Oct. 11, 1955 F. LAMBACH ET AL 2,720,093

WARP KNITTING MACHINE

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FIG. 1.

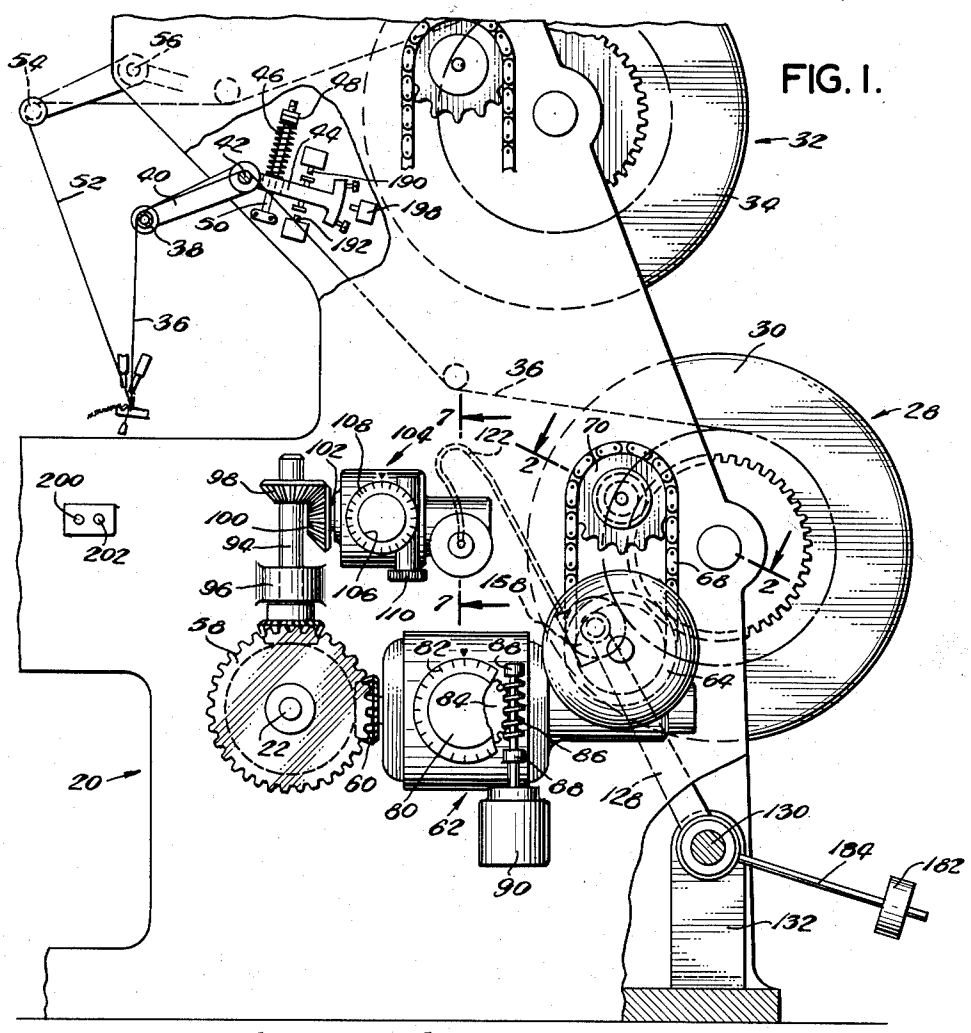
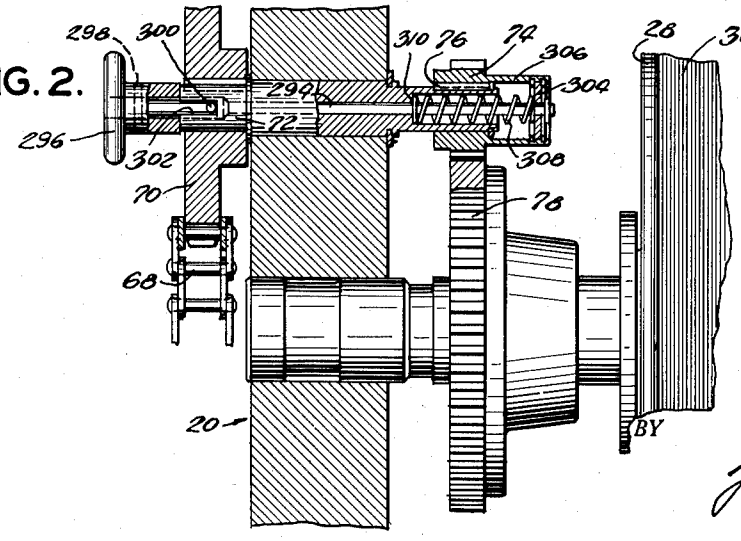


FIG. 2.



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FIG. 3.

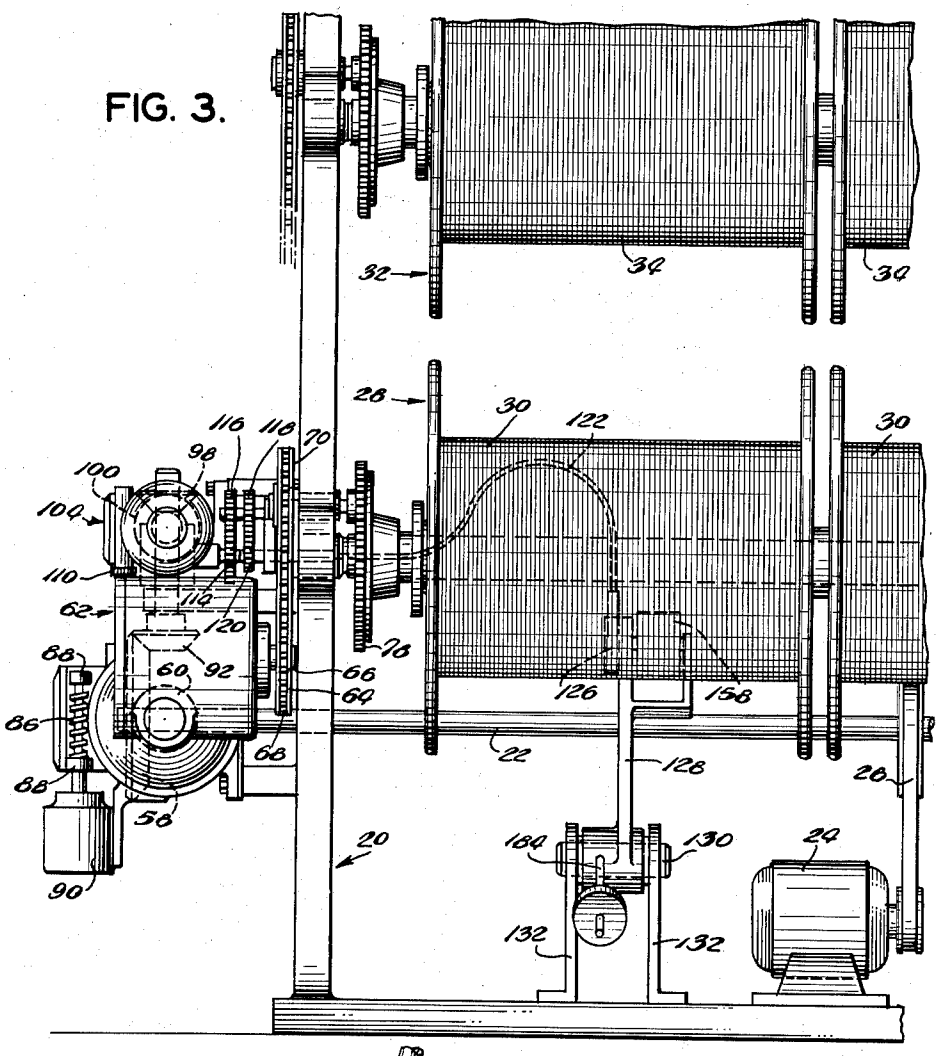
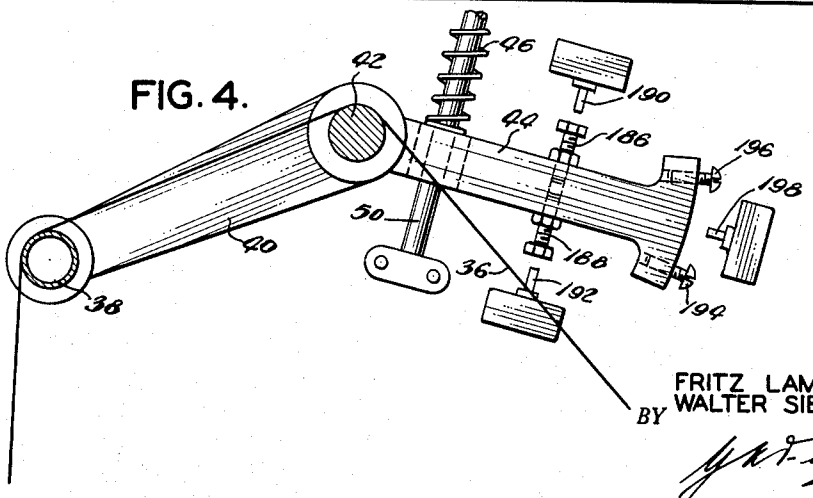


FIG. 4.



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WARP KNITTING MACHINE

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FIG. 5.

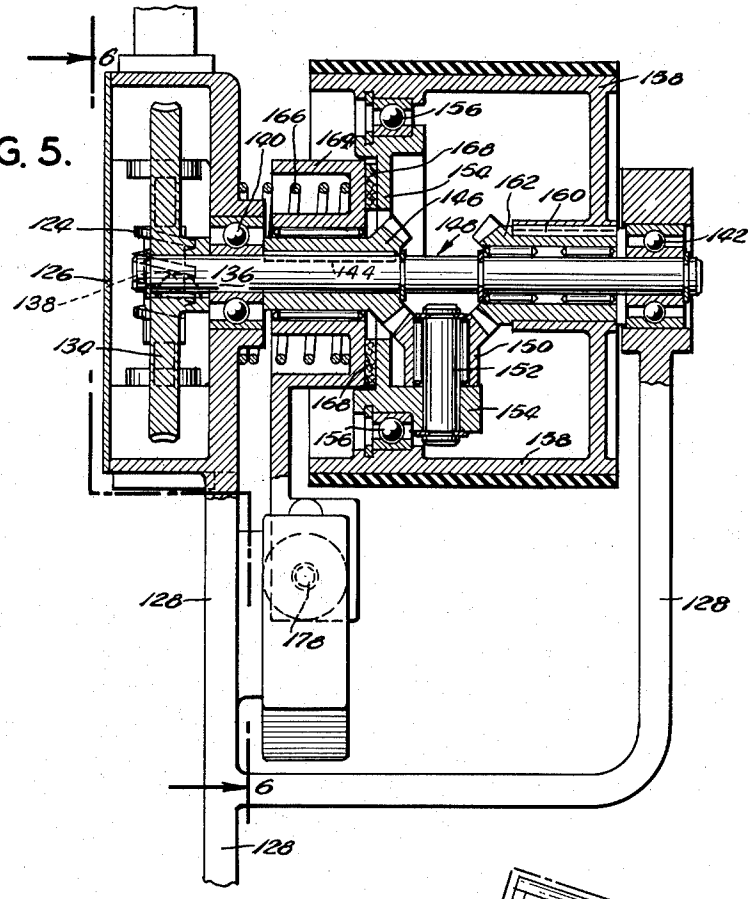
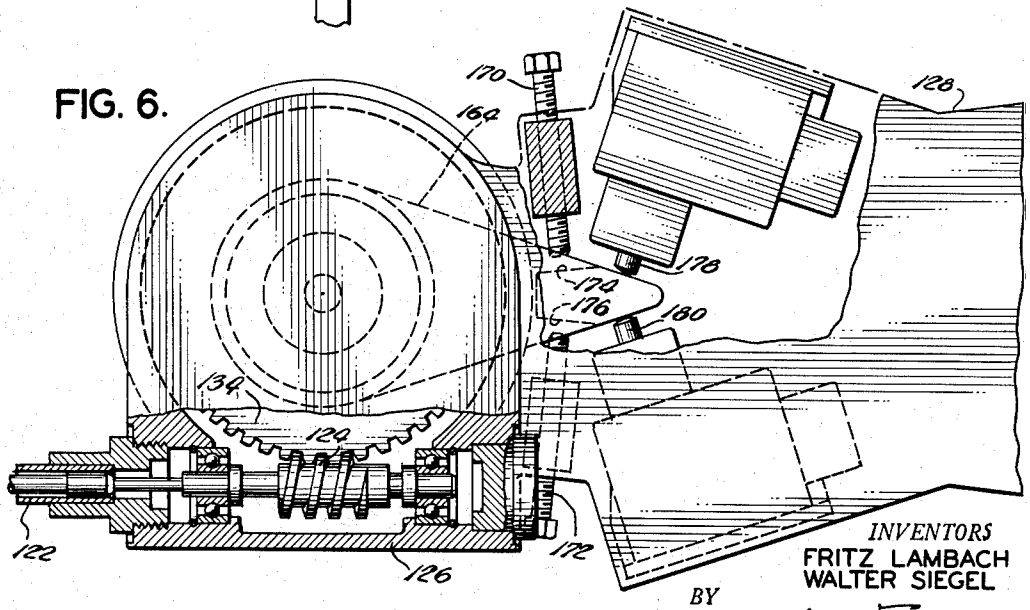


FIG. 6.



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WARP KNITTING MACHINE

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FIG. 8.

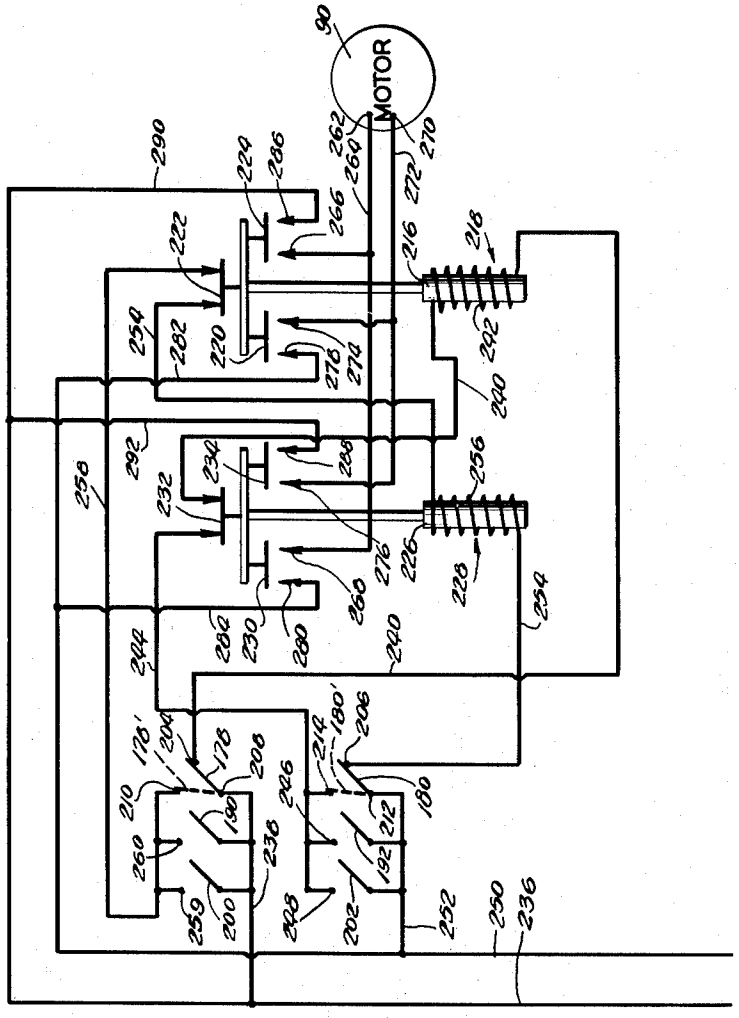
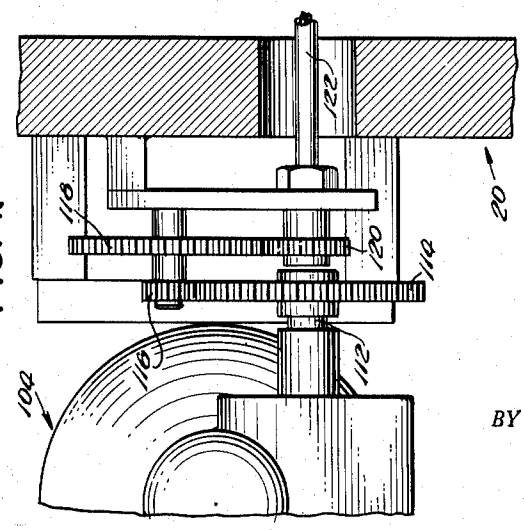


FIG. 7.



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United States Patent Office

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Patented Oct. 11, 1955

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WARP KNITTING MACHINE

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Application September 17, 1949, Serial No. 116,298

31 Claims. (Cl. 66—86)

This invention relates to knitting machines, and more particularly to warp knitting machines.

An object of the present invention is to provide a warp knitting machine, wherein the warp yarns are fed by the warp beam or beams to the knitting implements at a predetermined substantially constant travelling speed so as to avoid so-called "shade-marks" in the fabric, which may be caused by unbalanced beams when the yarns, especially yarns of very fine gauge, are drawn by the needles from the warp beam or beams.

A further object of the present invention is to provide a warp knitting machine, which may be readily adjusted for the knitting of a fabric of predetermined quality.

Another object of the present invention is to provide a warp knitting machine, wherein hitherto customary beam brakes and the somewhat delayed control thereof in response to movements of the tension rods may be eliminated, so that a more uniform tension of the warp yarns may be obtained.

A further object of the present invention is to improve on the construction of warp knitting machines as now ordinarily made.

Another object of the present invention is to improve the method of operating a warp knitting machine.

It is understood that the term "warp beam" used in the specification and claims indicates a single warp beam or an assembly of warp beams composed of a plurality of sectional warp beams.

Other objects and structural details of the invention will be apparent from the following description when read in conjunction with the accompanying drawings forming part of this specification, wherein:

Fig. 1 is a fragmentary side elevational view of a warp knitting machine according to the invention, some parts being shown in section,

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1,

Fig. 3 is a fragmentary rear elevational view of a warp knitting machine according to the invention,

Fig. 4 is a fragmentary side elevational view illustrating a switch control associated with a tension rod of the warp knitting machine,

Fig. 5 is a view, partly in section, of a controlling mechanism of the warp knitting machine,

Fig. 6 is a view on line 6—6 of Fig. 5,

Fig. 7 is a fragmentary sectional view taken on line 7—7 of Fig. 1, and

Fig. 8 is a diagrammatical illustration of a wiring system of the warp knitting machine.

The drawings illustrate only those parts of a warp knitting machine which are necessary for the understanding of the invention.

Referring now to Figs. 1 and 3, 20 generally indicates the frame of a warp knitting machine. A main cam shaft 22 journalled in suitable bearings of the frame 20 may be rotated by a main electromotor 24 through the medium of a belt drive 26.

28 generally indicates an assembly of lower sectional warp beams 30 rotatably arranged in the frame 20 of the machine. 32 generally indicates an assembly of top sectional warp beams 34 rotatably arranged in the frame 20 of the machine.

Warp yarns 36 fed by the lower warp beams 30 to the knitting implements of the knitting machine are engaged with a lower tension rod 38 carried by arms 40 rigidly connected with a shaft 42 rotatably arranged in suitable bearings of the frame 20 of the machine. Another arm 44 rigidly connected with said shaft 42 is under the action of a spring 46 interposed between said arm 44 and adjustable lock nuts 48 screwed on a rod 50 secured to the frame of the machine. The spring 46 tends to urge the lower tension rod 38 upwardly for tensioning the warp yarns 36.

In a similar manner, the warp yarns 52 fed by the top warp beams 34 to the knitting implements of the machine are engaged with a top tension rod 54 swingably mounted on the frame of the machine at 56 and biased by a spring (not shown) for tensioning the warp yarns.

As the various driving and controlling mechanisms associated with the lower assembly of warp beams and the top assembly 32 of warp beams are identical, it is sufficient to describe hereinafter only the driving and controlling means associated with the lower assembly 28 of warp beams.

As best shown in Figs. 1 and 3, a bevel gear 58 keyed to the main cam shaft 22 is in mesh with a bevel gear 60 keyed to the input shaft of a stepless change speed transmission generally indicated by 62. Said stepless change speed transmission may be of any customary construction. A sprocket wheel 64 keyed to the output shaft 66 of said stepless change speed transmission 62 may drive through the medium of a chain 68 another sprocket wheel 70 keyed to a shaft 72 (see Fig. 2) rotatably arranged in the frame 20 of the machine. The opposite end of said shaft 72 carries a pinion 74 keyed with said shaft by a feather key 76. When said pinion 74, which is axially slidable on the shaft 72, is in the position shown in Fig. 2, it is in mesh with a gear 78 connected to the assembly 28 of warp beams 30 in a manner known per se. Thus, the main cam shaft 22 drives the assembly 28 of warp beams through the medium of the stepless change speed transmission 62 and the various gears and wheels during the operation of the machine.

The stepless change speed transmission 62 is provided with a rotatable speed adjuster 80 including a scale 82 and a worm gear 84. Said worm gear 84 is in mesh with a worm 86 rotatably arranged in bearings 88. The shaft of a reversible electromotor 90 is rigidly connected with said worm 86. A rotation of said reversible electromotor 90 in one direction will cause a corresponding rotation of the speed adjuster 80 resulting in an increase in the speed of rotation of the output shaft 66 of the stepless change speed transmission 62, while a rotation of said reversible electromotor 90 in the opposite direction will result in a decrease in the speed of rotation of said output shaft 66. Thus, the speed of rotation of the warp beams 30 of the lower assembly 28 of warp beams may be controlled by means of a controlling action through the medium of said reversible electromotor 90.

Such a controlling action of the reversible electromotor 90 may be automatically obtained by the following controlling mechanism:

As best shown in Figs. 1 and 3, the bevel gear 58 keyed to the main cam shaft 22 is also in mesh with a gevel gear 92 keyed to a vertical shaft 94 rotatable in a bearing 96 of the frame of the machine. A bevel gear 98 keyed to the upper end of said shaft 94 is in mesh with a bevel gear 100 keyed to the input shaft 102 of an adjustable speed setting device generally indicated by 104. In the embodiment shown in the drawings, said adjustable speed setting device 104 is in the shape of a stepless change

speed transmission equipped with a rotatable speed adjuster **106** carrying a scale **108**. Said rotatable speed adjuster **106** may be manually set in a predetermined position by means of a knob **110** connected therewith in a suitable manner. The speed of rotation of the output shaft **112** of the stepless change speed transmission **104** (see Figs. 3 and 7) is determined by the setting of said speed adjuster **106**. A gear **114** keyed to the output shaft **112** of the stepless change speed transmission **104** drives through a set of speed increasing gears **116**, **118**, **120** the core of a flexible drive shaft **122**. As best shown in Figs. 3 and 6, the other end of the core of the flexible drive shaft **122** is rigidly connected with a worm **124** rotatably arranged in a casing **126** carried by a support **128** swingably mounted on a shaft **130** carried by brackets **132** secured to the frame **20** of the machine.

Referring now to Figs. 5 and 6, above-mentioned worm **124** is in mesh with a worm gear **134** rigidly connected with a shaft **136** by a key **138**. Said shaft **136** rotatably mounted in ball bearings **140** and **142** of the support **128** is rigidly connected by a key **144** with a first driver bevel gear **146** of a differential motion generally indicated by **148**. Said driver bevel gear **146** is in mesh with a follower bevel gear **150** of the differential motion **148**. Said follower bevel gear **150** is rotatably arranged on a stud **152** carried by a controlling body **154** rotatably arranged through the medium of a ball bearing **156** within a hollow rubber covered roller **158**. Said roller **158** is rigidly connected by a key **160** with a second driver bevel gear **162** of the differential motion **148**. Said second driver bevel gear **162** swingably mounted on the shaft **136** is in mesh with the follower bevel gear **150**.

A controlling member **164** rotatably arranged on the first driver bevel gear **146** is held by a spring **166** in frictional engagement with an annular lining **168** of frictional material, such as cork or felt or the like, attached to the outer surface of the controlling body **154**. This arrangement constitutes a slip clutch between the controlling body **154** and the controlling member **164**.

As best shown in Fig. 6, the reciprocating rocking movements of the controlling member **164** are limited by adjustable stops **170** and **172** arranged on the support **128** for cooperation with abutting surfaces **174** and **176** respectively on said member **164**.

The tapered free end of the controlling member **164** is arranged for cooperation with push button switches **178** and **180** respectively carried by the support **128**. Said push button switches **178** and **180** are in circuit with the reversible motor **90** connected with the speed adjuster **80** of the stepless change speed transmission **62**. The electrical connection between said switches **178** and **180** and said reversible motor **90** will be described hereinafter.

As best shown in Figs. 1 and 3, a weight **182** carried by a rod **184** secured to the hub of the swingable support **128** urges the roller **158** into operative engagement with the winding on the beam **30**. Consequently, during the operation of the machine, the roller **158** and the driver bevel gear **162** connected therewith are rotated at a speed depending on the circumferential speed of the winding on the warp beam. As long as the speed of the driver bevel gear **162** is equal to the speed of the driver bevel gear **146** set by an adjustment of the speed adjuster **106** of the adjustable speed setting device **104**, the follower bevel gear **150** of the differential motion **148** will merely rotate around its stud **152**. However, as soon as there is a speed differential between said driver bevel gears **162** and **146**, for example by a decrease of the circumferential speed of the winding on the beam, owing to the drawing off of warp yarns from the beam, the follower bevel gear **150** will cause a rotation of the controlling body **154** in one direction around the shaft **136**. Such a rotation of the controlling body **154** causes a limited swinging of the controlling member **164** in one direction through the medium of the slip clutch **168** until, for example, the abutting surface **174** abuts against the stop **170**, whereupon the controlling body **154** may continue to rotate in the same direction. Such a swinging movement of the controlling member **164** results in a closing of the associated switches, for example, the switch **178**. Assume now, that the closing of said switch **178** causes a rotation of the reversible motor **90** in such a direction that the driving speed of the output of the stepless change speed transmission **62** is increased with the result of an increase in the speed of rotation of the warp beam **30**. This, in turn, will result in an increase of the circumferential speed of the winding on the beam for a return to the preset circumferential speed thereof.

The arrangement of the elements of the differential motion within the roller **158** eliminates the provision of flexible drive shafts or the like between the roller **158** and the driver bevel gear of the differential motion driven by said roller, whereby the amount of friction in the controlling mechanism is reduced to a minimum, thus increasing the effectiveness of said controlling mechanism.

As best shown in Figs. 1 and 4, the arm **44** rigidly connected with the rockable shaft **42** carrying the tension rod **38** carries adjustable actuating screws **186** and **188** arranged for cooperation with auxiliary push button switches **190** and **192** respectively. Said auxiliary switches **190** and **192** are also in circuit with the reversible motor **90** connected with the speed adjuster **80** of the stepless change speed transmission **62**. The actuating screw **186** will cause a closing of the auxiliary switch **190** if the tension in the warp yarns **36** should exceed a certain degree resulting in a downward movement of the tension rod **38**. On the other hand, the actuating screw **188** will close the auxiliary switch **192**, if the tension in the warp yarns **36** falls below a certain degree resulting in an upward movement of the tension rod **38**.

Moreover, the arm **44** carries additional actuating elements **194** and **196** arranged for cooperation with a safety switch **198** in circuit with the main motor **24**. The actuating element **194** will cause a closing of the safety switch **198** for stopping the main motor **24** and the machine, if there is an undue high tension in the warp yarn **36** and the closing of the auxiliary switch **190** did not result in a restoration of the normal operating condition of the machine. Likewise, the actuating element **196** will cause a closing of said safety switch **198** for stopping the machine, if there is an undue slack in the warp yarns **36** and the previous closing of the auxiliary switch **192** by the actuating screw **188** did not result in a restoration of the normal operating condition of the machine.

There are also manual push button switches **200** and **202** (see Fig. 1) mounted on the frame **20** of the machine. Said switches **200** and **202** are in circuit with the reversible motor **90**, as will be described hereinafter, for a manual operation thereof.

The wiring diagram of Fig. 8 illustrates the various switches in their position prior to the start of the machine. The manual switch **200**, the auxiliary switch **190** (capable of actuation of the tension rod, as described above) and the switch **178** (capable of actuation by the controlling member of the differential motion) are arranged in parallel. Likewise, the manual switch **202**, the auxiliary switch **192** and the switch **180** are arranged in parallel. While the switches **200**, **190**, **202** and **192** are two-pole switches, the switch **178** as well as the switch **180** has a third pole **204** and **206** respectively. Springs (not shown) tend to urge the switches **200**, **190**, **178**, **202**, **192** and **180** into the position shown in full lines in Fig. 8. Therefore, the switches **200**, **190**, **202**, and **192** are normally in their open position. Likewise, the pole **208** of the switch **178** is disconnected from the pole **210** thereof and the pole **212** of the switch **180** is disconnected from the pole **214** thereof. However, the

pole 208 of the switch 178 is connected with the pole 204 thereof and the pole 212 of the switch 180 is connected with the pole 206 thereof.

The core 216 of a solenoid 218 is mechanically connected with three switches 220, 222, and 224; in the position shown in Fig. 8, the switches 220 and 224 are open, while the switch 222 is closed. In a similar manner, the core 226 of a solenoid 228 is mechanically connected with three switches 230, 232 and 234; the switches 230 and 234 are open and the switch 232 is closed.

When the switches are in the position shown in Fig. 8, the power line 236 is connected through the line 238, through the switch 178, through the line 240 including the coil 242 of the solenoid 218 and through the switch 232 with the line 244 connected with the pole 214 of the switch 180, the pole 246 of the auxiliary switch 192 and with the pole 248 of the manual switch 202. As the manual switch 202 and the auxiliary switch 192 are open and as the pole 214 of the switch 180 is disconnected from the pole 212 thereof, the circuit is interrupted and the solenoid 218 will not be energized. Likewise, the power line 250 is connected through the line 252, through the switch 180, through the line 254 including the coil 256 of the solenoid 228 and through the switch 222 with the line 258 connected with the pole 259 of the manual switch 200, the pole 260 of the auxiliary switch 190 and with the pole 210 of the switch 178. As as manual switch 200 and the auxiliary switch 190 are open and as the pole 210 of the switch 178 is disconnected from the pole 208 thereof, the circuit is interrupted and the solenoid 228 is not energized.

The terminal 262 of the reversible motor 90 (connected with the speed adjuster 80 of the stepless change speed transmission 62, as described above) is connected through the line 264 with the pole 266 of the switch 224 and with the pole 268 of the switch 230. The terminal 270 of the reversible motor 90 is connected through the line 272 with the pole 274 of the switch 220 and with the pole 276 of the switch 234.

The pole 278 of the switch 220 and the pole 280 of the switch 230 are connected through the lines 282 and 284 respectively with the power line 250.

The pole 286 of the switch 224 and the pole 288 of the switch 234 are connected through the lines 290 and 292 respectively with the power line 236.

Thus, when the switch 178 by an actuation of the controlling member 164 of the differential motion is brought into its closing position 178' shown in dash and dot lines in Fig. 8, the circuit including the solenoid 218 is interrupted at the pole 204 of the switch 178 and the circuit 236, 238, 258, 254, 252, 250 is closed, resulting in an energization of the solenoid 228. Owing to the energization of said solenoid 228, the switches 230 and 234 mechanically connected with the core 226 of the solenoid are closed and the switch 232 is opened. The closing of said switches 230 and 234 results in a closing of the circuit 250, 284, 264, 272, 292, 236 including the reversible motor 90 which now rotates in one direction causing an adjustment of the speed adjuster 80 of the stepless change speed transmission 62 for increasing the speed of the beam 30.

Now, if after increase of the speed of the beam 30 the circumferential speed of the winding on the beam should become somewhat higher than desired, the controlling member 164 of the differential motion will be swung in opposite direction whereby the switch 178 is returned from its position 178' (see Fig. 8) into the position shown in full lines in Fig. 8 and the switch 180 is brought into the closing position 180' shown in dash and dot lines in Fig. 8. Consequently, the circuit 250, 252, 254, 258, 238, 236 including the previously energized solenoid 228 is interrupted at the switch 180 between the poles 206 and 212, so that the solenoid 228 will be de-energized even if there should be an undesired delay in the return of the switch 178 from its position 178' into the normal position shown in full lines in Fig. 8. The de-energization of the solenoid 228 results in an opening of the switches 230 and 234 and a closing of the switch 232. Now when the switch 180 is in the position 180' and the switch 178 is in its full line position connecting the pole 204 with the pole 208, the circuit 250, 244, 240, 238, 236, including the solenoid 218 is closed, resulting in an energization of the solenoid 218, whereby the switches 220 and 224 are closed and the switch 222 is opened. This, in turn, results in a closing of the circuit 250, 282, 272, 264, 290, 236 including the reversible motor 90 which now is rotated in the opposite direction for adjusting the speed adjuster 80 in opposite direction so as to effect a decrease of the speed of the beam 30.

If it should happen that the auxiliary switch 190 or the manual switch 200 is closed while the switch 180 is still in the position 180', the solenoid 228 cannot be energized for closing the switches 230 and 234 in the circuit of the reversible motor 90 as the circuit including the solenoid 228 is interrupted at the open switch 222 mechanically connected with the core 216 of the solenoid 218 still energized by the switch 180 in the position 180'. However, as soon as the switch 180 reaches the position shown in full lines in Fig. 8, the solenoid 218 is de-energized, causing a closing of the switch 222, so that now the closing of the auxiliary switch 190 or manual switch 200 will result in an energization of the solenoid 228 for causing a rotation of the reversible motor 90 in the opposite direction.

In a similar manner, the closing of the auxiliary switch 192 and the manual switch 202 as long as the switch 178 is still in the position 178' cannot cause an energization of the solenoid 218 simultaneously with an energization of the solenoid 228, owing to the still open position of the switch 232.

As described above, the beam 30 is driven by the main cam shaft 22 through the medium of the stepless change speed transmission 62, the chain drive 64, 68, 70 and the train of gears 74, 78. In order to facilitate a manual rotating of the beam 30, which, for example, becomes necessary when prior to the operation of the machine, the warp yarns must be laid around the tension rod and threaded in the needles, the following disengageable coupling means are arranged between the beam 30 and its drive.

As best shown in Fig. 2, a rod 294 is slidably arranged in an axial bore of the shaft 72. A knob 296 is rigidly connected with the left-hand end (as viewed in Fig. 2) of said rod 294 by means of a pin 298. A transverse pin 300 secured to the rod 294 is slidably engaged with recesses 302 of the shaft 72.

A disc 304 secured to the right-hand end (as viewed in Fig. 2) of the rod 294 is rigidly connected with a hub 306 of the pinion 74 positively connected with the shaft 72 by the feather key 76. The pinion 74 may be displaced in axial direction on the shaft 72. A spring 308 interposed between an abutment 310 of the axial bore of the shaft 72 and the disc 304 tends to urge the pinion 74 into its active end position shown in Fig. 2, which is limited by an abutment of the knob 296 against the shaft 72. In said active end position, the pinion 74 is in mesh with the gear 78 connected with the beam.

If it is desired to rotate manually the beam 30 without a rotation of the main cam shaft 22, the knob 296 is pulled outwardly against the action of the spring 308 until the transverse pin 300 is brought out of engagement with the recess 302, whereby the pinion 74 is displaced in left-hand direction for disengagement from the gear 78. The pinion 74 may be readily held in said disengaged inactive position by a rotation of the knob 296 through 90° causing a locking of the pinion 74 in its disengaged position by an engagement of the transverse pin 300 with the outer surface of the shaft 72. In order to re-engage the pinion 74 with the gear 78, above-

described steps are reversed and the machine is ready for operation.

The operation of the machine is a follows:

The operator of the machine sets the speed adjuster **106** of the adjustable speed setting device **104** by means of a manual rotation of the knob **110** into such a position that the controlling means of the machine control a predetermined circumferential speed of the winding on the beam which, in turn, causes the feeding of a predetermined length of warp yarn for a predetermined number of rotations of the main cam shaft. The proper position of the speed adjuster **106** may be determined by a chart given to the operator.

Furthermore, the operator sets the speed adjuster **80** of the stepless change speed transmission **62** by pressing one of the manual switches **200** and **202** causing a rotation of the reversible motor **90** into such a position that in consideration of the diameter of the winding on the beam at the beginning of the subsequent operation of the machine, the driver bevel gear **162** of the differential motion will rotate at approximately the same speed as the driver bevel gear **146**, the speed of which is determined by the setting of the speed adjuster **106** of the setting device **104**.

Now, if after the start of the machine there is a speed differential between the driver bevel gears **146** and **162** of the differential motion **148**, the controlling member **164** of said differential motion will close one of the switches **178** or **180**, for example the switch **178**, for example for increasing the speed of the beam **30** by an automatic adjustment of the speed adjuster **80** by means of a rotation of the reversible motor **90** in one direction. If then the circumferential speed of the winding on the beam should slightly exceed the predetermined circumferential speed, so that there occurs an opposite speed differential between the bevel gears **146** and **162** of the differential motion **148**, the controlling member **164** will be swung into opposite direction closing the switch **180** for causing an adjustment of the speed adjuster **80** of the stepless change speed transmission **62** in opposite direction by a rotation of the reversible motor **90** in opposite direction, thus decreasing the circumferential speed of the winding on the beam.

This play back and forth of the controlling member **164** will continue during the normal operation of the machine, so that a substantially constant mean circumferential speed of the winding on the beam is obtained. The more the diameter of the winding decreases, the higher will be the speed of rotation of the beam **30**.

Owing to the thus obtained constant mean circumferential speed of the winding on the beam, the warp yarns will travel at a constant speed, whereby a constant length of warp yarn is fed to the needles of the machine during a certain number of rotations of the main cam shaft **22**.

The constant feed of a predetermined length of warp yarn to the needles during a certain number of rotations of the main cam shaft results in a uniform quality of the fabric knitted on the machine. The slight swinging movements of the controlling member **164** necessary for controlling the switches **178** and **180** permit a fast reaction of the controlling mechanism, so that practically a constant circumferential speed of the winding on the beam and, consequently, a constant travelling speed of the warp yarns is obtained. Also, it will be readily understood that the controlling means according to the invention, which are associated with the lower assembly **28** of warp beams and the top assembly **32** of warp beams permit an exact adjustment of the circumferential speed of the windings on the warp beams of the lower and top assembly relative to each other.

If an unforseeable incident should occur, for example if one of the switches **178** or **180** should get stuck or should work too slowly, so that either too little or too much yarn is fed to the needles with the result of an increase or decrease in the tension of the yarns, either the auxiliary switch **190** or the auxiliary switch **192** will be closed automatically by a movement of the tension rod **38**, so as to effect an operation of the reversible motor **90** for a return to the predetermined circumferential speed of the winding on the beam.

If there should be any reason that the automatic actuation of the auxiliary switch **190** or **192** does not accomplish the necessary increase or decrease in the tension of the yarns, a continued movement of the tension rod in one or the other direction will result in a stopping of the main motor **24** of the machine by means of the safety switch **198**.

We have described a preferred embodiment of our invention, but it is understood that this disclosure is for the purpose of illustration and that various omissions or changes in shape, proportion and arrangement of parts, as well as the substitution of equivalent elements for those herein shown and described, may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

For example, the adjustable speed setting device **104** must not necessarily be in the shape of a stepless change speed transmission. Instead, a train of gears with exchangeable gears could be used.

Moreover, if desired, the auxiliary switches **190** and **192** could be omitted.

What we claim is:

1. In a warp knitting machine, the combination of: a power driven main shaft, a rotatable warp beam, a variable speed drive for rotating said warp beam, controlling means including a first movable member and a second movable member, and mechanical means operatively connecting said first movable member with said main shaft for continuous rotation in dependence on the rotation of the latter, said second movable member being operatively engaged with the winding on said warp beam, and said controlling means being responsive to speed differentials between said two members and being associated with said variable speed drive for varying the speed of the output of said variable speed drive so as to maintain a substantially constant circumferential speed of said winding on the warp beam.

2. In a warp knitting machine, the combination of: a power-driven main shaft, a rotatable warp beam, a variable speed drive for rotating said warp beam, a movable speed adjusting element in said variable speed drive, electrical means associated with said speed adjusting element, controlling means including a first movable member and a second movable member, and mechanical means operatively connecting said first movable member with said main shaft for continuous rotation in dependence on the rotation of the latter, said second movable member being operatively engaged with the winding on said warp beam, and said controlling means being responsive to speed differentials between said two members and being in electrical connection with said electrical means for varying the speed of the output of said variable speed drive so as to maintain a substantially constant circumferential speed of said winding on the warp beam.

3. In a warp knitting machine as claimed in claim 2, said electrical means including a reversible electromotor connected with said speed adjusting element.

4. In a warp knitting machine, the combination of: a rotatable warp beam, a variable speed drive for rotating said warp beam, and controlling means in operative engagement with the winding on said warp beam and associated with said variable speed drive, said controlling means being settable for a predetermined circumferential speed of the winding on said warp beam and being responsive to a deviation of the circumferential speed of said winding from said predetermined circumferential speed for varying the speed of the output of said variable speed drive so as to effect a return to said predetermined circumferential speed.

5. In a warp knitting machine, the combination of: a

rotatable warp beam, a variable speed drive for rotating said warp beam, a movable speed adjusting element in said variable speed drive, electrical means associated with said speed adjusting element, and controlling means in operative engagement with the winding on said warp beam said controlling means being settable for a predetermined circumferential speed of the winding on said warp beam, and said controlling means being responsive to a deviation of the circumferential speed of said winding from said predetermined circumferential speed and being in electrical connection with said electrical means for varying the speed of the output of said variable speed drive so as to effect a return to said predetermined circumferential speed.

6. In a warp knitting machine, the combination of: a rotatable main shaft, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, and controlling means including a first movable member mechanically connected with said main shaft for continuous rotation in dependance on the rotation of the latter and a second movable member operatively engaged with the winding on said warp beam, said controlling means being responsive to speed differentials between said two members and being associated with said speed adjusting element of said stepless change speed transmission for maintaining a substantially constant circumferential speed of said winding on the warp beam.

7. In a warp knitting machine, the combination of: a rotatable main shaft, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, electrical means associated with said speed adjusting element, and controlling means including a first movable member mechanically connected with said main shaft for continuous rotation in dependance on the rotation of the latter and a second movable member operatively engaged with the winding on said warp beam, said controlling means being responsive to speed differentials between said two members and being in electrical connection with said electrical means associated with said speed adjusting element of said stepless change speed transmission for maintaining a substantially constant circumferential speed of said winding on the warp beam.

8. In a warp knitting machine as claimed in claim 7, said electrical means including a reversible electromotor connected with said speed adjusting element.

9. In a warp knitting machine, the combination of: a rotatable main shaft, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, controlling means including a first movable member and a second movable member, and an adjustable speed setting device, said adjustable speed setting device being arranged between said main shaft and said first movable member for setting a predetermined speed of the latter, said second movable member being operatively engaged with the winding on said warp beam, said controlling means being responsive to speed differentials between said two members and being associated with said speed adjusting element of said stepless change speed transmission for maintaining a substantially contant circumferential speed of said winding on the warp beam.

10. In a warp knitting machine as claimed in claim 9, said adjustable speed setting device being constituted by a second stepless change speed transmission.

11. In a warp knitting machine, the combination of: a rotatable main shaft, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, electrical means associated with said speed adjusting element, controlling means including a first movable member and a second movable member, and an adjustable speed setting device, said adjustable speed setting device being arranged between said main shaft and said first movable member for setting a predetermined speed of the latter, said second movable member being operatively engaged with the winding on said warp beam, said controlling means being responsive to speed differentials between said two members and being in electrical connection with said electrical means connected with said speed adjusting element of said stepless change speed transmission for maintaining a substantially constant circumferential speed of said winding on the warp beam.

12. In a warp knitting machine, the combination of: a rotatable main shaft, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, a differential motion including a first rotatable driver gear, a second rotatable driver gear, a rotatable controlling body and a follower gear rotatably mounted on said rotatable controlling body, said follower gear being in mesh with each of said driver gears, and a roller arranged for contacting engagement with the winding on said warp beam, said first driver gear being connected with said main shaft, said second driver gear being connected with said roller, and said controlling body being responsive to speed differentials between said two driver gears and being associated with said speed adjusting element of said stepless change speed transmission for maintaining a substantially constant circumferential speed of said winding on the warp beam.

13. In a warp knitting machine as claimed in claim 12, said roller being hollow, and the elements of said differential motion being arranged within said roller.

14. In a warp knitting machine as claimed in claim 12, a swingable support, said roller being carried by said support, said roller being hollow, the elements of said differential motion being arranged within said roller, and biasing means connected with said support for urging said roller against the winding on the warp beam.

15. In a warp knitting machine, the combination of: a rotatable main shaft, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, electrical means associated with said speed adjusting element for actuating same, switching means in circuit with said electrical means, and a differential motion including a first rotatable driver gear, a second rotatable driver gear, a rotatable controlling body and a follower gear rotatably mounted on said rotatable controlling body, said follower gear being in mesh with each of said driver gears, a reciprocable controlling member, a slip clutch between said controlling member and said controlling body, limiting means arranged for limiting end positions of said controlling member, said first driver gear being connected with said main shaft, and rotatable means arranged for rotation by warp yarn and connected with said second driver gear, said controlling body being responsive to speed differentials between said two driver gears and actuating said controlling member through said slip clutch, and said controlling member being arranged for cooperation with said switching means for actuating same upon its actuation so as to effect a substantially constant circumferential speed of the winding on the warp beam by said stepless change speed transmission.

16. In a warp knitting machine as claimed in claim 15, a reversible motor connected with said speed adjusting element, a first switch in circuit with said motor for effecting rotation thereof in one direction, a second switch in circuit with said motor for effecting rotation thereof in opposite direction, and said controlling member being arranged for actuation of said first switch in one of its

end positions and for actuation of said second switch in its other end position.

17. In a warp knitting machine, the combination of: a rotatable main shaft, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, electrical means associated with said speed adjusting element for actuating same, switching means in circuit with said electrical means, and a differential motion including a first rotatable driver gear, a second rotatable driver gear, a rotatable controlling body and a follower gear rotatably mounted on said rotatable controlling body, said follower gear being in mesh with each of said driver gears, a reciprocable controlling member, a slip clutch between said controlling member and said controlling body, limiting means arranged for limiting end positions of said controlling member, and a roller arranged for engagement with the winding on said warp beam, said first driver gear being connected with said main shaft, said second driver gear being connected with said roller, said controlling body being responsive to speed differentials between said two driver gears and actuating said controlling member through said slip clutch, and said controlling member being arranged for cooperation with said switching means for actuating same upon its actuation so as to effect a substantially constant circumferential speed of the winding on the warp beam by said stepless change speed transmission.

18. In a warp knitting machine as claimed in claim 15, an adjustable speed setting drive interposed between said main shaft and said first driver gear for setting a predetermined speed of the latter.

19. In a warp knitting machine as claimed in claim 17, an adjustable speed setting device interposed between said main shaft and said first driver gear for setting a predetermined speed of the latter.

20. In a warp knitting machine, the combination of: a rotatable main shaft, a main drive connected with said main shaft for rotating same, a rotatable warp beam, a variable speed drive for rotating said warp beam, a tension rod movably arranged for engagement with warp yarns fed by said warp beam to knitting implements of the machine, biasing means connected to said tension rod urging same against said warp yarns so as to tension same, said tension rod being associated with said main drive for stopping same when it reaches extreme end positions, a movable speed adjusting element in said variable speed drive, electrical means associated with said speed adjusting element, and controlling means in operative engagement with the winding on said warp beam, said controlling means being responsive to a variation in the circumferential speed of said winding on the warp beam and being in electrical connection with said electrical means for varying the speed of the output of said variable speed drive.

21. In a warp knitting machine, the combination of: a rotatable warp beam, a variable speed drive for rotating said warp beam, a movable speed adjusting element in said variable speed drive, electrical means associated with said speed adjusting element, first controlling means in operative engagement with the winding on said warp beam, said first controlling means being responsive to a variation in the circumferential speed of said winding on the warp beam, and second controlling means responsive to an undue variation in the tension of the warp yarns fed by said warp beam to knitting implements of the machine, each of said controlling means being in electrical connection with said electrical means for varying the speed of the output of said variable speed drive.

22. In a warp knitting machine, the combination of: a rotatable main shaft, a main drive connected with said main shaft for rotating same, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, a tension rod movably arranged for engagement with warp yarns fed by said warp beam to knitting implements of the machine, biasing means connected to said tension rod for urging same against said warp yarns so as to tension same, controlling means including a first movable member connected with said main shaft and a second movable member operatively engaged with the winding on said warp beam, said controlling means being responsive to speed differentials between said two members and being associated with said speed adjusting element of said stepless change speed transmission for maintaining a substantially constant circumferential speed of said winding on the warp beam, and stopping means associated with said main drive, said tension rod being arranged for actuating said stopping means in its end positions resulting from substantial variations in the tension of the warp yarns.

23. In a warp knitting machine the combination of: a rotatable main shaft, a main drive connected with said main shaft for rotating same, a rotatable warp beam, a stepless change speed transmission including a movable speed adjusting element, said stepless change speed transmission being arranged between said main shaft and said warp beam, electrical means associated with said speed adjusting element, first switching means in circuit with said electrical means, second switching means in circuit with said electrical means, a tension rod movably arranged for engagement with warp yarns fed by said warp beam to knitting implements of the machine, biasing means connected to said tension rod for urging same again said warp yarns so as to tension same, said tension rod being normally in a mean position during the operation of the machine, and controlling means including a first movable member connected with said main shaft and a second movable member operatively engaged with the winding on said warp beam, said controlling means being responsive to speed differentials between said two members and being arranged for actuating said first switching means of said electrical means for maintaining a substantially constant circumferential speed of said winding on the warp beam by said stepless change speed transmission, and said tension rod being arranged for actuating said second switching means of said eelctrical means for effecting a return to said circumferential speed upon a deviation of said tension rod from its mean position resulting from an undue variation in the tension of the warp yarns.

24. In a warp knitting machine as claimed in claim 23, an adjustable speed setting drive interposed between said main shaft and said first movable member for setting a predetermined speed of the latter.

25. In a warp knitting machine as claimed in claim 23, stopping means associated with said main drive, and said tension rod being arranged for actuating said stopping means in extreme end positions beyond its positions for actuating said second switching means.

26. In a warp knitting machine as claimed in claim 23, an adjustable speed setting drive interposed between said main shaft and said first movable member for setting a predetermined speed of the latter, and stopping means associated with said main drive, and said tension rod being arranged for actuating said stopping means in extreme end positions beyond its positions for actuating said second switching means.

27. In a warp knitting machine as claimed in claim 1, disengageable coupling means interposed between said variable speed drive and said warp beam.

28. In a warp knitting machine as claimed in claim 4, disengageable coupling means interposed between said variable speed drive and said warp beam.

29. In a warp knitting machine, the combination of: a rotatable warp beam, a power driven shaft, a pinion positively connected with said shaft for rotation therewith, a gear connected to said warp beam, said pinion being axially movable relative to said shaft from an active end

position in mesh with said gear into an inactive position out of mesh with said gear, biasing means engaged with said pinion for urging same into said active end position, and actuating means engaged with said pinion for displacing same from its active position into its inactive position.

30. In a warp knitting machine the combination of: a rotatable warp beam, a power driven shaft, a pinion positively connected with said shaft for rotation therewith, a gear connected to said warp beam, said pinion being axially movable relative to said shaft from an active end position in mesh with said gear into an inactive position out of mesh with said gear, biasing means engaged with said pinion for urging same into said active end position, actuating means engaged with said pinion for displacing same from its active position into its inactive position, and locking means associated with said pinion for holding same in its inactive position.

31. In a warp knitting machine, the combination of: a rotable main shaft, a main drive connected with said main shaft for rotating same, a rotatable warp beam arranged for feeding warp yarns to knitting implements of the machine, a stepless change speed transmission arranged between said main shaft and said warp beam, said stepless change speed tranmission including a movable speed adjusting element, a tension rod movably arranged for engagement with the warp yarns, biasing means conencted to said tension rod for urging same against said warp yarns so as to tension same, said tension rod being normally in a mean position during the operation of the machine, a reversible adjusting electromotor operatively connected with said movable speed adjusting element for adjusting same, a first switch connected with said reverible electromotor for causing a forward-run thereof, a second switch electrically connected with said reversible electromotor for causing a backward run thereof, and an actuating member connected with said tension rod and arranged for cooperation with said first and second switch, said actuating member being in a neutral position when said tension rod is in its mean position, and said actuating member being in a position for actuating one of said two switches so as to render operative said reversible electromotor upon movement of said tension rod in either direction from its mean position in dependence of a change in the tension of the warp yarns whereby a substantially constant tension in the warp yarns may be maintained during the operation of the machine.

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