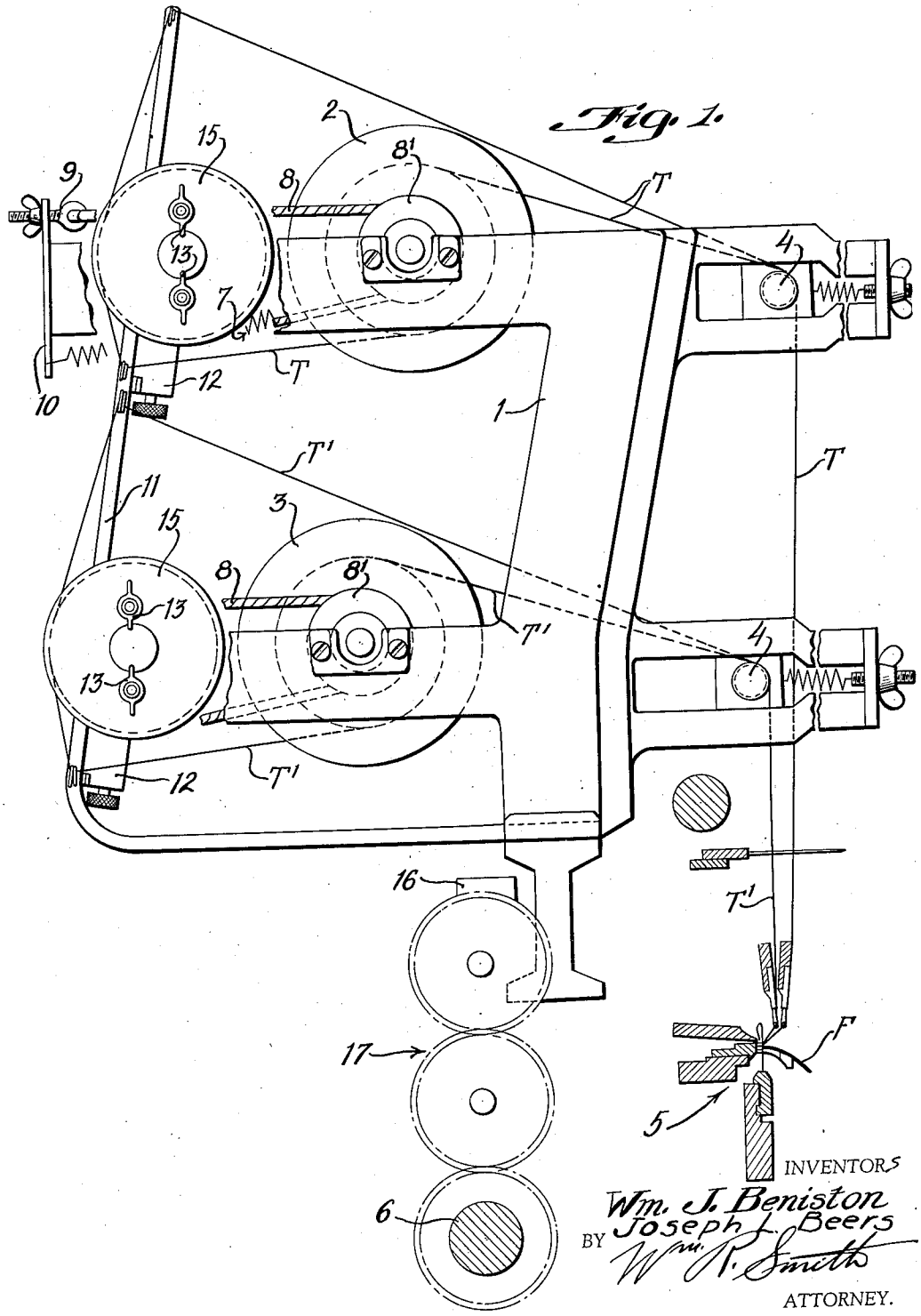
Feb. 11, 1936. W. J. BENISTON ET AL 2,030,425

SPEED INDICATOR AND TENSION REGULATOR FOR WARP KNITTING MACHINES

Filed Aug. 30, 1935 4 Sheets-Sheet 1

Fig. 1.



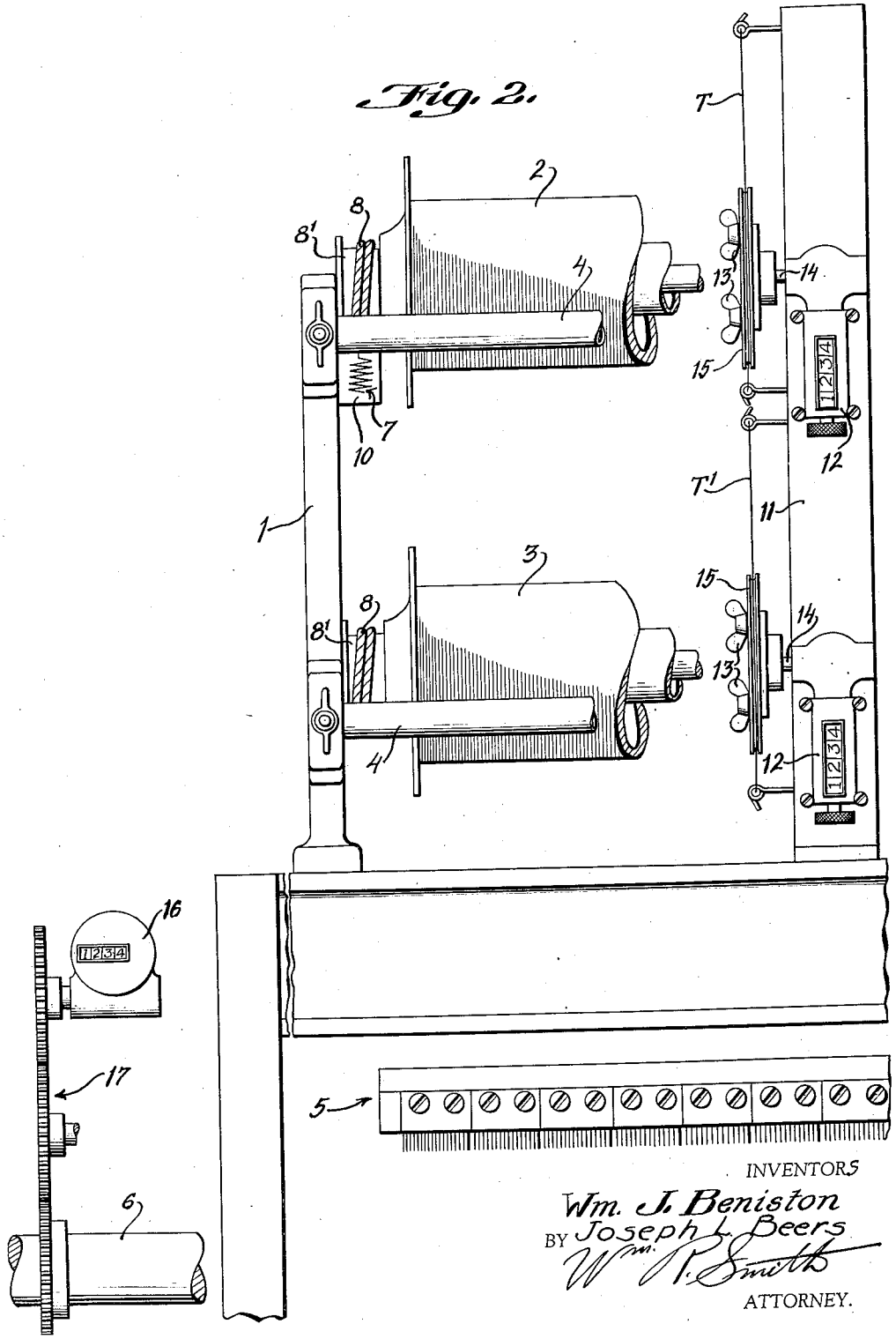
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Fig. 2.



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SPEED INDICATOR AND TENSION REGULATOR FOR WARP KNITTING MACHINES

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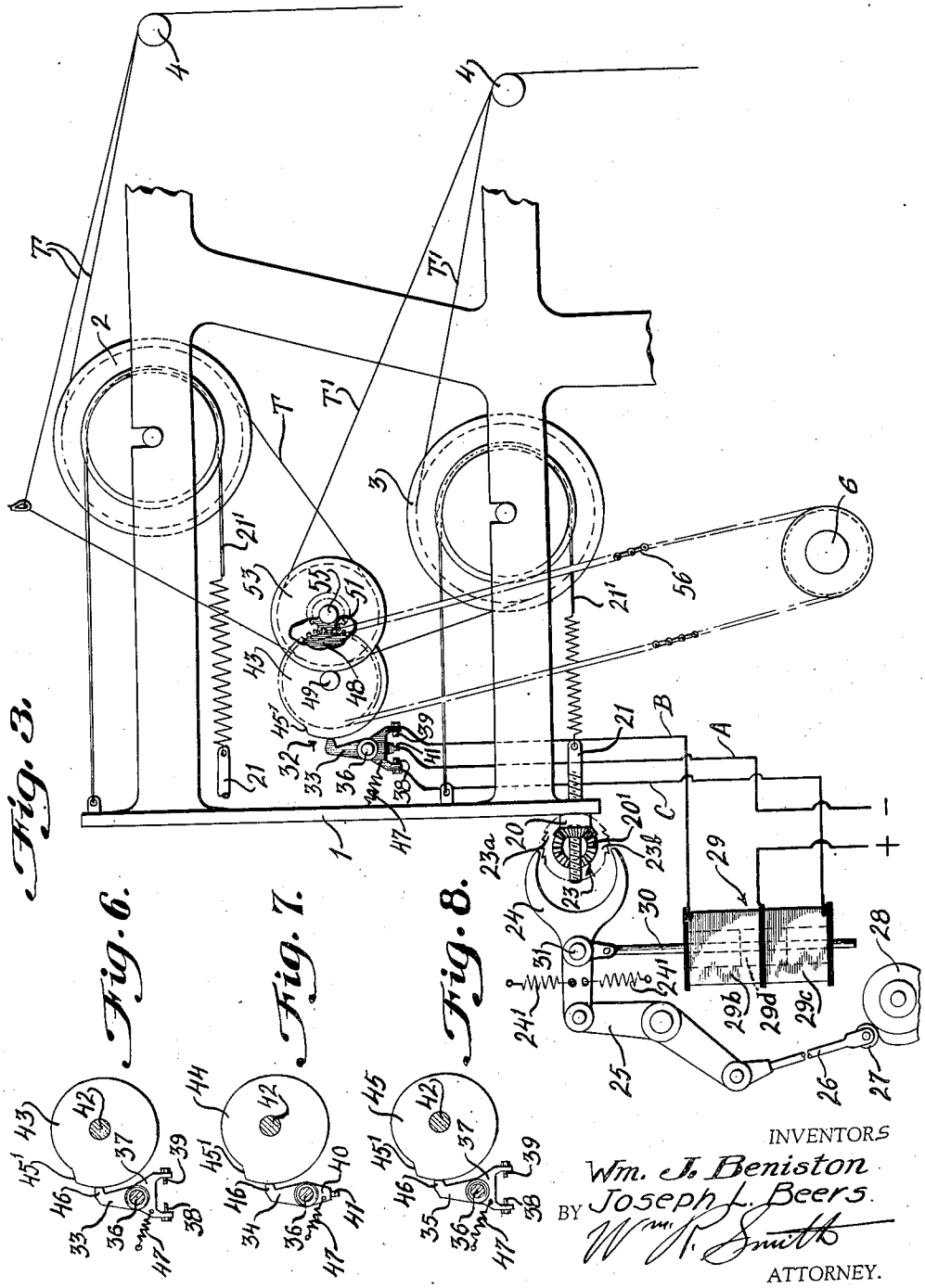


Fig. 3.

Fig. 6.

Fig. 7.

Fig. 8.

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SPEED INDICATOR AND TENSION REGULATOR FOR WARP KNITTING MACHINES

Filed Aug. 30, 1935 4 Sheets-Sheet 4

Fig. 4.

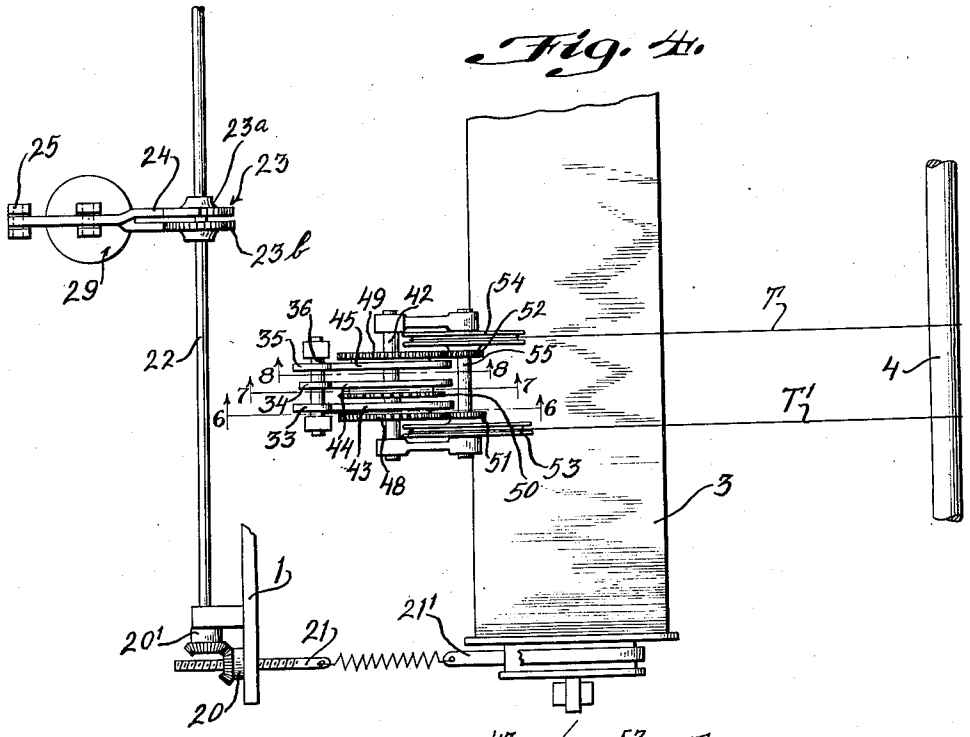
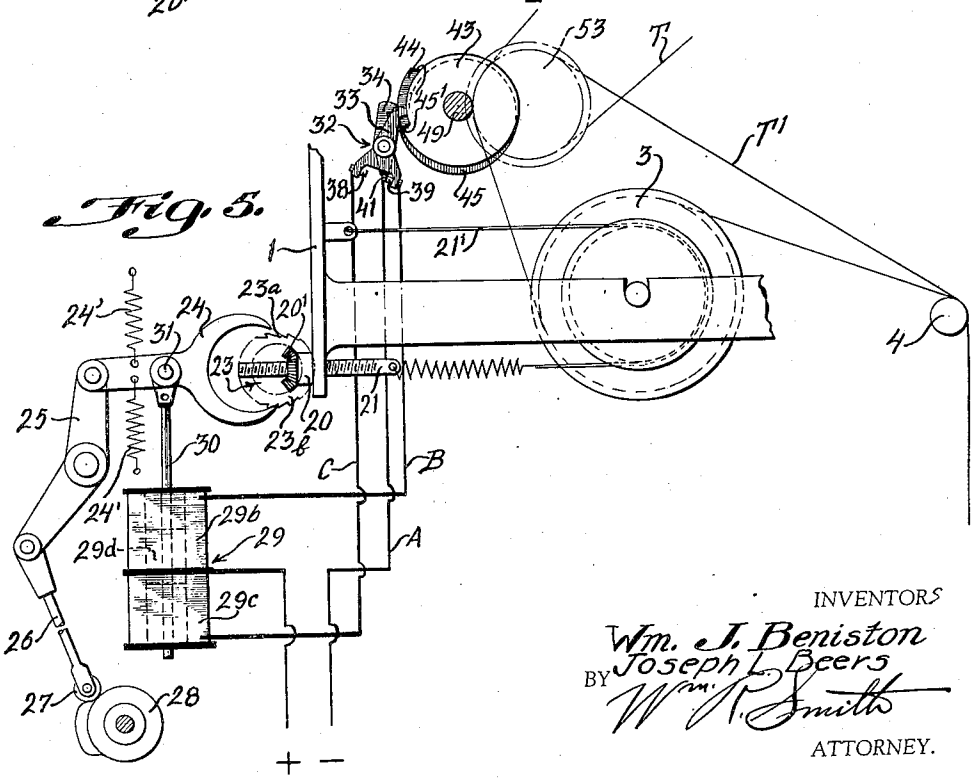


Fig. 5.



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2,030,425

SPEED INDICATOR AND TENSION REGULATOR FOR WARP KNITTING MACHINES

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Application August 30, 1935, Serial No. 38,596

18 Claims. (Cl. 66—125)

The present invention relates to an indicator mechanism particularly intended for use with warp knitting machines, and has for one of its main objects the provision of means capable of indicating the relative speed between the yarn beams and the course regulating element or main cam shaft of such machines.

The invention also contemplates the provision of a mechanism associated with the warp beams of a warp knitting machine and operable to automatically regulate the tension applied to said beams in order to control the free rotation thereof as the warp threads are being fed to the knitting section of the machine.

The invention further proposes a system including means whereby the individual rotation speed of the warp beams and course regulating element or main cam shaft of a warp knitting machine may be positively ascertained and means whereby to establish a synchronized movement therebetween, the indicating means working in conjunction with the automatic braking and controlling means to definitely assure the operator of the proper functioning of the latter.

One of the chief objects of our invention is the use of a plurality of independently operated indicators, namely, a rack indicator, and as many beam indicators as there are beams in use. The rack indicator records one digit after each predetermined number of revolutions of the machine (such as a rack of 480 revolutions), each beam indicator registering one digit for every predetermined length of yarn passing from its associated beam, all of the indicators giving visual indications to the operator that collectively enable the operator to prevent some beams from running too slack and others from running too tight which, if continuous, would cause wastage of material.

Another object of the invention is the use of a plurality of indicators that, when the readings thereof are identical, indicate that the rack and beams are operating in synchronization, thereby assuring quality of fabric and the elimination of the human element in synchronizing the operation of the warp beams and the racking of the fabric.

Moreover, our invention is distinguished in the use of a plurality of indicators, the group reading of which gives such visible indication to the operator that he may manually adjust, with minute exactness, the tension of the beams to regulate the feeding of the threads therefrom in relation to the speed of the course regulating element, the invention being further characterized in that said indicators may be associated with additional mechanism whereby the manual adjustment of the beams in the manner above referred to may be accomplished automatically.

Other important objects and advantages of the invention will be in part obvious and in part pointed out hereinafter.

In order that the invention and its mode of operation may be readily understood by persons skilled in the art, we have, in the accompanying drawings, and in the detailed description based thereupon, set out a possible embodiment of the same. In these drawings:—

Figure 1 is a diagrammatic view illustrating a portion of a warp knitting machine and the relative position of the component parts of our invention applied thereto.

Figure 2 is a diagrammatic front elevational view of the same.

Figure 3 is a diagrammatic view illustrating the automatic control and regulating means for the warp beams.

Figure 4 is a diagrammatic top plan thereof.

Figure 5 is a diagrammatic representation of one of the warp beams control means, illustrating the same in operative position.

Figures 6, 7, and 8 are sections respectively taken on lines 6—6, 7—7, and 8—8 of Figure 4, with certain parts removed to clearly show the structure of the various elements constituting the circuit maker and breaker embodied in said control means.

Referring more particularly to the drawings wherein like characters of reference will designate corresponding parts throughout, we have shown in Figures 1 and 2 a portion of the usual warp beam bracket 1 supporting for free rotation thereon the upper warp beam 2 and lower warp beam 3, and provided with the tension rods 4 over which pass the warp threads T leading from the upper warp beam 2 and the warp threads T' leading from the lower warp beam 3 to the knitting section 5 of the machine for the formation of the warp knitted fabric F. The operation of the knitting section 5 is controlled by means of the course regulating element, usually consisting of the main cam shaft 6, associated with commonly known operative connections (not shown).

Associated with each warp beam is a tension device consisting of a coil spring 7 having one end secured to a stationary support 10 and the other end attached to a cable 8 that is wrapped several turns about the brake drum 8' secured to the warp beam. This cable 8 has its remaining end

secured to a take-up element 9 mounted on the support 10.

In this manner, it will be understood that the brake cable 8 may be tightened or loosened at will to more or less brake the free rotation of the beams and, accordingly, control the feeding of the warp threads.

In accordance with the present invention, a bracket extension 11 is fixed to the bracket 1 and carries a pair of independently operable counters or indicators 12, of any suitable known type, one counter or indicator being provided for each warp beam. Detachably secured by means of wing nuts 13, or like fastening elements, to the operating shaft 14 of each counter or indicator 12, is a pulley 15 adapted for engagement with several warp threads from its associated warp beam, preferably in the manner illustrated in the drawings. It will be therefore understood that as the warp threads are drawn from the warp beams, those threads frictionally engaging the pulleys 15 will cause the same to revolve, thus operating the counters or indicators 12.

Another counter or indicator 16 is suitably geared, for instance, as shown at 17, to the course regulating element or cam shaft 6, the gearing between said element or shaft and the counter 16 being such that the latter will operate in predetermined timed relation with the counters or indicators 12 associated with the warp beams 2 and 3 respectively.

In practice, the counters or indicators 12 and 16 are set so that their individual reading is identical, that is, all of the counters or indicators will show the same figures. It will thus be appreciated that when the knitting machine is in operation, the counters will give visual indications of the relative speed of the warp beams and the course regulating element. If the reading of the various counters or indicators discloses the same figures, then the operator is assured that the movement of the beams and course regulating element is properly synchronized so that the yarn is being fed properly, but if the reading discloses a difference in figures shown by the several counters, then the operator is aware that the warp beams and course regulating element are rotating out of timed relation to one another.

In the latter event, the fault may be readily corrected by adjusting the braking action of the brake cables so that the warp beams will receive more or less freedom in their rotation, depending upon the particular exigency.

It is to be noted that by reason of the detachable connection of the pulleys 15 to the operating shaft 14 of the counters or indicators 12, said pulleys may be easily and quickly removed and replaced by others of larger or smaller diameter, to retard or hasten the operation of the counters, it being understood that the larger the circumference of the pulley 15, the slower the movement of the counters will be. In this manner, it becomes possible to initially set the speed at which the warp beams should rotate in relation to the speed of the course regulating element, to assure a proper feeding of the warp threads during the knitting operation.

The interchangeability of the pulleys 15 also makes it possible to associate pulleys of different diameters with the individual warp beams when it is necessary or desirable that the beams rotate at different speeds. Thus it will be understood that whereas the rotation speeds of the relative warp beams are different, the reading of the counters 12 will remain the same so long as the mutual speed relation between the beams remains the same because the difference in the diameter of the pulleys will cause the counters to work uniformly.

Also, according to this invention, there may be provided, instead of the manual adjustment of the warp beams braking device, as hereinbefore described, an electro-mechanical apparatus operable to automatically adjust said device. For this purpose, as shown in the drawings, a bevel gear 20 is adapted for screw-threaded engagement with the tension regulating member 21 of the brake bands 21'. Operatively associated with said bevel gear 20 is a second bevel gear 20' carried by a shaft 22 rotatably mounted upon a convenient portion of the supporting bracket 1. A ratchet mechanism 23, consisting of a pair of toothed wheels 23*a* and a 23*b* having their respective teeth directed oppositely for actuation in opposite directions by means of a double action pawl 24, is associated with the shaft 22 to impart reversible rotary motion thereto. Pivotally connected to said pawl 24 is a rocking lever 25 having a link 26 carrying a roller 27 disposed to ride upon the circumferential edge of a rotatable cam 28 which may be operated from any suitable power part of the machine.

Because of this construction, it will be apparent that upon rotation of the cam 28, the lever 25 will be rocked through the link 26 and thus impart a reciprocatory motion to the double action pawl 24. It is to be noted that in normal position, that is, in the position illustrated in Figure 3 of the drawings, the pawl 24 fails to act upon the ratchet mechanism 23 because of the provision of equalizing springs 24' adapted to hold the pawl so that the ratchet engaging portions thereof are out of engagement with said ratchet mechanism 23.

The pawl 24 is preferably adapted to be brought into operative position by actuation of specially devised electrical means, including a solenoid 29, wherein is slidably mounted a rod 30 having one of its extremities hingedly connected to the intermediate portion of the pawl 24, as indicated at 31.

The solenoid 29 consists of two coils 29*b* and 29*c*, the coil 29*b* drawing upwardly the armature 29*d* connected to the rod 30, and the coil 29*c* being utilized to draw the armature 29*d* downwardly, thereby rocking the pawl 24 to control its engagement with and its operation on the ratchet 23 associated with the gear carrying shaft 22.

The solenoid 29 is energized by means of a circuit maker and breaker, indicated in its entirety by the reference character 32. As shown in the drawings, the circuit maker and breaker consists of three paralleling fingers respectively designated by the reference characters 33, 34, and 35, pivotally mounted upon a shaft 36. The end fingers 33 and 35 are provided with a generally U-shaped portion 37, the branches of which carry contact points 38 and 39 disposed in diametrically opposed relation, whereas the intermediate finger 34 has a depending portion 40 carrying a single contact point 41 positioned to contact with points 38 and 39 of fingers 33 and 35 in a manner to be hereinafter specified.

One end of the coil 29*b* is connected by a lead B to the contacts 39 of the fingers 33 and 35, and one end of the coil 29*c* is connected by a lead C to the remaining contacts 38 of the fingers. A neutral lead A connects the remaining ends of the two coils 29*b* and 29*c* with a source of current and with the contact 41 of the finger 34.

Mounted to rotate idly upon a shaft 42 are three cams 43, 44, and 45 respectively, one cam being provided for each of said fingers, and each cam having a shoulder 45' formed on the marginal portion thereof. The head 46 of each finger 33, 34, and 35 bears upon the marginal edge of its associated cam and, in this connection, it is to be noted that the fingers are constantly maintained in riding engagement with their respective cams by means of springs 47 suitably connected to said fingers and to a convenient portion of the machine frame.

The cams 43 and 45 respectively associated with the end fingers 33 and 35 are provided with gears 48 and 49, while the cam 44 associated with the intermediate finger 34, is provided with a sprocket wheel 50. The gears 48 and 49 are individually enmeshed with pinions 51 and 52 rigid with pulleys 53 and 54 disposed to rotate freely upon a stub shaft 55, whereas the sprocket wheel 50 engages a sprocket chain 56 suitably linked to the course regulating element 6.

In use, several threads T from the upper warp beam 2 are wrapped about one pulley 54, and several threads T' from the lower warp beam 3 are wrapped about the other pulley 53. When the knitting machine is started, the shoulders 45' on cams 43, 44, and 45 are set in line so that the three fingers 33, 34, and 35 will fall together, maintaining their normal relationship and, therefore, the contacts of the various fingers remain out of engagement.

If, however, any of the cams 43, 44, and 45 become displaced so that the shoulders 45' lose their aligned relationship, then the fingers will be so positioned with respect to one another that certain contacts will be brought into engagement. For example, should the threads T' leading from the lower beam 3 and engaging the pulley 53 for actuation of the cam 43 be feeding too fast, with respect to the thread T leading from the upper beam 2 and engaging the pulley 54 for actuation of the cam 45, this will cause the shoulder 45' on said cam 43 to reach its corresponding finger 33 sooner and allow it to fall and engage the contact 39 with the contact 41 the latters being mounted on the intermediate finger 34 which is still on the high spot of the cam 44, rotating in time with the machine. The contacting of points 39 and 41 closes the circuit A—B of the solenoid coil 29b thus energizing the same to draw the rod upwardly causing the constantly reciprocating pawl 24 to register with the ratchet 23 to revolve the shaft 22 and actuate the gearing 20—20' for rotation in the one direction, which tightens the brake tension member 21'. This action continues until the braking action on the lower beam 3 causes its threads T' to feed in proper relation with the threads T of the upper beam 2, at which time the shoulders on the cams are restored to their aligned relationship and accordingly separate the contacts 39 and 41, thereby de-energizing the coil 29 to allow the pawl 24 to return to its normal position out of engagement with the ratchet mechanism 23.

If the threads T' of the lower beam 3 are feeding too slowly with respect to the threads T of the upper beam 2, then it will be understood, the shoulder 45' on the cam 43 will be retarded so that the finger 34 associated with the cam 44 in time with the machine will fall, while the finger 33 is still upon the high spot of the cam 43 and cause the contact 41 to engage the contact 39, thus closing circuit A—C, energizing the solenoid coil 29c to draw the rod 30 downwardly. Because of this latter action, the pawl 24 is brought to register with the ratchet 23 for actuating the same to revolve the shaft 22 and operate the bevel gearing 20—20' to rotate in the direction causing the brake pressure to be reduced. The latter action, of course, will continue until the shoulders 45' of several cams are again brought into aligned relationship in the manner heretofore described.

It is to be understood that whereas we have shown and described but one electro-mechanical apparatus associated with the lower beam 3, another similar apparatus is provided for the upper warp beam 2, the two apparatuses being identical in construction and operation so that the automatic control of the relative speed between the beams may be made from either the lower beam or the upper beam.

From the foregoing, it will be understood that by combining the automatic brake control with the counters or indicators hereinbefore described, it is possible to check the operation of the former, since said counters will give visual indication of the synchronized rotary movement of the machine parts with which they are associated.

Manifestly, the construction shown and described is capable of several modifications, and those modifications which come within the scope of the sub-joined claims are to be considered within the spirit of the invention.

What we claim is:

1. In combination with the upper and lower warp beams, and the course regulating element of a warp knitting machine, a separate counter independently mounted and operatively associated with each of said beams and said course regulating element, whereby the relative speed therebetween may be visually indicated.

2. In combination with the upper and lower warp beams and course regulating element of a warp knitting machine, a separate counter for each of said beams, an operating element connected to each counter, each of said elements being in operative engagement with and controlled by the threads from the respective associated beam whereby the relative speed therebetween may be visually indicated; an additional counter for the course regulating element and means connecting said last mentioned counter to the course regulating element for indicating the speed of the latter in relation to that indicated by the counters associated with the yarn beams.

3. In combination with the upper and lower warp beams and the course regulating element of a warp knitting machine, a separate counter for each of said beams, a pulley operatively connected to each counter for actuating the same and disposed for engagement with certain threads drawn from the associated beam to receive its movement therefrom, and an additional counter for the course regulating element operatively connected thereto, whereby the relative speed between the yarn beams and the course regulating element will be visually indicated.

4. In combination with the warp beams of a warp knitting machine, and the braking mechanisms therefor, an electro-mechanical mechanism associated with said beams and braking mechanisms whereby the action of the latter may be automatically controlled according to the travel of the threads from the warp beams.

5. In combination with the warp beams of a warp knitting machine and the braking mechanisms therefor, a ratchet mechanism for operating said braking mechanisms and an electro-mechanical device associated with said beams

and ratchet mechanism for operating the latter, thereby controlling the braking action of said braking mechanisms.

6. In combination with the warp beams of a warp knitting machine and the braking mechanisms therefor, a ratchet mechanism for operating said braking mechanisms and electro-mechanical means operatively associated with and controlled by the threads passing from said beams and adapted to operate said ratchet mechanism, whereby the relative travel of the warp beams may be controlled.

7. In combination with the warp beams of a warp knitting machine and the braking mechanisms therefor, a ratchet mechanism for operating said braking mechanisms, and electro-mechanical means operatively associated with and controlled by the threads passing from said beams and adapted to operate said ratchet mechanism, whereby the relative travel of the warp beams may be controlled, said electro-mechanical means including a solenoid having means connected to said ratchet for actuating the same, and a circuit maker and breaker operatively associated with and controlled by the travel of the yarn from the said warp beams.

8. In combination with the warp beams of a warp knitting machine and the braking mechanisms therefor, a ratchet mechanism controlling the action of said braking mechanisms, electro-mechanical means acting on said ratchet mechanism for operating the same to control the action of the braking mechanism, including a circuit maker and breaker operatively associated with the yarns travelling from said warp beams and adapted to control the energization of said electro-mechanical means, said circuit maker and breaker including a cam for each warp beam directly operated by one of the threads travelling from said warp beam, and a finger cooperating with each of said cams for movement thereby, said fingers adapted to control the energization of the electro-mechanical means according to the relative speed of travel of the warp beams.

9. In combination with the warp beams of a warp knitting machine, and the braking mechanisms therefor, a ratchet mechanism for operating said braking mechanisms, said ratchet mechanism including a pair of toothed wheels operatively connected to said braking mechanisms, said wheels having their respective teeth directed in opposite directions, a double action pawl operable for selective engagement with either of said wheels for imparting forward or reverse movement to the ratchet mechanism, a solenoid having means connected to said pawl for actuating the same, and a circuit maker and breaker operatively associated with the yarn beams and adapted to energize said solenoid for actuation of the ratchet mechanism whereby the action of the braking mechanisms may be automatically controlled according to the speed of travel of the threads from the warp beams, to automatically control the relative speed of travel of the warp beams.

10. In combination with the yarn beams of a warp knitting machine, and the braking mechanisms therefor, a ratchet mechanism for operating said braking mechanisms, said ratchet mechanism including a rotatable shaft, means between said braking mechanisms and shaft whereby the rotation of the latter will operate the former, a pair of toothed wheels mounted on said shaft, said wheels having their teeth directed in opposite directions, a double action pawl operable for selective engagement with either of said wheels for imparting forward or reverse movement to the ratchet mechanism, a solenoid having means connected to said pawl for actuating the same, and a circuit maker and breaker operatively associated with the yarn beams and adapted to energize said solenoid for actuation of the ratchet mechanism whereby the action of the braking mechanism may be automatically controlled according to the speed of travel of the threads from the warp beams.

11. In combination with the yarn beams of a warp knitting machine and the braking mechanisms therefor, a ratchet mechanism for operating said braking mechanisms, said ratchet mechanism including a rotatable shaft, a bevel gearing between said braking mechanisms and shaft whereby the rotation of the latter will operate the former, a pair of toothed wheels mounted on said shaft, said wheels having their teeth directed in opposite directions, a double action pawl operable for selective engagement with either of said wheels for imparting forward or reverse movement to the ratchet mechanism for actuating the same, a solenoid having means connected to said pawl, and a circuit maker and breaker operatively associated with the yarn beams and adapted to energize said solenoid for actuation of the ratchet mechanism whereby the action of the braking mechanism may be automatically controlled according to the speed of travel of the threads from the warp beams.

12. In combination with the upper and lower warp beams and the course regulating element of a warp knitting machine, a separate counter independently mounted and operatively associated with each of said beams and said course regulating element, whereby the relative speed therebetween may be visually indicated, and mechanism controlling the relative speeds of said upper and lower warp beams and said course regulating element to the extent that the reading of all counters will be identical.

13. In combination with the upper warp beam, the lower warp beam, the braking mechanism therefor, and the course regulating element of a warp knitting machine, ratchet mechanism for controlling the action of each braking mechanism, including a pair of ratchet wheels having their teeth inclined in opposite directions, a pawl movably mounted for selective engagement with the ratchet wheels for the turning thereof, a double coil solenoid having an operative connection with said pawl, to selectively move the pawl into engagement with either of said ratchet wheels, means for reciprocating said pawl from a power element of the warp knitting machine, a set of three cams, one operated from a thread travelling from the upper warp beam, another operated from a thread travelling from the lower warp beam, and the remaining cam directly operated by the course regulating element; a circuit for the coils of said solenoid, including a source of current and a circuit maker and breaker for each cam under the control thereof and collectively acting to selectively energize and de-energize the coils of said solenoid.

14. In combination with the upper and lower warp beams and course regulating element of a warp knitting machine, a separate counter independently mounted and operatively associated with each of said beams and said course regulating element, whereby the relative speed therebetween may be visually indicated; braking mechanisms for said warp beams, a ratchet mechanism

for operating said braking mechanisms, said ratchet mechanism including a pair of toothed wheels operatively connected to said braking mechanisms, said wheels having their respective teeth directed in opposite directions, a double action pawl operable for selective engagement with either of said wheels for imparting forward or reverse movement to the ratchet mechanism, a solenoid having means connected to said pawl for actuating the same, and a circuit maker and breaker operatively associated with the yarn beams and adapted to energize said solenoid for actuation of the ratchet mechanism whereby the action of the braking mechanisms may be automatically controlled according to the speed of travel of the threads from the warp beams, to automatically control the relative speed of travel of the warp beams.

15. In combination with the upper and lower warp beams and course regulating element of a warp knitting machine, a separate counter for each of said beams, an operating element connected to each counter, each of said elements being in operative engagement with and controlled by the threads from the respective associated beam whereby the relative speed therebetween may be visually indicated; an additional counter for the course regulating element and means connecting said last mentioned counter to the course regulating element for indicating the speed of the latter in relation to that indicated by the counters associated with the yarn beams; braking mechanisms for said warp beams, a ratchet mechanism for operating said braking mechanisms, said ratchet mechanism including a pair of toothed wheels operatively connected to said braking mechanisms, said wheels having their respective teeth directed in opposite directions, a double action pawl operable for selective engagement with either of said wheels for imparting forward or reverse movement to the ratchet mechanism, a solenoid having means connected to said pawl for actuating the same, and a circuit maker and breaker operatively associated with the yarn beams and adapted to energize said solenoid for actuation of the ratchet mechanism whereby the action of the braking mechanisms may be automatically controlled according to the speed of travel of the threads from the warp beams, to automatically control the relative speed of travel of the warp beams.

16. In combination with the upper and lower warp beams and the course regulating element of a warp knitting machine, a separate counter for each of said beams, a pulley operatively connected to each counter for actuating the same and disposed for engagement with certain threads drawn from the associated beam to receive its movement therefrom, and an additional counter for the course regulating element operatively connected thereto, whereby the relative speed between the yarn beams and the course regulating element will be visually indicated; braking mechanisms for said warp beams, ratchet mechanism for operating said braking mechanisms, said ratchet mechanism including a pair of toothed wheels operatively connected to said braking mechanisms, said wheels having their respective teeth directed in opposite directions, a double action pawl operable for selective engagement with either of said wheels for imparting forward or reverse movement to the ratchet mechanism, a solenoid having means connected to said pawl for actuating the same, and a circuit maker and breaker operatively associated with the yarn beams and adapted to energize said solenoid for actuation of the ratchet mechanism whereby the action of the braking mechanisms may be automatically controlled according to the speed of travel of the threads from the warp beams, to automatically control the relative speed of travel of the warp beams.

17. A method of determining the relative speed of the upper warp beam and lower warp beam, and the course regulating element of a warp knitting machine which consists in attaching an indicator to each of said beams and said course regulating element and comparing the numerical indications thereof, and adjusting the tension of said beams in relation to the speed of the course regulating element to an extent that the numerical indication on all the indicators will be identical.

18. A method of regulating the travel of yarn from the upper warp beam and lower warp beam of a warp knitting machine in accordance with the operation of the course regulating element of the warp knitting machine which consists in associating an indicator with each warp beam and with said course regulating element and braking the action of said beams to an extent that the numerical indication on all the indicators will be identical.

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