

[54] **APPARATUS FOR THE CLOSING OF THE  
TOE OF A CIRCULARLY KNIT STOCKING  
ALONG A LOOPER-LINE**

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112/121.12, 121.11

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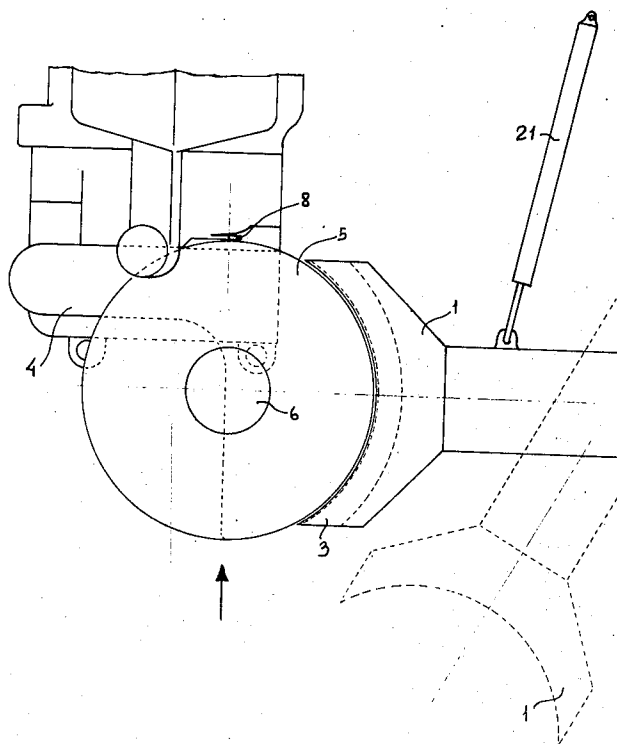
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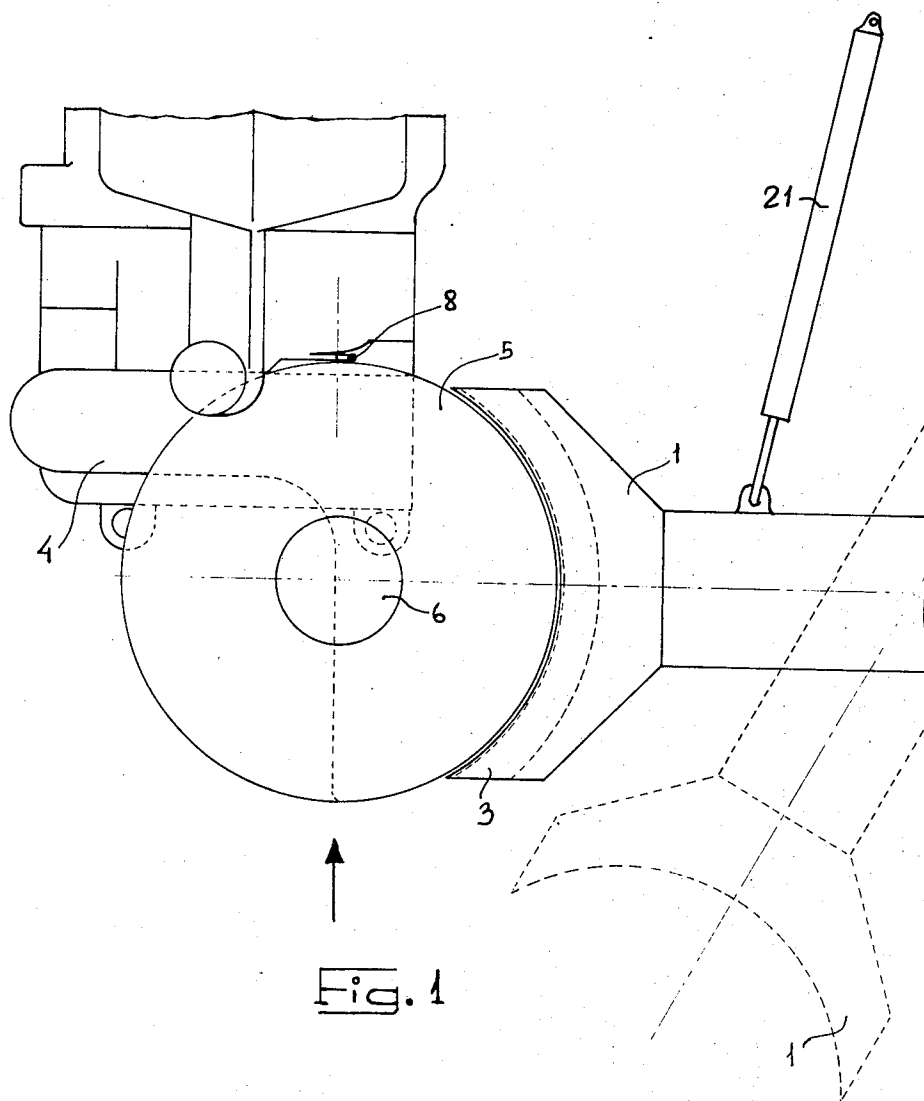
Primary Examiner—Geo. V. Larkin

[57] **ABSTRACT**

In an apparatus for the closing of the toe of a circularly knit stocking along a looper-line, a pair of jaws are provided which between them form a guiding slot into which the juxtaposed halves of the bead along the non-closed opening of the stocking may be pushed, the apparatus further comprising gripping means to grip the stocking as held between the jaws whereupon the latter are spread apart and withdrawn and the gripping means move the stocking past a working position in which trimming and stitching means are provided.

**5 Claims, 6 Drawing Figures**





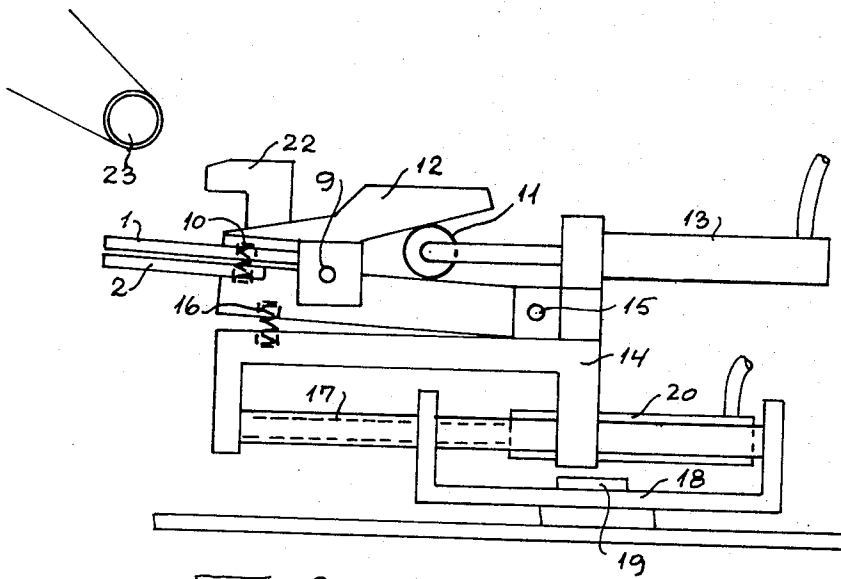


Fig. 2

Fig. 3

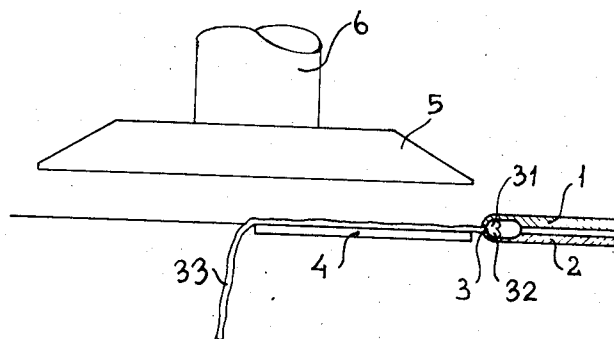


Fig. 4

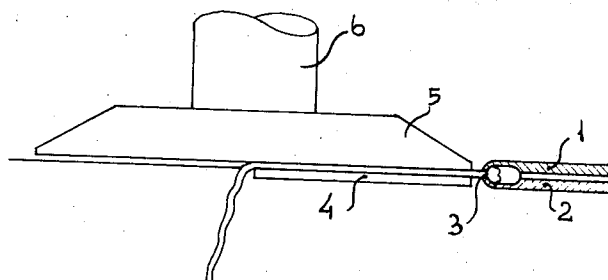


Fig. 5

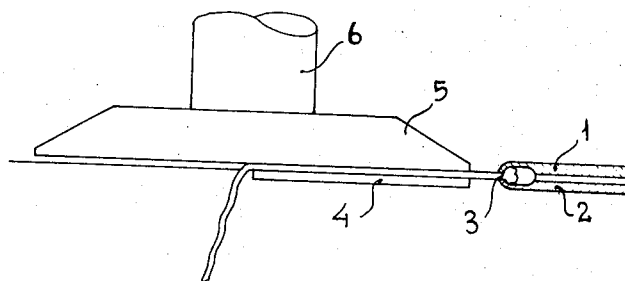
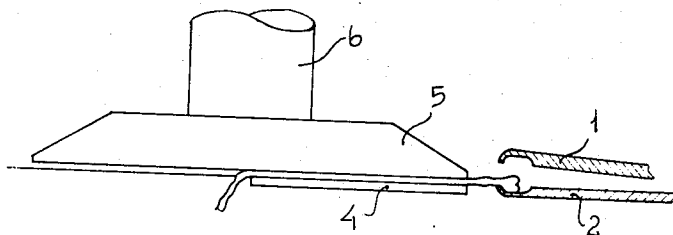


Fig. 6



# APPARATUS FOR THE CLOSING OF THE TOE OF A CIRCULARLY KNIT STOCKING ALONG A LOOPER-LINE

## BACKGROUND OF THE INVENTION

This invention relates to an apparatus for the closing of the toe of a circularly knit stocking along a looper-line. In such a stocking, the toe portion is formed in the circular knitting machine by causing the knitting head to perform an oscillating movement instead of a progressively rotating movement. As a consequence the subsequent closing of the toe does not take place at the very tip of the toe, but along a so-called looper-line which extends across the upper side or underside of the stocking foot near the tip thereof. By this method an improved configuration of the toe is obtainable which is particularly of importance for stockings of a heavier quality such as socks.

As an expedient in the closing operation it is known to knit the stocking with guiding beads along the lips of the opening formed by the knitting and to be closed along the looper-line. To close said stocking blanks it is known to use apparatus which is constructed with a pair of jaws defining a guiding slot into which the lips may be introduced with their guiding beads in engagement with the rear edges of the guiding slot.

In the known apparatus of this type the guiding slot is rectilinear and according to this known technique, the stocking, upon introduction of its lips into the guiding slots, is advanced along the guiding slot and is then gripped by conveying means such as a pair of belts or a circular row of closely arranged needles which move the stocking further forwards to a seaming position where means are provided for seaming the stocking blanks along the looper-line, e.g., by stitching.

It has been found that in order to bring the juxtaposed beads into rectilinear form to be introduced into the rectilinear guiding slot and to be advanced along the latter, the fabric must be stretched and this may frequently give rise to a non-uniform seaming and an objectionable form of the seaming line in the finished stocking. In particular irregularities are apt to occur at the ends of the seaming line.

## SUMMARY OF THE INVENTION

It is the object of the invention to remedy this drawback. According to the invention the guiding slot is curved and the apparatus is provided with means for moving the pair of jaws from a first position for receiving said lips to a second position, gripping means engageable with the stocking from both sides thereof in said second position along a contour line behind the beads, said contour line having a geometrical shape substantially corresponding to that of said guiding slot, means for thereafter withdrawing and opening said jaws and returning them to said first position, and seaming means operable to close the toe of the stocking along the contour of said gripping means while it is being held therebetween.

The invention is based on the recognition that the juxtaposed beads have a more natural tendency to assume a curved shape than a rectilinear shape, and that the beads may therefore be introduced into a curved guiding slot with considerable less deformation than when introducing them into a rectilinear guiding slot. Since moreover the stocking, upon introduction of its

lips into the curved guiding slot, is not to be further advanced along the slot and out of the same, but is instead gripped between gripping means of substantially the same geometrical shape as the guiding slot and corresponding to the desired form of the seaming line, and is being firmly held between these gripping means while the seaming takes place in a manner known per se, it has been found possible to obtain a perfectly uniform seam and to eliminate the tendency towards the occurrence of irregularities adjacent the ends of the seam.

In a preferred embodiment of the invention, said gripping means comprise a stationary smooth surface, and a presser foot engageable with said smooth surface and movable along the contour thereof, said seaming means being mounted at a point of the contour of said stationary smooth surface. Such an arrangement of gripping and seaming means is known per se, e.g., from British patent specification No. 1,201,829, and the structure there illustrated may be used for the purposes of the present invention when replacing the stocking toe holder of the known apparatus by the guiding jaws according to the present invention.

It has been found in practice that as a rule a perfectly satisfactory seam can be obtained by using a guiding slot and gripping means of circular shape, which is a simple solution from a structural point of view, but other curved shapes can also be used. The guiding jaws may advantageously be exchangeable so that the apparatus can readily be adjusted to varying types and sizes of stockings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view of the essential parts of the apparatus.

FIG. 2 is a side view of a jaw assembly forming part of the apparatus.

FIGS. 3-6 show the essential parts of the apparatus as viewed in the direction of the arrow in FIG. 1 in four different phases of operation.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawing, 1 and 2 are jaws between which a circular guiding slot 3 is formed. The jaws 1 and 2 form part of an assembly to be described in further detail below, which assembly is movable from the position indicated in dotted lines in FIG. 1 to the position indicated in full lines in the same figure. 4 is a stationary table and 5 is a presser foot which is adapted to be pressed towards the table 4 and to perform a rotary motion, the presser foot being mounted on a shaft 6 which is slidable in the vertical direction and rotatable under the influence of operating and drive means, not shown, of a manner known per se, cf. e.g., the above mentioned British patent specification No. 1,201,829. 8 is a working station where a set of stitching needles of a sewing machine as well as a trimmer for cutting off excess fabric are arranged immediately outside the circumference of the table 4 and the presser foot 5.

The jaw assembly is illustrated in more detail in FIG. 2. As will be seen the upper jaw 1 is tiltably mounted on the lower jaw 2 for tilting movement about a horizontal axis 9, and between the upper and the lower jaw there is provided a spring 10 which tends to keep the upper jaw in a slightly raised position with respect to the lower jaw. A roller 11 is mounted for rectilinear movement along the upper jaw and is engageable with

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a nose 12 of the upper jaw to tilt the upper jaw downwards about the axis 9 against the action of the spring 10. The movement of the roller 11 to perform the said operation is controlled by a pneumatic cylinder 13 at an appropriate time in the operating cycle of the apparatus as will be described below.

The lower jaw is similarly tiltably mounted on a carriage 14 for tilting movement about an axis 15 and a spring 16 is inserted between the lower jaw and the carriage 14 tending to keep the lower jaw in a slightly raised position with respect to the carriage 14. The carriage 14 is slidable along two pins, only one of which is visible in FIG. 2 and is denoted by 17, the other pin extending parallel to the pin 17 at a distance therefrom behind the plane of the drawing, which are supported in a turret 18 which is again rotatably mounted in the frame of the apparatus for rotation about a vertical axis 19. A pneumatic cylinder 20 serves to displace the carriage 14 along the pins 17, and a pneumatic cylinder 21, FIG. 1, serves to turn the turret 18 about the axis 19.

A nose 22 on the upper jaw 1 is engageable with a stationary roller 23 in the last phase of the movement of the jaw assembly from the position shown in dotted lines in FIG. 1 to the position shown in full lines in FIG. 1, thereby to depress both jaws 1 and 2 jointly, the jaws lying already close together in this phase of the operation as will be described below.

The operation is as follows:

As is conventional in the art, the pneumatic cylinders 13, 20, 21 may be connected to a source of compressed air or vacuum by means of a programming device that causes the various cylinders to be actuated in proper sequence to produce the sequence of movements of the various elements of the apparatus as described below.

While the jaws 1 and 2 are in the position shown in dotted lines in FIG. 1, the beads 31, 32 of the stocking 33 - or more accurately the two halves of the bead along the opening of the stocking - are placed close together and the lips thereby formed are introduced into the guiding slot from one end thereof so that the beads are caused to engage behind the rear edges of the guiding slot to be guided thereby. The roller 11 is now pushed forward by the pneumatic cylinder 13 to engage the nose 12 thereby to press the upper jaw 1 firmly against the lower jaw so that the beads will now be firmly held between the two jaws. The operator may now manually exert a pull in the stocking in order to stretch the fabric behind the beads. The turret 18 is now caused, by the pneumatic cylinder 21, to rotate about the axis 19 and the carriage 14 is thereafter pushed forward on the pins 17, and by these combined movements the jaws 1 and 2 are caused to assume the position shown in full lines in FIG. 1. During this movement the lower jaw 2 is at first in its slightly raised position and can therefore pass across the top of the table 4, but when the jaw assembly is finally pushed forward by the pneumatic cylinder 20 the nose 22 of the upper jaw is engaged by the stationary roller 23 whereby the two jaws are pressed downwards to assume the position illustrated in FIG. 3. This downward tilting of the jaws could of course be dispensed with, but in that case the jaw assembly would have to be mounted at a considerably greater distance from the table 4 and would have to perform a correspondingly longer translatory movement. In the position illustrated in FIG. 3, the guiding

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slot is located immediately adjacent the edge of the table 4. In this phase the presser foot 5 is still elevated from the table 4.

The presser foot 5 is now pressed towards the table 4 by any suitable actuating device such as a pneumatic cylinder controlled by the programming device, whereby the stocking is gripped between the table and the presser foot, cf. FIG. 4, the table and the presser foot thus forming gripping means to take over the holding of the stocking for the seaming operation. Thereafter the jaws 1 and 2 are withdrawn and opened as illustrated in FIGS. 5 and 6, these operations being controlled by the pneumatic cylinders 13 and 20. Preferably, as illustrated, this opening and withdrawing operation can be carried out as a two-stage operation, a certain withdrawal taking place before the jaws are opened, whereby the fabric held between the table 4 and the presser foot 5 may be completely stretched. However, the opening of the jaws may, if desired, also take place before or simultaneously with the withdrawal of the jaws.

The stocking is now held between the table 4 and the presser foot 5 and when the presser foot 5 is now caused to rotate it will move the stocking across the table 4 past the trimmer and the sewing machine in the working station 8, whereby the toe closing operation is performed. The table 4 should preferably be smooth while the presser foot 5 should engage the stocking frictionally, e.g. by being provided with a rubber collar engaging the stocking.

After the toe closing has taken place, the presser foot 5 is again lifted and the jaw assembly is returned to the position illustrated in full lines in FIG. 1.

I claim:

1. An apparatus for the closing the toe of a circularly knit stocking knit with a thickened bead along the edge of an opening formed by the knitting and to be closed by means of the apparatus, said apparatus comprising gripping means engageable with a flattened stocking from both sides thereof near the end of the stocking to hold the stocking along a curved contour line, seaming means operable to close the toe of the stocking along the contour of said gripping means while it is being held therebetween, and a stocking receiving and transfer device having a pair of superimposed jaws having marginal portions defining between them a longitudinally slotted guiding channel to receive the superimposed bead halves of the stocking, said channel being curved in accordance with the contour of said gripping means, said stocking receiving and transfer device being movable between a stocking receiving position remote from said gripping means in which position the superimposed bead halves of a stocking may be slid into said guiding channel from one end thereof, the stocking web extending through said slot, and a stocking delivery position in which the stocking web extending through the slot of the guiding channel is present between said gripping means, means for clamping said gripping means together to grip the stocking web when said stocking receiving and transfer device is in its delivery position and means for thereafter withdrawing and opening said jaws and for returning said stocking receiving and transfer device to its stocking receiving position.

2. An apparatus as in claim 1, in which said stocking receiving and transfer device comprises a turret rotatably mounted in the frame of the apparatus, a carriage

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slidably mounted on said turret, said jaws being mounted on said carriage.

3. An apparatus as in claim 2, in which said pair of jaws comprises a lower jaw which is tiltably mounted on said carriage, and an upper jaw which is tiltably mounted on said lower jaw, spring means being provided for normally keeping said lower jaw in a slightly raised position with respect to said carriage and for normally keeping said upper jaw in a slightly raised position with respect to said lower jaw, and means for tilting said jaws downwards from said raised positions in selected phases of the operating cycle of the apparatus.

4. An apparatus as in claim 1, in which said gripping means comprise a stationary smooth surface, and a presser foot engageable with said smooth surface and movable along the contour thereof, said seaming means being mounted on the frame of the apparatus at a point of the contour of said stationary smooth surface.

5. A method of closing the toe of a circularly knit

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stocking knit with a thickened bead along the edge of an opening formed by the knitting, comprising the steps of placing the two halves of said bead on top of each other, sliding the super-imposed bead halves of the stocking into a longitudinally slotted curved guiding channel formed between marginal portions of a pair of superimposed jaws from one end of said guiding channel, the stocking web extending through said slot, moving said jaws to a position in which the stocking web extending through the slot is present between a pair of gripping means having a curved configuration substantially corresponding to that of said guiding slot, clamping said gripping means together to grip said stocking web, opening said jaws to release said superimposed bead halves and at the same time withdrawing said jaws from said gripping means, and closing the toe of the stocking along the contour of said gripping means while it is being held therebetween.

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