being fixedly connected to a drive pulley of the thread supply system.

7. A positive thread feeder for a circular knitting machine comprising:

a. means for entering and discharging the thread,

b. a plurality of knitting points each including a rotary winding body,

c. a storage coil embracing the winding body slip-free with a plurality of turns,

d. axial feeding means for forming the storage coil on the winding body,

e. said feeding means including a plurality of lamellae having operating edges,

f. means for mounting said lamellae in longitudinal gaps of the winding body at the circumference thereof,

g. means for guiding said lamellae individually to perform oscillating axial and radial motions superimposed upon one another,

h. the operating edges of the lamella being constructed and arranged to transport during said motions the storage coil over part of the circumference of the winding body, and

i. the thread discharge means comprising means for pivoting the same from a tangential position relative to the winding body to an overhead position relative thereto.

8. A positive thread feeder for a circular knitting machine comprising:

a. means for entering and discharging the thread,

b. a plurality of knitting points each including a rotary winding body,

c. a storage coil embracing the winding body slip-free with a plurality of turns,

D. axial feeding means for forming the storage coil on the winding body,

e. said feeding means including a plurality of lamellae having operating edges,

f. means for mounting said lamellae in longitudinal gaps of the winding body at the circumference thereof,

g. means for guiding said lamellae individually to perform oscillating axial and radial motions superimposed upon one another,

h. the operating edges of the lamella being constructed and arranged to transport during said motions the storage coil over part of the circumference of the winding body, and

i. the means for guiding the individual lamellae including wobbling elements and means for eccentric positioning of the feeding means relative the winding body.

9. A positive thread feeder for a circular knitting machine comprising:

a. means for entering and discharging the thread,

b. a plurality of knitting points each including a rotary winding body,

c. a storage coil embracing the winding body slip-free with a plurality of turns,

d. axial feeding means for forming the storage coil on the winding body,

e. said feeding means including a plurality of lamellae having operating edges,

f. means for mounting said lamellae in longitudinal gaps of the winding body at the circumference thereof,

g. means for guiding said lamellae individually to perform oscillating axial and radial motions superimposed upon one another,

h. the operating edges of the lamella being constructed and arranged to transport during said motions the storage coil over part of the circumference of the winding body, and

i. wherein the winding body comprises a first group of lamellae and the feeding means comprises a second group of lamellae, the thread feeder further including means for guiding both groups of lamellae to perform oscillating radial and axial motions superimposed upon one another, and means for causing the lamellae of the feeding means and the winding body to alternately transport the storage coil and move thereunder without affecting the same.

* * * * *