

[54] FOOTWEAR

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[63] Continuation of Ser. No. 140,255, May 4, 1971, abandoned.

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[58] Field of Search 36/43, 44

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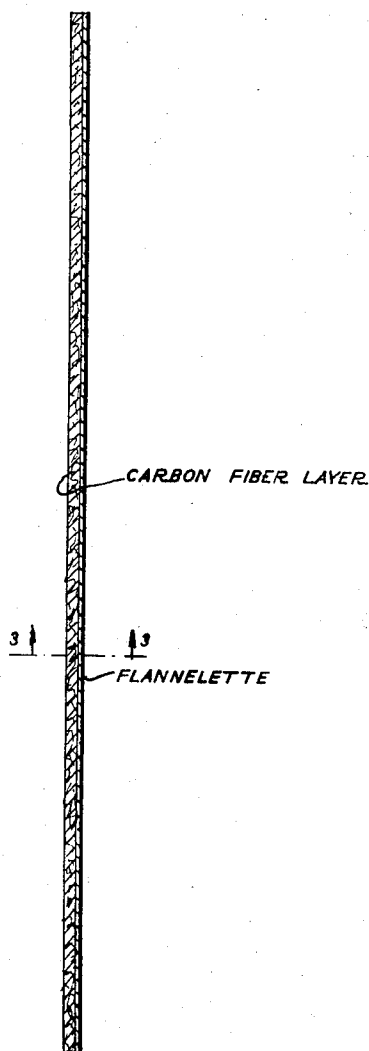
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[57]

ABSTRACT

The present invention provides a shoe insock especially for use by people whose feet excessively perspire and/or are unduly odorous, said insock comprising a fibrous web or mat loaded with active carbon and a binder, the binder being disposed predominantly at and adjacent to the surfaces of the web or mat.

14 Claims, 4 Drawing Figures



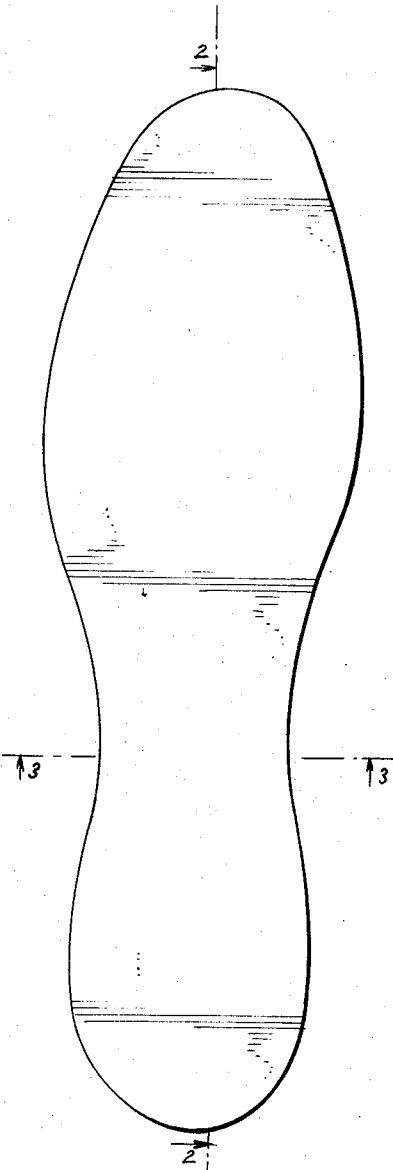


FIG-1

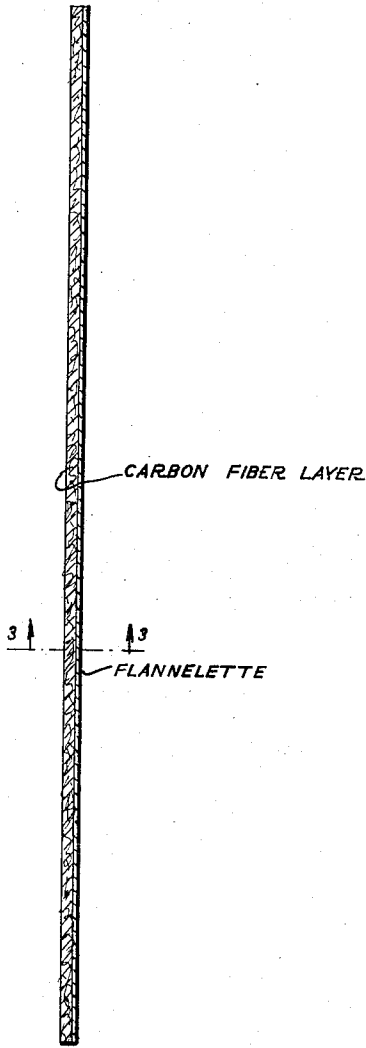


FIG-2

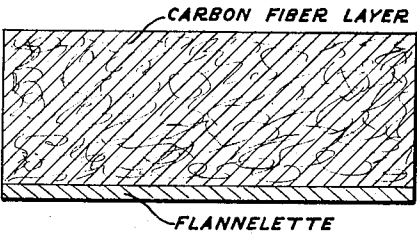


FIG-3

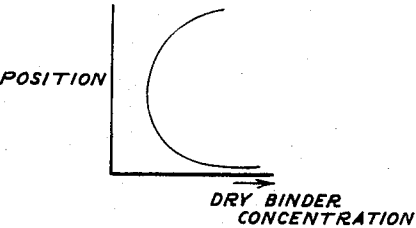


FIG-3A

FOOTWEAR

The present invention relates to insocks for foot-wear and in particular to such an insock which may reduce odours which sometimes occur due to feet sweating or perspiring. This application is a continuation in part of application Ser. No. 140,255 filed on May 4, 1971, now abandoned.

It is a particular object of the present invention to provide such insocks which have good surface abrasion resistance whilst retaining a high absorption potential for odours. It is a further object to provide insocks which do not disintegrate readily during wear.

According to the present invention these objects are achieved by providing an insock for insertion into the shoe, said insock comprising a fibrous web or mat loaded with active carbon and a binder, the binder being disposed predominantly at and adjacent to the surfaces of the web or mat.

The invention will be better understood by reference to the drawings wherein:

FIG. 1 is a plan view of an insock according to the invention.

FIG. 2 is a section of the plan view of FIG. 1 taken at 2—2.

FIG. 3 is another sectional view of the insock and FIG. 3A is a graph of cross-sectional position of the insock versus dry binder concentration.

It is preferred that the insock is of such a shape that it is able to cover substantially all of the area of inner sole of the shoe and a plan view of such an insock is shown in FIG. 1.

The fibers may be natural or synthetic and are preferably wood fibers.

It is preferred that the web or mat be supported by a backing material. The backing material may be, for example, paper; a cloth obtained from natural sources, e.g., a cotton scrim, flannelette or swansdown; or a synthetic material such as nylon. In the cross-sectional view of FIG. 2 a layer of flannelette is illustrated being adhered to the carbon/fibre layer.

The backing material may have one or two "fluffy" surfaces, and preferably at least one and this arranged so as to be in contact with the fibrous web. The fibres of the fluffy surface intertwine with the web material thereby aiding the bonding of the backing material to the web substantially.

The insock may also have a layer of foam e.g. polyurethane foam, attached thereto. The foam gives increased strength and a pleasant "spring" in the step of the wearer.

The insock material can be of any desired thickness but preferably has a total thickness of from about 30 to 100 thousands of an inch, (about 0.75 mm to 2.5 mm.).

In a preferred embodiment the web comprises 20 to 65 percent by weight based on the air dry loaded web, of active carbon.

The binder material may be any of the types known in the art provided it is compatible with the materials constituting the web and any backing material. Preferred binders include natural and synthetic latices especially acrylic and acrylonitrile butadiene latices.

It is preferable to use from 10 to 30 percent by weight of binder, based on the air dry loaded web. These amounts have been found to give satisfactory abrasion resistance at the surface without significantly decreasing the absorption potential of the loaded web.

In an especially preferred embodiment therefore, there is provided an insock comprising a backing material to which is affixed a fibrous web loaded with 20 to 65 percent of active carbon and 10 to 30 percent of a binder material, these percentages being by weight based on the air dry loaded web.

If the amount of binder used is much above 30 percent by weight then the concentration of binder at and adjacent the surface of the mat will reach levels at which the absorption potential of the web is significantly affected. Preferably the amount of binder incorporated should be such as to minimise the loss of absorption potential of the active carbon to less than 10 percent, e.g., about 5 percent.

The active carbon loaded web may be made by methods known in the art such as deposition of web components including the active carbon filler, from a fluid media, for example water or air.

It is especially preferred that the web or mat be made by the air-laying process described and claimed in our corresponding application Ser. No. 842889 Filed on July 18, 1969.

The incorporation of the binder in the carbon loaded web may be effected by impregnation with an aqueous latex, the latex being allowed to migrate freely within the web. Such migration takes place towards the surface of the web so that the end result is a web in which the binder is predominantly at and adjacent to the surfaces of the web. In this way the resulting web has the advantage of good surface abrasion resistance because of the high concentration of binder at and near to the surface whilst retaining high absorption potential because of the low concentration of binder within the web. A graph of cross-sectional position within the web versus dry binder concentration is shown in FIG. 3A and it is seen that the concentration is higher near the surfaces than at the middle of the web. The insock of the invention therefore possesses not only the high absorption potential required but also good abrasion resistance and mechanical strength coupled with positive retention of the active carbon particles.

The invention will be further described by reference to the following examples which are descriptive only and not to be regarded as limiting.

EXAMPLE 1

A fibrous web was formed by the air-laying method described in application Ser. No. 842889 filed on July 18, 1969, now abandoned on to a muslin scrim as backing material of 50 × 40 mesh and of thickness 0.009 inches, so as to form a laminate sheet.

The web had the following composition:

Active carbon filler	about 35%
Butadiene acrylonitrile latex binder	about 15%
Basic woodpulp fibres	remainder

From the laminate sheet, two insocks were cut out, of a shape and size such that, when inserted into a pair of shoes, each was able to substantially cover the inner soles thereof, and having the muslin scrim uppermost so as to be able to make contact with the foot of the wearer.

These insocks were worn in shoes of a person suffering very badly from excessively sweating feet and they

efficiently removed objectionable odours from the wearer's shoes and were mechanically sound for more than two weeks.

Throughout the specification "air dry weight" when applied to materials means the weight of such materials in an ambient air atmosphere, i.e., one having an average moisture content.

EXAMPLE 2

A fibrous web was formed from equal parts of bleached kraft pulp and coconut shell active carbon by the air-laying method described in application Ser. No. 842889 filed on July 18, 1969, now abandoned onto a cotton flannelette backing with the raised nap, or fluffy side, uppermost. The web was 12 inches wide and was produced at the rate of 4 feet per minute. The composite web was then impregnated with a mixture of 10 percent acrylic latex and 2 percent melamine formaldehyde syrup and dried on thin walled stainless steel cylinder of 28 ins diameter at a steam pressure of 31 P.S.I.

The amount of binder incorporated was 15 percent by weight based on the air dry weight of the loaded web.

The resulting product sheet had the following properties:

Basic weight (g./m ²)	700
Caliper (mm)	2.13
Apparent specific gravity (g./cm ³)	0.33
Active Carbon Content (%)	29

From this sheet was cut insocks as described in Example 1. These insocks were then tested as laid out in Example 1.

The insocks showed similar odour absorbing properties to the insock described in Example 1 but exhibited greater mechanical strength. Furthermore, the wet strength of the insock was appreciably increased, a property which becomes increasingly important to people whose feet perspire excessively. The insocks last longer and remain efficient in the presence of excess perspiration which would generally cause their mechanical breakdown and finish their efficient life.

To illustrate the preponderance of binder at and adjacent the surface the following tests were carried out:

- A sample of the product sheet was tested for plybond strength using the TAPPI specification. This gave a figure of 81lbs/sq.ins. One of the two sections of the split web resulting from this test was then split repeatedly using the same test procedure. Each succeeding split occurred nearer to the origi-

nal surface of the web. If the distribution of binder were uniform then a uniform set of test results should be obtained. The results in fact found were as follows:

Initial split	subsequent split	
1st		8 lbs/sq.ins.
2nd	do	8 lbs/sq.ins.
3rd	do	7 lbs/sq.ins.
4th	do	6 lbs/sq.ins.
5th	do	17 lbs/sq.ins.
		24 lbs/sq.ins.

It is seen that the last two splits gave values well above the remainder and that these splits occurred very close to the original surface (scrim side). The amount of binder at and adjacent the surface is thus seen to be several times that in the interior.

- Another sample of this product sheet was split into three layers which consisted of:

Top layer	active carbon/fibre	
Middle Layer	do.	
Bottom Layer	do.	& scrim backing (flannelette)

The basic weight, caliper and bursting strength of each layer was measured, the results found are set out below in Table I

TABLE I

LAYER	BASIC WEIGHT	CALIPER	BURSTING STRENGTH	BURSTING STRENGTH CORRECTED TO 1mm THICKNESS
Top	166 g/m ²	0.64 mm	20.5 lb/in ²	32.1
Middle	315 g/m ²	0.84 mm	10 lb/in ²	11.9
Bottom	219 g/m ²	0.67 mm	—	—
Composite	700 g/m ²	2.13 mm	—	—

It is seen that the top layer even though thinner than the middle layer had more than twice the bursting strength which indicates a much higher proportion of binder in the top layer than the middle layer.

EXAMPLE 3

An active carbon web of increased wet strength was produced using the technique described in Example 2 except that the web width was 36 inches and the production rate 5ft per minute. The composite web was then impregnated with a mixture of 10 percent acrylic latex and 4 percent melamine formaldehyde syrup and dried on cast iron cylinders having a diameter of 4feet at a steam pressure of 30 lb/in². The resulting product sheet had the following properties:

Basic weight (g/m ²)	7.50
Caliper (mm)	2.13
Apparent Specific Gravity (g/cm ³)	0.35
Active carbon Content	30%
Binder Pickup by Weight	19%

A sample of the product sheet was then split into three as in Example 2 (ii) with the following results:

TABLE II

LAYER	BASIC WEIGHT	CALIPER	BURSTING STRENGTH	BURSTING STRENGTH CORRECTED TO 1mm THICKNESS
Top	140 g/m ²	0.55 mm	15 lb/in ²	27.3
Middle	500 g/m ²	1.4 mm	23 lb/in ²	16.4
Bottom	110 g/m ²	0.5 mm	—	—
Composite	150 g/m ²	2.13 mm	—	—

This example used twice the amount of wet-strength additive as Example 2. The effect, due to cross-linking is to reduce the degree of migration of the binder so that the strength of the middle section is higher. The amount of migration is still sufficient to provide good absorption potential. Too great an increase in wet strength additive would however reduce the absorption potential to unacceptable levels.

The drying conditions also affect the degree of migration of binder and these should be selected to give a satisfactory level of migration of binder towards the surfaces of the web. The conditions in Example 3 give rise to slightly less migration than those in Example 2.

We claim:

- 1. An insock, for insertion into a shoe comprising a fibrous web or mat loaded with active carbon and a binder, the binder being disposed predominantly at and adjacent to the surfaces of the web or mat.
- 2. The insock of claim 1 which is of such a shape that it is able to cover substantially all of the area of the inner sole of the shoe.
- 3. The insock of claim 1 wherein the web is supported by a backing material.
- 4. The insock of claim 3 wherein the backing material is flannelette.
- 5. The insock of claim 1 which has a total thickness of from 30 to 100 thousandths of an inch.
- 6. The insock of claim 1 wherein the web comprises from 20 to 65 percent by weight on the air dry loaded web, of active carbon.
- 7. The insock of claim 1 wherein the web comprises from 10 to 30 percent by weight of binder.
- 8. The insock of claim 1 which further has a coating of a foam material.
- 9. The insock of claim 8 wherein said foam layer is polyurethane foam.
- 10. The insock of claim 1 which comprises a fibrous web or mat loaded from 20 to 65 percent of active carbon and from 10 to 30 percent of binder material, these percentages being by weight based on the air dry loaded web and a backing material affixed thereto.

bon and from 10 to 30 percent of binder material, these percentages being by weight based on the air dry loaded web and a backing material affixed thereto.

11. An insock for insertion into a shoe comprising a web of natural or synthetic fibres adhered to a backing material, said web being held together by a binder which is 10 to 30 percent of the total weight of the air dry loaded web and being loaded with active carbon which is 20 to 65 percent of the total weight of the air dry loaded web, said binder being disposed predominantly at and adjacent to the surfaces of the web or mat, said insock having a total thickness of between 30 and 100 thousandths of an inch.

12. The insock of claim 11 wherein the backing material is flannelette having at least one side which has a fluffy texture and wherein said web is adhered to a side of the backing material which has a fluffy texture.

13. An insock, for insertion into a shoe comprising a fibrous web or mat loaded with active carbon and a binder which is disposed predominantly at and adjacent to the surfaces of the web or mat, the final disposition of the binder adjacent to said surfaces being effected by a partial migration of the binder from its original distribution throughout the web.

14. An insock for insertion into a shoe comprising a web of natural or synthetic fibers adhered to a backing material, said web being held together by a binder which is 10 percent to 30 percent of the total weight of the air dry loaded web and being loaded with active carbon which is 20 to 65 percent of the total weight of the air dry loaded web, said binder being disposed predominantly at and adjacent to the surfaces of the web or mat, said insock having a total thickness of between 30 and 100 thousandths of an inch, the final disposition of the binder adjacent to said surfaces being effected by a partial migration of the binder from its initial distribution throughout the web.

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