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(54) **Protective headwear.**

(57) A hair net or similar head wear and method of manufacture thereof for use in manufacturing industries where hygiene and anti-contamination measures are required. The hair net includes a quantity of metallic fibre within the web of material used to manufacture the hair net of sufficient quantity to render the hair net metal detectable by metal detectors commonly installed, for example, in food production lines.

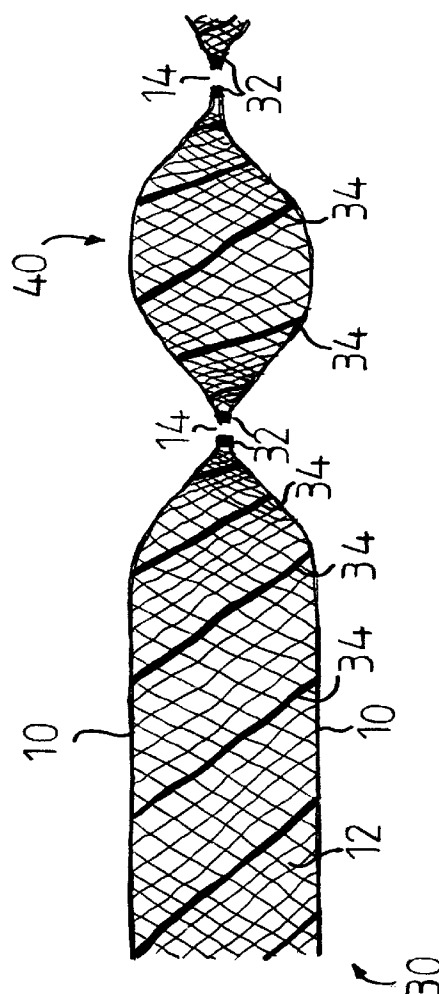


FIGURE 2

The present invention relates to protective headwear for use in food manufacturing, processing and preparation industries, and in particular to headwear incorporating features allowing for the detection thereof by means of metal detection systems.

It is now widespread practice in the food manufacturing industry to enforce the usage of protective garments by employees, generally designed to prevent unwanted contaminants from entering the food products. Specifically, hair nets and other similar head coverings are used in order to prevent hair and other contaminants from so contaminating the food products. Throughout the present specification, it is intended that the use of the term "hair net" also encompasses all other forms of such protective headwear.

Although throughout the present specification reference is made to the food manufacturing industry, it will be understood that the invention has utility in other environments such as the pharmaceutical industry.

An accepted and traditional method of manufacturing hair nets is to form the net by the use of metal staples at each end of a knitted fabric as will be described in more detail later. Such metal staples are widely considered to be unacceptable in the food manufacturing environment due to the risks associated with the entry of the metal staples into the food product, whether by accidental or deliberate detachment from the hair net. Hair nets manufactured without using metal staples are therefore preferred, and are usually offered with tied or knotted ends as an alternative to the staples.

However, it is also of concern that such hair nets, being small, lightweight and fairly insubstantial articles, should not also accidentally find their way unnoticed into the food product.

It is now widespread practice to monitor the food product on the production line, or at the end thereof by means of metal detection systems which are designed to suit a number of environments. The automatic metal detection systems available are, for example, designed to be able to detect metal objects passing thereby within food ingredients in powder, liquid and solid form at various stages of the manufacturing process, as well as within final packaged products.

It is therefore evident that hair nets manufactured without the use of metal staples, although solving the above identified problem, are disadvantageous, at least in that they may well remain largely undetected, and will certainly not be detectable with the metal detection systems now commonly installed in food processing plants.

It is therefore an object of the present invention to provide a hair net not incorporating metal staples, which is, however, still metal detectable.

It is a further object of the present invention to

provide a more expedient alternative to the present known manufacturing techniques for knitted hair nets avoiding the use of a knotting or stapling procedure while still rendering the hair net metal detectable.

According to one embodiment of the present invention there is provided a hair net formed from a woven or knitted fabric, and including one or more metallic fibres incorporated within said hair net in sufficient quantity to render said hair net metal detectable.

According to a further embodiment of the present invention there is provided a method of manufacturing a plurality of hair nets by knitting two continuous webs of material in overlying relationship, the webs of material including one or more metallic fibres and the webs being joined during the knitting process:

a) continuously along one longitudinal edge of each web, and

b) at regular predetermined intervals laterally across the webs using a dense knit pattern to form a closure portion.

According to a further embodiment of the present invention there is provided a method of manufacturing a hair net comprising the steps of:

a) substantially simultaneously knitting a first web and a second web of material in overlying relation to a first predetermined length, at least one web including one or more metallic fibres woven therein, and each web having two longitudinal edges: a first longitudinal edge of the first web and a first longitudinal edge of the second web being connected by the knitting operation; the second longitudinal edge of the first web substantially overlying the second longitudinal edge of the second web;

b) knitting the first web and the second web together laterally for a second predetermined length of web to form a closure portion; and

c) successively repeating steps a) and b).

Embodiments of the present invention will now be described in detail, by way of example, and with reference to the accompanying drawings in which:

Figure 1 shows a prior art hair net and its method of construction;

Figure 2 shows a hair net according to one embodiment of the present invention, and its method of construction;

Figure 3 shows a plan view of a plurality of hair nets being manufactured in accordance with a further embodiment of the present invention;

Figure 4 shows a cross-sectional end view through the line A-A on figure 3; and

Figure 5 shows a completed hair net manufactured in accordance with the embodiments of figures 3 and 4.

With reference to figure 1 there is shown a prior art hair net manufactured using metal staples. A long, continuous web of net material 5 incorporates a net

portion including web fibres 12 and two elasticated hems 10 which terminate the lateral edges of the web. The two elasticated hems 10 are brought together at binding portions 14, where two metal staples 16,18 may be applied around the binding portion 14 in order to bind the two elasticated hems 10 and all of the web fibres 12 in the net portion together. The web is then severed between the staples 16,18. Repetition of this operation further down the length of the web results in formation of a hair net 20.

As has been described above, the presence of the metal staples 16,18 is undesirable in the food manufacturing environment in that staples may become dislodged and accidentally or maliciously enter the food product.

Exemplary prior art techniques for providing the binding function without using metal staples include the use of two knots in the web 5 in place of the staples, fabric ties or, in the case of plastic based webbing material, heat welding the elasticated hems 10 and individual web fibres 12 together. As has been described, this results in the hair net being rendered non-detectable by metal detectors commonly installed in food manufacturing production lines.

Referring now to figure 2, there is shown a hair net according to a preferred embodiment of the present invention. A long, continuous web of net material 30 incorporates a net portion including web fibres 12 and two elasticated hems 10 which terminate the lateral edges of the web in similar manner to that of figure 1. The two elasticated hems 10 are brought together at binding portions 14, where the elasticated hems 10 and web fibres 12 are bound without using metal staples, for example by knots 32, or other suitable technique as already described with reference to figure 1. The web is severed between knots 32, resulting in formation of hair net 40.

The web fibres 12 are typically monofilament plastic threads such as nylon or polyester. Elasticated threads are inserted to create the elasticated hems 10. The web of net material incorporates at regular intervals metallic fibres 34 which, for clarity, are shown in the drawing thicker than the plastic web fibres 12. The metallic fibre 34 is, however, any suitable gauge fibre. The metallic fibre 34 may be a textile yarn containing a certain percentage of stainless steel fibre or other suitable metallic compound, and such yarns are readily available in various types to suit incorporation with the web fibres 12. Alternatively, 100% metal filaments may be used as the metallic fibre. Such filaments or fibres are readily available for use in the manufacture of carpets having antistatic properties, and examples are Bekitex yarn types H54, BK50, or Bekinox VN continuous filament yarns (Bekitex and Bekinox are Registered Trade Marks).

The spacing of the metallic fibres 34 in the web material is arranged such that sufficient metal is incorporated within a single hair net 40 to be detectable

by a metal detection system as commonly installed in a food production line.

The exact spacing of fibres will therefore depend upon a number of factors including: a) the quantity of web material 30 used to make a single hair net 40; b) the quantity of metal in each metallic fibre 34; and c) the sensitivity of the individual metal detection systems being used to the particular metallic fibre being incorporated into the hair net.

Metal detection systems depend upon the type and size of product. They are designed to detect over certain distances. Thus for larger objects, such as loaves of bread, more metal may be required to compensate for the distance or cross-sectional area over which the detection system must operate. For smaller objects, such as chocolate bars, the detector can operate over much smaller distances, or cross-sectional areas, and thus smaller quantities of metal area required.

Thus the quantity of metallic fibre which must be woven into the hair net is determined empirically with regard to the sensitivity of the detector, and the distance over which it must operate. Allowance must also be made for the likelihood that a hair net will be fragmented by the processing equipment through which it has travelled. The quantity of metallic fibre used should also reflect the extent to which this fragmentation is likely to occur and its effect upon the detectability.

It is also possible to incorporate the metallic fibre in the elasticated hem 10 of the hair net, rather than within the net portion of the web 30.

It will be evident from the foregoing description that the present invention may also be applied to head wear having a close mesh fabric in place of the net material, such as uni-caps or mob-caps.

An alternative technique for the manufacture of hair nets according to the present invention, which obviates the necessity for tying, knotting or otherwise binding the nets at binding portions 14 will now be described. This considerably simplifies the manufacturing process by the elimination of the binding step.

The continuous web of knitted net material 5 as described with reference to figure 1 is typically manufactured using a warp knitting Raschel machine with a single needle bar in conjunction with two or more guide bars.

As has been described above, the operation of stapling or tying the web material, together with the severing of the web must be carried out, increasing the complexity of the operation.

Referring now to figures 3 and 4, there is shown a continuous web 30 for the manufacture of a hair net. A warp knitting machine, such as a Raschel machine, is used with a two needle bar rather than the single needle bar machine used in the manufacture of the prior art hair nets described with reference to figure 1. Instead of a single web 5 of, for example, thirty cen-

timetres width being knitted, two webs 132,134 of, for example, approximately fifteen centimetres width are knitted simultaneously using the two needle bar facility. It will be understood that the width of the knitted fabric will be adjustable to suit the particular application.

The mechanism of the machine is set such that the two webs 132,134 are knitted together at one longitudinal edge 136 to form a join connecting the two webs 132,134 thereby forming the single web 130. The other two longitudinal edges 140,142 of the webs 132,134 have thin covered rubber or elastic threads 143 of known type included within the webs. The longitudinal edges 140,142 are not mutually joined unlike the edge 136.

In the same manner as the embodiment of the present invention described with reference to figure 2, the knitted webs 132,134 include, at appropriate intervals, metallic fibres (not shown in figure 3). The metallic fibres may be a textile yarn containing a certain percentage of stainless steel fibre or other suitable metallic compound, or 100% metallic filaments, both of which have been previously described with reference to figure 2.

At a predetermined length of knitting "B" (figure 3), the mechanism of the machine is so set as to form a lateral closure in the manner described below.

The two webs 132,134 being knitted independently, though joined on one longitudinal edge 136 of each, are then joined together laterally using a dense knitted lateral course by the set construction of the machine at a predetermined distance down the lengths of the webs. The two longitudinal edges 140,142 containing the elastic threads are thus enclosed in the dense knitted course. The dense knitted course forms a lateral closure construction 144 which continues down the length of the webs 132,134 for a distance "C" of, for example, five to seven millimetres, thereby firmly anchoring the elastic threads within the lateral closure construction.

When the continuous web 130 is removed from the machine, the web is then cut laterally along the knitted lateral closure construction 144 (ie. across the web within the length defined as "C"). No tying, knotting, stapling or other form of closure of the lateral edges produced by the lateral cutting operation is necessary.

With reference to figure 5, the final form of a hair net 150 is shown. The net may be likened to an envelope-type structure with the an opening in the left hand side formed by the two elasticated edges 140,142.

In an alternative embodiment, the hair net may incorporate an elastane fibre yarn such as "Lycra" (a DuPont trade mark). Such a yarn may form part of the knitted construction at the longitudinal edges 140,142, replacing the thin covered rubber threads.

Claims

1. A hair net formed from a woven or knitted fabric, and including one or more metallic fibres incorporated within said hair net in sufficient quantity to render said hair net metal detectable.
2. A hair net according to claim 1 wherein said woven or knitted fabric from which said hair net is manufactured includes at regular intervals therein said metallic fibres.
3. A hair net according to claim 1 or claim 2 wherein said metallic fibre is a metallised fibre yarn.
4. A hair net according to claim 1 or claim 2 wherein said metallic fibre is a monofilament metal thread.
5. A hair net according to claim 1 wherein said metallic fibre is incorporated into a hem of said woven or knitted fabric.
6. A method of manufacturing a metal-detectable hair net from a woven or knitted fabric including the steps of:
 - weaving into said woven or knitted fabric at intervals therein metallic fibres; and
 - forming said knitted fabric into a hair net, wherein said metallic fibres in said formed hair net are in sufficient quantity to render said hair net metal detectable.

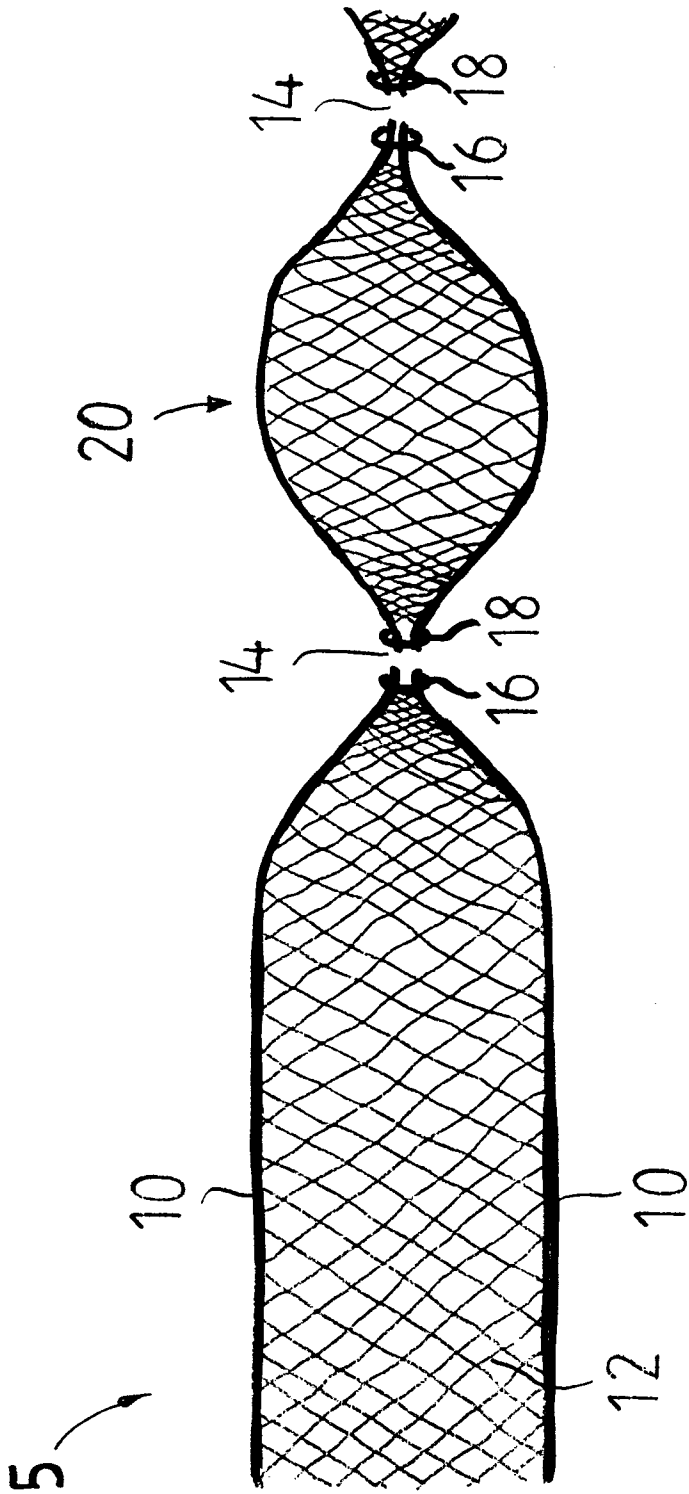


FIGURE 1

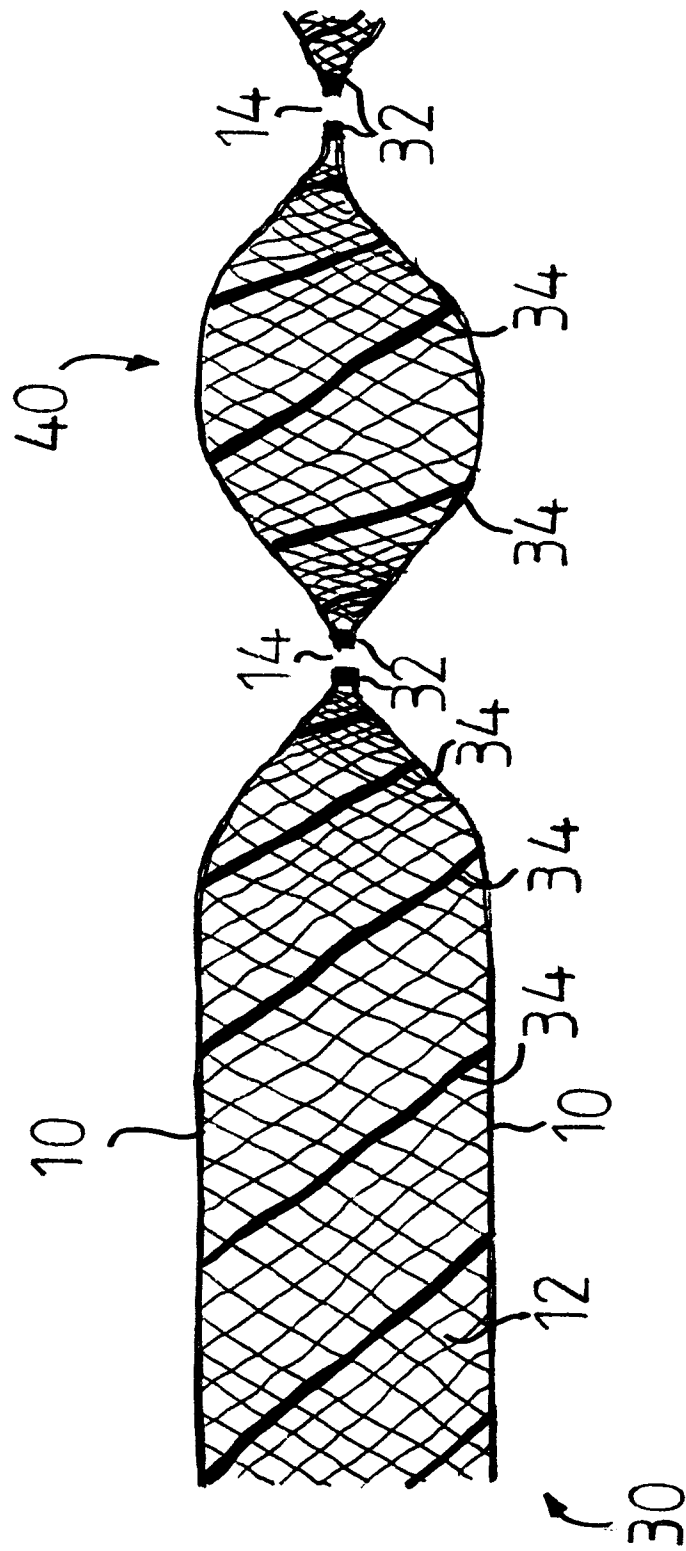
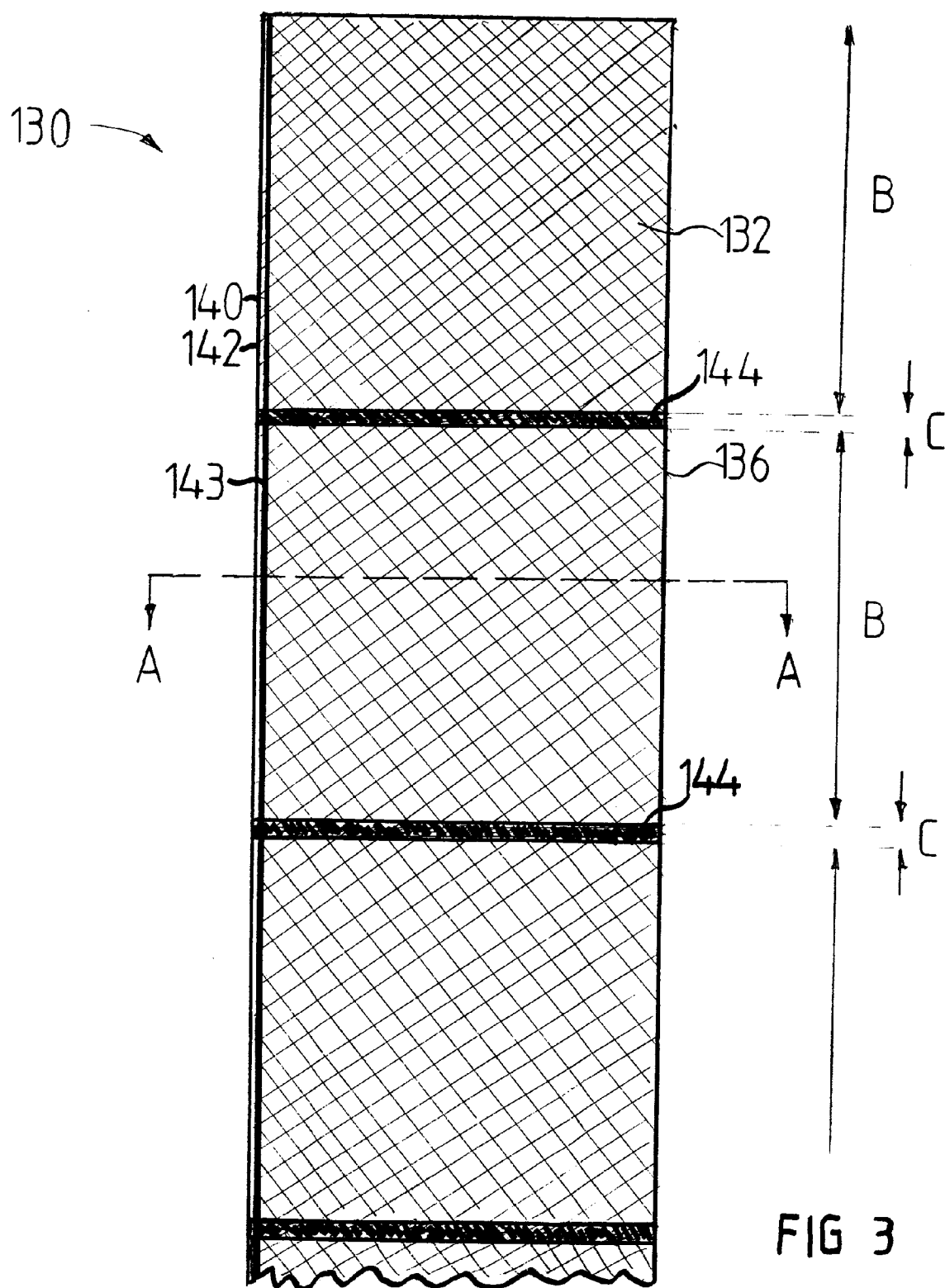


FIGURE 2



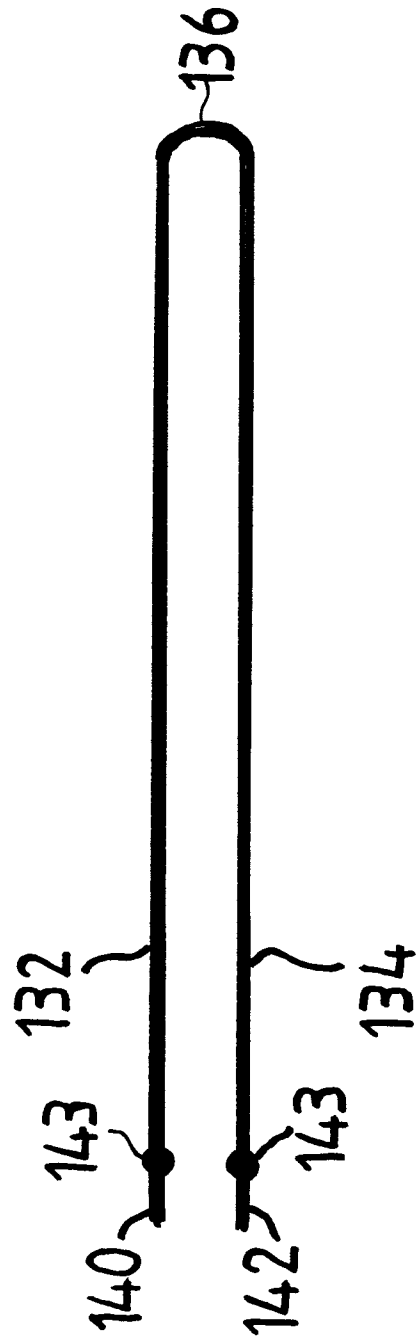


FIGURE 4

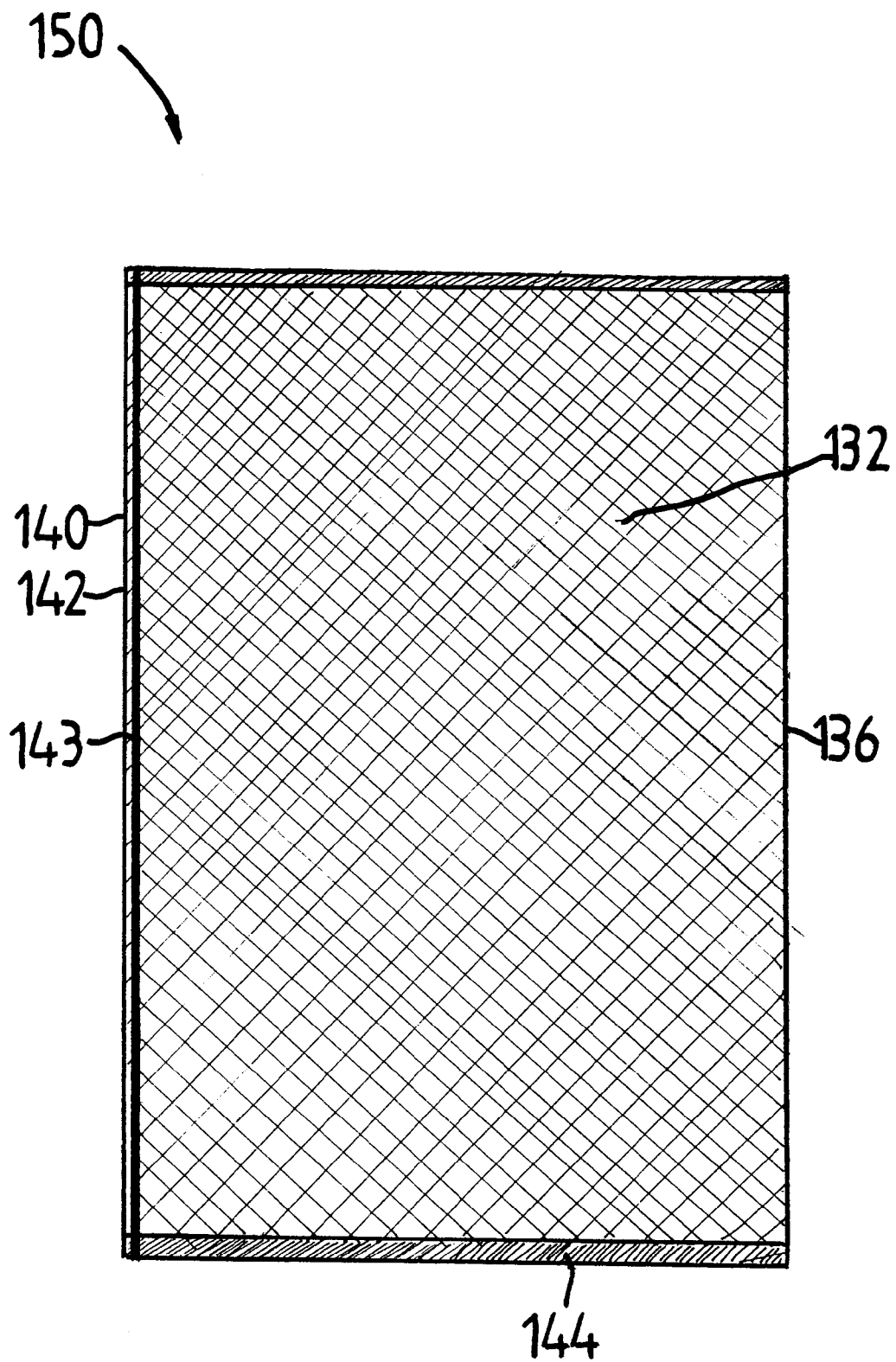


FIGURE 5