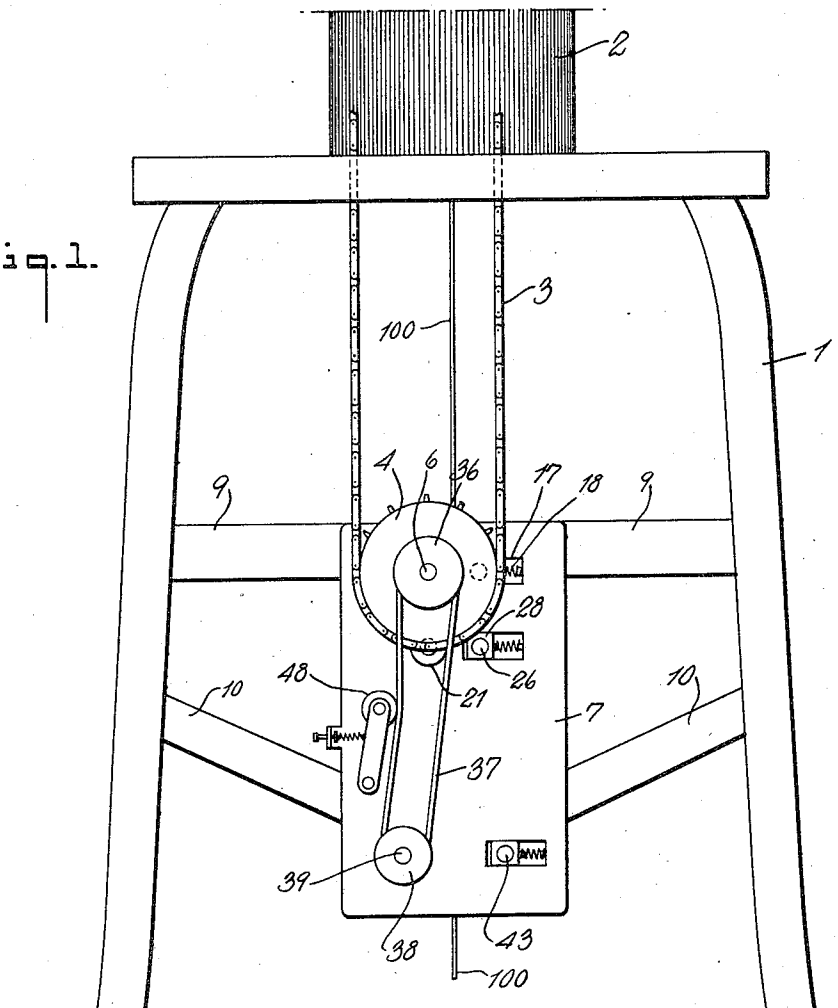
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METHOD OF AND APPARATUS FOR SEPARATING KNITTED FABRICS

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Fig. 1.



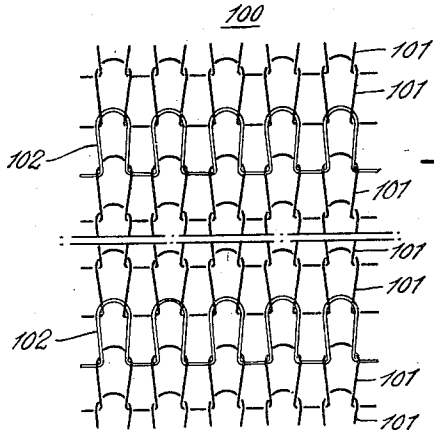


Fig. 2.

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Fig. 4.

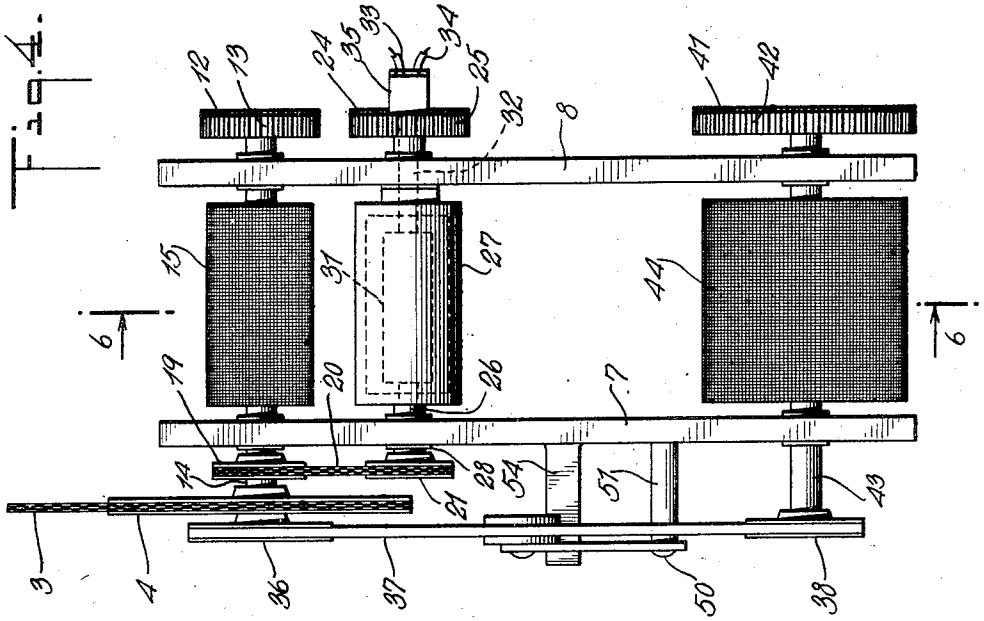
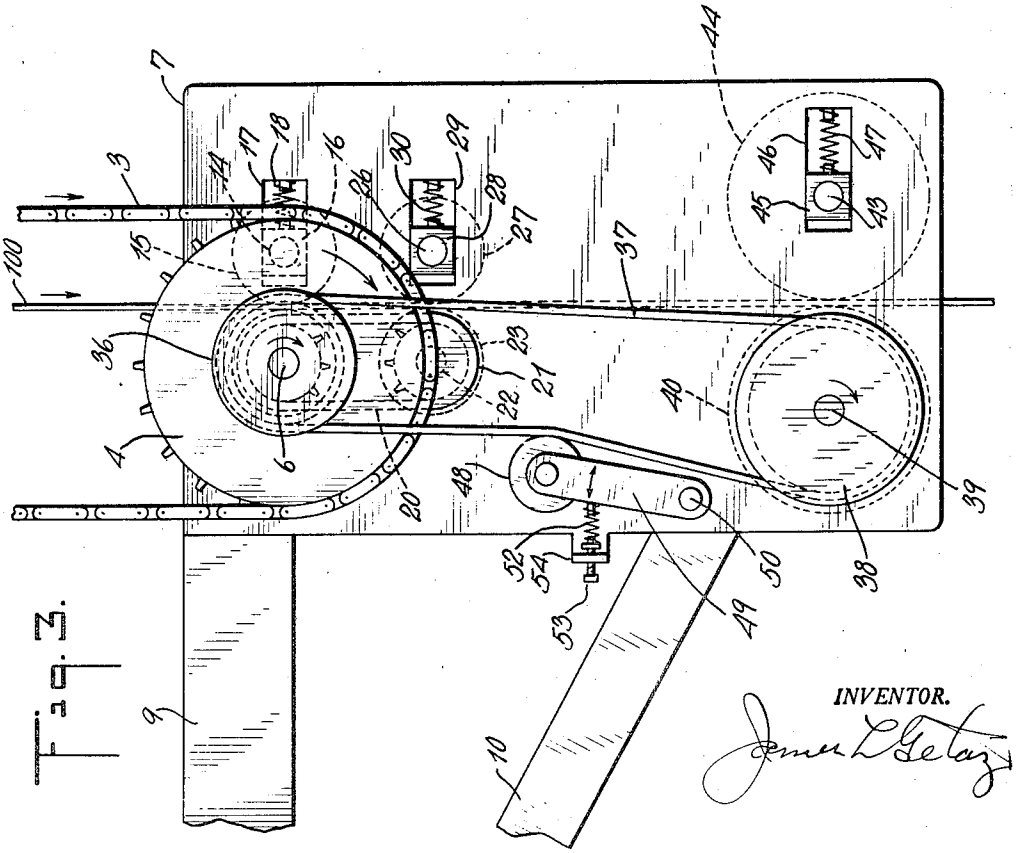


Fig. 3.



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Fig. 5.

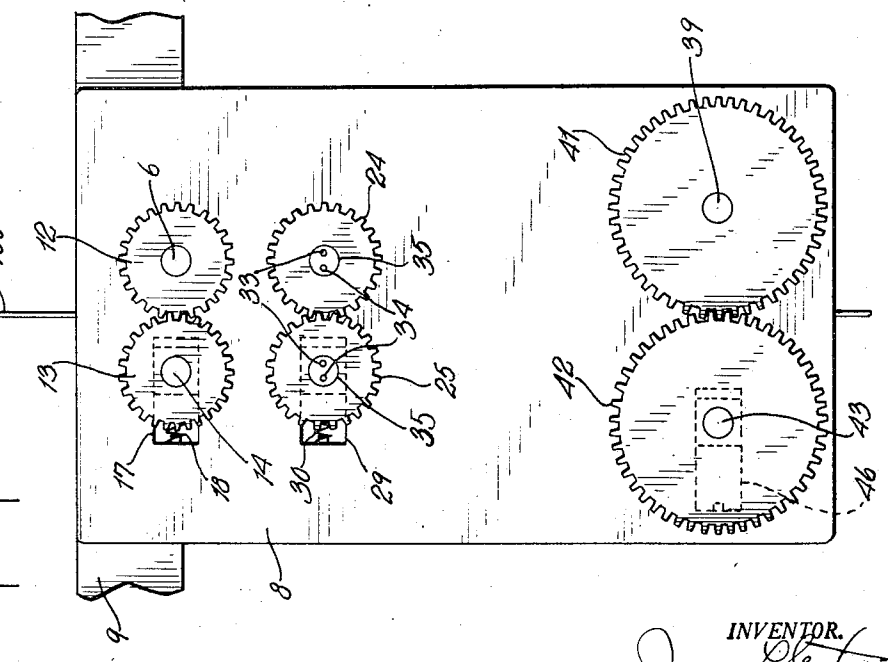
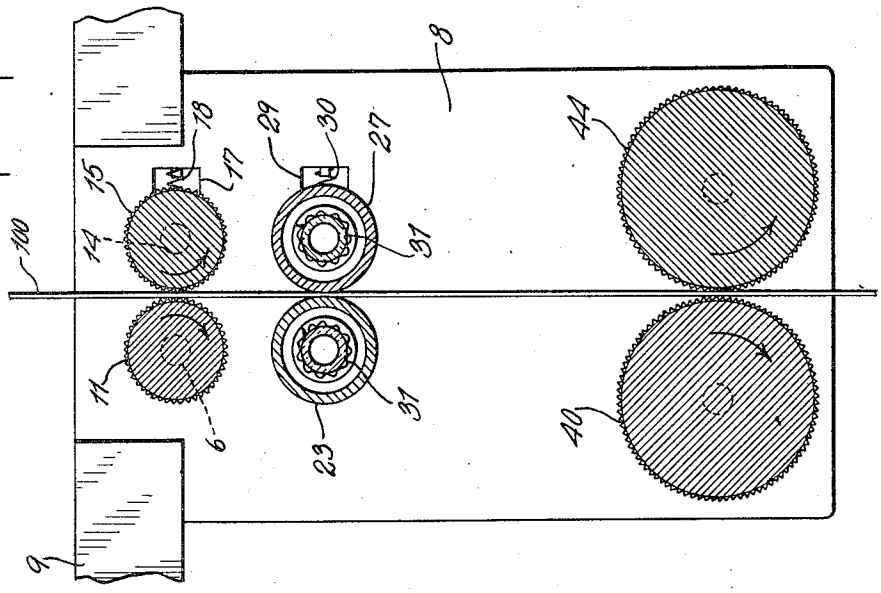


Fig. 6.



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UNITED STATES PATENT OFFICE

2,437,735

METHOD OF AND APPARATUS FOR SEPARATING KNITTED FABRICS

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Application July 25, 1945, Serial No. 606,899

6 Claims. (Cl. 66—147)

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This invention is related to the knitting of textile fabrics or articles of apparel. It is related especially to means and method of separating a continuous length of knitted fabric into units which are made into finished articles such as hosiery, sweaters, etc.

In many types of knitting, it is desirable to keep the knitted fabric under tension as it is drawn from the knitting needles. A tension of this kind may be applied by feeding the knitted fabric through rolls, or winding it on a shaft, or it may be applied by attaching a weight to the knitted fabric. This tension is necessary in some types of knitting in order to make the stitches of the fabric shed properly over the heads of the needles. In other types of fabrics, this tension improves the quality of the fabric by making a tighter stitch, which gives the fabric more elasticity. This tension is preferably applied by feeding the knitted fabric through corrugated rolls which are driven at the proper speed for keeping the desired tension applied to the fabric as it is knitted. The fabric is delivered from these rolls in a continuous length which is then separated into units of the desired length for making articles of apparel. These units may be fashioned as they are knitted, as in hosiery, pockets are knitted for the heel and toe, and in sweaters the neck and arm holes may be fashioned; also such units may contain different kinds of stitches which are suitable for different parts of the article of apparel.

In order to separate these units so that the articles of apparel may be uniform in size and the different kinds of stitches may be in their proper place in the finished article, it is desirable to perform the separation along a certain course of knitting. This may be done by cutting the fabric with scissors, and this method is sometimes used for separating wristlets for the sleeves of sweaters and ribbed tops for hosiery. But it is difficult to follow a certain course of knitted fabrics in cutting, and when articles are separated in this way, the edges may be uneven. A better way of separating these units is to knit at the points of separation a loose course with a "pull" thread which may be drawn out by hand and leave the edges even.

The pulling of the threads in these loose courses requires time on the part of the operator of the knitting machine, and restricts the number of knitting machines which one person can operate. The operator of a hosiery knitting machine may not have time to separate each hose as it comes from each one of the machines which he is operating. In such a case, he cannot inspect each hose and stop a knitting machine as soon as it becomes out of adjustment or has a broken needle, and this may cause additional seconds.

It is the purpose of this invention to provide means for separating these units of knitted fabric

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automatically as they leave the knitting machine without interfering with the tension on the fabric, which is useful in drawing the stitches from the knitting needles. It is also a purpose of this invention to make this separation along one course of the knitted fabric so as to leave the edges of the fabric even. By means of this invention a knitter may be able to operate a larger number of knitting machines and at the same time improve the quality of his work by being able to inspect each knitted unit as soon as it is completed.

In this invention the rolls which apply the tension to the knitted fabric operate in the usual manner, and the separation occurs just after the point, at which separation is to be made, passes through these rolls. In making the separation, use is made of a yarn which has certain characteristics which are different from the characteristics of the yarns which are used in the body of the fabric. Such a yarn is used in knitting one or more courses at the point where the separation is to be made, and is referred to herebelow as the separating yarn. This separating yarn may be of several types which have the characteristic of a tensile strength suitable for knitting under normal conditions, but when special conditions are applied, such as are described below, the strength of the separating yarn is diminished or is reduced to nothing while the strength of the body yarn is not affected.

The type of separating yarn to be used may be selected to suit the special conditions which may be most conveniently applied for reducing its strength. One of the special conditions which may be used for this purpose is the application of solvents, which will dissolve the separating yarn and not affect the body yarn. In this case, the separating yarn may be made of polyvinyl alcohol and water may be used as a solvent.

The preferred method is to apply special conditions by the control of temperature. In this case, the temperature may be raised to a point at which the separating yarn becomes very soft or melts and the body yarn is not affected. For this purpose, the separating yarn may be made from a base of vinyl resin. A yarn may be made of this material which has a good tensile strength at atmospheric temperatures, but as the temperature is raised, this strength is reduced to practically nothing at temperatures which do not affect the body yarns. If such a yarn is used as a separating yarn and the proper temperature is applied to the knitted fabric at the point of separation, the units of knitted fabric come apart.

Where the term body yarns is used in this application it is intended to include yarns made of cotton, wool, silk, rayon, Celanese, nylon, rubber or other fibres which are commonly used in textile fabrics. Whether the special conditions

mentioned above, which are applied to produce separation include the use of a solvent or the control of temperature, the body yarns are not affected by the special conditions. If control of temperature is used, a temperature of 180 degrees to 200 degrees F. is suitable to remove the separating yarn without affecting the body yarns.

This invention is useful in the manufacture of various kinds of knitted articles and has special advantages in the manufacture of hosiery. In the knitting of ribbed tops for hosiery, these may be knit under tension on a rib machine with one or more courses of separating yarn at the end of each top. By applying heat to the fabric, the separating yarn is removed and the labor of separating these tops eliminated. In hosiery, which is decorated with vertical wrapped stripes, a tension is needed to obtain proper knitting of the wrap threads, and this tension is usually applied by feeding the hose in continuous fabric through tensioning rolls and separating them by hand, or by knitting the hose separately and attaching a weight to the top of each hose before the knitting of the wrap stripe begins. By the use of this invention these hose may be knit in continuous length of fabric and separated automatically. Also in the knitting of ribbed hosiery, tension is applied by feeding the continuous fabric through tensioning rolls and the hose are separated by hand. By the use of this invention, they are separated automatically. This automatic separation permits the knitter to operate more machines and to inspect his work more closely.

The uses mentioned above for this invention in the manufacture of hosiery are related especially to hosiery of medium and coarse gauge for children and men and anklets and sport hose for ladies. In making hosiery of very fine gauge, such as sheer lady's stocking, the stocking is fashioned by varying the length of the stitch, a tight stitch being desirable in the ankle and foot. This stitch may be made tighter by applying tension to the fabric, especially if it is knitted with a yarn like nylon, which has an appreciable amount of elasticity. By the use of this invention, tension may be applied to the lady's stocking as it is being knitted in continuous fabric and the stocking separated automatically. The use of tension improves the fabric of the lady's stocking, and the automatic separation permits the knitter to operate the same number of machines as though the stockings were knit separately. In knitting ladies' stockings with an automatic welt, one or more courses of separating yarn is knitted at the end of the looper heading, then the knitting yarn is changed to a body yarn before the stitches of alternate needles are held by the dial bits. The tensioning device is inoperative during the knitting of the welt, and tension is applied after the stitches have been transferred from the dial bits to the knitting needles and knitting is begun below the welt. As the welt passes below the tensioning rolls, heat is applied to the fabric containing the courses of separating yarn and the looper heading of the stocking below is separated from the welt of the stocking above.

Means for making this separation automatic without interfering with the tension are shown in the following drawings:

Fig. 1 is an elevation of a knitting machine embodying this invention.

Fig. 2 shows a piece of knitted fabric which is knitted according to the method of this invention.

Fig. 3 is a detailed view of the mechanism shown in Fig. 1.

Fig. 4 is a side view of the mechanism as shown in Fig. 3.

Fig. 5 is a rear view of the mechanism shown in Fig. 3.

Fig. 6 is a sectional view along line 6—6 of Fig. 4.

In Fig. 1 is shown the frame 1 of a knitting machine with a stationary cylinder 2. Extending below the cylinder is a chain 3 which is driven by the driving shaft of the knitting machine by a mechanism which is not shown. Yarns are fed to the cylinder 2 with suitable yarn feeding devices such as are commonly used with means for changing from one knitting yarn to another.

In Fig. 2 are shown courses of fabric 100 which contain the body yarn 101 in certain courses which comprise the body of the fabric, and the separating yarn 102 in those courses at which it is desired that the fabric be separated.

The chain 3 drives a sprocket wheel 4, as shown in Figures 3 and 4, which is mounted on a shaft 6, which turns in bearings in plates 7 and 8, and these are mounted on the frame 1 by arms 9 and 10. On shaft 6 between plates 7 and 8 is a roll 11, and on the end of shaft 6 outside plate 8 is a gear wheel 12. Meshed with gear wheel 12 is a gear wheel 13 mounted on shaft 14, which is parallel to shaft 6 and on shaft 14 is a roll 15. The bearings 16 of shaft 14 slide in grooves 17 in plates 7 and 8 and springs 18 press against bearings 16, which causes roll 15 to press against roll 11.

On shaft 6 is a sprocket wheel 19 driving a chain 20 and sprocket wheel 21 on shaft 22. Shaft 22 turns in bearings in plates 7 and 8, and on this shaft 22 between plates 7 and 8 is a roll 23, and on the end of shaft 22 outside of plate 8 is a gear wheel 24. Meshed with gear wheel 24 is a gear wheel 25 mounted on shaft 26, which is parallel to shaft 22, and on shaft 26 is a roll 27. The bearings 28 of shaft 26 slide in grooves 29 in plates 7 and 8 and springs 30 press against bearings 28, which causes roll 27 to press against roll 23. Rolls 23 and 27 are hollow and inside of each roll is a resistance element 31. Shafts 22 and 26 are hollow and extending through these shafts are stationary tubes 32, and through these tubes 32, the electric leads 33 and 34 are connected to resistance elements 31. On the ends of tubes 32 are regulators 35 for controlling the temperature produced by resistance elements 31.

On shaft 6 is a pulley 36 driving a belt 37 and pulley 38 on shaft 39. Shaft 39 turns in bearings in plates 7 and 8, and on this shaft 39 between plates 7 and 8 is a roll 40, and on the end of shaft 39 outside of plate 8 is a gear wheel 41. Meshed with gear wheel 41 is a gear wheel 42 mounted on shaft 43, which is parallel to shaft 39, and on shaft 43 is a roll 44. The bearings 45 of shaft 43 slide in grooves 46 in plates 7 and 8 and springs 47 press against bearings 45, which cause roll 44 to press against roll 40. The belt 37 which drives pulley 38 is a loose belt and pressing against belt 37 is an idler pulley 48 mounted on an arm 49. Arm 49 turns on a pin 50 on stud 51 fastened to plate 7; pressing against arm 49 is a spring 52 with adjustment screw 53, supported by projection 54 from plate 7.

The operation of the above mechanism is as follows:

The fabric 100 is fed from the knitting machine, and is held between the rolls 11 and 15. These rolls are driven by the chain 3 at the proper speed to give the right tension to fabric 100, as it is being knitted. The speed of chain 3 may be varied according to the length of stitch drawn

by the knitting needles. The rolls 23 and 27 are driven at practically the same peripheral speed as rolls 11 and 15. The fabric 100, after being drawn under tension between rolls 11 and 15, passes between rolls 23 and 27, where it is heated by the heat from resistance elements 31 which heat the rolls 23 and 27. This heating is controlled by regulators 35 so that the temperature of rolls 23 and 27 does not exceed a given temperature, such as 200 degrees. This temperature is sufficient to melt or greatly reduce the tensile strength of yarn 102 without affecting yarns 101, which causes the fabric to separate.

The rolls 40 and 44 and the mechanism which drives these rolls are not a necessary part of this invention, but are useful in separating the fabric should there be some threads which cause the units of fabric to hang together. If the rolls 40 and 44 are free to turn as driven by belt 37, their peripheral speed is slightly greater than that of rolls 23 and 27, and rolls 11 and 15, so that when the fabric is separated by the heat of rolls 23 and 27, the action of rolls 40 and 44 pulls the lower unit of fabric 100 away from the unit above. Before the fabric 100 is separated as it comes through the rolls, the rolls 40 and 44 apply some additional tension to the fabric and the belt 37 slips so that the peripheral speed of rolls 40 and 44 is the same as that of the rolls above, until the fabric is separated.

After an article has been thus separated from the length of fabric and as the fabric continues to issue from the machine, its foreshortened end gravitates between and is engaged by the rotating lower rolls 40 and 44 and the separating operation is repeated.

While the above description is for knitting machines with stationary cylinders, this invention applies also to machines with rotating cylinders in which the mechanism above mentioned containing the rolls rotates with a cylinder.

I claim:

1. The method of manufacturing knitted articles which includes knitting in a continuous length of fabric a series of articles of body yarn with at least one course of a separating yarn therebetween, said separating yarn having reduced tensile strength under certain conditions which do not adversely affect said body yarn, and, as said length of fabric issues from said knitting point, applying said conditions to weaken said separating yarn and tension to separate said articles.

2. The method of manufacturing knitted articles which comprises knitting in a continuous length of fabric a series of articles of body yarn with at least one course of a separating yarn therebetween, said separating yarn having reduced tensile strength under certain conditions which do not adversely affect said body yarn, applying tension along successive portions of said length of fabric as it issues from the knitting point, and applying said conditions to the portion of said length of fabric under tension, whereby to separate said articles.

3. The method of manufacturing knitted articles which includes knitting in a continuous length of fabric a series of articles of body yarn with at least one course of a separating yarn therebetween, said separating yarn having reduced tensile strength at a higher temperature at which said body yarn is not adversely affected, and, as said length of fabric issues from said knitting point, applying heat to weaken said separating yarn and tension to separate said articles.

4. The method of manufacturing knitted articles which includes knitting in a continuous length of fabric a series of articles of body yarn with at least one course of a separating yarn therebetween, said separating yarn having reduced tensile strength at a higher temperature at which said body yarn is not adversely affected, applying tension to successive portions of said length of fabric as it issues from the knitting point, and applying heat to the portion of said length of fabric under tension, whereby to separate said articles.

5. In a knitting machine of the type adaptable to produce a series of knitted articles in a continuous length of fabric with at least one course of a separating yarn therebetween, said separating yarn having reduced tensile strength under certain conditions which do not adversely affect the yarn of said articles, the combination with said machine of means for separating said articles, said means comprising a first pair of rotating rollers adapted to frictionally engage said length of fabric as it issues from the knitting point, a second pair of rotating rollers adapted to frictionally engage said length of fabric at a point spaced from said first pair of rollers, said second pair of rollers tending to rotate at a peripheral speed slightly greater than that of said first pair of rollers, whereby to apply tension to the portion of said length of fabric between said first and second pairs of rollers, and means to apply said conditions to the portion of said length of fabric under tension.

6. In a knitting machine of the type adaptable to produce a series of knitted articles in a continuous length of fabric with at least one course of a separating yarn therebetween, said separating yarn having reduced tensile strength at a higher temperature at which the yarn of said articles is not adversely affected, the combination with said machine of means for separating said articles, said means comprising a first pair of rotating rollers adapted to frictionally engage said length of fabric as it issues from the knitting point, a second pair of rotating rollers adapted to frictionally engage said length of fabric at a point spaced from said first pair of rollers, said second pair of rollers tending to rotate at a peripheral speed slightly greater than that of said first pair of rollers, whereby to apply tension to the portion of said length of fabric between said first and second pairs of rollers, and a heating surface adapted to contact said portion of said length of fabric.

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