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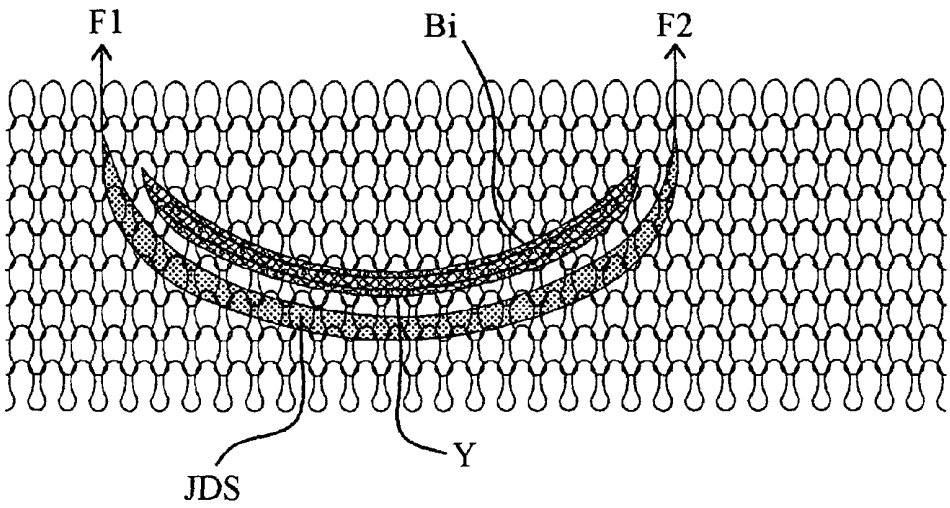
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(54) Title: METHOD FOR PRODUCING KNITWEAR ITEMS PROVIDED WITH HOUSINGS FOR INTRODUCING, SHAPING AND CONNECTING MEANS FOR ANATOMIC SUPPORT AND SHAPING, AND PRODUCTS OBTAINED THEREBY




(57) Abstract: The invention relates to tubular knitwear items (1) such as brassieres, bras, teddies, dresses and technical items (1), provided with suitable housings or small knitted tubes (Bi) automatically obtained for introducing and keeping additional elements such as wires (Y) and the like, whose functions concern anatomic shaping and support, or for aesthetic and functional connections and weavings. The invention co-ordinates the suitable needle (A) selection according to the jacquard design and to the work cycle of the knitting machine, thus causing for definite fabric areas and needles (A) the partial and temporary stop of the knitting process for groups of needles (A) variously alternated with other needles which are still engaged in the knitting process.

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**Method for producing knitwear items provided with housings for introducing, shaping and connecting means for anatomic support and shaping, and products obtained thereby.**

Technical Field

The introduction of "full electronic" circular knitting machines with differentiated diameters has attracted the knitting industry's interest since their versatility allows to produce a wide range of shaped tubular items, such as for instance bras, brassieres, dresses, teddies, swimsuits, technical items and more.

But due to some inherent technical and textile limitations, such as for instance the lack of suitable passages and housings, substantially and preferably closed, for introducing and keeping additional elements for anatomic support and shaping, such as the usual wires placed at the base of bras, most of the aforesaid knitwear items systematically require laborious and expensive additional finishing operations concerning cutting and sewing, with the subsequent fabric scraps which affect production costs extensively and permanently. Or said knitwear items, bras for instance, are considered as lower-quality products since they do not fully satisfy traditional customers' requests and needs related to support and anatomic shaping of the concerned body portion.

As is generally known, a recent patent relates to a knitwear bra provided with a support wire which is then introduced into a plurality of additional non-continuous stitches, following a suitable profile. Said solution, however, shows various technical and functional difficulties with unsatisfying results, since the aforesaid

wire is introduced into a series of openings or knitted structures placed on the reverse or back side of the jersey fabric, substantially open and resulting in the following disadvantages:

- said wire is clearly visible;
- it comes out easily;
- it gets into touch with the skin;
- it can be used only wearing the bra with the fabric on the front side.

Aims of the present invention

All this stated, the present invention aims at reducing to a significant extent or at wholly eliminating the aforesaid technical and productive limitations, with original productive, technical, aesthetic and commercial purposes.

A main aim of the present invention consists in providing a method for producing tubular items, also shaped or fitted, which allows to automatically obtain semi-finished or finished tubular knitwear items, provided with passages and housings for introducing and housing means for anatomic support and shaping. Another main aim consists in providing a method for producing tubular items automatically provided with improved anatomic support. Another main aim consists in providing a method for producing tubular items which allow to introduce and keep additional elements for anatomic support and shaping, such as the usual wires placed at the base of bras, without laborious and expensive additional finishing operations concerning cutting and sewing. Another main aim consists in providing a method for producing tubular items provided with housings for additional elements for anatomic support and shaping without producing fabric scraps which affect production

costs. Further aims will be evident from the description, examples and accompanying drawings, per se or in combination, beyond the final claims.

Disclosure of the invention

The above mentioned aims are substantially achieved by a method for producing knitwear items provided with housings for introducing, shaping and connecting means for anatomic support and shaping, and products obtained thereby, according to the appended claims. The characteristics of the invention and the advantages resulting therefrom will be more evident from the following description of embodiments provided by way of example, which can be advantageously applied to the majority of circular knitting machines.

Brief Description of the Drawings

The description will be made with reference to the accompanying drawings in which:

- figure 1 technically shows a mechanical-textile diagram for the sequences to be followed in the production of three-dimensional knit frills Bi;
- figure 2 is another diagram for the sequences to be followed in the production of knit frills Bi;
- figure 3 is a front view of a fabric having frills Bi made only with odd needles AD, with even needles AP not operating;
- figure 3a shows a needle A, usually housed within a bed or cylinder, on whose stem the underlying fabric and the inner frill Bi are still engaged;
- figure 4 shows a missing stitch W and a single "bridle" BR of the needle A2 within a knitted structure;
- figure 5 is a technical key for the patterns of figures 1

and 2;

- figure 6 is a perspective view of needles A1, A2, A3 starting the sequences for the production of knit frills Bi, by weaving a single "bridle";

- figure 7 is a front view of a jersey fabric MJN having a closed frill Bi, produced with jersey fabric with alternated needles MJAA;

- figure 7A is a lateral sectioned view of figure 7;

- figure 8 shows a wire Y adapted to be inserted in the frill Bi of figure 7;

- figure 8A is a sectioned lateral view of the wire of figure 8;

- figure 9 shows a sectioned view of the wire Y completely covered with the rim sheath L;

- figure 10 shows the rim sheath L of figure 9 joined to the frill Bi placed within the knitted tube TM.

- figures 10A and 10B show two different embodiments in which the sheath L is fastened directly onto the fabric;

- figure 11 shows a brassiere or breast band 1 produced according to the prior art;

- figures 12 schematically show a knitted item with fabric areas A,B,C,F1,F2;

- figure 13 shows the knitted item of figure 12 structurally shaped with interventions on the fabric areas A,B,C,F1,F2;

- figure 14 schematically show a knitted item in which the partial or integral two-layer ring-shaped welts 2 and 3 house the wires Y;

- figures 14A and 14B are respectively front and sectioned views of the double welt 2 of figure 14 housing the wire Y;

- figures 14C and 14D are respectively front and sectioned

views of the double welt 3 of figure 14 housing the wire Y;

- figure 15 schematically show a knitted item with small knitted tubes Bi1,Bi2, similar to frills Bi, produced for about 180° and housing the wires Y;

- figure 16 shows a manufactured items 1 in which the functions of local support of the wires Y are implemented by suitable knitted structures directed towards the shoulder straps SD-SS;

- figure 17 is a front view of a variant of the fabric in figure 7 with a wire Y housed within the frill Bi and a dimensionally very stable fabric zone JDS;

- figure 17A is a lateral sectioned view of figure 17;

- figure 18 is a lateral view of the item of figure 16.

Description of the Illustrative Embodiments

The following description will be carried out, with descriptive and non-limiting purposes only, with reference to a circular knitting machine for producing knitted items comprising at least: a needle bed or rotary cylinder versus fixed cams or vice versa; a complete working feed, provided with one or more yarn feeders, also moving feeders; preferably electronic needle selection for controlling the elements involved in the knitting process according to a work cycle and/or a jacquard design; stitch cams which can also be individually adjusted by means of motors and computer; a device for opening needle latches upon actuation; a fabric suction or pulling system. The machine is also equipped with a suitable dial with selectable needles or jacks, beyond the usual pneumatic yarn suction and cutting device. In particular most of the description relates to a "full electronic" single-cylinder circular machine such as for instance Santoni SM8-8. In a first

preferred embodiment the invention is carried out by preparing a work cycle and jacquard design, i.e. direct inputs to needles or jacks or other elements directly or indirectly involved in the knitting process, by means of a graphics workstation or other control and memory devices, i.e. other known means suitable to said purpose, considering at least partly the teachings contained in the Italian patent belonging to the writer no. 1255008, partially shown in figs. 1-2-3. Among other things, said patent relates to the production of knitwear items characterised by fabric areas with differentiated growth due to the exclusion of a given number of needles, alternated with respect to the adjacent ones, for instance 1:1, or 2:1-2:2 and the like. Unusually, a great part of inputs or commands usually directed to the needles is not sent to a part of the latter, following a given pattern or program according to the original design. This results in the exclusion of the needles without inputs or commands from the knitting process; said exclusion, if total and related to specific zones, would produce floating yarns; in the specific case these are handled by means of some operating needles AD, fig. 3, suitably spaced, with the double purpose of reducing the length of floating yarns and of creating interesting knitted structures, that is to say three-dimensional frills Bi, fig. 3. Figures 1-6 show technical and graphic patterns belonging to knitting technologies related to the particular arrangement of the needles in the production of the three-dimensional knitted frill Bi. Therefore, the invention is carried out by means of a jersey fabric produced with only part of the needles which are present in the concerned areas or zones. For

instance only even needles AP will be excluded, or alternated pairs of needles, i.e. three-needle operating groups followed by one or more excluded needles, and so on. The simultaneous presence of operating needles, for instance A1-A3-A5 etc., alternated with excluded needles, A2-A4-A6, etc., figs. 1,2,3,4 and 6, in specific zones and for an even relatively long time (corresponding to a suitable number of knitted courses), is the sufficient and necessary condition for manufacturing a knitted fabric by means of operating needles and corresponding stitches AD, though interrupted and still intermeshed to excluded needles and stitches AP, so as to produce a substantially closed knitted frill with two layers or fabrics Bi, fig. 3, whose height, width and diagonal are repeatable.

Fig. 7 shows in a front view a schematic embodiment of the invention: the standard jersey fabric MJN, seen from the reverse side, shows in the middle a zone of darker three-dimensional fabric shaped as a half-ring, indicated with MJAA, produced with a reduced number of needles, variously alternated. This is the inner frill generally indicated with Bi in the various figures, whose function is to contain the above-lying wire Y or another similar element for the anatomic support or shaping. With particular reference to the end of the frill Bi, it should be pointed out that the introduction of said wire Y is simplified both by the intrinsic elasticity of the fabric and by the possibility to plan an opening of variable size, related to the number of needles engaged to this purpose, figs. 2-6.

Moreover, as far as the presence of improved knitted openings are concerned, we advise to refer to the writer's patent no. CO-2000-A000012, which is here recalled also in

relation to the present description.

Fig. 7A shows a sectioned view of the same elements as in figure 7; so the three-dimensional profile of the frill Bi can be seen within the knitted tube TM. Among the aims of the invention there is also the structural stiffening of the fabric zone JDS, fig. 17, around the inner frill Bi (containing the wire Y), in order to co-ordinate the local functions of anatomic support of the wire Y with the general support functions of the possible shoulder straps of the bra, swimsuit, teddy, dress, brassiere and the like. In practice the support and lifting functions of the wire Y are further increased by the adjacent fabric JDS which actively contributes along arrows F1-F2, towards the shoulder straps. The fabric zone indicated with JDS consists of one or more knitted courses of dimensionally more stable or non-run jersey fabric, i.e. characterised by the simultaneous presence of normal or elongated stitches, laid-in stitches and welts, these terms being known to people skilled in the art, beyond the possible use of thermosetting or thermo-retractile yarns, or other yarns suitable to this purpose. Or, and preferably, by a plurality of frills Bi suitably placed. Therefore, knitted structures of the described type with variable thicknesses electronically controlled via computer by the corresponding motorised cams (not shown), together with the possible use of other yarns, for instance thermo-adhesive yarns, i.e. gradually melting and weaving with the adjacent loops or stitches during the following hot fixing stage. These stable fabric zone next or adjacent to said small knitted tubes connect and co-ordinate the functions of anatomic support of the breast towards the shoulder straps and the

like. Eventually, figure 17A shows a lateral view of the previous figure with the wire Y introduced into the inner frill Bi within the knitted tube TM.

The present invention is further developed in the embodiment shown in figures 9, 10, 10A, 10B. To the purposes of the invention it should be observed that the shape, the materials and the section of the aforesaid wire Y are substantially irrelevant technical features, which can be modified in presence of contingent variables together with production needs and conditions. For instance, said wire Y can be provided with one or more holes, suitably placed, helping the following fastening to the fabric by means of a sewing operation. Among the aims of the invention there are also the presence and functions of a wire Y, which is wrapped up in its turn within a sheath L, preferably made of textile material, figs. 9,10,10A,10B.

Independently from other embodiments of the present invention and from the manifold shapes said wire Y can take on, the presence of the sheath L is advantageous to fasten, connect or join, preferably by sewing, said sheath with the aforesaid inner frill Bi. In the embodiment shown in fig. 10, the sheath L is therefore sewn onto the frill Bi placed within the knitted tube TM, on the arrow F. In the specific case, the frill Bi modifies its original function of shaping element and takes on a base or support function.

The additional embodiments shown in figures 10A and 10B is characterised in that the sheath L, provided in this case with an edge or rim, is fastened or sewn to the knitted tube (on the inside or outside) according to the fabric design or profile. These guidelines are obtained by

planning a suitable jacquard design or pattern related to colour or structure.

Arrows F3-F4 indicate here two different ways of fastening the sheath L onto the fabric. Fig. 16 shows in further detail the manufactured item 1 whose wires Y are introduced into the corresponding frills Bi and whose ends are directed upwards in the direction of arrows F7. According to the invention the functions of anatomic support of the wires Y are repeated and increased by suitable knitted structures placed on the shoulder straps SD-SS.

Fig. 18 shows a lateral view of a manufactured item 1, which is also provided with shoulder straps SD-SS operating with the wire Y introduced into the frill Bi, or fastened to the fabric in other ways according to the invention.

Another preferred embodiment of the present invention relates to the presence of the wires Y introduced into or fastened to a manufactured item having the same general features as the brassiere 1, shown in fig. 11 as an example from the prior art.

Let us notice the usual elastic two-layer bands or welts 2 and 3, the additional shoulder straps SD-SS and the shaping between the breasts. The fabric between the aforesaid welts 2 and 3 generally consists of jersey MJ whose intrinsic elasticity is a huge disadvantage in the possible function of breast support.

To this purpose, according to the invention, it is advisable first to shape the generally rectangular shape of the manufactured item 1 in fig. 12 on the areas indicated with A-B-C, where various interventions are carried out:

- reducing the thickness of single stitches by means of known motorised stitch cams;

- reducing the number of operating needles;
- producing fabric with differentiated growth as the aforesaid frills Bi.

These interventions modify the structure of the manufactured item 1 of fig. 12, in the manufactured item 1 of fig. 13 on the fabric areas already indicated with A-B-C-F1-F2.

Said areas are therefore produced with laid-in floating yarns FFT or intermeshed floating yarns FFI; or with non-run knitted structures IND; with tuck stitches PT, with alternated-needle fabric MAA, and eventually with the described technique using the frills Bi.

The two-layer welts indicated with 2 and 3 in fig. 12 are usually produced with the additional jacks or needles of the dial (not shown), a term which is known to people skilled in the art, or only with the cylinder needles.

According to the present invention, in order to produce suitable small knitted tubes housing the wires Y only a part of the jacks or needles of the dial are further used, i.e. for about 180°, fig. 14 and 14B.

Or the ring-shaped welts 2 and 3 are replaced by an initial (and/or final) small knitted tube, produced only with the cylinder needles, then a fixed selection of alternated needles Bi, 2 and 3 (fig. 14, 14A, 14B, 14C, 14D).

Beyond the aforesaid complete ring-shaped welts and/or small knitted tubes, the invention also claims partial welts and/or small knitted tubes, preferably for about 180° corresponding to the front part of the manufactured item.

Fig. 15 shows a schematic view of the manufactured item 1, characterised by structures of three-dimensional fabric Bi and by the presence of the wires Y which should shape and

fit the breast profile in an evident way. Bi1 and Bi2 indicate said partial small knitted tubes on the front part of the manufactured item 1, produced according to the invention, figs. 1-2-3-6. As far as said small tubes Bi1 and Bi2 are concerned, it should be pointed out that they are produced at the beginning and at the end of the manufactured item 1 in the same way as the bands or welts 2 and 3 of figures 11 to 14 included. The details of execution can equally vary as far as shape, dimensions and/or arrangement are concerned, and also in the nature of the technical and/or textile materials used, though always falling within the framework of aims of the present patent.

Claims

1. Method for producing tubular knitwear items (1), in circular knitting machines provided with at least a cylindrical needle-bed, comprising the step of producing at least a tubular knitted fabric (TM), characterised in that it further comprises the steps of producing in said tubular knitted fabric (TM) at least a determined portion of fabric different from the remaining portion of the tubular knitted fabric (TM) and applying to said determined portion of tubular knitted fabric (TM) additional means (Y) for anatomically shaping the knitted item (1) and supporting a body part of a user.

2. Method according to claim 1 characterised in that said step of producing said tubular knitted fabric (TM) comprises the following steps:

inactivating and excluding from the knitting process a predetermined number of needles (A) of the needlebed, chosen according to a predetermined alternated sequence in at least a defined knit area of the needlebed, for a predetermined time interval;

producing, with the remaining working needles (A) of the needlebed and with a continuous motion of the needlebed, a first length of tubular knitted fabric (TM) including at least: a first portion, corresponding to said determined portion and to said defined knit area of the needle-bed, and having a differentiated growth of knitted courses with inner frills (Bi); and at least a remaining portion, corresponding to a remaining area of the needle-bed; said additional means (Y) for anatomically shaping and supporting being applied to said inner frills (Bi) of said first portion.

3. Method according to claim 2 characterised in that said predetermined number of needles (A) of the needle-bed are excluded progressively from the knitting process.

4. Method according to claims 2 or 3 characterised in that said step of producing said tubular knitted fabric (TM) further comprises the steps of reintroducing, after said predetermined time interval, said predetermined number of needles (A) of the needle-bed in the knitting process and producing a second length of tubular knitted fabric (TM).

5. Method according to claim 4 characterised in that said predetermined number of needles (A) of the needle-bed are reintroduced progressively in the knitting process.

6. Method according to any of claims from 2 to 5 characterised in that in said step of excluding from the knitting process a predetermined number of needles (A), the excluded needles (A) are chosen in at least two separated areas of said needle-bed, corresponding at least to a first and a second portion of the first length of tubular knitted fabric (TM), according to a predetermined sequence for each separate area of the needle-bed.

7. Method according to claim 2 characterised in that said steps of inactivating and excluding from the knitting process a predetermined number of needles (A) and producing a first length of tubular knitted fabric (TM) are carried out at the beginning and/or at the end of said step of producing said tubular knitted fabric (TM), to obtain welts (2, 3) with inner frills (Bi1, Bi2).

8. Method according to any of claims 2-8 characterised in that said additional means (Y) for anatomically shaping and supporting are introduced into said inner frills (Bi).

9. Method according any of claims from 1 to 8 for producing

knitted items (1) such as brassieres, bras, teddies, dresses, technical items and the like characterised in that it further comprises the steps of providing said items (1) with one or more structurally woven small textile tubes (Bi, Bi1, Bi2) and applying said additional means (Y) for anatomically shaping and supporting to said small textile tubes (Bi, Bi1, Bi2).

10. Method according to claim 9 characterised in that said small textile tubes (Bi, Bi1, Bi2) are automatically produced with groups of needles (A) variously alternated with disengaged needles (A), only with the cylinder needles (A), to produce inner frills (Bi) by a fixed selection of a part of the needles (A).

11. Method according to claim 9 characterised in that said continuous ring-shaped small knitted tubes (Bi) are produced by means of the dial additional jacks or needles, and also knitted to the ends or welts (2, 3) of the knitted item (1)..

12. Method according to claim 9 characterised in that said small knitted tubes (Bi, Bi1, Bi2), also partial, are produced only on the front part of the manufactured item (1), therefore with the additional and reduced use, preferably for about 180°, of the dial jacks or needles.

13. Method according to claim 9 characterised in that at least a part of said small knitted tubes (Bi, Bi1, Bi2) is produced with the cylinder needles (A) together with the dial needles or with the needles of another needle bed.

14. Method according to any of claims from 9 to 13 characterised in that said additional means (Y) for anatomical shaping and support comprise at least a wire (Y)

or other element of anatomic support and in that it further comprises the steps of introducing said wire (Y) into said small knitted tubes (Bi, Bi1, Bi2).

15. Method according to any of claims from 1 to 13 characterised in that said additional means (Y) for anatomic shaping and support comprise at least a wire (Y) or other element of anatomic support and in that it further comprises the steps of wrapping up said wire (Y) in a sheath (L) and fastening, preferably by sewing, said sheath (L) onto said determined portion of said knitted item (1).

16. Method according to claim 15 characterised in that said step of fastening said sheath (L) onto said knitted item (1) is carried out by fastening or sewing to the knitted tube, inside or outside, at least an edge or rim of said sheath (L), according to the fabric design or profile, i.e. according to guidelines obtained by planning and carrying out on the item (1) a suitable jacquard design or pattern related to colour and/or textile structure.

17. Method according to claim 15 characterised in that said step of fastening said sheath (L) wrapping said wire (Y) onto said knitted item (1) is carried out by fastening or knitting said sheath (L) onto said small knitted tubes (Bi, Bi1, Bi2) acting as guides and supports for said wire (Y).

18. Method according to any of claims from 1 to 17 characterised in that it further comprises the step of providing said manufactured items (1) with one or more zones of dimensionally more stable fabric next to said determined portion of said tubular knitted fabric (TM), so as to implement and co-ordinate the local support functions of said additional means (Y) with the general support functions of shoulder straps (SS, SD) of the knitted item

(1).

19. Equipment or means for shaping and anatomic support, such as a wire (Y) and the like, according to any of claims from 1 to 18 also characterised in that they are wrapped up in suitable sheaths (L) which can be fastened to the aforesaid manufactured items (1).

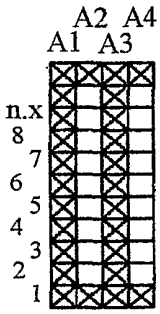



Fig. 1

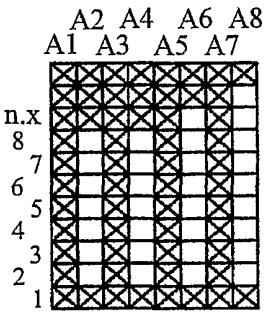



Fig. 2




Fig. 3A

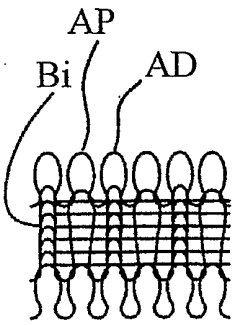



Fig. 3

Fig. 5

Fig. 6

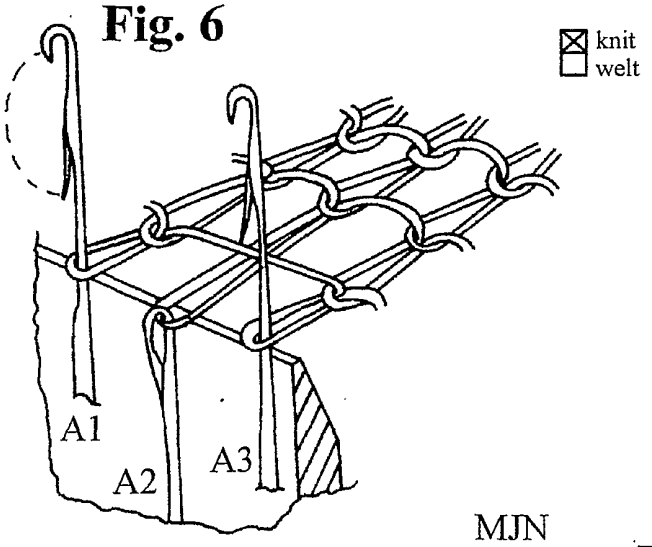



Fig. 4

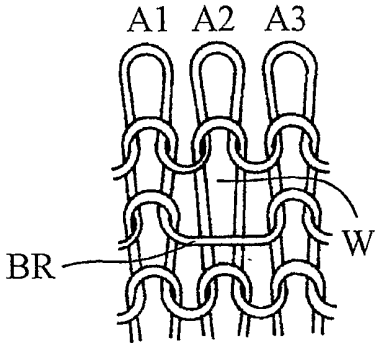



Fig. 7A

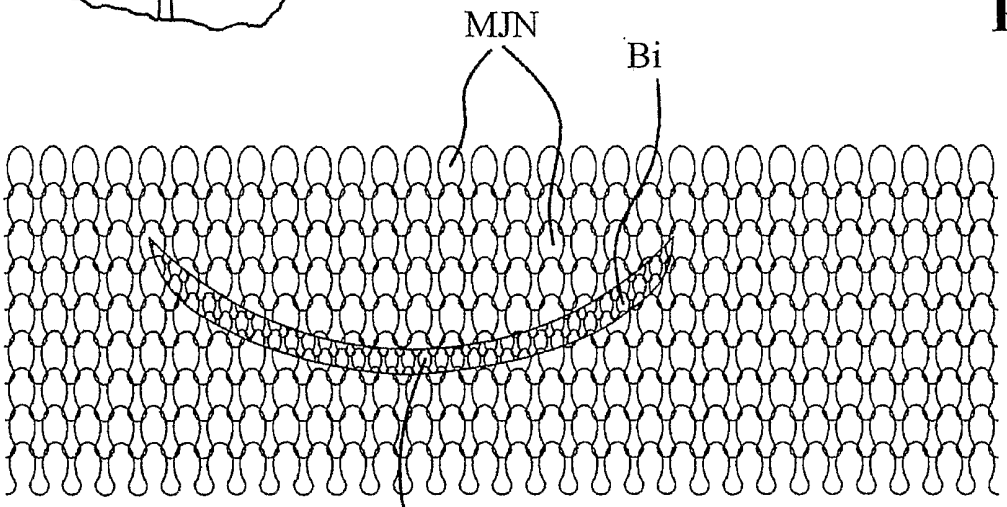
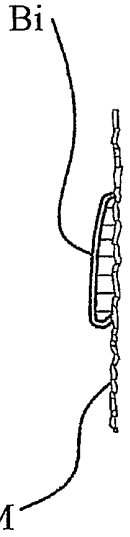



Fig. 7



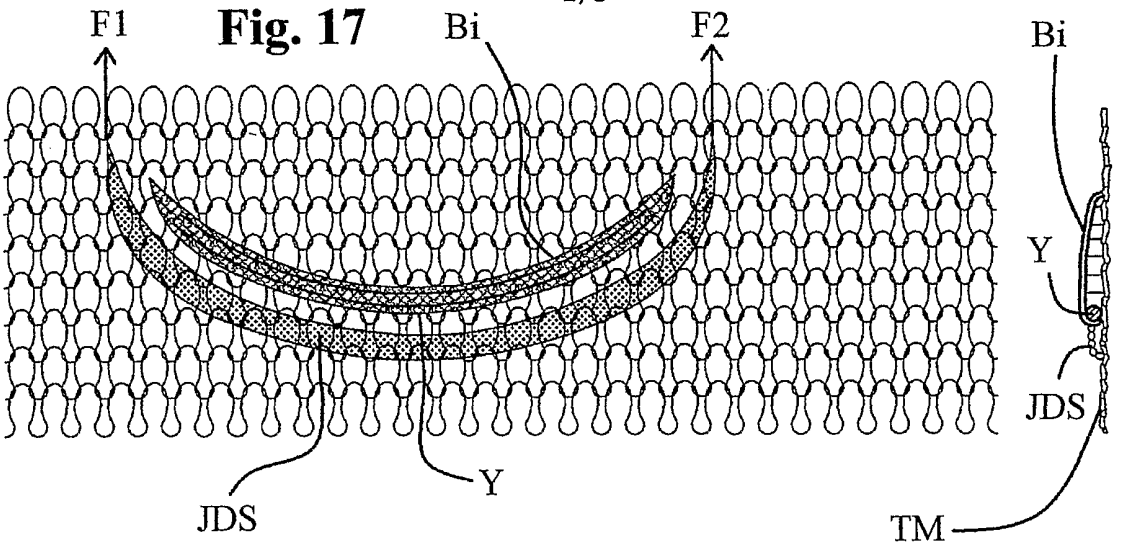



Fig. 17

Fig. 17A

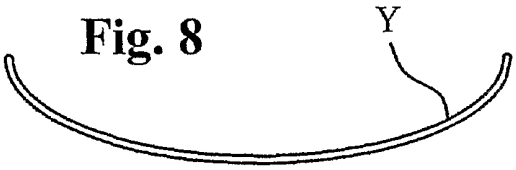



Fig. 8




Fig. 8A

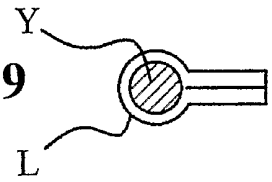



Fig. 9

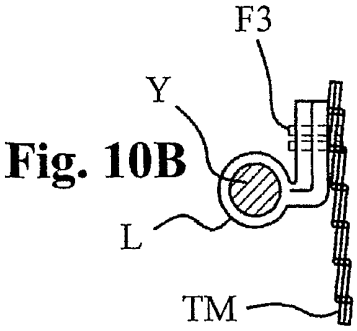



Fig. 10B

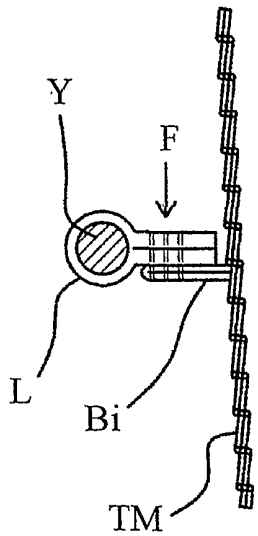



Fig. 10

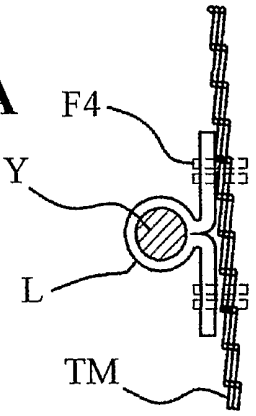



Fig. 10A

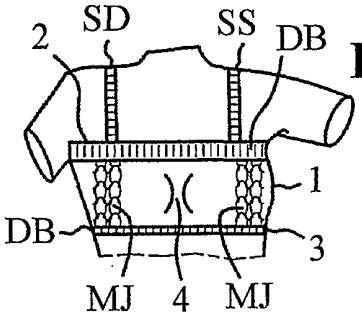



Fig. 11

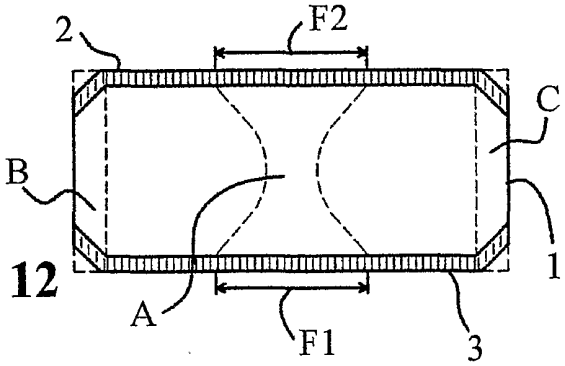



Fig. 12

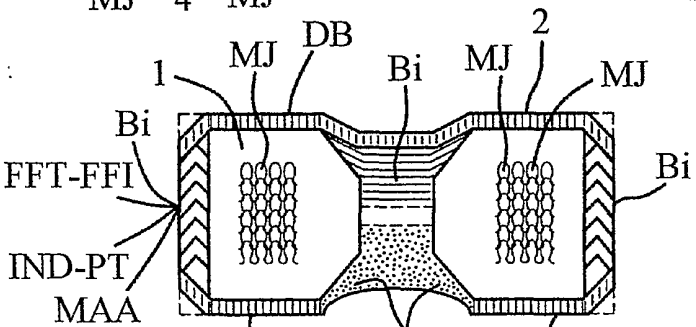



Fig. 13

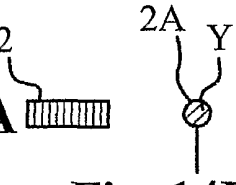



Fig. 14A

Fig. 14B

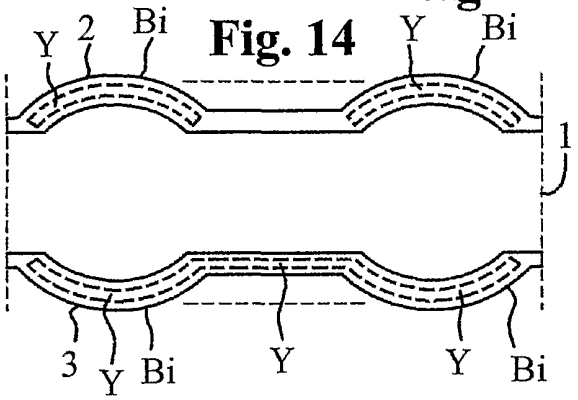



Fig. 14

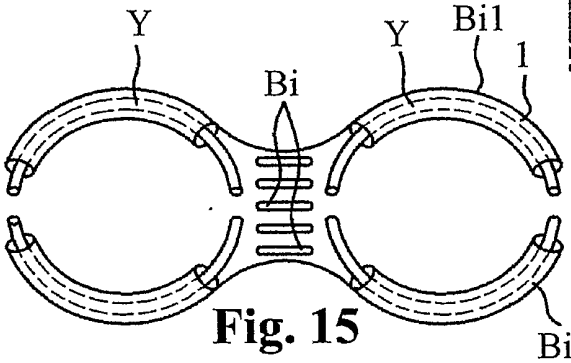



Fig. 15

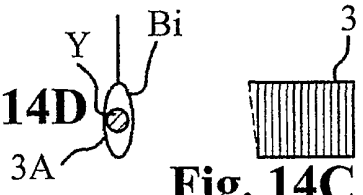



Fig. 14D

Fig. 14C

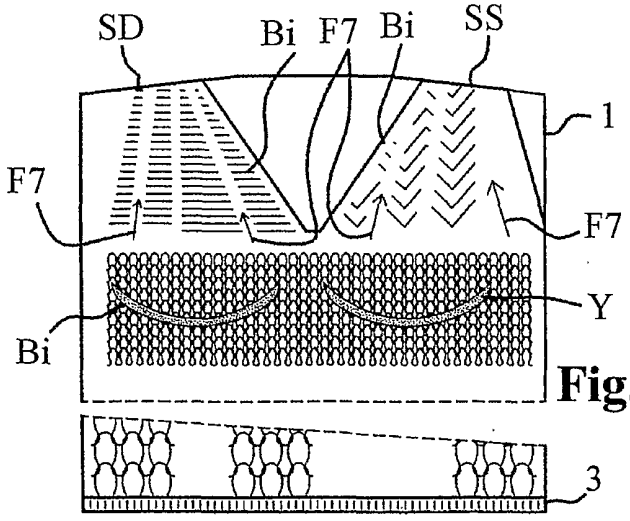



Fig. 16

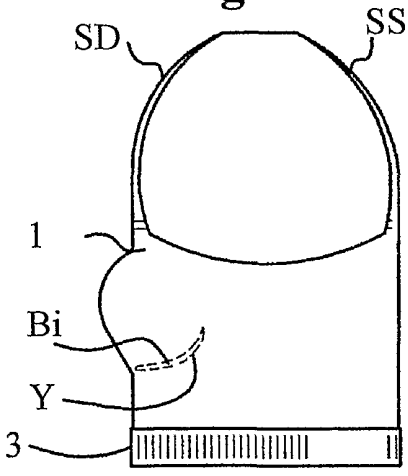



Fig. 18

# INTERNATIONAL SEARCH REPORT

Inter al Application No
PCT/IT 01/00335

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 terms 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 | Date of mailing of the international search report |
|---|---|
| 26 October 2001 | 05/11/2001 |

| Name and mailing address of the ISA | Authorized officer |
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| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Van Gelder, P |

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