Title: SYSTEM FOR THE AUTOMATIC CREATION OF ELASTIC HEMS

Abstract: Method for the automatic creation of elastic hems on knitwear garments, made by processing along the length of the tubular knit, both straight and diagonal, with seams of elastic thread (D, D1) (H, H1) manufactured with opposite falls, while the other falls make the knit in the areas (L, L1) in 1/1 inverted. When cutting the cloth along the lines (C-C1) and (G-G1), the elastic seams roll on themselves creating the hems. The cut can be made automatically, by known systems, or manually after the manufacture of the same garment.
before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
System for the automatic creation of elastic hems.

Description

Technical Field

The present invention concerns the technical sector relating to the production of stockings, underwear and knitwear, in particular to a system allowing the automatic creation of elastic hems on garments, during the weaving process.

Background Art

Experts in this field know the current manufacturing processes, comprising a first weaving phase of the tubular knit, a second phase when it is shaped by cutting and a final phase providing the trimmings in the area of the neckline, of the sleeve, of the top of the leg, of various openings, of supporting bands, etc., by means of cut-and-sew machines or hems applied by suitable apparatus. Said systems have different times of processing needing labour and time to transfer the manufactured product from a machine to another; in addition, they create a waste of material for the additional part of cloth that will be eliminated during hemming and trimming. All that involves greater acquisition costs of raw material, processing and staff, which increase the final cost of the manufactured product.

Other weaving methods are also known, which allow to automatically make the cut directly during the weaving of the garment, so reducing the processing phases and the labour, but however requiring trimming in a later moment.

Disclosure of invention

This invention principally aims at avoiding the above mentioned drawbacks, providing a system, valid for any kind of garment,
both for adults and children, capable of automatically realizing the elastic hems during its weaving.

We reached this result, according to the invention, adopting the technical solution of realizing a system for the automatic creation of elastic hems, by means of seams of elastic thread processed along the length of the tubular knit that, when cut, roll on themselves, so avoiding further processing passages and reducing to a minimum the operation of trimming. Said system has the characteristics described in the separate claims; other characteristics of the present invention are the object of dependent claims.

The advantages resulting from the present invention essentially consist of the fact that it's possible to realize finished clothes avoiding many processing phases and requiring the least manual labour; that the elastic hems are automatically created by their rolling, after the cutting of the corresponding seams of elastic thread processed on the tubular knit, along the prefixed sections; that said seams of elastic thread are automatically applied along the length of the tubular knit, by the traditional machines during the weaving of the garment; that said seams of elastic thread, processed for automatically creating the elastic hems, but without cutting, permits the reduction of the knit in several garments; that this system permits to reduce the waste of cloth, to save time on processing and therefore on the realization of the finished clothes; that the processing of the manufactured product results, on the whole, neater, faster and more pleasing to look at.

Reduced to its essential structure and with reference to the
figures of the enclosed drawings, a method for the automatic creation of elastic hems, according to the present invention, comprises:

- means to create the elastic seams (D, D1) (H, H1) as well as the areas (L, L1) placed between the cutting line (G, G1) and the two seams (D, D1), during the weaving of the tubular knit (1), processing along the length of the knit, both straight and diagonal, with opposite falls on the seams (D, D1) and with falls constituting the knit in 1/1 inverted in the areas (L, L1);

- means to automatically create the elastic hem, during the weaving, with the cut of the tubular knit (1) along the lines (C-C1) (G-G1) on the bases (L, L1), which involves, consequently, the rolling of the seams (D, D1) with their relative bases (L, L1) and middle gaps (I, I1).

Conveniently, in order to avoid any possible ladder at the cutting lines (C-C1) (G-G1), two sections of stitches that cannot ladder (F, F1) are placed perpendicularly to the same cuts.

Conveniently, in order to avoid too many processing passages, considerably reducing the manual labour to finish the garment, this method is carried out on circular machines for hosiery, large diameter circular machines, straight machines or general knitwear machines, even using very stretchy yarns, capable of carrying out at the same time the weaving, the cutting in the prefixed sections (C-C1) (G-G1) and the elastic hem.

Conveniently, the method of automatic creation of elastic hems can be carried out on the above cited or other machines, during the weaving and cutting phase, in order to avoid the traditional
trimmings in the area of the neckline, of the sleeve, of the top of the leg, of various openings, of supporting bands, etc., usually carried out in a later moment, by means of cut-and-sew machines or hems applied by suitable apparatus. Conveniently, the cut can be made automatically, by methods already known to experts in this field, during the manufacture of the garment, or manually in a later moment after the production of the same garment.

Conveniently, the trimmings essentially consist of a least manual operation.

Conveniently, the elastic hems are applied along the length of the tubular knit, both straight and diagonal, with seams of elastic thread (D, D1) (H, H1) processed with opposite falls, while the other falls make the knit in the areas (L, L1) in 1/1 inverted. When cutting the cloth along the lines (C-C1) and (G-G1), the elastic seams roll on themselves creating the hems.

Conveniently, this method of creation of the hems can be used to realize many garments, hosiery, underwear, medical or other clothes, both for adults and children, among which bras, tops, shirts, blouses, suits, dresses, underclothes, body stockings, body briefers, knickers, pants like briefs or boxers, stockings with an opening working as a suspender, unisex stockings with opening for sanitary needs, tights resting of the hips, shorts, stockings processed with crossed system resting on the hips, socks for football players or other sports, top-shirt-dress supported on the neck, hi-leg bodies supported on the neck, hi-leg bodies, shoes, bathing suits, etc.
Conveniently, according to this method and with reference to Figs. 5 and 6, it's possible to realize two feet (M, N), by means of circular machines that process a first part of the knit by alternate motion for the manufacture of the heel on the half cylinder (P) and the successive manufacture of the other heel on the other half cylinder (Q), going on in alternate motion using all the needles of the cylinder and automatically creating two elastic hems in opposite position. At the end of this operation, the half cylinder (P1) keeps on working in alternation in order to realize the first tip, while the other half cylinder (Q1) holds the knit. Once the tip of the half cylinder (P1) has been finished, the processing of the second tip (Q1) starts. At the end of the two tips, the garment will be finished taking care of any suitable ladder.

Conveniently, according to this method and with reference to Figs. 7 and 8, it's possible to realize a body stocking or body briefer, when the cut and the relative hem are realized respectively in areas (S) or (R), made by two tubular knits (J, K) that, divided by cutting along the line of the automatic elastic hems (T-T1, T2-T3), are later sewn together in the central part (T2-T3). This characteristic makes it possible to leave a suitable central opening (X) in the garment for sanitary needs without getting undressed. Obviously, this garment may otherwise be completely sewn in order to be used for dancing or gym.

Conveniently, according to this method and with reference to Fig. 9, it's possible to realize a pair of knickers for circular machines over 5'’ for children and adults, by means of a tubular
knit (O) that starts with a double stretchy hem (U) and goes on from the larger portion of knit at the waist until the smallest portion of knit at the crotch. The processing of this section of tubular knit includes, at the same time, the automatic creation, for the desired length, of two sections (V-V1) (Z-Z1) of elastic hems in opposite position, at the top of the leg. The lower central part (W) can be compared with the tip of the foot of a stocking and like this can be trimmed.

Conveniently, according to this method and with reference to Figs. 10, 11 and 12, it’s possible to realize a unisex tight, which is or can be united at the centre or with the central sewing (11C) not completely closed, leaving a large circular opening (11A, 12B), obtained by two tubular knits (8A, 8B) manufactured by using, for the length of the body, a single section of automatic elastic hems (Y-Y1), so that, after the union of the two knits (8A, 8B), the not sewed part is already hemmed.

The two tubular knits (8A-8B), open or cut, can be otherwise united only at the waist by hooks or sewing.

Conveniently, this method does not only permit the creation of elastic hems in the area of the neckline, of the sleeve, of the top of the leg, of various openings, of supporting bands, etc., for the above cited garments, but also for any kind of garment or other not cited, where openings or slits require it, as they are currently hemmed or trimmed in a later moment with buttons, zips or stretch.

Conveniently, this system permits the automatic creation of buttonholes; it also permits to cut the medical stretchy bands or
the band hems, which can be manufactured by tubular machines, directly during the weaving; in the current tights, it permits a greater accuracy in matching the two tubular knits; it also permits the definition of the design of a false pair of knickers. Conveniently, this method can be applied to tubular knits having the same essential shape, only varying the length of the garment and the type of the end edge, as well as the position or the size of the points of automatic elastic hems.

Conveniently, this system permits to realize less perceptible hems to the touch at the openings or other parts, which some garments like socks require, so avoiding any projection that may be too visible, therefore not good to look at, and makes trouble or pressure on the wearer’s body, causing problems to blood circulation.

Conveniently, for the bras, it’s possible to use pre-shaped supporting cups to be inserted in the two tubular knits, which union will involve a pleasant double function of holding and beauty.

Conveniently, with this system for hems, it’s possible to save cloth, because there’s no more need to provide a longer cloth for the hem, the excess of which is normally eliminated by cut and trim.

Conveniently, this method permits to save time in processing, as it synthesized weaving, cutting and hemming in a single operation, so it permits to increase production and therefore receipts. Consequently, also the consumer will be able to buy the finished product at a lower price.
Brief description of drawing

These and further advantages and characteristics of the present invention can be better understood by every expert in this field by referring to the enclosed drawings, given as practical examples of the invention, but not to be considered restrictive.

- Fig. 1 is a schematic drawing of a tubular knit (1) of a garment manufactured on a machine, in the phase preceding the cut, showing: the upper (E) and lower (E1) ends, realized with double hem; a series of seams of elastic thread in position (D, D1) for the neckline and the ones in position (H, H1) for the sleeves, processed by the machine during the weaving along the length of the tubular knit (1), which are the elements constituting the hems after the cut (see Fig. 4); the vertical cutting lines of the neck and of the entire tubular knit (1), corresponding to the section (C-C1) and the cutting lines of the sleeves corresponding to (G-G1); two sections of stitch (F-F1) perpendicular to the seams of thread (D, D1), which are necessary to avoid any possible ladder at the cuts (G-G1).

Fig. 1 shows in particular a detail of the hem at the neck made by processing along the length of the tubular knit - both straight and diagonal - by means of seams of elastic thread (D, D1), manufactured with opposite falls, while the other falls in the areas (L-L1), placed between the cutting line (G-G1) and the seams of elastic thread (D, D1) make the stitch in 1/1 inverted. This detail also shows the horizontal section (F) over the hem, processed with stitches that cannot ladder in order to avoid such unpleasant ladders.
- Fig. 2 shows the body (2) obtained by the processing of the tubular knit (1), after the cutting in the sections (C-C1) and (G-G1), with the elastic hems at the neck (D, D1) and the sleeves (H, H1) that automatically came up rolling on themselves. The garment (2) is simply trimmed by sewing the hems of knit represented by (A) with (A1) and (B) with (B1), realized with stitches 3/1, different compared with the processing of the other areas of the body (2).

- Fig. 3 shows the frontal view of the hem of the tubular knit (1) before the cutting, with the two seams of elastic thread (D, D1) depicted with their respective projections and relative bases (I, I1). It’s also possible to see the areas of cloth (L1, L) divided by the cutting line (G-G1) and respectively placed between (D1, G-G1) and (G-G1, D).

- Fig. 4 shows the frontal view of the hem of the tubular knit (1) after the cutting along the line (G-G1), highlighting how the two seams (D, D1), rolling on themselves with their relative bases (I, I1) and areas of cloth (L, L1), automatically constitute a circular outline forming the real hem, in this case of the neck of the tubular knit of the body (2).

We are now going to describe, for example, some models that can be made by means of this system for the automatic creation of elastic hems.

- Figs. 5-6 show the simultaneously manufacture of two feet (M, N), by means of circular machines that process a first part of the knit by alternate motion for the manufacture of the heel on the half cylinder (P) and the successive manufacture of the...
other heel on the other half cylinder (Q), going on in
alternate motion using all the needles of the cylinder and
automatically creating two elastic hems in opposite position.
At the end of this operation, the half cylinder (P1) keeps on
working in alternation in order to realize the first tip,
while the other half cylinder (Q1) holds the knit. Once the
tip of the half cylinder (P1) has been finished, the
processing of the second tip (Q1) starts. At the end of the
two tips, the garment will be finished taking care of any
suitable ladder.

- Figs. 7-8 show the manufacture of a body stocking or body
briefer, when the cut and the relative hem are realized
respectively in areas (S) or (R), made by two tubular knits
(J, K) that, divided by cutting along the line of the
automatic elastic hems (T-T1, T2-T3), are later sewn together
in the central area (T2-T3). This characteristic makes it
possible to leave a suitable central opening (X) in the
garment for sanitary needs without getting undressed.
Obviously, this garment may otherwise be completely sewn in
order to be used for dancing or gym.

- Fig. 9, shows the manufacture of a pair of knickers, for
circular machines over 5’’ for children and adults, by means
of a tubular knit (O) that starts with a double stretchy hem
(U) and goes on from the larger portion of knit at the waist
until the smallest portion of knit at the crotch. The
processing of this section of tubular knit includes, at the
same time, the automatic creation, for the desired length, of
two sections (V-V1) (Z2-Z1) of elastic hems in opposite
position, at the top of the leg. The lower central part (W) can be compared with the tip of the foot of a stocking and like this can be trimmed, for example: a) with a flat sewing (hand operation); b) with a process of closed tip (automatic), in this case the knickers (O) could be completely manufactured automatically.

- Figs. 11-12 respectively show the front and back view of a unisex tight with the central sewing (11C) not completely closed, leaving a large circular opening (11A, 12B) for sanitary needs, also suitable in case of illnesses or allergies.

- Fig. 10 shows the two tubular knits (8A, 8B) of the tight, which are manufactured by using, for the length of the body, a single section of automatic elastic hems (Y-Y1), so that, after the union of the two knits (8A, 8B), the not sewed part is already hemmed.
CLAIMS

1) Method for the automatic creation of elastic hems, characterized in that it comprises:

- means to create elastic seams as well as areas placed between the cutting line and the two seams, during the weaving of the tubular knit, processing along the length of the knit, both straight and diagonal, with opposite falls on said seams and with falls constituting the knit in 1/1 inverted in the areas (L, L1);

- means to automatically create the elastic hem, during the weaving, with the cut of the tubular knit along the lines (C-C1) (G-G1) on the bases (L, L1), which involves, consequently, the rolling of the seams (D, D1) with their relative bases (L, L1) and middle gaps (I, I1).

2) Method according to claim 1, characterized in that, in order to avoid any possible ladder at the cutting lines (C-C1) (G-G1), two sections of stitches that cannot ladder (F, F1) are placed perpendicularly to the same cuts.

3) Method according to claim 1, characterized in that it is carried out on circular machines for hosiery, large diameter circular machines, straight machines or general knitwear machines, even using very stretchy yarns, capable of carrying out at the same time the weaving, the cutting in the prefixed sections (C-C1) (G-G1) and the elastic hem.

4) Method according to claims 1 and 3, characterized in that it can be carried out on the above cited or other machines, during the weaving and cutting phase, in order to avoid the traditional trimmings in the area of the neckline, of the sleeve, of the top
of the leg, of various openings, of supporting bands, etc., usually carried out in a later moment, by means of cut-and-sew machines or hems applied by suitable apparatus.

5) Method according to claim 1, characterized in that the cut can be made automatically, by methods already known to experts in this field, during the manufacture of the garment, or manually in a later moment after the production of the same garment.

6) Method according to claim 1, characterized in that it's possible to realize two feet (M, N), by means of circular machines that process a first part of the knit by alternate motion for the manufacture of the heel on the half cylinder (P) and the successive manufacture of the other heel on the other half cylinder (Q), going on in alternate motion using all the needles of the cylinder and automatically creating two elastic hems in opposite position. At the end of this operation, the half cylinder (P1) keeps on working in alternation in order to realize the first tip, while the other half cylinder (Q1) holds the knit. Once the tip of the half cylinder (P1) has been finished, the processing of the second tip (Q1) starts. At the end of the two tips, the garment will be finished taking care of any suitable ladder.

7) Method according to claim 1, characterized in that it's possible to realize a body stocking or body briefer, when the cut and the relative hem are realized respectively in areas (S) or (R), made by two tubular knits (J, K) that, divided by cutting along the line of the automatic elastic hems (T-T1, T2-T3), are later sewn together in the central part (T2-T3). This characteristic makes it possible to leave a suitable central
opening (X) in the garment for sanitary needs without getting undressed.

8) Method according to claim 1, characterized in that it's possible to realize a pair of knickers for circular machines over 5'' for children and adults, by means of a tubular knit (O) that starts with a double stretchy hem (U) and goes on from the larger portion of knit at the waist until the smallest portion of knit at the crotch. The processing of this section of tubular knit includes, at the same time, the automatic creation, for the desired length, of two sections (V-V1) (Z-Z1) of elastic hems in opposite position, at the top of the leg. The lower central part (W) can be compared with the tip of the foot of a stocking and like this can be trimmed.

9) Method according to claim 1, characterized in that it's possible to realize a unisex tight, which is or can be united at the centre or with the central sewing (11C) not completely closed, leaving a large circular opening (11A, 12B), obtained by two tubular knits (8A, 8B) manufactured by using, for the length of the body, a single section of automatic elastic hems (Y-Y1), so that, after the union of the two knits (8A, 8B), the not sewed part is already hemmed; the two tubular knits (8A-8B), open or cut, can be otherwise united only at the waist by hooks or sewing.

10) Method according to claim 1, characterized in that it permits the creation of elastic hems in the area of the neckline, of the sleeve, of the top of the leg, of various openings, of supporting bands, etc., for any kind of garment or other not cited, where
openings or slits require it, as they are currently hemmed or trimmed in a later moment with buttons, zips or stretch.

11) Method according to claim 1, characterized in that it permits the automatic creation of buttonholes.

12) Method according to claim 1, characterized in that it permits to cut the medical stretchy bands or the band hems, which can be manufactured by tubular machines, directly during the weaving; in the current tights, it permits a greater accuracy in matching the two tubular knits; it also permits the definition of the design of a false pair of knickers.

13) Method according to claim 1, characterized in that it can be applied to any tubular knit having the same essential shape, only varying the length of the garment and the type of the end edge, as well as the position or the size of the points of automatic elastic hems.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 D04B1/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 D04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search forms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search

6 February 2003

Date of mailing of the international search report

18/02/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5018 Patentiers 2 NL - 2280 HV Rijswijk

Tel: (+31-70) 900-0000, Tx: 31 651 epo nl, Fac: (+31-70) 340-3016

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