Dec. 1, 1942. R. BASSIST 2,303,903

KNITTING MACHINE

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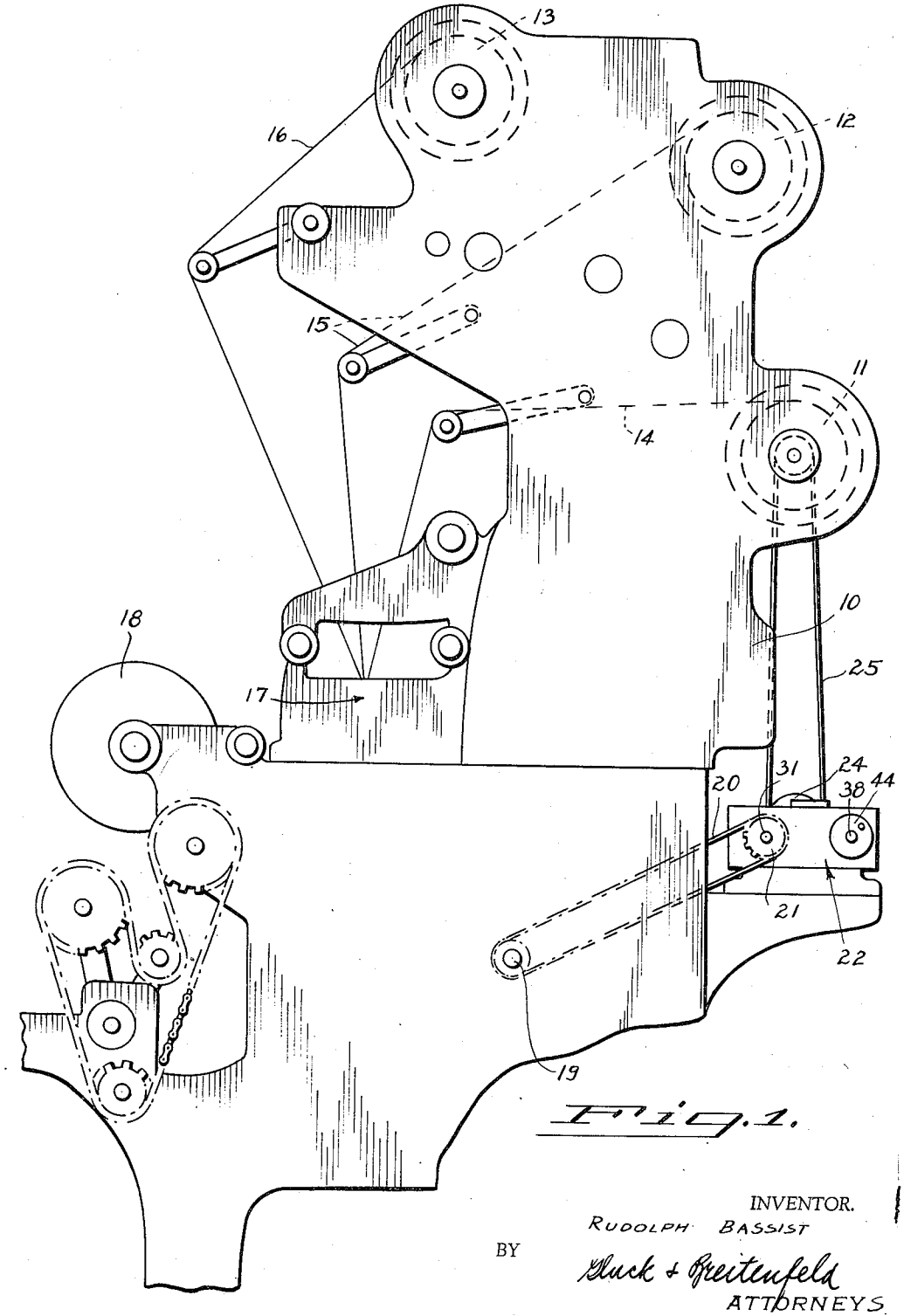

Fig. 1.

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Fig. 2.

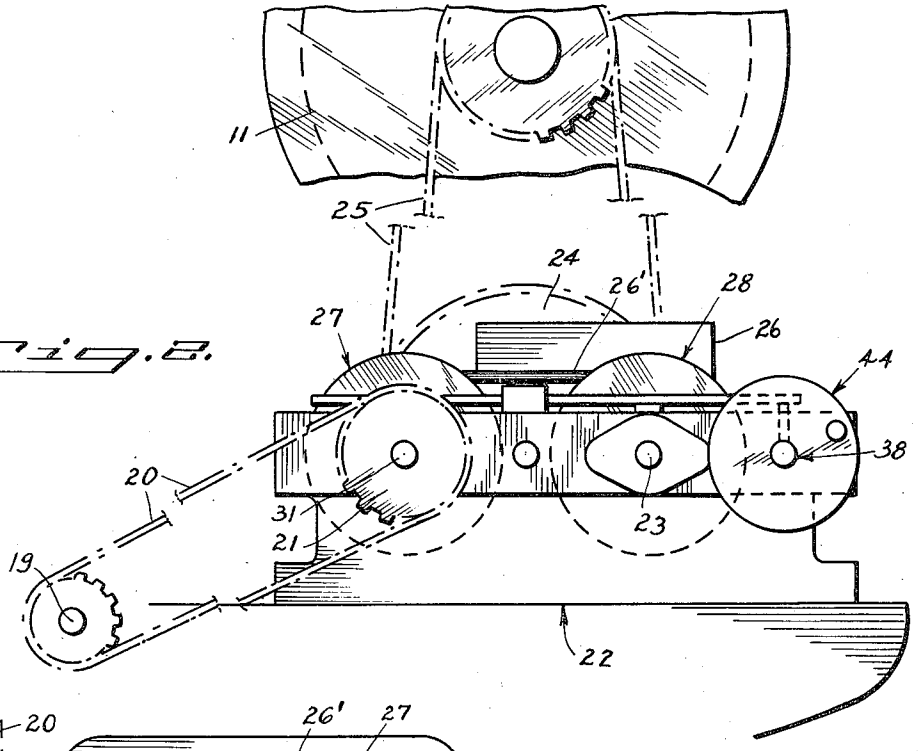

Fig. 3.

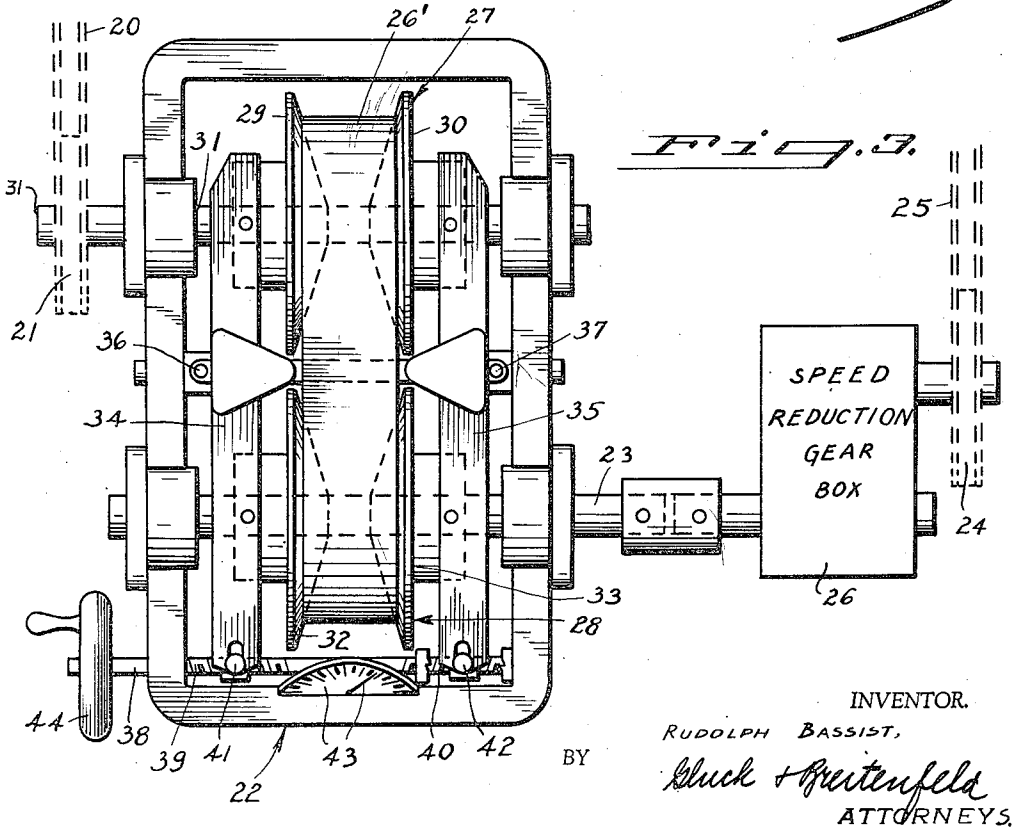

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Fig. 4.

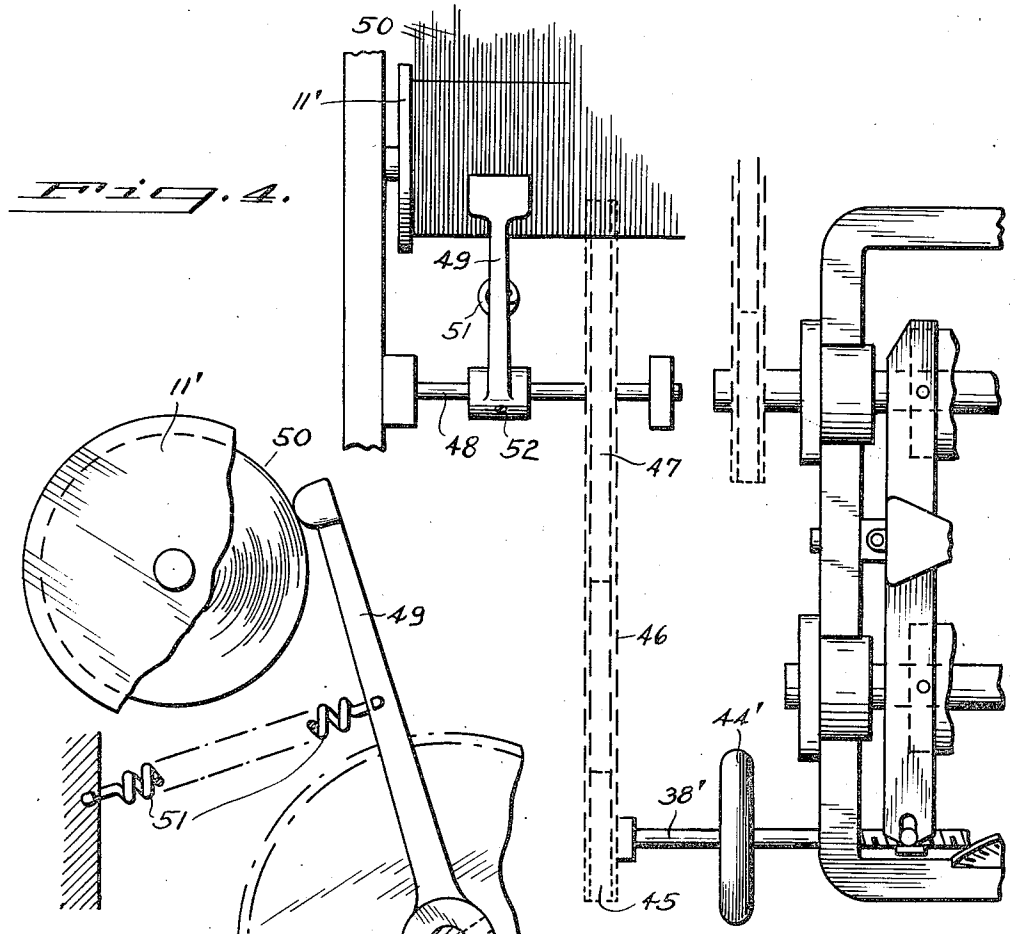
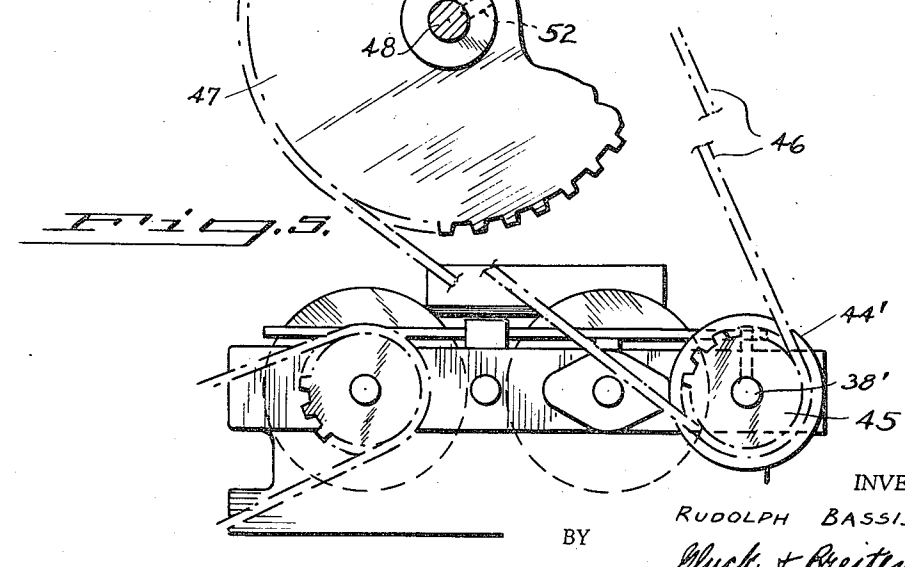


Fig. 5.



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Patented Dec. 1, 1942

2,303,903

UNITED STATES PATENT OFFICE

2,303,903

KNITTING MACHINE

Rudolph Bassist, New York, N. Y., assignor, by direct and mesne assignments, of forty-five per cent to said Bassist, ten per cent to Harold H. Stern, twenty-two and one-half per cent to Edith Abrams, and twenty-two and one-half per cent to Edith April, all of New York, N. Y.

Application August 6, 1941, Serial No. 405,631

5 Claims. (Cl. 66—86)

My present invention relates generally to knitting machines, and has particular reference to so-called warp knitting machines.

In a warp knitting machine, the yarn is initially wound on one or more warp beams and is fed in parallel rows to a bank of needles which operate to interengage the threads to produce a knitted fabric of the jersey type. The yarn is directed to the needles by suitable guiding means, including one or more guide bars through which the individual strands are threaded and by means of which the threads are looped around the needles, or otherwise subjected to their operation, in predetermined direction and sequence, depending upon the particular pattern or style of knitted fabric to be produced.

While my invention is particularly adapted and primarily intended for use in high-speed knitting machines of the so-called "Tricot" type, it is not restricted in its applicability to any particular kind of warp knitting machine. The high speed machines to which reference is made are those which are of relatively fine gauge, having approximately 28 to 34 needles per inch, and operating at the rate of about 600 courses or stitches per minute.

A general object of my invention is to provide certain improvements in warp knitting machines, whereby many of the disadvantages heretofore encountered are avoided, whereby the structure and operation are in many respects simplified, and whereby certain patterns and types of knitted fabrics, not heretofore capable of production on such machines, may be manufactured.

In the conventional warp knitting machine, the threads are drawn from the warp beam by a pulling action initiated by the needles themselves. The warp beam is associated with a suitable brake or equivalent clutch mechanism whereby it is released for rotation whenever the needles call for thread, and whereby it is secured against rotation in the interim periods. This arrangement has numerous disadvantages. In the first place, the yarn is always under tension, and this imposes limitations on the kinds of fabric that may be produced. In the second place, any stopping or starting of the machine produces an irregularity in the knitting operation whereby an undesirable line or streak, known as a "stop-mark," is produced in the fabric.

The latter disadvantage is a serious one, often causing material impairment of the commercial value of the fabric. It manifests itself most frequently in high-speed machines (i. e., machines producing up to six hundred stitches per minute), and in cases where the yarn is of the relatively slippery character of rayon or similar material.

In accordance with my present invention these disadvantages, and others, are overcome; and, in addition, a warp knitting machine incorporating the structural improvements of the present invention is capable of producing fabrics of varied kinds not heretofore capable of manufacture by means of such a machine.

The ordinary warp knitting machine may use either one, two, or three warp beams. My present invention is predicated upon an arrangement whereby at least one of these warp beams is caused to be rotated independently of any torque imparted to the beam by the threads that are being fed from it. More particularly, the warp beam is caused to be rotated in a yarn-feeding direction by a mechanism that is independent of the needles but which operates in timed relation to the needle operation.

In a preferred embodiment of the invention, the warp beam is rotated by a mechanism that establishes a direct connection between the warp beam and the driving shaft of the machine, i. e., the shaft which operates the needles.

In accordance with my invention, this mechanism is of adjustable character, preferably assuming the form of an adjustable change-speed gearing whereby the timed relation between the yarn feed and the needle operation may be varied. Thus, with a predetermined speed of yarn feed a knitted fabric may be produced, if desired, which is identical with the type of fabric heretofore manufactured; but by increasing or decreasing the speed with which the yarn is fed to the needles, relative to the speed of needle operation, knitted fabrics having different characteristics may be produced. For example, if the yarn is fed at an increased rate of speed, a fabric may be produced having a "crepe" or "bouclé" effect, such a fabric being characterized by the appearance of relatively loose loops similar to those which exist in ordinary woven "terry-cloth."

In any case, the highly undesirable "stop-marks" are completely avoided, regardless of the type of yarn that is employed, or of the high speed at which the machine may be operated.

The independent drive or rotation of the warp beam may be associated with any one or more of the warp beams that are employed.

Preferably, I provide an additional means, in association with the beam-driving mechanism, which is responsive to the varying diameter of

the warp beam and which continuously adjusts the mechanism to compensate for this varying diameter.

Preferably, the mechanism is of such a character that means may be provided, independent of the compensating means, for adjusting the mechanism to vary the timed relation between warp beam rotation and needle operation. It is advantageous in any case to provide such an adjusting means in a manually-controllable form. Under certain circumstances, it may be additionally desirable to provide an adjusting means which operates automatically at predetermined intervals of time. In the latter case, for example, the adjusting means may be driven or controlled by the main driving shaft of the machine and may be provided with adjustable or replaceable cams or chains whose selection and relative arrangement may be altered in accordance with the particular pattern to be produced in the knitted fabric.

I achieve the foregoing objects and advantages, and such other objects and advantages as may hereinafter be pointed out, in the manner illustratively exemplified in the accompanying drawings in which:

Figure 1 is a fragmentary end view of a typical warp knitting machine embodying the features of the present invention;

Figure 2 is a fragmentary view, taken in the same direction, of the change-speed mechanism illustratively shown in Figure 1;

Figure 3 is a plan view of the principal elements of the mechanism shown in Figure 2;

Figure 4 is a view similar to Figure 3 illustrating a modification; and

Figure 5 is an end view of the parts shown in Figure 4.

In the warp knitting machine illustratively shown in Figure 1, a suitable framework 10 supports the various operating parts. I have illustratively shown the machine provided with three warp beams 11, 12 and 13. The threads 14, 15 and 16 emanating from these warp beams, respectively, are passed over suitable guides and ultimately converge toward the needles of the machine. These needles, as well as the guide bars which cooperate with the needles and through which the strands of yarn are individually threaded, are not shown in the present drawings, since they are well-known per se. It will suffice to point out that these guide bars and needles are in the region of the machine designated by the reference numeral 17, and that the resultant knitted fabric is automatically wound on the collecting beam 18 as it is manufactured.

I have illustratively shown yarn emanating from each of the three warp beams 11, 12 and 13, but it will be understood that the machine may be employed, if desired, with only one or two of the warp beams operative, as is well known to those skilled in the art.

Furthermore, I have chosen to show an independent beam-driving mechanism, constructed and arranged in accordance with the present invention, in association with only the warp beam 11, since this will suffice to explain the nature of my invention. In such a case, each of the other warp beams is operated in the usual manner, i. e., by the pulling action of the needles, and each of these warp beams will therefore be provided in the usual way with the customary brake or equivalent clutch device (not shown) to permit rotation of the warp beam when the needles call for thread and to restrain the warp beam in the intermediate periods.

At 19 I have shown the usual cam shaft which constitutes a driving shaft (driven by any suitable motive power such as an electric motor or the like) by means of which the needles, the guide bars, and the other operative parts of the machine may be actuated. From a convenient portion of the driving shaft 19, a chain or belt 20 extends to a pulley 21 associated with the change-speed mechanism 22. This mechanism is provided with a driven shaft 23 (see Figure 3) which transmits the power of the driving shaft 19 through a pulley 24 and a chain or belt 25 to the shaft of the warp beam 11. A speed-reduction gear box or equivalent mechanism 26 is preferably interposed in this transmission.

The change-speed mechanism 22 may be of any suitable character. I have illustratively shown the well known type of device in which a belt 26' is in driving relationship between two conical pulleys 27 and 28, the effective diameters of these pulleys being relatively adjustable.

In a mechanism of this type the pulley 27 consists of the two sections 29 and 30 splined to a shaft 31, while the pulley 28 consists of similar sections 32 and 33 splined to the shaft 23. The shaft 31 is driven by the pulley 21 and the power is transmitted by means of the belt 26' to the shaft 23. By separating the sections 29 and 30, and by bringing about a corresponding mutual approach of the sections 32 and 33, the speed of the driven shaft 23 can be correspondingly reduced; and by bringing the sections 29 and 30 together and by causing a corresponding separation of the sections 32 and 33 the speed of the driven shaft 23 can be correspondingly increased.

This adjustment is effected by means of levers 34 and 35 pivoted respectively at their centers 36 and 37, the opposite ends of the lever 34 being pivotally connected to the pulley sections 29 and 32, while the opposite ends of the lever 35 are pivotally connected to the pulley sections 30 and 33. A worm shaft 38, provided with the oppositely-directed worm portions 39 and 40 causes relative separation or mutual approach of elements 41 and 42 which engage the ends of levers 34 and 35 respectively. If desired, any suitable dial-and-pointer arrangement 43, calibrated in any desired manner, may be arranged in association with the worm shaft 38 to indicate the relative relationships of the parts.

In the embodiment illustrated in Figures 1–3, a manually-controllable handle 44 is mounted on the end of the worm shaft 38. By manipulating this handle to rotate the worm shaft 38 in one direction or the other, the pulleys 27 and 28 may be relatively adjusted to bring about any desired speed relationship between the shafts 31 and 23. Accordingly, by a suitable adjustment of the mechanism 22, i. e., by rotation of the shaft 38, any desired speed of rotation may be imparted to the warp beam 11.

Since this warp beam derives its driving power from the driving shaft 19, it rotates in timed relation to the needles and associated portions of the machine. When the driving shaft 19 slows up or accelerates, a corresponding retardation or acceleration is imparted to both the knitting needles themselves and to the warp beam 11. Consequently, no "stop-mark" is ever caused by the yarn 14. If this yarn is being used, as it well may be, as a sort of filler yarn, there will be no visible "stop-marks" in the resultant fabric, even though the other warp beams continue to be ro-

tated by the usual pulling action of the threads 15 and 16. Moreover, by suitably adjusting the mechanism 22, the yarn 14 may be fed to the needles at predetermined increased or decreased speeds to produce a variety of different patterns and effects.

In Figures 4 and 5 I have illustrated a modification in which the varying diameter of the warp beam 11 is automatically compensated for. The shaft 38' is provided with the hand wheel 44', these parts corresponding to the elements 38 and 44 of Figures 2–3. Mounted on the shaft 38' is an additional pulley or sprocket 45 which is connected by means of a belt or equivalent device 46 with the relatively large pulley or sprocket 47. The latter is mounted on a jack shaft 48 on which a feeler 49 is secured. The end of this feeler rests against the peripheral surface of the yarn 50 that is wound on the warp beam 11', and a tension spring 51 keeps the feeler 49 in this position.

As the threads 50 are fed from the warp beam 11', and as the diameter is thereby reduced, the spring 51 swings the feeler 49 in a counter-clockwise direction (as viewed in Figure 5) and this brings about a compensating rotation of the shaft 38'. As a result, the lineal speed of feed of the yarn leaving the warp beam 11' remains constant for any initial setting of the change-speed mechanism.

Suitable provision is made for permitting manipulation of the hand wheel 44' independently of this compensating means, i. e., without altering the position of the feeler 49. This may be accomplished by mounting the feeler 49 on the shaft 48 in a frictional manner, or by permitting the feeler 49 to be temporarily released from shaft 48 (e. g., by means of a set screw 52), or, if the element 46 is a belt, and the elements 45 and 47 are pulleys with which the belt is in frictional engagement, slippage of the belt over one or the other of these pulleys will allow independent adjustment of the change-speed mechanism by means of the hand wheel 44'.

Under certain circumstances, it may be desirable to bring about automatic adjustments of the change-speed mechanism at predetermined intervals of time. This would result in knitting a fabric with bands of different style or character arranged in predetermined sequence. To achieve this result, rotation of the shaft 38 (Figures 1–3) or of the shaft 38' (Figures 4–5) may be brought about automatically by an adjusting means operating in the desired manner at predetermined intervals of time. For example, such a control means may be driven or controlled by the driving shaft of the machine, such as the cam-shaft 19, and may function by means of adjustable or replaceable cams, chains or equivalent instrumentalities, similar to those which are customarily used to actuate the guide bars of knitting machines of this kind.

In each of the constructions herein illustrated and described it will be observed that the warp beam is not dependent for its rotation upon the operation of the needles in pulling on the yarn, thus causing the tensioned yarn to be the instrumentality through which a rotative force is imparted to the warp beam. In this sense, therefore, the present warp beam rotating device may be said to be independent of the needles, even though it operates in timed relation to the needles, and it is this relationship of parts which is intended to be referred to herein and in the appended claims, by describing the warp beam rotating mechanism as being "independent of the needles."

In general, it will be understood that those skilled in the art may make changes in the details herein described and illustrated without departing from the spirit and scope of the invention as expressed in the appended claims. It is, therefore, intended that these details be interpreted as illustrative, and not in a limiting sense.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. In a warp knitting machine, a warp beam, needles, guiding means for directing yarn from said warp beam to said needles, adjustable mechanism independent of the needles but operated in timed relation to the operation of said needles for continuously rotating said warp beam in yarn-feeding direction, and means for adjusting said mechanism to vary said timed relation.

2. In a warp knitting machine, a warp beam, needles, guiding means for directing yarn from said warp beam to said needles, adjustable mechanism independent of the needles but operated in timed relation to the operation of said needles for continuously rotating said warp beam in yarn-feeding direction, means responsive to the varying diameter of said warp beam for continuously adjusting said mechanism to compensate for said varying diameter, and means independent of said compensating means for adjusting said mechanism to vary said timed relation.

3. In a warp knitting machine, a warp beam, needles, guiding means for directing yarn from said warp beam to said needles, adjustable mechanism independent of the needles but operated in timed relation to the operation of said needles for continuously rotating said warp beam in yarn-feeding direction, and automatic means operable at predetermined intervals of time for adjusting said mechanism to vary said timed relation.

4. In a warp knitting machine, a warp beam, needles, guiding means for directing yarn from said warp beam to said needles, adjustable mechanism independent of the needles but operated in timed relation to the operation of said needles for continuously rotating said warp beam in yarn-feeding direction, means responsive to the varying diameter of said warp beam for continuously adjusting said mechanism to compensate for said varying diameter, and automatic means independent of said compensating means and operable at predetermined intervals of time for adjusting said mechanism to vary said timed relation.

5. In a warp knitting machine, a warp beam, needles, guiding means for directing yarn from said warp beam to said needles, and mechanism independent of the needles but operated in timed relation to the operation of said needles for continuously rotating said warp beam in yarn-feeding direction, said mechanism comprising an adjustable change-speed gearing by means of which said timed relation may be varied.

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