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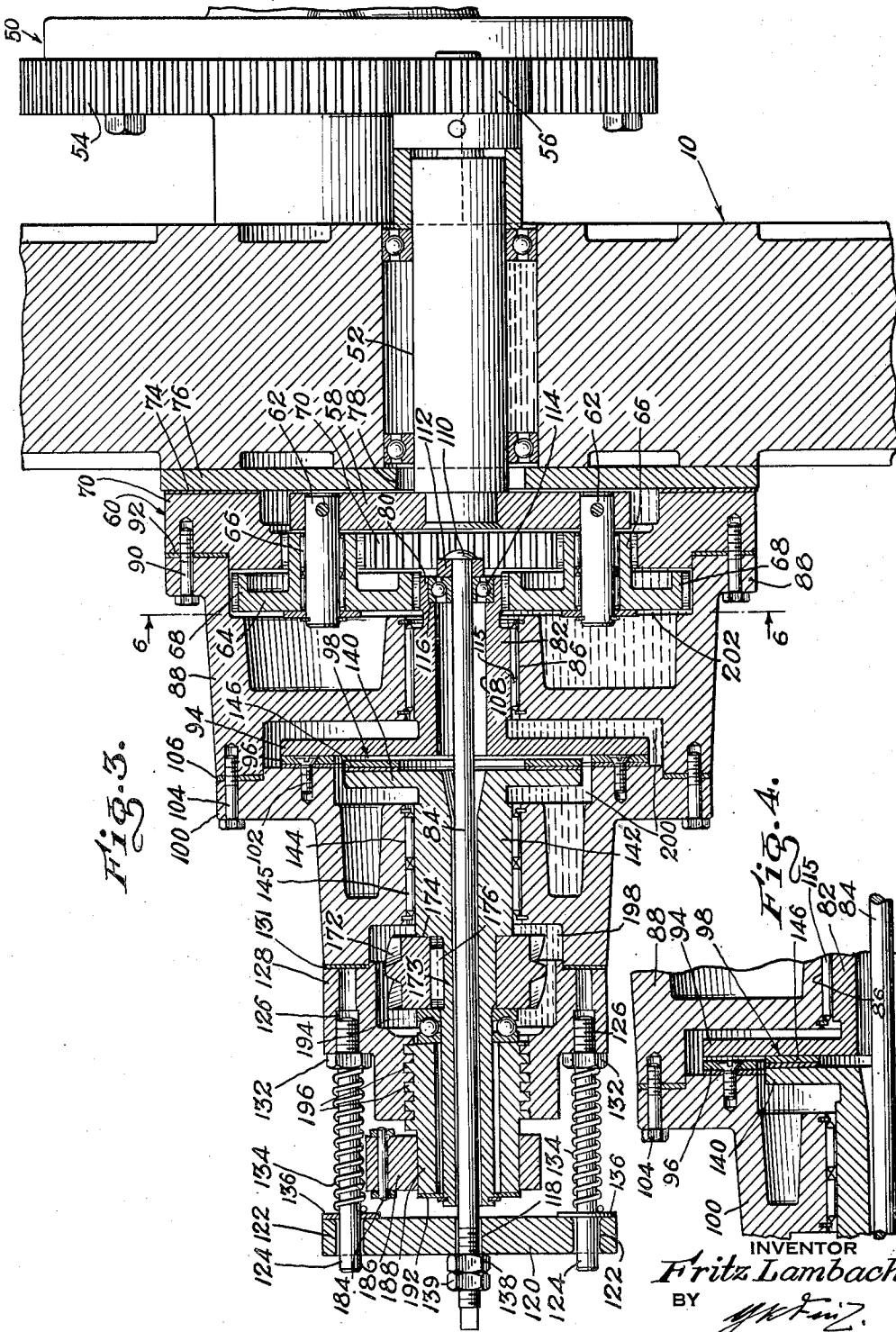
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2,448,035

WARP KNITTING MACHINE

Filed Jan. 24, 1947

3 Sheets-Sheet 2



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Fig. 5.

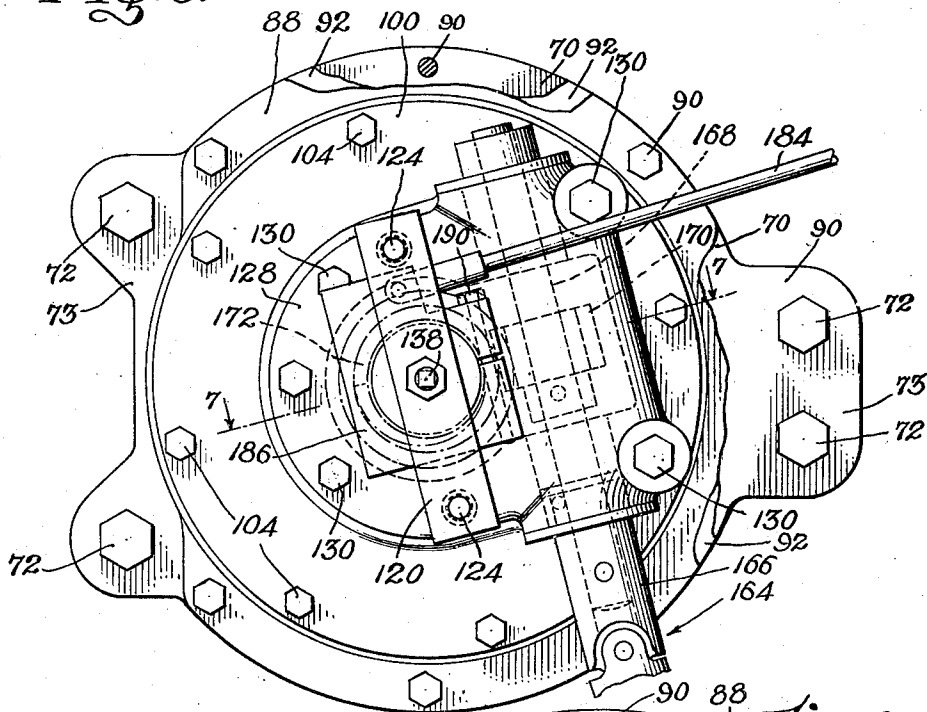


Fig. 6.

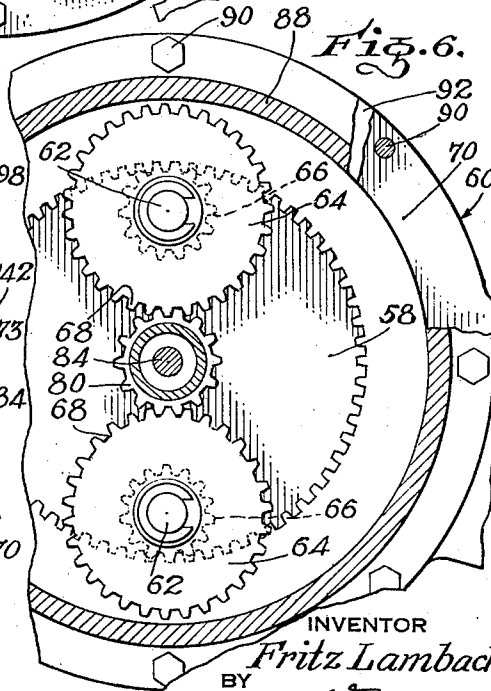
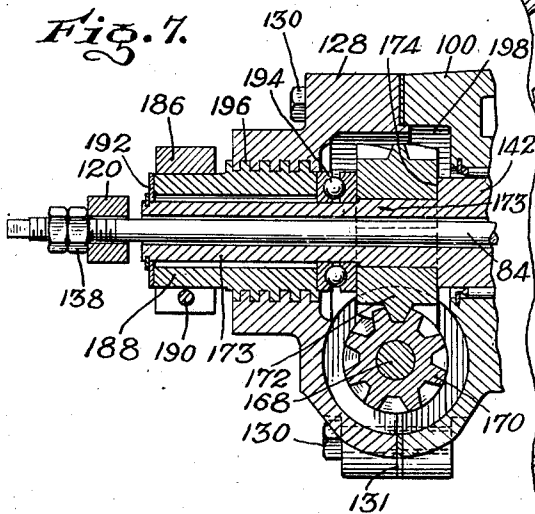


Fig. 7.



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WARP KNITTING MACHINE

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13 Claims. (Cl. 66—86)

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This invention relates to warp knitting machines, and more particularly to a warp beam feeder drive for feeding warp yarns from the warp beam or beams to the knitting implements of a warp knitting machine.

An object of the present invention is to equip a warp knitting machine with a warp beam feeder drive, which responds fast to a change in the tension of the warp yarns, so that immediately upon a pulling action of the knitting implements on the warp yarns the warp beam is driven by the warp beam feeder drive for feeding warp yarns to the knitting implements.

A further object of the present invention is to provide a warp beam feeder drive for a warp knitting machine, which includes efficient braking means assuring a fast stoppage of the warp beam upon the termination of the pulling action of the knitting implements on the warp yarns.

Still another object of the present invention is to equip a warp knitting machine with a warp beam feeder drive, which may be readily adjusted to the conditions prevailing in the warp knitting machine during an operation of the latter.

A further object of the present invention is to provide a warp beam feeder drive for a warp knitting machine, wherein the principal elements run in an oil bath.

Still another object of the present invention is to improve upon the construction of warp knitting machines as now ordinarily made.

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.

With the above and other objects of the invention in view, the invention consists in the novel construction, arrangement and combination of various devices, elements and parts, as set forth in the claims hereof, an embodiment of the same being described in the specification and being illustrated in the accompanying drawings forming part of this specification, wherein:

Fig. 1 is a fragmentary side elevational view of the upper portion of a warp knitting machine equipped with warp beam feeder drives according to the present invention,

Fig. 2 is a fragmentary front elevational view of the upper portion of a warp knitting machine illustrating a warp beam feeder drive according to the invention, a portion of the frame of the warp knitting machine being shown in section,

Fig. 3 is a sectional view of the warp beam feeder drive shown in Fig. 2, in an enlarged scale,

Fig. 4 is a fragmentary sectional view of the warp beam feeder drive similar to that shown in Fig. 3, wherein, however, the coupling means of the clutch are in a different position,

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Fig. 5 is a side elevational view of the warp beam feeder drive in an enlarged scale,

Fig. 6 is a fragmentary sectional view taken along line 6—6 of Fig. 3, and

Fig. 7 is a fragmentary sectional view taken on line 7—7 of Fig. 5.

Referring now to Figs. 1-3, 10 generally indicates the frame of a warp knitting machine, 12 indicates a top warp beam, 14 indicates a lower warp beam, and 16 generally indicates knitting implements of the machine. The knitting implements are actuated in a manner known per se by mechanisms driven by a main cam shaft 18 journaled in suitable bearings of the frame 10 and rotated by a main drive (not shown). The warp yarns 20 fed by the top warp beam 12 to the needles 22 are guided by a stationary rod 24 and travel around a tensioning rod 26 held by arms 28 keyed to a shaft 30 journaled in the frame 10 of the warp knitting machine. An adjustable spring 32 acting on an extension 34 of the arm 28 carrying the tensioning rod 26 tends to urge said arm 28 in counter-clockwise direction (as viewed in Fig. 1) whereby the warp yarns 20 are tensioned in a manner known per se. Likewise, the warp yarns 36 fed by the lower warp beam 14 of the needles 22 are guided by the stationary rod 38 and travel around a tensioning rod 40 carried by arms 42 keyed to a shaft 44 journaled in the frame 10 of the machine. Said warp yarns 36 are tensioned by an adjustable spring 46 acting on an extension 48 of the arm 42 in a manner known per se.

The top warp beam is coupled through a suitable mechanism generally indicated by 50 (see Figs. 2 and 3) with a shaft 52 journaled in ball bearings of the frame 10. Said mechanism 50 including for example gear segments 54 in mesh with a pinion 56 keyed to one end of the shaft 52 may be of the type shown in the U. S. Patent 2,376,364 issued on May 22, 1945, to Fritz Lambach. A disc 58 of a planetary gear drive generally indicated by 60 (see Figs. 3 and 6) is rigidly secured to the other end of said rotatable shaft 52. Said disc 58 carries diametrically opposite studs 62. On each of said studs 62 a planet gear 64 is rotatably arranged. Each planet gear comprises a pinion 66 of small diameter and a pinion 68 of large diameter rigidly connected with each other.

The pinions 66 are in mesh with a ring gear 70 rigidly secured to the frame 10 by means of screws 72 passing through bores of lugs 73 of said ring gear 70 (see Figs. 1, 2 and 5). As best shown in Fig. 3, a gasket 74 and a cover plate 76 having a bore 78 for the passage of the shaft 52 are interposed between the ring gear 70 and the frame 10 for a purpose to be described hereinafter. The large pinions 68 of the planet gears 64 are in

mesh with the sun gear 80 forming a part of an element 82 rotatably arranged through the medium of a ball bearing 114 on a rod 84 and by means of a needle bearing 115 in a bore 86 of a member 88 rigidly secured to the stationary ring gear 70 by screws 90. A gasket 92 is interposed between said member 88 and the ring gear 70.

Above mentioned rotatable element 82 is provided with a disc 94 at the end opposite the sun gear 80. Said disc 94 capable of cooperation with an annular braking lining or ring 96 also forms one of the coupling means of a frictional clutch generally indicated by 98. The annular braking ring 96 is secured to a stationary member 100 by means of screws 102 which, in turn, is secured to the stationary member 88 by screws 104. A gasket 106 is interposed between the members 88 and 100. The rod 84 passing through a bore 108 of the element 82 is provided at its right-hand end (as viewed in Fig. 3) with a head 110 abutting against a collar 112 in engagement with the inner race of the ball bearing 114. The outer race of said ball bearing 114 inserted into a recess of the element 82 abuts against a shoulder 116 of said recess. The left-hand end (as viewed in Fig. 3) of the rod 84 passes through a center bore 118 of a bar 120. Said bar 120 is provided with diametrically opposite apertures 122 shiftably engaged with bolts 124 screwed into threaded bores 126 of a body 128 secured to the member 100 by means of screws 130 (see Figs. 5 and 7). A gasket 131 is interposed between the body 128 and the member 100. As best shown in Fig. 3, a locking nut 132 is arranged on each of the bolts 124. Furthermore, a coiled spring 134 surrounding each of said bolts 124 is interposed between said locking nut 132 and a ring 136 abutting against said bar 120. The tension of said coiled spring 134 arranged outside the body 128 may be adjusted during the operation of the machine by means of an adjusting nut 138 screwed on the threaded end of the rod 84 and resting against the surface of the bar 120. Said adjusting nut 138 is held in its position by a lock nut 139. As will be readily understood, the coiled springs 134 tend to urge the bar 120 in left-hand direction (as viewed in Fig. 3) whereby the disc 94 of the element 82 connected with said bar 120 through the rod 84 and adjusting nut 138 is urged against the stationary braking ring 96 for an arresting of the warp beam 12 positively connected with said element 82 through the medium of the mechanism 50 and the planetary gear drive 60.

As mentioned above, the disc 94 of the element 82 forms also a coupling member of a frictional clutch generally indicated by 98. The other coupling member of said clutch 98 is formed by a disc 140 arranged on the right-hand end of a member 142 rotatably arranged in a bore 144 of the member 100 through the medium of a needle bearing 145. Said coupling member 140 carrying a clutch lining 146 is permanently rotated during the operation of the machine by the following mechanism:

As best shown in Fig. 1, a gear 148 keyed to the end of the main cam shaft 18 of the machine is in mesh with a gear 150 keyed to the lower end of a shaft 152 carrying at its upper end a member 154 of a universal joint 156. The other member 158 of said universal joint 156 is keyed to the lower end of a connecting shaft 160, the upper end of which carries one member 162 of a second universal joint 164. As best shown in Fig. 5, the other member 166 of said universal joint 164 is secured to the lower end of a shaft 168 rotat-

ably, but axially immovably arranged in suitable bearings carried by the bodies 100 and 128. According to Figs. 5 and 7, a spiral gear 170 secured to the shaft 168 is in mesh with a gear 172 arranged on a reduced portion 173 of the element 142. Said gear 172 rests against a shoulder 174 of the element 142 and is positively connected with said element by means of a key 176. Therefore, during the operation of the machine, i. e. during a rotation of the main shaft 18, the coupling member 140 forming a part of the element 142 is permanently rotated through the medium of the mechanism including the universal joints 156 and 164 and the gearing 170, 172.

Above mentioned coupling discs 140 and 94 may be engaged with each other and disengaged from each other the following controlling mechanism:

As best shown in Fig. 1, a split arm 178 having a plurality of holes 180 is rigidly connected by means of a clamping screw 182 with the shaft 30 carrying the arms 28 holding the tensioning rod 26. One end of a connecting rod 184 is selectively pivotally connected with one of the series of holes 180 of the arm 178. The other end of said connecting rod 184 is pivotally connected with a split arm 186 rigidly secured to a cylindrical element 188 by means of a clamping screw 190 (see Figs. 1-3, 5 and 7). Said cylindrical element 188 is interposed between a set collar 192 and a thrust-ball-bearing 194 arranged on the reduced portion 173 of the element 142. The thrust-ball-bearing 194 abuts against the gear 172. The cylindrical element 188 has a threaded portion 196 in engagement with a threaded bore of the stationary body 128. Therefore, if in response to a pulling action of the knitting implements 16 (Fig. 1) on the warp yarns 20, the tensioning rod 26 is swung in clockwise direction against the action of the spring 32, the arm 178 likewise swung in clockwise direction causes a corresponding rocking movement of the arm 186, which results in a slight rotation of the cylindrical element 188; owing to the engagement of the threads 196 of the cylindrical element 188 with the threaded bore of the body 128, such a slight rotation of the element 188 by means of the arm 186 causes a shifting of the member 142 through the medium of the thrust-ball-bearing 194 and the gear 172 in right-hand direction (as viewed in Fig. 3) whereby the coupling member 140 is brought into engagement with the coupling member 94. Upon said engagement of the coupling members 140 and 94 with each other and during a further swinging movement of the arm 186 in clockwise direction, the continued displacement of the element 142 towards the right causes a displacement of the disc 94 towards the right away from the annular braking lining 96 against the action of the coiled springs 134 into the position shown in Fig. 4, whereby the braking means is released. The rotating coupling disc 140 engaged with the thus released coupling disc 94 causes an immediate rotation of the warp beam 12 through the planetary gear drive 60 and the mechanism 50 for feeding warp yarns to the knitting implements. Said feeding of warp yarn to the knitting implements by the thus driven warp beam, in turn, results after a short interval into a lessening of the tension in the yarns, so that the spring 32 (Fig. 1) may cause a movement of the tensioning rod 26 in counter-clockwise direction. Said movement of the tensioning rod 26 in counter-clockwise direction causes a similar movement of the arms 178 and 186 in counter-clockwise direction, whereby the coupling disc

140 is retracted from the position shown in Fig. 4 into the position shown in Fig. 3 by means of the element 188 having its threaded portion 196 engaged with the threaded portion of the body 128. During said retracting movement of the coupling member 140, the coupling member 94 may follow said retracting movement towards the left by means of the action of the springs 134, until the disc 94 abuts against the braking ring 96, whereby the warp beam 12 is arrested. During the operation of the warp knitting machine, above described releasing of the beam brake 96 by an engagement of the clutch members 140 and 94, driving of the warp beam by the engaged clutch members 140 and 94, and application of the beam brake and disengagement of the clutch members 140, 94 repeats itself at short intervals in response to the intermittent pulling actions of the knitting implements on the warp yarns and a subsequent lessening of such pulling actions.

Above described construction permits a fast response of the warp beam feeder drive to a change in the tension of the yarns for causing an immediate release of the beam brake and an immediate rotation of the warp beam by the feeder drive. Furthermore, the rather large braking surface of the braking ring 96 assures an efficient braking means for a quick stoppage of the warp beam upon the termination of a pulling action of the knitting implements on the warp yarns.

Furthermore, said braking action may be readily adjusted to the conditions prevailing in the machine by an adjustment of the tension of the coiled springs 134 arranged outside the casing inclosing the braking means by means of the readily accessible adjusting nut 138.

As best shown in Figs. 3 and 7, the gears 170 and 172 of the warp beam feeder drive are arranged in a compartment 198, the coupling discs 140, 94 of the clutch 98 are arranged in a compartment 200 and the elements of the planetary gear drive 60 are arranged in a compartment 202; each of said compartments 198, 200 and 202 is sealed by above mentioned gaskets and has a sump capable of receiving oil. The gears 170, 172, the coupling members 140, 94 and the elements of the planetary gear drive 60 are arranged for dipping into oil in said sumps. If desired, said sumps may communicate with each other by lines or bores (not shown in the drawings).

As best shown in Fig. 1, a warp yarn tension controlled warp beam feeder drive of the type described above in connection with the top warp beam 12 is also associated with the lower warp beam 14. The mechanism including the two universal joints 204 and 206 for rotating one of the two friction clutch members during the operation of the machine is coupled with the main shaft 18 of the machine by means of a gear 208 meshing with the gear 148 keyed to the end of the main shaft 18. The controlling mechanism for engaging and disengaging the clutch members and for releasing and applying the braking means in timed relationship thereto is coupled with the tensioning rod 40 by means of the connecting rod 210 pivotally connected with the arm 212 positively connected with the shaft 44 which, in turn, is positively connected with the arms 42 carrying said tensioning rod 40. As the construction of the warp beam feeder drive associated with the lower warp beam 14 corresponds entirely to the construction of the warp beam feeder drive associated with the top warp beam 12 as described above, a detailed description of the

warp beam feeder drive associated with the lower warp beam 14 is unnecessary, and it is sufficient to state that the permanently rotating clutch member of the warp beam feeder drive drives the lower warp beam 14 each time upon a pulling action of the knitting implements on the warp yarns 36 causing an increase in the tension of said warp yarns, and that the warp beam is automatically arrested by the braking means each time upon a sufficient lessening of the pulling action of the knitting implements 16 on the warp yarns 36.

It is understood, that the driving means for rotating the clutch member 140 during the operation of the machine may be replaced by any other suitable driving mechanism, which may be coupled with the main drive of the machine or which may include an independent drive, such as an electric motor.

Furthermore, the controlling mechanism for shifting the clutch member 140 in response to a change in the tension of the yarns may be replaced by any other suitable controlling mechanism responsive to a change in the tension in the yarns.

I have described a preferred embodiment of my invention but it is understood that numerous changes and omissions may be made without departing from the spirit of my invention.

What I claim is:

1. In a warp knitting machine, the combination of: a rotatable warp beam, knitting implements arranged for engagement with yarns fed by said warp beam, said knitting implements being capable of causing intermittent pulling actions on said yarns, a feeder drive, a clutch interposed between said feeder drive and said warp beam, said clutch having cooperating first and second rotatable coupling means capable of being engaged with each other and of being disengaged from each other, said first coupling means being positively connected with said feeder drive so as to be rotated by the latter during the operation of the machine, means arranged for a positive connection of said second coupling means with said warp beam, braking means, said braking means being capable of applying a braking action on said warp beam, a controlling mechanism associated with said clutch for engaging said coupling means with each other in response to such a pulling action and for disengaging said coupling means from each other in response to a lessening of such a pulling action, one of said coupling means being arranged for cooperation with said braking means so as to release same in response to an engagement of said coupling means with each other, and means for an automatic application of said braking means upon a disengagement of said coupling means from each other.

2. In a warp knitting machine as claimed in claim 1, said feeder drive being coupled with and driven by the main drive of the warp knitting machine.

3. In a warp knitting machine, the combination of: a rotatable warp beam, knitting implements arranged for engagement with yarns fed by said warp beam, said knitting implements being capable of causing intermittent pulling actions on said yarns, a feeder drive, a clutch interposed between said feeder drive and said warp beam, said clutch having cooperating first and second rotatable coupling means capable of being engaged with each other and of being disengaged from each other, said first coupling means being

positively connected with said feeder drive so as to be rotated by the latter during the operation of the machine, means arranged for a positive connection of said second coupling means with said warp beam, braking means associated with said second coupling means, said braking means being capable of applying a braking action on said second coupling means, a controlling mechanism associated with said clutch for engaging said coupling means with each other in response to such a pulling action and for disengaging said coupling means from each other in response to a lessening of such a pulling action, one of said coupling means being arranged for cooperation with said braking means so as to release same in response to an engagement of said coupling means with each other, and means for an automatic application of said braking means upon a disengagement of said coupling means from each other.

4. In a warp knitting machine, the combination of: a rotatable warp beam, knitting implements arranged for engagement with yarns fed by said warp beam, said knitting implements being capable of causing intermittent pulling actions on said yarns, a feeder drive, a clutch interposed between said feeder drive and said warp beam, said clutch having cooperating first and second rotatable coupling means capable of being engaged with each other and of being disengaged from each other, said first coupling means being positively connected with said feeder drive so as to be rotated by the latter during the operation of the machine, means arranged for a positive connection of said second coupling means with said warp beam, braking means associated with said second coupling means, said braking means being capable of applying a braking action on said second coupling means, a controlling mechanism associated with said clutch for engaging said coupling means with each other in response to such a pulling action and for disengaging said coupling means from each other in response to a lessening of such a pulling action, said first coupling means being arranged for cooperation with said braking means so as to release same in response to an engagement of said coupling means with each other, and means for an automatic application of said braking means upon a disengagement of said coupling means from each other.

5. In a warp knitting machine, the combination of: a rotatable warp beam, knitting implements arranged for engagement with yarns fed by said warp beam, said knitting implements being capable of causing intermittent pulling actions on said yarns, a feeder drive, a clutch interposed between said feeder drive and said warp beam, said clutch having cooperating first and second rotatable coupling means, said first coupling means being shiftable towards and away from said second coupling means and being positively connected with said feeder drive so as to be rotated by the latter during the operation of the machine, means arranged for a positive connection of said second coupling means with said warp beam, stationary braking means, said second coupling means being shiftable towards and away from said braking means, resilient means acting on said second coupling means for urging same against said braking means so as to cause a braking action by the latter on said second coupling means, and a controlling mechanism, said controlling mechanism being associated with said first coupling means for shifting same in response

to such a pulling action in one direction towards said second coupling means and upon contact with the latter together with the latter in the same direction against the action of said resilient means whereby said coupling means are engaged with each other and said braking means is released, and said controlling mechanism being further associated with said first coupling means for shifting same in response to a lessening of such a pulling action in the opposite direction away from said second coupling means whereby said coupling means are disengaged from each other and said braking means is applied to said second coupling means by the action of said resilient means.

6. In a warp knitting machine as claimed in claim 5, said coupling means being of the frictional disc-type.

7. In a warp knitting machine as claimed in claim 5, said coupling means being of the frictional disc-type, the disc of said first coupling means being smaller in diameter than the disc of said second coupling means, and said braking means being in the shape of an annular ring.

8. In a warp knitting machine as claimed in claim 5, a casing, said coupling means of said clutch being rotatably arranged within said casing, said resilient means being arranged outside said casing, and an actuating mechanism connecting said resilient means with said second coupling means.

9. In a warp knitting machine as claimed in claim 5, a casing, said coupling means of said clutch being rotatably arranged within said casing, said resilient means being arranged outside said casing, adjusting means arranged outside said casing and associated with said resilient means for adjusting same, and an actuating mechanism connecting said resilient means with said second coupling means.

10. In a warp knitting machine as claimed in claim 5, a casing, said coupling means of said clutch being rotatably arranged within said casing, said casing having a sump capable of receiving oil, and said coupling means being arranged for dipping into oil in said sump.

11. In a warp knitting machine as claimed in claim 5, said feeder drive including a pair of relatively shiftable gears meshing with each other, one of said gears being coupled with said first shiftable coupling means, the other gear being coupled with and driven by the main drive of the machine.

12. In a warp knitting machine as claimed in claim 5, said feeder drive including a pair of relatively shiftable gears meshing with each other, one of said gears being coupled with said first shiftable coupling means, the other gear being coupled with and driven by the main drive of the machine, and a casing, said gears of the feeder drive and said coupling means of the clutch being rotatably arranged within said casing.

13. In a warp knitting machine as claimed in claim 5, said feeder drive including a pair of relatively shiftable gears meshing with each other, one of said gears being coupled with said first shiftable coupling means, the other gear being coupled with and driven by the main drive of the machine, and a casing, said gears of the feeder drive and said coupling of the clutch being rotatably arranged within said casing, said casing having at least one sump capable of receiving oil, and said gears and said coupling means being arranged for dipping into oil in such a sump.

14. In a warp knitting machine as claimed in claim 1, a planetary gear drive arranged between said second coupling means and said warp beam for a positive connection of said second coupling means and said warp beam.

15. In a warp knitting machine as claimed in claim 5, a planetary gear drive arranged between said second coupling means and said warp beam for a positive connection of said second coupling means and said warp beam, and a casing, said planetary gear drive being arranged within said casing.

16. In a warp knitting machine as claimed in claim 5, a planetary gear drive arranged between said second coupling means and said warp beam for a positive connection of said second coupling means and said warp beam, and a casing, said casing having an oil sump, and said planetary gear drive being arranged for dipping into oil in said sump.

17. In a warp knitting machine as claimed in claim 5, a planetary gear drive arranged between said second coupling means and said warp beam for a positive connection of said second coupling means and said warp beam, and a casing said coupling means of said clutch and said planetary gear drive being rotatably arranged within said casing, said casing having at least one sump capable of receiving oil, and said coupling means

and said planetary gear drive being arranged for dipping into oil in such a sump.

18. In a warp knitting machine as claimed in claim 5, said feeder drive including a pair of relatively shiftable gears meshing with each other, one of said gears being coupled with said first shiftable coupling means, the other gear being coupled with and driven by the main drive of the machine, a planetary gear drive arranged between said second coupling means and said warp beam for a positive connection of said second coupling means and said warp beam, and a casing, said gears of the feeder drive, said coupling means of the clutch and said planetary gear drive being arranged within said casing, said casing having at least one sump capable of receiving oil, and said gears of the feeder drive, said coupling means and said planetary gear drive being arranged for dipping into oil in such a sump.

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