United States Patent

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[54] **PROSTHETIC ARTICLE OF APPAREL FOR TRACHEOTOMY PATIENTS**
4 Claims, 4 Drawing Figs.

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[51] Int. Cl. A62b 23/00
[50] Field of Search 128/146.2, 351, 140, 142.5, 142.6

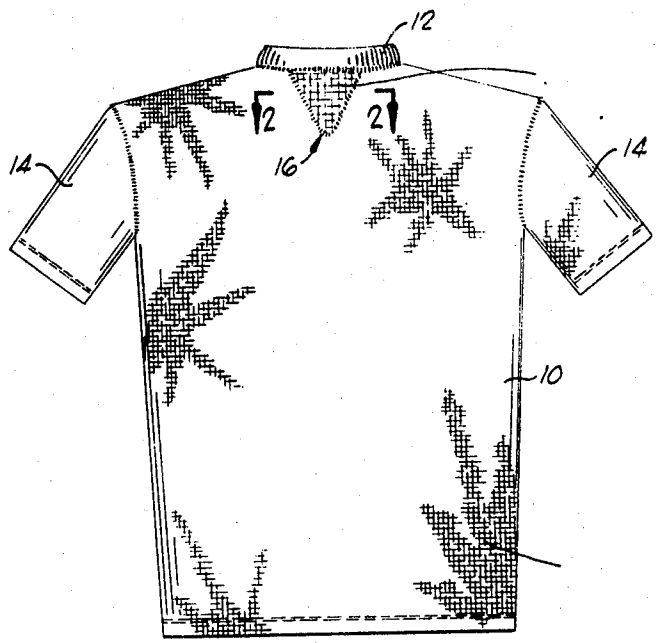
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ABSTRACT: An article of apparel for tracheotomy patients which includes an undershirt type garment having an elastic neckband, and having disposed in juxtaposition to the neckband, a filter section of interwoven hydrophobic synthetic fibers. The filter section of synthetic fibers which is positioned adjacent the neckband is centered in the garment so as to occupy a position directly over the surgical opening in the neck of the tracheotomy patient when the garment is worn. The hydrophobic fibers which are used in the filter section of the garment are preferably constructed of a synthetic resin which is at least as hydrophobic as nylon, and thus does not undergo any substantial swelling or entrapment of moisture so as to obstruct or impair the inhalation and exhalation of air from the lungs of the tracheotomy patient through the filter section of the garment.



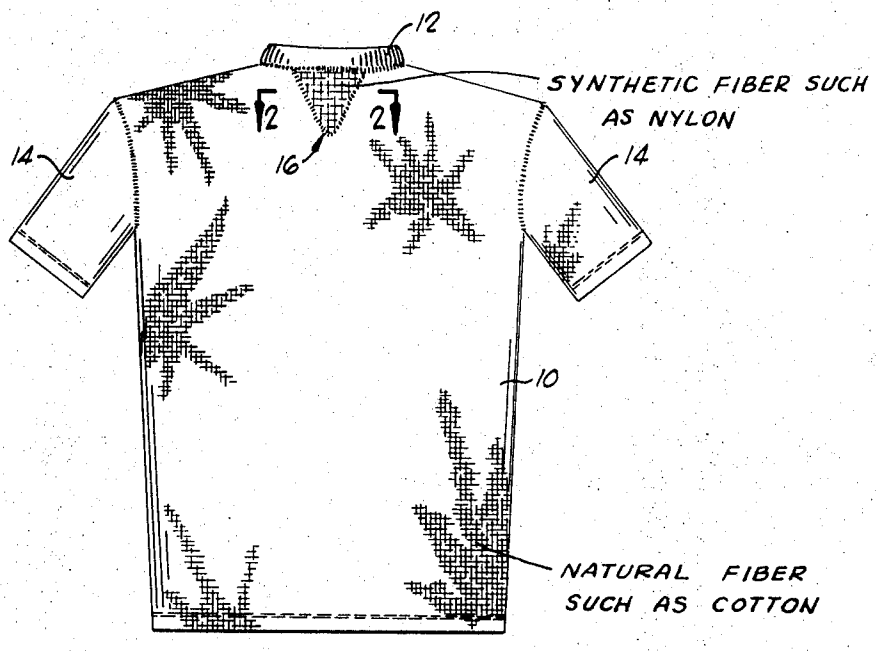


Fig. 1

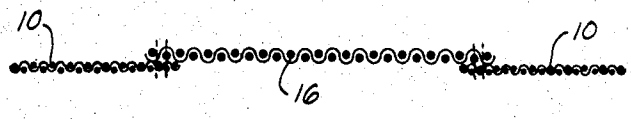


Fig. 2

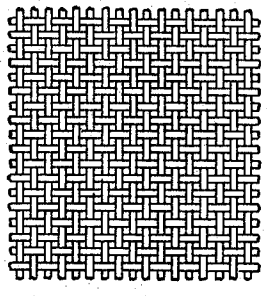


Fig. 3

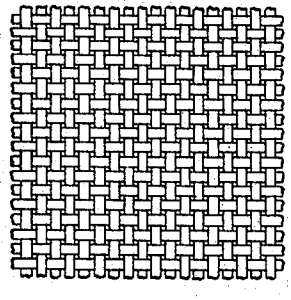


Fig. 4

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PROSTHETIC ARTICLE OF APPAREL FOR TRACHEOTOMY PATIENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates broadly to prosthetic devices and, more particularly, to devices which are utilized in place of or in partial substitution for the larynx and trachea of tracheotomy patients. More specifically, the present invention relates to an article of apparel which includes as a portion thereof, a filtering device which can be utilized to filter air inhaled and exhaled by a person who has had the larynx removed from the throat, and who accomplishes the breathing function by expelling air through an opening formed in the throat and trachea, rather than through the mouth.

2. Brief Description of the Prior Art

A number of devices have been proposed for assisting those who have undergone surgery for the removal of the larynx to permit such persons to accomplish the breathing and talking functions with a minimum of difficulty. In the case of those devices which have been contrived to provide a filtering function to assure that clean air is inhaled, a number of such devices have been proposed and variously take the form of masks which can be secured around the neck of the patient and filtering devices which include rigid screens and the like which are inserted in the opening in the neck. In the case of those devices which have been placed in the neck of the patient, irritation of the tissues around the surgical opening in the throat frequently develops from such use, and installation and removal of such devices is also frequently troublesome. Cloth type filtering devices or masks which have been secured around the neck in bib fashion are also less than optimum in utilization in that they are frequently unsightly, and are subject to choking or clogging by dust, and by moisture vapor exhaled with the breath of the patient.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

The present invention provides a prosthetic device for use by tracheotomy patients which dually functions as an article of apparel. Broadly described, the invention comprises a shirt-like undergarment to be worn over the torso by the user, and may be of sleeveless form, or of a type which has relatively short sleeves. The garment is especially made and adapted for use by tracheotomy patients, although it is not limited thereto, and includes an elastic neckband which is dimensioned and adapted to retain the neck portion of the garment in close fitting relation to the neck of the patient at all times over an extended period of wear and utilization.

Positioned immediately below the neckband and toward the center of the front of the garment is a filter section which, in a preferred embodiment of the invention, is of generally V-shaped or triangular configuration. The filter section, as contrasted with the remainder of the garment, is constructed of a mesh or grid of artificial, hydrophobic fibers which demonstrate little or no propensity to entrap or retain moisture, and which do not swell or become enlarged in diameter upon the passage of moisture therethrough, and particularly when moisture tends to condense on the fibers as a result of the wear of the garment by the patient during cold weather. I have found that when wool, cotton, silk or other natural fibers that are commonly used in the manufacture of clothing are employed in the article of apparel at the point where such fibers are contacted by the air inhaled and exhaled by the tracheotomy patient, such fibers, particularly in cold weather, tend to become swollen and/or clogged by the entrapment or condensation of moisture thereon with the result that free breathing by the patient is impeded and an inadequate supply of air can be drawn through the undergarment during inhalation. On the other hand, I have determined that synthetic fibers having an affinity for moisture which is no greater than that of nylon, and including such synthetic fibers as polyesters and polyolefinic materials do not swell appreciably in the presence of moisture, and the spaces or pores between the fibers do not become clogged or blocked to the extent that breathing is impaired.

From the foregoing description of the invention, it will have become apparent that the present invention provides an improved combination prosthetic-apparel article of manufacture for tracheotomy patients which can be usefully employed to provide a dust and deleterious material shield for the opening through the throat of the patient, and yet can be relied upon to provide free passage of air through the article of apparel over extended periods of time.

A more specific object of the invention is to provide a mask or shield for emplacement over the opening in the throat of a tracheotomy patient to filter air passing to and from the lungs of the tracheotomy patient, which mask or shield will not become obstructed as a result of contact with water vapor of the fibers of which the mask or shield is made.

A further object of the invention is to provide an aesthetically attractive undergarment which may be worn by a tracheotomy patient, and which functions to filter air inhaled and exhaled by the tracheotomy patient without any impairment to the flow of air resulting from stoppage or blockage of the pores or openings through the undergarment.

A further object of the invention is to provide an undergarment which may be particularly helpfully worn by tracheotomy patients, and which can be manufactured relatively inexpensively, and yet is characterized in having a long and durable service life.

In addition to the foregoing described objects and advantages, additional objects and advantages will become apparent from the following detailed description of the invention when such description is read in conjunction with the accompanying drawings which illustrate the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation view of a garment constructed in accordance with the present invention.

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a schematic view of cotton fibers woven in a plain weave customary in many articles of apparel, and prior to the time that the cotton fiber is exposed to passage therethrough of relatively cold, moisture laden air.

FIG. 4 is a view similar to FIG. 3, but illustrating the cotton warp and woof fibers shown in FIG. 3 after they have been exposed to passage through the plain woven fibers of air having entrained therein a substantial amount of moisture.

DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

Referring initially to FIG. 1 of the drawings, the combination garment-prosthetic device of the invention includes an undergarment having a torso portion 10 which is open at the bottom. The torso portion 10 has a front and a back, and has a small opening at the top for the neck as in the conventional construction of an undershirt or similar article of apparel. The torso portion 10 is preferably made of cotton or other natural fiber.

Surrounding the opening at the neck of the torso portion 10 is a neckband 12 which extends vertically upwardly from the opening in the torso portion 10, and includes an elastomeric material such as rubber filaments or the like for a purpose hereinafter to be described. The neckband 12 is preferably made of a knitted material which is doubled or folded back upon itself to form a channel. A removable band of elastic material is then placed in this channel, and can be replaced from time to time to assure continued resiliency and long service life. The size of the small opening through the upper end of the torso portion 10, and the diameter of the neckband 12 are such that, in the unstressed or relaxed status of the material of which the garment is made, the opening is adapted to closely surround, and the neckband to fit snugly against, the neck of the wearer. In the embodiment of the invention illustrated in FIG. 1, the prosthetic article of apparel of the inven-

tion includes a pair of sleeves **14** which are secured to the torso portion **10** of the article of apparel. It should be noted, however, that the garment may also be made sleeveless, and that the sleeves are an optional feature of the invention, and are in no way critical to its proper functioning.

Adjacent and immediately beneath the central portion of the neckband **12** of the garment, and on the front side of the torso portion **10**, is a filter or shield section, designated generally by reference numeral **16**. In the illustrated embodiment, the filter section **16** is of generally triangular configuration, but it should be pointed out that various other shapes of filter sections can be provided in the article of apparel if desired. The filter section **16** is made by interweaving with a relatively loose weave (low yarn count), a plurality of fibers constructed of a synthetic material such as nylon or polyester, with such synthetic fibers having a hydrophobic or hygroscopic characteristic which is at least as water repellent as that of nylon, and which is no more susceptible to swelling in the presence of water than nylon. Many synthetic fibers are less sensitive to moisture, and less retentive of moisture, than is nylon. Nylon, however, demonstrates much less water absorptivity than the natural fibers such as cotton, wool, silk, and linen and therefore provides a novel function in the filter section **16** which enables it to serve effectively as an air passageway in the manner hereinafter described. It is generally accepted in the art that nylon will contain between about 4 and 5 weight percent moisture at 70°F. and 65 relative humidity. The fibers of the filter section should therefore contain a moisture content of less than 5 weight percent under the same conditions. This necessarily excludes cotton, wool, silk, linen and rayon from the group of textile materials suitable for use in the filter section.

The effective porosity of the filter section **16**, will, of course, be determined by the tightness of weave of the fibers provided therein and the presence of any obstructing moisture in the pores. It is essential that sufficient porosity be provided in the filter section **16** to permit the free passage of air therethrough, and yet to provide good filtering action for the removal of coarse particles of dust and other deleterious materials from the air as it is inhaled through the filter section. To this end it is desirable that the yarn count and denier of the fibers in the filter section be such that at 70°F. and 65 relative humidity, the average spacing of adjacent fibers in said filter section is from about 0.1 mil to about 100 mils.

Many tracheotomy patients are engaged in occupations which require them to work out-of-doors for at least a substantial portion of their total period of employment. Where a filtering device is employed which is made of rayon or a natural fiber, such as cotton or wool, a tendency has been observed to exist in such material to swell and to occlude or entrap moisture on occasions when the ambient temperature is low. As a result of the condensation of moisture on the natural fibers, these fibers have a tendency to become choked, and also to swell considerably in the presence of moisture. The result is that the filter devices which have been employed, and which utilize natural fibers in their construction, tend to afford inadequate circulation of air through the material so that the patient cannot inhale and exhale freely. Another problem which has existed with many of such filters is their tendency to become displaced from, or dislocated with respect to, the opening through the throat of a tracheotomy patient so that no filtering action is actually accomplished by the device, but the air is actually inhaled and exhaled directly through the opening in the throat.

I have now determined that by the use of certain synthetic fiber materials which are generally at least as hydrophobic as nylon in their affinity for, and reaction with water, a filtering action can be obtained which obviates the difficulty experienced in trying to breathe through filter devices made of woven natural fibers on occasions when the ambient temperature is quite cold. The precise mechanical explanation for the improvement realized with synthetic fibers of the type described is not thoroughly understood by me, and may be due to entrapment of moisture by the natural fibers to a degree not exhibited by the artificial fibers or, on the other hand, may be due to the propensity of the natural fibers to swell in the presence of water to an extent not characteristic of synthetic fibers, or perhaps both of these mechanisms are accountable for the blockage or interruption of air flow which has been perceived to occur. In any event, it has been my observation that some swelling of cotton fibers in the presence of moisture does result, and the effect of such swelling can be perceived in referring to FIGS. **3** and **4** in which a plain weave cotton fabric as it appears under magnification in FIG. **3** is shown to have relatively large sized openings or pores therethrough, as contrasted with the same fabric following the application of water to the fabric and the resulting swelling of the fibers as shown in FIG. **4**.

Although nylon filaments or fibers are the preferred material of construction from which the filter section **16** of the garment of the present invention is made, its preference is based mainly upon its durability, ease of cleaning and other properties, in addition to the relatively hydrophobic character of the nylon as contrasted with natural fibers. Other synthetic fibers can, however, be used and, in fact, many of them are even more hydrophobic than nylon. Examples of other synthetic fibers or filaments which can be employed are polyester materials, such as Dacron, Terylene, Vycron and Fortrel, polyolefin materials such as polyethylene and polypropylene, and acrylic fibers such as Orlon and Acrilan.

The neckband **12**, containing the elastic material to retain the neckband closely around the neck of the wearer, functions conjunctively with the remainder of the garment and with the filter section **16** to assure that the filter section will always be retained precisely over the opening in the throat. The neckband **12** further assures that the front or vest portion of the garment will not commence to sag after extended periods of usage, and that the filter section **16** will always be retained relatively high up on the chest or neck of the user, and will thus cover the opening in the neck of the tracheotomy patient. To assure adequate coverage of the surgical opening in the throat, the filter section preferably has an area of at least 4 square inches.

From the foregoing description of the invention, it will have become apparent that the present invention provides a relatively economically constructed yet highly useful article of apparel which may be beneficially worn by tracheotomy patients. The undergarment which is proposed by the invention is especially useful for out-of-doors wear on cold days, and the filtering action which is provided by the filter section **16** continues to be efficiently performed by this section of the garment despite sharp changes in the ambient temperature around the wearer, and despite the presence of high humidity in the atmosphere. The garment can be washed and reworn a number of times without encountering the problem of the filter section **16** becoming dislocated with respect to the surgical opening through the throat of the user during wear.

Although certain preferred embodiments of the invention have been herein described in order to provide an example of the manner in which the invention is to be practiced, certain modifications and changes can be made in the described and illustrated structure without departure from the basic principles which underlie the invention. All such changes and modifications are deemed to be circumscribed by the spirit and scope of the invention except as the same may be necessarily limited by the appended claims or reasonable equivalents thereof.

I claim:

1. A prosthetic article of apparel comprising:

(a torso covering portion fabricated of natural fibers) a portion comprised of natural fibers and being of a size and shape to cover substantially all of the upper torso portion of a user and having a front, a back, an open bottom, a neck opening, and a pair of sleeve openings;

an elastic neckband surrounding and extending upwardly from said neck opening; and

a filter section positioned in said portion and adjacent said neckband and comprising a plurality of interwoven artificial fibers having a moisture content at 70°F. and 65 relative humidity of less than 5 weight percent, said filter section having an area of at least 4 square inches, and said interwoven fibers having a yarn count and denier such that, at 70°F. and 65 relative humidity, the average spacing of adjacent fibers in said filter section is from 0.1 mil to about 100 mils.

2. A prosthetic article of apparel as defined in claim 1 wherein said filter section is of generally V-shaped configuration and is sewn into the front of said torso covering portion immediately below said neckband.

3. A prosthetic article of apparel as defined in claim 1 wherein each of said interwoven artificial fibers is a nylon chiffon material.

4. An article of manufacture comprising a prosthetic article of apparel to be worn on the torso and upper body portion of the user, said prosthetic article of apparel comprising:

(a torso covering portion of natural fibers) a portion comprised of natural fibers being of a size and shape to cover substantially all of the upper torso portion of a user and

having sleeve openings on the opposite sides thereof, a waist opening at the lower side thereof and a neck opening at the upper side thereof between said sleeve openings;

a filter section positioned in said (torso) portion comprised of natural fibers immediately adjacent said neck opening and centered between said sleeve openings on the front of said (torso) portion comprised of natural fibers whereby said filter section is adapted to be positioned over the opening in the throat of a tracheotomy patient wearing the article of apparel, said filter section comprising a plurality of interwoven synthetic fibers which are at least as hydrophobic as nylon, and which are spaced from each other by an average distance of from about 0.1 mil to about 100 mils to permit normal respiratory inhalation and exhalation of air therethrough;

a resilient annular neckband having a lower edge secured to said (torso) portion comprised of natural fibers around the neck opening at the top of said (torso) portion and surrounding said neck opening, said neckband extending upwardly from said filter section.