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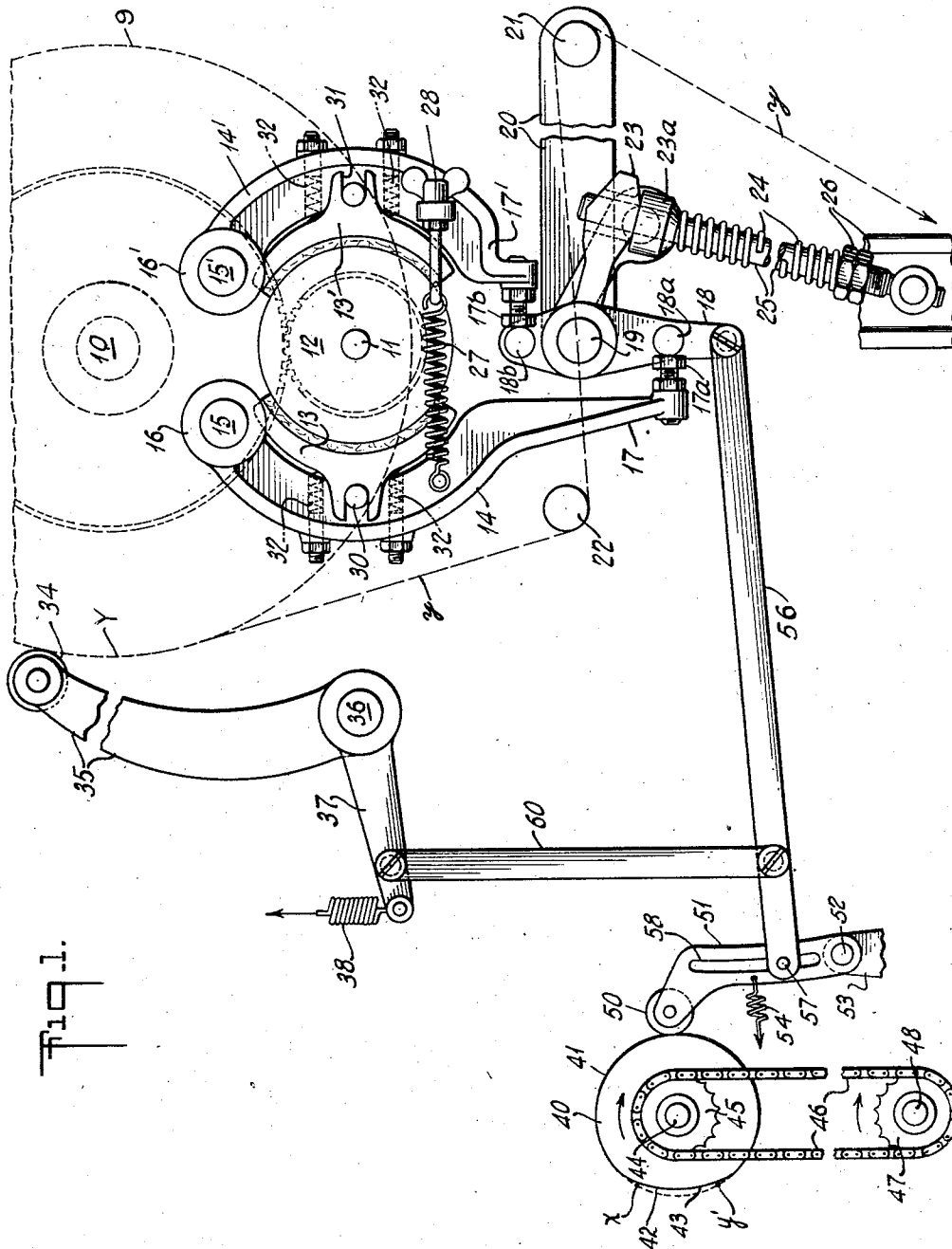
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2,397,663

WARP-KNITTING MACHINE

Filed Dec. 3, 1943

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

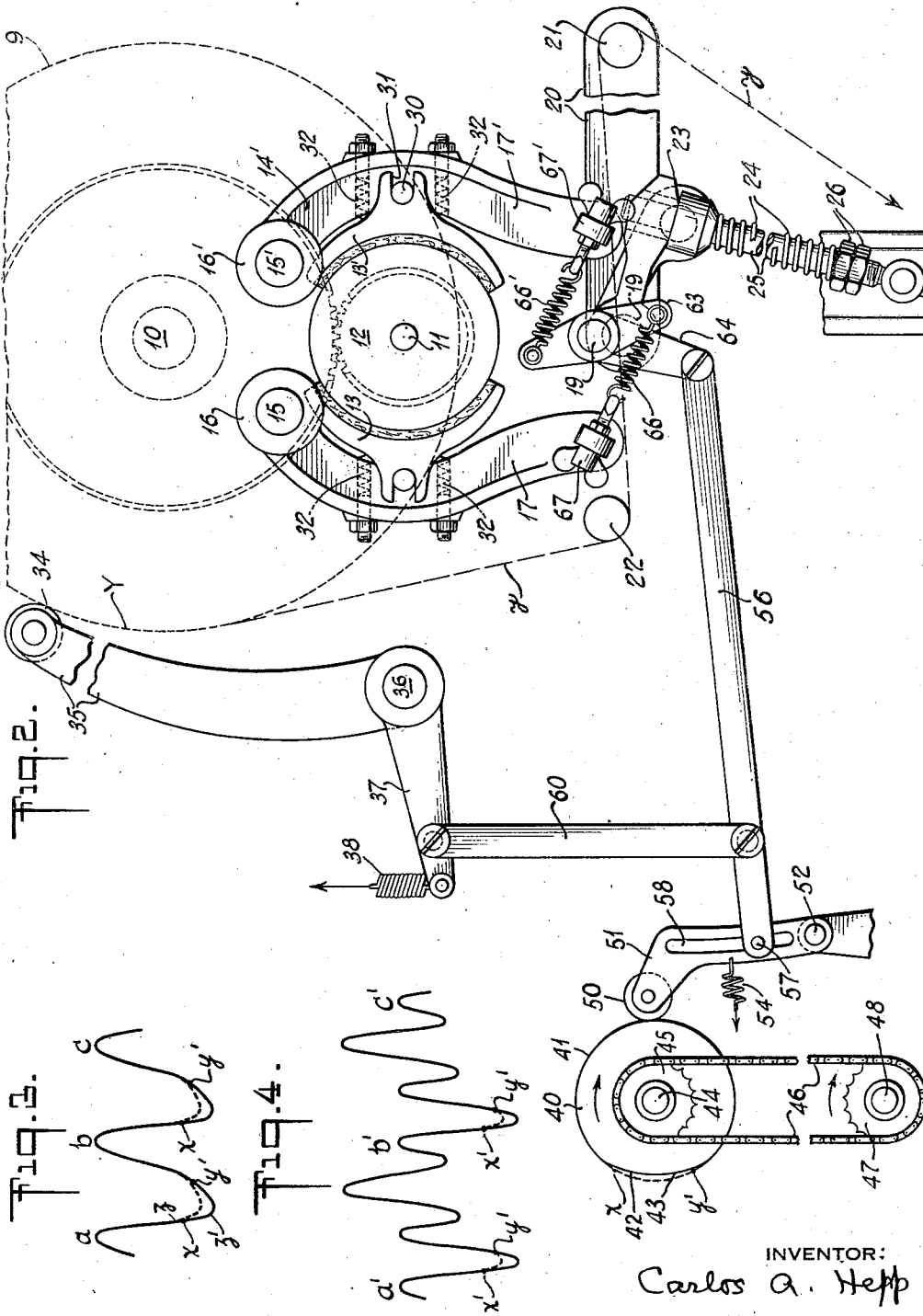


Fig. 3.

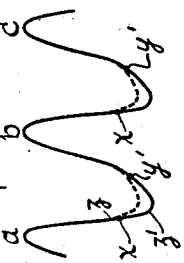
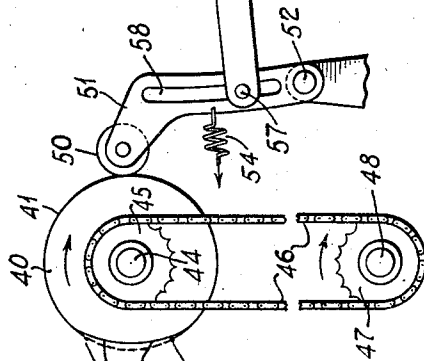
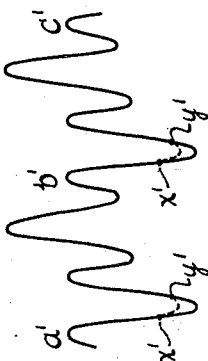


Fig. 4.



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UNITED STATES PATENT OFFICE

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WARP-KNITTING MACHINE

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17 Claims. (Cl. 66—36)

This invention relates to warp-knitting machines, a well known class wherein numerous warp yarns are fed from one or more supplies or reels and through one or more banks of yarn guides for manipulation into warp-knitted fabric by cooperation with needles and other conventional knitting instruments; a typical prior instance of such a machine being the double tricot knitting machine shown in prior copending application of same assignee, Serial No. 455,186, filed August 18, 1942.

In the warp-knitting machine of said prior application there is provided an arrangement for relieving the yarns, as they are manipulated, during knitting cycle after cycle, from the greater part of burden of having to start into rotation each yarn reel at that part of each cycle when feed is demanded by the action of the knitting instruments; this object being attained by the use of a power driving mechanism, with timed clutch, and a yarn pilot or guide rod which is resiliently supported but is caused to yield by the pull of the yarns traveling over it, such pilot or guide rod being connected through a shipper device to operate the driving clutch and impose the driving force upon the reel. The reel is thus power-rotated for a small arc of movement by the combined tension pull of the yarns and power drive, which movement is thereupon caused to cease as the reel advance supplies the needed yarn or causes yarn slack, by reason of which the pilot relaxes or terminates the clutch drive and on the contrary operates or imposes the action of a brake to retard or stop the rotation of the reel; both the driving clutch and the retarding brake being frictional in character and comprising friction shoes bearing upon friction disks or drums with greater or less pressure, under the described control of the pilot.

The mechanism of said prior application, particularly in regard to the control of the yarn tension, possessed a certain objection due to the extensive variation, in each cycle, of the tension on the yarn, as will be further explained. This problem, and the solution of it by this invention, pertain to any warp-knitting machine, single or double, wherein each reel has to be stopped and restarted in each cycle, and whether the restarting is by the mere pull of the yarns upon the reel or is aided by the provision of a power drive mechanism with clutch, such as is shown in said prior application but which, to simplify illustration, is omitted from the drawings of the present application. The present invention relates more particularly to the control of the reel braking

and releasing action, that is, the imposing of friction to retard and stop the reel, and the relaxing of the friction to aid restarting into the rotation necessary to supply the amount of yarn needed during each cycle.

In said prior application the yarn, acting through its resiliently supported guide rod or pilot, brings about the relaxing of the brake, namely, by overcoming the brake-imposing spring, at the proper instant and for the proper period in each cycle. A long spring was provided to predetermine the yarn tension, this spring taking the weight of the pilot rod and the pull of the yarn; but this action was disturbed at that point in the cycle when the braking friction had to be relaxed, this for the reason that the pull of the yarn, and the pilot rod, then became subjected to a substantial additional strain, namely the strain caused by having to overcome the pull of the brake-imposing spring, with the result that undue tension was unavoidably caused and the yarn was found to be subject to breakage, especially at the higher speeds of operation.

The general object of the present invention is to improve on prior known machines of the kind by providing for a substantially uniform or equalized yarn tension throughout each knitting cycle, thus relieving the resilient pilot rod and the yarn of having to receive excess strain, in this case by the explained need of assuming the added function of operating the friction brake at a critical stage in the cycle. A particular object of the invention is to separate the functions of predetermining the yarn tension through the operation of the spring-yielding guide rod, and of relaxing the friction brake of the reel to aid the turning thereof and supplying of yarn at a suitable part of the cycle. Other and more detail objects and advantages will be explained in the hereinafter following description of certain mechanisms embodying the principles herein or will be understood to those conversant with the subject.

To the attainment of such objects and advantages the invention may be described, in one aspect, as relating to a warp-knitting machine having a resiliently applied friction brake operative for stopping the reel rotation in each cycle and a yieldable guide rod over which the yarns pass from the reel toward the knitting point, together with automatic or cam means driven in time with the knitting cycle and operative to cause the predetermined relaxing of the brake friction pressure at that part of each cycle when the yarn tension acts to depress the rod and when the reel is required to be rotated to supply the yarn needed

for such cycle. The invention provides independent timed means to cause the imposing and relaxing of the brake, and by thus releasing the brake assisting the flow of yarn at the critical part of the cycle while relieving the yarn of any additional strain on that account, which otherwise would produce a sort of shock, by the abrupt extra strain that the yarn would have to receive. These statements apply in the case of a machine provided with power-drive of the reel put into effect by the yarn pull through the guide rod or pilot, or on the other hand in cases where there is no such power drive and the pull of the numerous yarns is relied upon to cause the intermittent turning of the reel under the control of the braking means.

Having thus outlined the class and type of warp-knitting machines to which the invention applies, the illustrative embodiments may be explained upon the accompanying drawings, in which Fig. 1 may be considered an end elevation view of sufficient of the parts of a warp-knitting machine to explain the principles of the invention, the machine frame and many details and auxiliaries of construction and operation being omitted from the drawings but which are adapted to be supplied by reference to the drawings of said prior application.

Fig. 2 is an elevation view similar to Fig. 1 but showing a second form or embodiment of the invention.

Figs. 3 and 4 are diagrams intended to facilitate the description of the action and advantages of the invention, these showing the character of the downward yielding and upward return movements of a yarn guide rod or pilot such as is shown herein and in said prior application; Fig. 3 showing the guide rod movements which are found to occur in one type of single tricot knitting machine, Fig. 4 showing the corresponding diagram in a double tricot knitting machine.

Describing first the embodiment shown in Fig. 1 the sheet of many warp yarns *y* is provided from a cylindrical supply *Y* thereof carried upon a reel or so-called warp beam 9 mounted for rotation on a reel shaft 10, as is conventional, and corresponding with said prior application. Preferably upon a separate or countershaft 11, parallel with and geared to the reel shaft to turn with it, is mounted a disk or drum 12, constituting the rotary member of a friction brake comprising also one or more friction shoes each carried on a shoe lever operated to vary the frictional pressure and thus impose or relax the braking force on the disk and therefore upon the reel. As in said prior application it is preferred that the brake means shall comprise opposite friction shoes 13 and 13', at the left and right respectively, bearing upon opposite sides of the brake disk 12 and carried respectively upon left and right brake or shoe levers 14 and 14'. The respective shoe levers are swung from axles 15 and 15' at their upper ends, the levers having hubs 16 and 16' for this purpose. At their lower or swinging ends the levers have depending extensions 17 and 17' respectively, the former being longer than the latter to cooperate in the brake-controlling action as will be further described, performed through a rock lever 18, the hub of which turns loosely on an axle 19, the lever standing substantially upright or parallel to and between the shoe levers. By this arrangement when the shipper or lever rocks clockwise its lower contact 18^a presses outwardly on contact 17^a on the left shoe lever, while the shipper upright contact 18^b presses rightwardly

or outwardly against the contact 17^b on the right-hand shoe lever; this motion therefore tending to spread apart the shoe levers and shoes and thus relax or decrease the braking pressure and friction on the drum 12 and reel. The actual braking pressure is preferably provided by a resilient element or spring 21 which is extended across from one shoe lever to the other, under initial adjustment by a thumb screw 28 by which a predetermined shoe braking pressure is applied when the shipper is idle and exerts no separating thrust upon the shoe levers.

As in said prior apparatus, this figure may be considered a left elevational view of the machine, so that the righthand side of the figure constitutes the front of the machine, whereby the shoe 13 and lever 14 may be considered as the rear shoe and lever, and 13' and 14' the front shoe and lever of the apparatus. Further, a general framework is to be understood, and it may be generally analogous to that which is shown in said prior application, wherein also many of the mechanical elements herein described are shown in connection with the mechanism of said application. Indeed the parts so far herein described are substantially the same as the corresponding parts in said prior application, with the exception that the shipper rock lever 18 is herein loose on an axle 19, whereas in said prior application the shipper is fast upon its rockaxle, which is also the rockaxle of certain other elements as it is also in the present application as will next be described; the difference thus existing that in said prior application the movements of the shipper are tied to and dependent upon the movements of these other parts, whereas in the present application the shipper is independent and adapted to bring about the operations of the reel brake means independently thereof, although in coordination therewith as will be further described.

The rockaxle 19, as in said prior application, is a long axle, running preferably the full length of the machine, and extending frontwardly from it are carrier arms 20, at the free ends of which is supported a guide rod 21 for the yarns advancing from the reel to the knitting point. The guide rod therefore is a floating element over which the sheet of yarns *y* passes at a downward slant to the needles and other knitting instruments. The path of the yarn *y* may be from the supply *Y* on the reel 9, and thence down and around a first or fixed guide rod 22, and thence forwardly over the front guide rod 21 carried shiftably by the swingable carrier arms 20. On the same rockaxle 19 on which the arms 20 and rod 21 are mounted is provided also a forwardly extending shorter rockarm 23 which is arranged to be spring-lifted by a long depending spring 24. Preferably there are a rockarm 23 and a spring 24 at each end of the long rockaxle 19. Each spring 24 surrounds a depending bar 25 near the top end of which slides a head 23^a upon which the spring 24 bears upwardly and which in turn bears upwardly on the rockarm 23 and, through the rockaxle, causes resilient lifting of the carrier arms 20 and guide rod 21. The springs 24 therefore normally take the weight of the arms 20 and 23 and thus are under some compression, and take also the stress of the pull of the yarns as they are manipulated during the knitting, the yarns pulling down variably upon the guide rod 21, while the springs 24 resiliently take these forces and provide a resistance which determines the tension upon the advancing yarns. In order to predetermine the operation of the guide rod

supporting springs 24 and the knitting tension of the yarns there is shown provided, at the lower end of each interior bar 25, an adjustable abutment 26 for the lower end of the spring 24, this adjusting device being shown in the form of a pair of locknuts which may be readily shifted along the bar as required for any particular knitting operation.

There has been described the cross spring 27 which pulls together the brake levers to impose friction on the disk 12 geared to the reel, this spring being adapted to be partially overcome by the shipper device when operated to relax the braking action; and it is preferred also that resilient means or springs be interposed between each brake shoe and the lever that carries it, so that as each lever is backed away to reduce frictional pressure the shoe nevertheless will be thrust relatively from the lever toward the disk, thus to maintain continuous contact, under varying pressure and friction. For these purposes each shoe lever is provided with a stud 30 while each shoe is provided with an outwardly extending slotted lug or ear 31, providing a fork which straddles the stud and thus permits the movements of the shoe relative to the lever; the forked ears being preferably in duplicate, so as to extend at each side of and to straddle the web of the lever. In cooperation with this construction of shoe and lever is shown a resilient device in the form of a pair of shoe springs 32, these being mounted in the shoe lever, above and below the shoe ear and pressing constantly against the outer side of the shoe in order to hold the shoe and its lining in continuous but variable pressing contact upon the friction disk 12. This shoe-and-lever construction corresponds substantially to that shown in said prior application.

For purposes to be further described hereinbelow a follower or rolling element 34 is provided at the free or upper end of a follower arm 35 turning on a fixed pivot or axle 36 and having a rearward extension or rockarm 37, this system being stressed by spring 38 which acts to hold the follower upon the body of yarn Y on the reel in such manner that the follower shifts inwardly toward the axis of the reel as the yarn is gradually used and becomes depleted, this mechanism therefore being adapted to afford certain progressive controls of the feeding and tension of the yarns as is found to be desirable to secure uniformity of operation and product.

Coming now to the automatic or cam means driven in time with each knitting cycle to bring about a predetermined relaxing of the braking friction at that part of the cycle when the yarn tension depresses the guide rod to the extreme and thus requires the rotation of the reel to feed the additional yarn needed, the description thereof may begin with the shipper 18 by the rocking of which the brake levers and shoes are operated to relax the braking friction as already described. When the feed point of each cycle arrives the shoe levers have to be forcibly thrust apart to relax the friction and facilitate the turning of the reel, and in the prior apparatus this sudden increase of load, which at high speeds has an abrupt effect, was thrown upon the resiliently supported yarn guide rod 21 and upon the yarns themselves, which thus, already opposed by the long springs 24, were required to overcome and stretch the cross spring 27, involving the objections already hereinabove explained. With the present invention the shipper 18 is operated independently of the guide rod movements, so

that the yarn tension is determined solely by the movements of the knitting instruments and the action of the long supporting springs 24.

The operation of the present invention is to relax independently and regularly the braking friction at that point of each cycle when the manipulation of the yarns tends to cause the maximum depression of the guide rod, and compression of the springs 24, thus to facilitate the starting into rotation of the reel to supply the needed additional yarn; and as well preferably to relieve the braking action to a progressively increasing extent as the warp supply diameter decreases as will be more fully explained.

The diagrams of Figs. 3 and 4 throw light on the cyclic action, being diagrams which represent in a way the manipulation of the yarns and the tension thereon, but being actually a representation of the periodic upward and downward movements of the pilot or guide rod 21, under these actions of the yarn and the resistance of the long springs 24. Referring to Fig. 3, for convenience the references a, b and c have been placed at convenient corresponding points which may be considered as the beginnings of the successive cycles, in plain or single tricot knitting. When the main call for yarn occurs the guide rod dips from the maximum height a to the lowest point of the curve, and thereafter returns to the high point b, but with some irregular motions between the high and low points, due to the knitting manipulations of the yarns. It is deemed sufficient to indicate in this diagram the general character of the guide rod motions without explaining how the needles and other instruments act upon the yarns to give this effect, since indeed the guide rod motions will differ quite materially under differing conditions, such as changes in yarn, or of the tensions, type of fabric being produced and the like. Similar observations apply to the diagram Fig. 4 of double tricot knitting, wherein there are further complications of guide rod movement between the commencement and completion of each cycle.

The point in each cycle when the reel must be slightly turned in order to feed to the knitting point the necessary length of each yarn for each course of the fabric may be considered as the low portion or bottom of the curve in the dip of the guide rod, and in said prior application the guide rod had at this point had to take the duty of relaxing the brake to facilitate such rotation, in conjunction with a power driving action there employed. On the diagrams the feeding stage of the cycle is roughly indicated in Fig. 3 as beginning at the point x and ending at the point y' or in Fig. 4 at the points x' and y'; and the lowest dipping motion of the guide rod may in some cases be between these two points. The tendency at this moment is to place an undue tension on the yarn, but with the present invention this is anticipated by the use of a positively timed cam operating to relax the brake in time to permit the feeding rotation of the reel, for example, preferably during the part x-y' of the cycle. The present invention thus cooperates automatically in assisting the supplying of additional yarn from the reel during that part of each cycle when the guide rod is near the low working range of its movement. The described control of the brake action is thus performed independently of but in timed coaction with the motion of the guide rod, resulting in a better controlled yarn tension and avoidance of undue strain on the yarn.

By a modified action anticipating the yarn re-

quirements at approximately the curve portions or points x and y' , or in Fig. 4 x' and y' , the extreme low of the downward motion of the guide rod may be modified, as with the yielding and feed of the yarn from the reel the pulling action of the yarn against the guide rod will be relaxed; this giving the result that the motion curves shown in Figs. 3 and 4 will follow approximately the modified curves indicated in dotted lines thereon. Although the consequent reduction in the dipping motion of the yarn guide rod is very small, due to the fact that for example only one-eighth inch of yarn is required in each cycle in a 30-gauge machine, this reduction in the guide rod motion will in itself contribute to the equalization and steady control of the tension of the yarn. The anticipated relaxing of braking may extend from x to x' instead of x to y' on Fig. 3.

The mechanism disclosed in Fig. 1 to afford the described functions and advantages includes primarily a timed means or rotary cam 40 which makes one rotation per cycle, and which has a concentric cam portion or surface 41 rendering the cam idle or passive throughout the greater part of its rotation, but with an active cam portion consisting of a drop or inward slant 42 followed by a rise 43. The cam 40 is mounted on a convenient shaft or axle 44 and may be driven as follows. A sprocket wheel 45 attached to the cam is driven by a sprocket chain 46 from a sprocket wheel 47 on a preexisting shaft 48, which is a cyclical shaft, making one turn per cycle, and may be the main cam shaft of the machine.

In order to communicate the control of the cam 40 to the shipper 18 to relax the reel brake means at the proper stage of the cycle, as illustrated in Figs. 3 and 4, and as determined by the cam surface 42, 43, the following convenient mechanism is illustrated. A follower or roll 50 bears on the cam and is mounted on an arm or swinging carrier 51 which is pivoted at 52 in such arrangement that the arm is swung by the cam through an arc extending rightwardly and leftwardly, toward and from the shipper. The pivot 52 is provided on any fixed part or bracket 53. A spring 54 pulls upon the arm 51 and thus holds the follower upon the open cam, this having certain advantages over a closed cam, without spring. From an oscillating part of the arm 51 is shown a connection or link 56 extending to the lower end of the shipper 18. By this means the cam control is communicated to the device or shipper by which the brake means is relaxed or imposed. For the purposes of adjusting the throw of the link 56 and the shipper, the first end of the link is provided with a stud 57 which is engaged adjustably in a longitudinal slot 58 in the arm 51. When the stud is lifted higher in the slot, the throw is increased, and a greater degree of relaxing of brake occurs. Such an adjustment may be effected automatically and progressively in accordance with the depletion of the yarn on the reel, for which purpose a drop link 60 is shown extending between the link 56 and the rockarm 37 previously described which latter rises little by little as the follower 34 approaches the center of the reel with the using up of the yarn thereon.

The operation of the Fig. 1 mechanism may be further reviewed as follows. The follower 50 is on some concentric part of the cyclical cam 40 and consequently the swinging arm 51 stands in its rightward position, the shipper 18 stands rocked counterclockwise, the brake levers 14, 14'

are fully drawn toward each other by spring 27, and the brake shoes 13, 13' are applied fully without relaxation. With the clockwise turning of cam 40, its drop part 42 reaches the follower and the swinging arm commences to swing leftward. This may anticipate slightly the call for yarn feed as indicated approximately by the position of the point x on the cam part 42, corresponding with the point x in the diagram of Fig. 3. The leftward swinging of the arm 51 causes the shipper 18 to rock clockwise and this thrusts apart the shoe levers, overcoming the spring 27 and relaxing the braking friction, the local springs 32 keeping the shoes upon the disk, but with decreasing pressure so as to substantially overcome the operative braking force. At the apex of this relaxation, which may correspond with the apex of the dip of the guide rod as indicated in Fig. 3, the follower 50 enters upon the second active cam part 43 and thereupon the shipper rocks back again, counterclockwise, to allow the full braking force to be restored, which may be timed to occur slightly beyond the point y as noted in both Figs. 1 and 3. The desired result is thus secured and the reel is readily put through its short feeding rotation at the critical point of each cycle when yarn must be supplied to the knitting instruments.

Referring next to the progressive readjustment of the described mechanism effected by reason of the gradual depletion of the yarn on the reel this may operate as follows. The follower or roll 34 moves inwardly toward the reel shaft 10 through knitting cycle after cycle, and this acts through arm 37 and link 60 to lift the transmitting link 56 and its stud 57 which is entered in the slot of the swinging arm 51; and this progressively lengthens the effective length of the arm 51 and the consequent throw of the link 56 which occurs in each cycle to rock the shipper 18 clockwise and relax the brake means. Owing to the progressive adjustment of the action, each relaxing operation is in a slightly greater degree, so that during the knitting of a piece of fabric the cyclical relaxation of the brake means is increased as the yarn becomes depleted, this being due to the gradually increasing rocking of the shipper and spreading of the brake levers. This progressive change in brake control is of value in respect to the gradual increase of effort necessary to start the reel into rotation as the yarn thereon becomes of less and less diameter. It will be understood that the pull of the yarn is relied upon to aid in or to bring about the actual rotation of the reel, by its tangential pull on the lessening cylinder Y of yarn, and that as the diameter thereof grows less and less the leverage to produce such rotation grows correspondingly less while at the same time the reel has to be turned somewhat further angularly and faster to deliver the required length of fed yarn. The adjustments therefore that originate from the yarn follower 34 provide a practical tendency to keep the yarn tension substantially uniform throughout cycle after cycle, thus improving the general operation of the machine, minimizing breakage of yarn and delivering a better quality of fabric.

The second form of construction shown in Fig. 2 is in part the same as that in Fig. 1 but differing in the manner in which the cam action during each cycle communicates relaxing action to the reel braking means. Instead of the shipper 18 acting to spread apart the shoe levers and allow them to return, Fig. 2 shows a movable device or rocker 63 which is in a similar location be-

tween the shoe levers, and arranged on any suitable fulcrum, but illustratively shown loose upon the same rockaxle 19 as before, but in this case interposed in the cross spring means which pulls together the shoe levers, in such manner that the clockwise rocking of the rocker 63 relaxes the cross spring pull and in that sense relaxes the frictional braking pressure. To rock the device 63 it is shown as provided with a downward extension or arm 64 which is connected with the cam 40 through the link 56 and other parts as already described in connection with Fig. 1.

These principles are shown as carried out by splitting the shoe lever spring into two sections 66 attached to the left shoe lever extension 17, with an initial adjusting device 67, and at the other side a half spring 66' connected to the shoe lever extension 17' by an adjusting device or screw 67'. When the cam 40 causes the arm 51 to swing leftward in each cycle this turns clockwise the rocker 63 and relieves the shoe levers of the full tension of the cross spring device, thus aiding the starting of reel rotation at the time that yarn must be fed to the needles etc., on the principles already described. Preferably the rocker 63 is loose on the axle 19, as is the shipper 18 in Fig. 1, but it might be on an independent fulcrum so that the cam-controlled relaxation of the brake means is wholly independent of the resilient movements of the guide rod 21 and the tension of the yarn passing thereover.

There have thus been described several illustrative mechanisms embodying the principles and attaining the purposes of the invention; and since many matters of arrangement, structure, design and operation may be variously modified without departing from such principles it is not intended to limit the invention except to the extent set forth in the appended claims.

What is claimed is:

1. In a warp-knitting machine having a resilient or spring-applied friction brake adapted and operative for stopping the rotation of the warp reel in each cycle, and a yieldable or spring-supported tensioning guide rod over which the yarns pass from the reel toward the knitting point; automatic means driven in time with the knitting cycle and adapted and operative to cause, independently of the tensioning operation of the guide rod, the predetermined relaxing of the brake friction pressure at that part of each cycle when the yarn pull or tension depresses the rod and when the reel is required to be rotated to supply the yarn needed for each cycle.

2. A warp-knitting machine as in claim 1 and wherein the automatic means includes a brake pressure relaxing lever, and a timed rotary cam, with connections from the cam to the lever to swing the same thereby to relax the braking friction when the yarn is to be supplied by the rotation of the reel during each cycle.

3. A warp-knitting machine as in claim 1 and wherein the friction brake comprises shoes on opposite levers, with spring means drawing together the levers to impose braking by the shoes, and the automatic means comprises a shipper arranged to apply spreading thrust between the levers and connections thereto from the timed means to shift the shipper for each required relaxation of brake.

4. A warp-knitting machine as in claim 1 and wherein the friction brake comprises shoes on opposite levers, with spring means drawing together the levers to impose braking by the shoes, and the automatic means comprises a spring-relaxing de-

vice interposed in said spring means and timed connections thereto to shift the relaxing device and relax said spring means for each required relaxation of brake.

5. A warp-knitting machine having a warp reel and a resilient warp tensioning means and a spring-applied friction brake operative upon a friction disk for stopping the rotation of the warp reel in each cycle and adapted to be relaxed in each cycle during feeding rotation of the reel, and characterized by automatic means positively driven in time with the knitting cycle and operative, independently of the operation of said tensioning means, to cause the predetermined relaxing of the brake friction pressure at that part of each cycle when the reel is required to be rotated to supply the yarn needed for each cycle.

6. A warp-knitting machine as in claim 5 and wherein is a pair of brake levers carrying opposite shoes, and a cross spring pulling the levers together to apply the brake, and shoe springs between the levers and shoes acting to maintain the shoes in frictional contact with the disk.

7. A warp-knitting machine as in claim 5 and wherein the automatic means comprises a driven cam having an active non-concentric cam part and an idle part, with a follower actuated by the active cam part and a device operated from the follower to relax the braking pressure at that part of each cycle when yarn is fed from the reel.

8. A warp-knitting machine as in claim 5 and wherein the brake comprises a shoe lever spring-pressed toward the friction disk, and the automatic means comprises a driven cam and a shipper actuated by the cam to thrust the shoe lever from the disk.

9. In an automatic tricot knitting machine having a warp beam supplying yarns to knitting instruments, the combination of a resilient yarn guide means or rod for predetermining the tension of the yarn throughout each knitting cycle, and an independently operated braking means with timed connections for relaxing the braking action during the yarn feed point of each cycle and thereupon imposing the braking means to stop the feed.

10. In a warp-knitting machine of the kind having a spring-applied friction brake adapted and operative for stopping the rotation of the warp reel in each knitting cycle, and a spring-supported guide rod over which the yarns pass from the reel toward the knitting point; automatic or cam means driven in time with the knitting cycle and adapted and operative to cause the predetermined relaxing of the brake friction pressure at that part of each cycle when the yarn pull or tension has depressed the rod and when the reel is required to be rotated to supply the yarn needed for each cycle, in combination with means operated from the yarn supply diameter on the reel and operative with decrease of diameter to modify the action of the brake relaxing means by increasing the degree of relaxing of the brake progressively with the decrease of yarn supply diameter caused by depletion of yarn.

11. A warp-knitting machine as in claim 10 and wherein said modifying means comprises a follower bearing on the yarn supply, a device to adjust the relaxing action and a connection from said follower to said device.

12. A warp-knitting machine having a spring-applied friction brake operative upon a friction disk for stopping the rotation of the warp reel in each cycle and adapted to be relaxed during

feed rotation of the reel, and characterized by automatic means driven in time with the knitting cycle and operative to cause the predetermined relaxing of the brake friction pressure at that part of each cycle when the reel is required to be rotated to supply the yarn needed for each cycle, and in combination therewith a means or connection controlled by the circumference of the warp supply on the reel and operative to increase the action of the relaxing means progressively with the depletion of the yarn and decrease of its circumference.

13. A warp-knitting machine having a warp reel, a spring-supported yarn-tensioning guide rod over which the sheet of yarns travels, a friction disk turning with the reel, opposite braking shoes bearing on the disk, opposite levers carrying the shoes, spring means urging the shoe levers toward each other to impose the braking action, and cushion means between each lever and its shoe to maintain friction contact between shoe and disk throughout the brake imposing and relaxing operations; and characterized by the combination therewith of a timed means or driven cam adapted and connected to operate through the shoe levers at predetermined points of time in each cycle to relax the reel braking action in coordination with but independently of the yarn-tensioning control by the guide rod, whereby such yarn tensioning control is free of interference from the brake operating actions; said timed means having an adjusting device to vary the degree of cyclical brake relaxing actions caused thereby, and connections operated from the body of the yarn on the reel according to the decreasing diameter thereof and extending to said adjusting device to increase progressively the degree of such cyclical relaxation of brake with the progressive depletion of the yarn.

14. A warp-knitting machine having a warp reel, a spring-supported yarn-tensioning guide rod over which the sheet of yarns travels, a friction disk turning with the reel, opposite braking shoes bearing on the disk, opposite levers carrying the shoes, spring means urging the shoe levers toward each other to impose the braking action, and cushion means between each lever and its shoe to maintain friction contact between shoe and disk throughout the brake imposing and relaxing operations; and characterized by the combination therewith of a timed means or driven

cam adapted and connected to operate through the shoe levers at predetermined points of time in each cycle to relax the reel braking action in coordination with but independently of the yarn-tensioning control of the guide rod, whereby such yarn tensioning control is free of interference from the brake operating actions.

15. A warp-knitting machine having a warp reel, a spring-supported yarn-tensioning guide rod over which the sheet of yarns travels, a friction disk turning with the reel, opposite braking shoes bearing on the disk, opposite levers carrying the shoes, spring means urging the shoe levers toward each other to impose the braking action, a shipper to thrust apart the levers to relax the braking action in each knitting cycle, and cushion means between each lever and its shoe to maintain friction contact between shoe and disk throughout the brake imposing and relaxing operations; and characterized by the combination therewith of a timed means or driven cam adapted and connected to actuate the shipper at predetermined points of time in each cycle to relax and impose the reel braking action in coordination with but independently of the yarn-tensioning control by the guide rod, whereby such yarn tensioning control is free of interference from the brake operating actions.

16. A warp-knitting machine having a resilient tension controlling mechanism and a spring-applied friction brake operative upon a friction disk for stopping the rotation of the warp reel in each cycle and adapted to be relaxed during feeding rotation of the reel, and characterized by automatic means driven in time with the knitting cycle and operative independently of said mechanism to cause the predetermined relaxing of the brake friction pressure at that part of each cycle when the reel is required to be rotated to supply the yarn needed for each cycle; the brake comprising a shoe lever and a brake-spring pressing the lever toward the disk, and the automatic means comprising a device operative to relax the stress of the brake spring, and a driven cam with connections to the device to operate it.

17. A warp-knitting machine as in claim 16 and wherein the tension controlling mechanism comprises a spring-supported yarn guide rod, the brake spring relaxing device being independent of said guide rod.

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