Oct. 22, 1935. D. STROMBERG 2,018,290

KNITTING MACHINE ADAPTED TO SHAPE KNITTED ARTICLES

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Fig. 1.

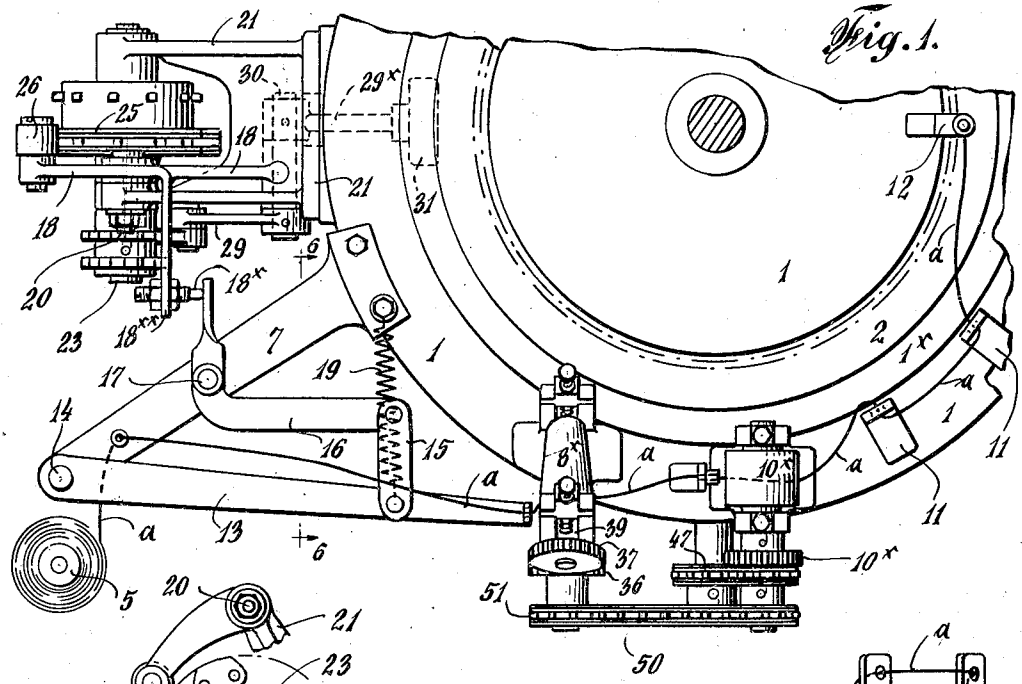


Fig. 3.

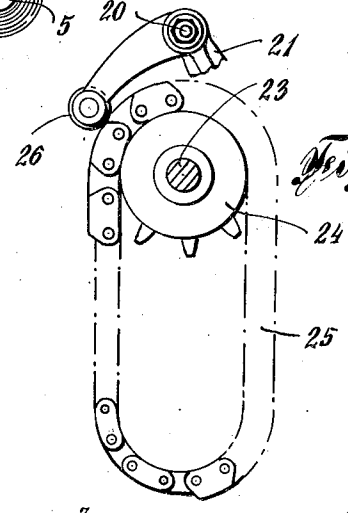


Fig. 2.

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Fig. 4.

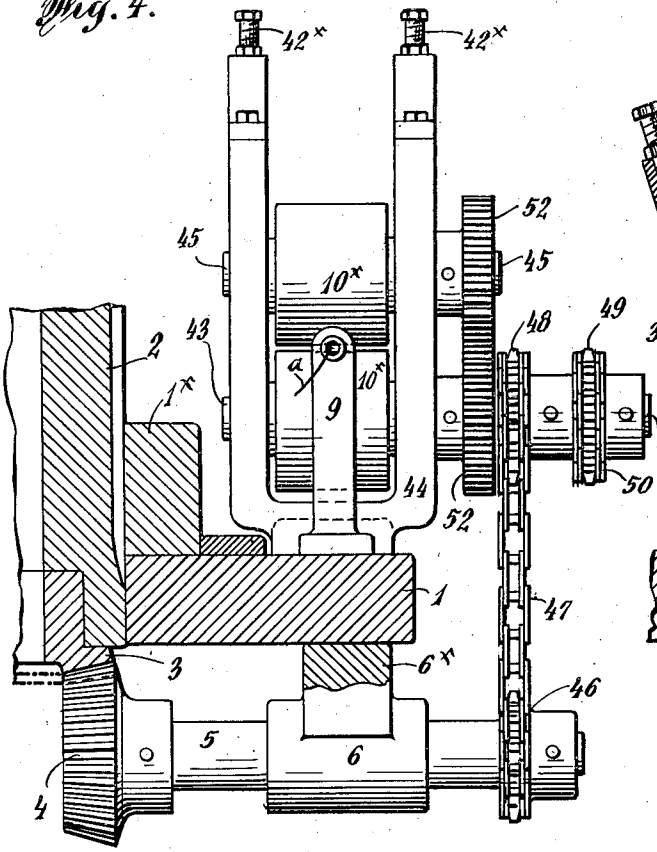


Fig. 5.

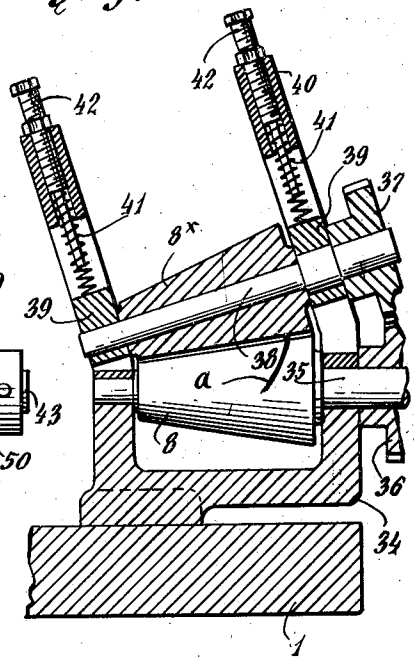


Fig. 6.

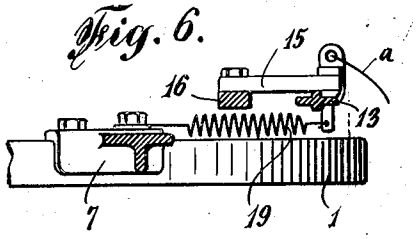
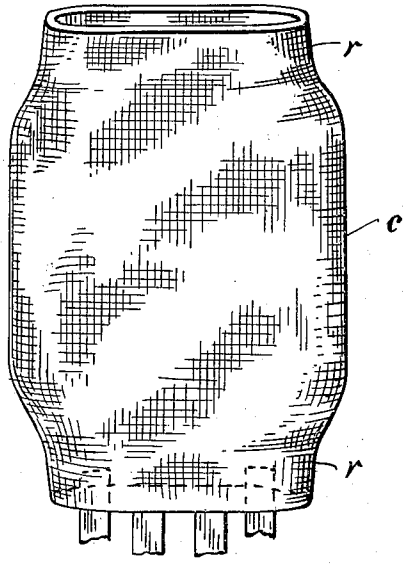


Fig. 8.



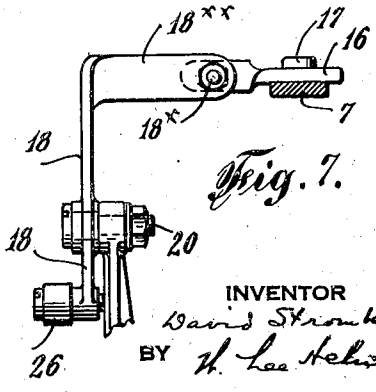


Fig. 7.

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UNITED STATES PATENT OFFICE

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KNITTING MACHINE ADAPTED TO SHAPE KNITTED ARTICLES

David Stromberg, Brooklyn, N. Y.

Application February 19, 1934, Serial No. 711,893

3 Claims. (Cl. 66—132)

The present invention relates to knitting machines particularly of that type adapted for the knitting of tubular articles and its primary object is to provide means for controlling one or a plurality of threads, as, for example, elastic yarn, in such manner that a garment may be formed with areas of different widths, tubular garments being knitted with form-fitting areas relatively different as to diameter.

A further object of the invention is to provide yarn-controlling means of special form, simple in construction, and having positive control over one or more strands of yarn, as, for example, the elastic inlaid yarn threads of a tubular knitted garment.

The invention will be described with reference to the accompanying drawings, in which:—

Fig. 1 is a plan view of an apparatus constructed in accordance with the invention, the same being partly broken away.

Fig. 2 is a view in elevation showing the structure of Fig. 1.

Fig. 3 is a fragmentary detail view of certain operating elements of the yarn controlling mechanism.

Fig. 4 is a sectional elevation on the line 4—4, Fig. 2, looking in the direction of the arrows.

Fig. 5 is a sectional elevation on the line 5—5, looking in the direction of the arrows.

Fig. 6 is a vertical section on the line 6—6, Fig. 1.

Fig. 7 is a vertical section on the line 7—7, Fig. 1.

Fig. 8 is a schematic view of a simple type of knitted garment for which the machine is adapted.

Referring to the drawings, I have indicated in Figs. 1 and 2, a known type of tubular knitting machine comprising the annular horizontal frame member 1 provided with vertical guide annulus 1*x* forming one element of a raceway for the rotating needle frame 2, at the base of which is a bevelled ring gear 3 in mesh with bevelled pinion 4 on shaft 5. Shaft 5 is journalled in a bearing boss 6 held by bracket arm 6*x* depending from member 1. Shaft 5 is thus rotated by ring gear 3 for a purpose hereinafter to be explained.

Inasmuch as the knitting elements form no part of the invention, they are shown diagrammatically and not in detail. It will be understood that they are adapted to form a tubular knitted structure in which all of the threads may be elastic and in which one or more threads may be regarded as transversely extending inlaid threads lying in a spiral end to end of the woven structure. Ordinarily the said inlaid thread is of heavier gauge than the filling and tie threads so that the garment will have a ribbed appearance, the ribs extending transversely and in reality extending spirally, as above stated. The present invention has for its primary object control of such inlaid thread or threads.

In the present embodiment, a single inlaid thread *a* is shown fed from the spool 5. The inlaid thread *a* is guided through an eye formed in bracket arm 7, the latter being secured to frame member 1, the thread then being led between two conical feed rollers 8, 8*x*, thence through the eye of a guide arm 9 and between two feed rollers 10, 10*x* of uniform diameter, and thence through suitable guiding means such as guide arms 11 and guide arm 12 to the needle frame 2.

In its passage to the conical rollers, the inlaid thread *a* passes through the eyeletted end of a swinging arm 13 pivoted at 14 on arm 7. Arm 13 is connected by a link 15 with a lever 16 pivoted at 17 upon arm 7. Lever 16 is normally held in abutment with an adjustable stud 18*x* by means of a coil spring 19 having one end fixed to bracket arm 7 and its opposite end connected to swinging arm 13. Adjustable abutment stud 18*x* is carried by arm 18*xx* of a rock lever 18.

Rock lever 18 is pivoted at 20 upon a bracket 21 secured to a vertical frame member 22 of the machine. Bracket 21 also serves to rotatably support a shaft 23 which carries a sprocket 24 adapted to operate a chain 25 composed of link sections of different heights relatively to the axis of the sprocket. Riding upon the periphery of the chain is a roller 26 carried by rock lever 18, the roller being held in operative engagement with the chain by spring 27 engaging the end of lever 18 opposite the roller and held in a seat provided by bracket 21, as shown in Fig. 2. Thus, in the movement of chain 25, links of successively greater and less height will engage roller 26 and cause rock arm 18 to be rocked on its pivotal point, motion being transmitted to lever 16, and thence to swinging arm 13 so as to vary the position of inlaid thread *a* relatively to the conical feed rollers, as will be hereinafter explained more in detail.

Shaft 23 may receive rotation by the application thereto of a ratchet wheel 28 engaged by pawl 29*xx* of pawl lever 29, the latter being connected to shaft 30 supported in bracket 21, the shaft having fixed thereto rearward projected arm 29*x* carrying a roller 31. Roller 31 lies in the path of a cam plate 32 carried by depending arm 33 of the rotating needle frame so that in each rotation of the needle frame roller 31 is engaged and the pawl arm swung in reverse positions to impart progressive movements to the chain.

The lowermost roller 8 of the two conical rollers is rotatably supported in a bracket 34 on frame member 1, the roller being carried by a shaft 35 having fixed thereto a pinion 36 engag-

ing an overlying pinion 37 on a shaft 38, which supports the uppermost conical roller 8x. Shaft 38 is journalled in slide blocks 39 each free for vertical sliding movement in a raceway formed by upwardly projecting spaced arms 34x of bracket 34. Connected to arms 34x at their upper ends is the T-head of a threaded socket member 40 within which is projected a spring 41 bearing upon the appropriate slide block 39, the tension of the spring being regulated by an adjusting bolt 42 threaded in the upper end of the socket member. By such means conical roller 8x is spring-pressed toward roller 8 and the inlaid thread *a* between the rollers is firmly gripped. At the same time, the yielding relationship of the rollers permits swinging arm 13 to move the inlaid thread *a* from the point of the major diameters of the rollers to the point of minor diameter and vice versa. The lower roller 8 is rotated clockwise and the upper roller 8x counter-clockwise to feed the "warp" thread *a* toward feed rollers 10x, the latter being of equal diameter. The lowermost roller 10x is mounted upon a shaft 43 carried by bracket 44 mounted on frame member 1 and the uppermost roller 10x is carried by shaft 45 journalled in slide blocks (not shown) of the same construction as the slide blocks 39, Fig. 5, the blocks being engaged by springs similar to springs 41, and the springs being adjusted by means of adjusting bolts 42x operating in the same manner as adjusting bolts 42. Shaft 43 is driven from shaft 5, the latter carrying a sprocket 46 connected by chain 47 with a sprocket 48 fixed to shaft 43. Shaft 43 also carries a sprocket 49 connected by chain 50 with a sprocket wheel 51, Fig. 2, carried by shaft 35 of the conical roller assembly. The uppermost roller 10x is driven in unison with the lower roller by means of the gear connections 52.

In the operation of the device, two sets of feed rollers will feed inlaid thread *a* to the knitting frame at a predetermined rate. The rate of feed of the inlaid thread will be so proportioned to the take up thereof by the needle frame that the thread should be kept under tension intermediate the rollers 10x and the final guide arm 12. Figs. 1 and 2 show the apparatus after threading and preliminary to operation so that the thread is shown loose. When the apparatus is started in action however, the thread will be under tension.

When a section of the tubular knitted article is to be of even equal diameter, the inlaid thread *a* may be fed by the conical rollers 8, 8x at substantially the rate of feed of the straight rollers 10x. When it is desired that a given section of the article be of reduced diameter, the links of a section of chain 25 will be reduced in height so as to cause roller 26 to be moved toward the axis of shaft 23, thereby retracting stud 18 from lever 16, the lever following the stud under the influence of spring 19 and the spring acting upon swinging arm 13 to carry inlaid thread *a* toward the ends of the conical rollers having minor diameter. This will reduce the rate of feed of the conical rollers relatively to the rate of feed of the straight rollers 10x and a lesser length of elastic inlaid thread per spiral convolution thereof in the article, will result. When, therefore, the article is removed from the knitting machine, the tension thus placed upon the inlaid thread in the knitting operation will cause that thread in the tension section to reduce the width of the article in proportion to the degree of tension. Thus, by proportioning the movement of swinging arm 13 and hence the rate of feed of rollers 8x in accordance with the effect desired in the knitted article the latter may, when formed as a garment, Fig. 8, have relatively wide areas such as the central area *c* and areas of reduced width as at *r*, and the reduction may be gradual relatively to the length of the article, or, it may be a sudden and sharp reduction, as will be understood without further explanation.

The chains 25 may be of a length proportionate to the effect desired and the links will be placed and formed in accordance with the timing and degree of action required with respect to the swinging arm 13 and the feed rollers. By the arrangement described, knitted articles may be produced of widely varying shaping which is particularly desirable in the production of knitted garments.

Having described my invention, what I claim and desire to secure by Letters Patent, is as follows:—

1. In a knitting machine, in combination with a needle frame, of feeding means for advancing an inlaid thread to said needle frame, said feeding means having two sections, one section comprising opposed feed rollers, each of substantially equal diameter and the second section comprising conical feed rollers with their respective major and minor diameters in mutual registration, means for controlling the action of said second feeding section comprising a thread carrying arm, and automatic means for actuating said arm in accordance with a predetermined pattern comprising a pattern chain and means for moving the same in a vertical path, two levers, one having an arm engaged by said pattern chain and movable in a vertical plane and the second lever mounted for movement in a horizontal plane, an adjustable connection between said levers and a link connecting the horizontal movable lever with the thread carrying arm.

2. In a knitting machine, in combination with a needle frame, of feeding means for advancing an inlaid thread to the needle frame, said feeding means being adapted to feed thread under different tensions, and comprising feed rollers and supplementary feed rollers, said supplementary feed rollers being conical in formation, a shifting arm for the thread led between said conical feed rollers, a lever for moving said shifting arm, and automatic means for actuating said lever in accordance with a predetermined pattern comprising a pattern chain, means for moving the chain in a vertical path, a second lever having an arm operatively engaging the pattern chain and having a second arm operatively connected with the first lever for moving the first lever in a path substantially at right angles to the path of movement of said second lever.

3. In a knitting machine, feeding means for advancing an inlaid thread to the needle frame, constructed in accordance with claim 2, in combination with spring tension means for maintaining the first named lever and adjustable contact in engagement.

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