THE JOINT EXAMINATION BOARD

PAPER P6

INFRINGEMENT AND VALIDITY

3rd NOVEMBER 2004

10.00a.m.- 2.00p.m.

Please read the following instructions carefully. ***Time Allowed – FOUR HOURS***

1. Please note the following:
   - Write on one side of the paper only, within the printed margins using a **BLACK** pen.
   - Enter the Paper Number, and your Examination Number in the appropriate boxes at the top of each sheet of paper.
   - **DO NOT** use coloured pens or highlighters within the answer-they will not photocopy.
   - **DO NOT** staple or join pages together in any way.
   - **DO NOT** state your name anywhere in the answer.

2. **NO** printed matter or other written material may be taken into the examination room. **ALL** mobile phones and electronic devices **must be** switched off and stored away.

3. Answers **MUST** be legible. If the examiners cannot read a candidate's answer no marks will be awarded. Number the pages of your paper sequentially.

4. Candidates are reminded that marks are awarded for the reasoning displayed and the points selected for discussion rather than the conclusions reached.

5. **NO WRITING OF ANY KIND WILL BE PERMITTED AFTER THE TIME ALLOTED TO THIS PAPER HAS EXPIRED. At the end of the examination assemble your answer sheets in page number order and place in the WHITE envelope provided.**

Document checklist:-

Client's letter: (2 pages)

Document A: Client's Patent GB 1010101B (4 pages)

Document B: Extracts from Chapter 3 of "Abrasive Surface Cleaning", 1990. (1 page)

Document C: US Patent No. 4040404 (3 pages)

Document D: Abrazosphere Internet Website (2 pages)

This paper consists of 13 pages in total, including this page.

The managing director of a company called Spongoclean writes as follows:

Dear Sir,

You helped us obtain a British patent which was granted last year (GB 1010101B) relating to cleaning bodies for heat exchanger circuits.

As you know, we are providers of services and products to the power industry and other heavy industries where heat exchangers involving cooling water are used. One of the products we supply is for removal of scale from the internal surfaces of such heat exchangers. The product consists of foam bodies impregnated with abrasive and we also supply a device (a retrofit device), which enables the foam bodies to be removed from the heat exchanger, cleaned and replaced in the heat exchanger. Although the foam bodies are reused, after a period of time it is found they may disintegrate and therefore we recommend replacement every six months. The foam bodies are a very important part of our business, while we usually provide the retrofit device free of charge if the industrial partner enters into a long term supply contract for the product.

We sell a variety of abrasive foam body products for use under different circumstances such as high or low scale situations and all of the foam bodies are manufactured for us in the UK. Our most popular product contains spherical foam bodies formed of foamed polyurethane with an average diameter of 1 mm and a narrow range of diameters of 0.8 to 1.2 mm, with dispersed abrasive particles both on the surface and in the body.

We recently become aware of new products being made available in our market because we lost a contract to supply foam bodies to a customer when it came up for renewal. The customer is now purchasing spherical foam bodies from Abrazosphere, a UK importer supplied directly from an overseas manufacturer. Abrazosphere has a website (extract enclosed) and we obtained samples of two products through this website and analysed them. We think they infringe the claims of our patent.

The first product, which we will call SB1, was irregular chunks of natural rubber latex foam containing dispersed abrasive particles. It was difficult to assess an average longest diameter as these chunks were highly variable, but we estimate that about 20% of the longest "diameters" were below 0.5 mm or above 1.5 mm. The second product (SB2) has a construction which is completely new to us and is shown in the enclosed internet website page and our analysis of the SB2 product confirms this information. The sample was described as containing spheres of 1 mm diameter but we found that the diameter range was from 0.9 to 1.5 mm. We also found that the abrasive particles ranged in length from 100 to 200 microns (n.b. 1mm = 1000 microns).

Our other problem is that while our ex-customer has returned the retrofit device we supplied to them, we are aware that the overseas manufacturer has supplied them with an

identical retrofit device.

We would like your advice on the strength of our case for enforcing our patent against Abrazosphere for the supply of the SB1 and SB2 products and the retrofit device.

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When you retrieve your file relating to this case you find that the UK Patent Office search revealed only one document, Chapter 3 of a text book called Abrasive Surface Cleaning. The book was published in 1990 and was cited as an X category document. The prosecution shows that claims 1 and 6 were amended in view of this citation. Claim 1 was amended to insert the range of the average largest diameter and claim 6 was amended to define the foam bodies as those claimed in claims 1 to 5. You conduct a further search of the prior art and find granted US Patent No. 4040404, which relates to cleaning sponges which have been sold for some years prior to the priority date of your client's patent.

Write a letter of advice to your client on the following points:

1. whether SB1 and SB2 foam bodies infringe your client's patent GB 1010101B;
2. whether the retrofit device infringes your client's patent GB 1010101B;
3. whether your client's patent GB 1010101B is valid; and
4. what options your client has for exerting GB 1010101B against Abrazosphere and/or the ex-customer [ignore any issues of registered or unregistered design rights] .

GB 1010101 B

Filing Date: 2 May 2000
Grant Date: 23 September 2003
Priority Date: 3 May 1999
Patentee: Spongoclean

CLEANING PROCESSES

The present invention relates to automated processes for cleaning surfaces. In particular, the invention relates to processes for cleaning interior surfaces of cooling water circuits.

It has been realised for many years that the efficiency of heat exchangers decreases with constant use, particularly in systems which use hard water (i.e., containing significant amounts of calcium salts) or other heat transfer fluids, because films or limescale develop upon the heat transfer surface. Chemical descalents are known and may be incorporated into the water continuously cycling in closed loop cooling water circuits. The problem with chemical descalents is that they may damage sensitive pieces of equipment which are located in the loop, for instance pumps and valves. Systems have been developed for intermittent descaling operations, in which water flowing in the circuit may be diverted through an alternative conduit joined to a reservoir from which descalent liquid may be provided. Thus descalent may be passed through the heat exchange portions of the circuit intermittently, followed by rinsing of the heat exchange portions with clean water. In this way, the chemical descalent may be confined to components of the circuits which are not sensitive to the corrosive chemicals.

Domestic and industrial processes for cleaning surfaces have, for many decades, utilised simple blocks of foam sponge into which may be absorbed a detergent liquid. The wet sponge is rubbed under pressure over a surface to collect the dirt into the sponge. Dirt may then be rinsed from the sponge and the sponge may be reused for subsequent cleaning operations. Sponges are made from foamed elastomeric material which is insoluble in the detergent liquid. The ability of sponges to clean dirt from a surface is improved by providing a scouring capability. It is known to use abrasive particles on the surface or in the matrix of the foam to provide scouring action.

According to the present invention there is provided a process for cleaning surfaces in which a continuously circulating liquid detergent containing foam bodies as described hereinbelow, is passed over a surface to be cleaned such that the foam bodies contact the surface and remove unwanted particles therefrom, wherein the foam bodies are collected from the circulating detergent using a pivotal sieve positioned in an outlet connection, transferred to cleaning means, cleaned and returned to the detergent.

The process is particularly suitable for systems where liquids circulate at a flow rate which moves the foam bodies against the internal walls thereby causing them to rub along the surface to be cleaned.

This process is of particular value for continuously cleaning internal surfaces of tubular heat exchangers in use in closed loop cooling water circuits, especially tubes of condensers in steam power plants.

The foam bodies may be continuously cycled in the cooling water circuit but must be removed from the circuit at intervals either to replace with new foam bodies or for removal of dirt and/or scale. Retrofit devices for removal and return of cleaning bodies in heat exchange systems are known in the art and involve collecting the cleaning bodies in a sieve from water discharged from the heat exchanger when an outlet valve is opened. New or cleaned cleaning bodies are returned to the continuously circulating cooling water via a return valve. The continuous opening and closing of valves is a problem with the retrofit devices known in the art. We have developed an improved retrofit device which uses a pivotal sieve for diverting cleaning bodies from the circulating cooling water discharged from the heat exchanger to a sluice and sieve basket where they are replaced or cleaned. The cleaning bodies are returned to the cooling water circuit via a second pivotal sieve as the cooling water re-enters the heat exchanger.

The improved retrofit device allows the cleaning bodies to be continuously or intermittently circulated in the cooling water circuit during cleaning cycles.

The foam bodies for use in the process may be of any size suited for the cleaning operation and surfaces to be cleaned. Where a surface is substantially smooth, it is possible to use relatively large bodies. Where the surface has many irregularities or complex shapes, the use of smaller bodies will be preferred. In general the use of bodies of relatively uniform size is preferred, since this facilitates design of the apparatus for collecting the dirty bodies and detergent liquid.

In one embodiment of the process the foam bodies are formed of irregularly shaped chunks of foam material. These chunks may be manufactured by chopping a preformed block of sponge material into smaller size particles using appropriate knives.

According to an alternative embodiment the bodies are substantially spherical in shape. Spherical bodies may be produced, for instance, by forming the polymer foam in spherical moulds. In this way it is possible to achieve very uniform sized bodies at a specific temperature. Conditions for moulding and foaming may be selected by the person skilled in the art of making foam polymers. The preferred polymer is polyurethane.

According to a particularly preferred embodiment of the invention the foam bodies comprise abrasive particles suspended in a matrix of polymer so that the abrasive is contained in the body and on the surface of the polymer. The particles may be formed by dispersing particles of abrasive material into the liquid prepolymer prior to curing, followed by curing

and foaming carried out in the normal manner. The abrasive content is preferably in a particle to polymer ratio of about 5 to 6 parts by weight of the abrasive particle to 1 part by weight of the polymer.

Suitable abrasive materials comprise, for instance, dispersed particulate minerals such as dispersed silica or particulate pumice. The particle size of the abrasive can be selected according to the size of the foam bodies and the particular deposits which are to be removed. In general the particle size of the abrasive is between 50 and 150 microns and preferably about 80-120 microns. Sieves can be used to obtain particular particle size range of abrasive.

Very small foam bodies are difficult to remove from the circuit for cleaning and are not very effective at cleaning the entire surface. We have found that using a narrow range of diameters of the foam bodies maximises the cleaning ability of the foam bodies. Larger foam bodies impede the flow of the cooling water and prevent the optimum sized foam bodies from continuously impacting the sides of the tubes. The conditions under which the size is measured are intended to simulate the temperature conditions of at least a portion of the cooling water circuits, and to provide a standardised entraining liquid. The reason for this is that measuring the bodies dry size, whilst straightforward, may not reflect the size of the bodies in use, which is the significant measure.

Foam bodies having a relatively uniform diameter at 60°C are believed to be new and advantageous. The preferred average largest diameter is from about 0.5 mm to 1.5 mm and most advantageously substantially all the largest diameters are between 0.8 and 1.2 mm. By largest diameter, whether the foam body is a sphere or irregular, we mean the longest axis through the central point.

Preferably, however, the bodies are substantially spherical in shape. It is particularly preferred that the foam comprises polyurethane, and that abrasive particles are suspended in a matrix of the polyurethane.

The invention is illustrated in the following examples:

Example 1

An open cell foam of natural rubber latex available in block form is chopped in a Waring blender, either dry or immersed in water, until the average longest diameter is from 0.5 mm to 1.5 mm. Small bodies having a diameter less than 0.5 mm are removed from the product by sieving. The cleaning bodies are then introduced into the cooling water circuit of an apparatus described above.

After circulating in the apparatus for one hour at a constant temperature of 60°C and with removal of dirt by sequential steps of addition of clean water, agitation, then squeezing water and dirt from the bodies, the level of removed dirt was found to be about 3g per g of dry cleaning bodies.

Example 2

Commercially available polyurethane prepolymer, trade name Urifoam 321 (from

Ping Pong Manufacturing Co Ltd), is mixed with dry silica particles (particle sizes from 80 to 120 μm) and then introduced into spherical moulds of 1 mm diameter, along with foaming and curing agent. After foaming and curing for 30 minutes at 60°C, spherical bodies are formed. These are rinsed and dried in the normal way. The polyurethane spherical bodies are subsequently introduced into the cooling water circuit used in Example 1. Using the same cleaning routine, these bodies removed 5 g of dirt per gram of dry polyurethane spheres. As well as providing higher dirt removal level, the bodies were easier to remove from the cooling water circuit, with fewer bodies being carried over into the pumps and valves of the circuit.

What we claim is:

1. Foam bodies for cleaning internal surfaces of heat exchangers in cooling water circuits, in which the bodies are formed of spherical or irregular pieces of polymer with an average largest diameter of from about 0.5 to about 1.5 mm.

2. Foam bodies according to claim 1 in which the polymer comprises polyurethane.

3. Foam bodies according to claim 2, which further comprise abrasive particles embedded in a matrix of the polymer.

4. Foam bodies according to claim 3 in which the abrasive particles are about 100 microns in diameter.

5. Foam bodies according to claim 3 or 4 in which the polymer to abrasive particle ratio is 1 to about 5 or 6.

6. A process for cleaning surfaces in which a continuously circulating liquid detergent containing foam bodies as defined in any of claims 1 to 5 is passed over a surface to be cleaned such that the foam bodies contact the surface and remove unwanted particles therefrom, wherein the foam bodies are collected from the circulating detergent using a pivotal sieve positioned in an outlet connection, transferred to cleaning means, cleaned and returned to the detergent.

Extracts from ABRASIVE SURFACE CLEANING
Published July 1990

Chapter 3: Self Cleaning Heat Exchanger Separators

Open and closed loop water circulation systems such as central heating systems and air conditioning units suffer from a build up of deposits on the internal surfaces of pipes, tanks, fins and the like from hard water or other fluids such as the heat transfer medium. The build up of deposits seriously reduces the lifetime of these systems either by reducing their efficiency below an acceptable level or by causing damage, such as corrosion and leakage of the circulating water. There are a variety of methods for self-cleaning of heat exchangers but the currently most popular method is by means of circulating cleaning bodies. Commonly used cleaning bodies are steel balls or sponge rubber bodies. Cleaning bodies of this type typically have an average largest diameter of 2 mm. Suitable material for forming the sponge rubber is natural rubber latex formed into balls by known moulding technologies. Synthetic rubber may also be utilised if desired. .....

The cleaning bodies are available in a variety of types but most of them must be removed from the heat exchanger either to be replaced at the end of their useful life, or to be cleaned and returned to the heat exchanger for further use. .....

One commonly used method for collecting cleaning bodies for replacement or cleaning in a continuous circulating water system is a retrofit apparatus placed in the system. Generally, in such apparatus the cleaning bodies to be re-circulated are collected from the water discharged from the heat exchanger in a sieve and then directed into a cleaning sluice provided with a sieve basket. The bodies are allowed to enter the sluice through a channel which passes fluid through the sieve basket when a first valve in the system is open. Subsequently the cleaning bodies re-enter the fluid stream via a second channel. The cleaning bodies leave the sluice in fluid passing in the opposite direction through the sieve basket when a second valve is opened. The continuous opening and closing of the first and second valves allows the cleaning bodies collected in the sieve basket to be replaced or cleaned without causing the whole system to be discharged to allow this operation. .....

US 4040404
Granted on 14 July 1995

CLEANING DEVICES

The present invention relates to a cleaning product and in particular to abrasive materials for scouring, such as scouring pads and abrasive paper or cloth.

Domestic scouring pads are well known in the art, comprising a layer of cellulosic sponge material having intimately bonded thereto an abrasive surface layer comprising a mass of non-woven synthetic fibres and optionally particles of an abrasive material bonded to the non-woven fibres in a synthetic resin. The problem with scouring pads of this sort is that they easily damage surfaces in use by gouging or scratching because there is very little flexibility in the complete product and in the layer of fibres and abrasive. The present invention addresses these disadvantages.

In a first embodiment, the present invention provides a cleaning product characterised in that it comprises basically a flexible or pliable substrate or backing having a multiplicity of upstanding fibres on one face thereof, these fibres being interspersed with and having adhered thereto nodules, globules, tubercules or the like particles of polymerised acrylic resin.

In a second embodiment of the invention, abrasive particles such as emery, sand, glass, aluminium oxide or the like, are adhered to the fibres by the acrylic resin. The degree of abrasive action available from this form of the product will depend upon the size and nature of the abrasive particles, and the amount thereof.

In the product of the invention, the substrate or backing may take various forms. It may for instance be a textile fabric with a pile surface providing upstanding fibres or more preferably the substrate or backing is a resilient cellular backing to which upstanding nylon fibres are adhered these fibres having been applied by electrostatic deposition after an adhesive coating has been applied to the backing.

Alternately, the backing may be a polymer, for example, natural or artificial rubber foam, and most preferably the backing is of polyurethane or polyester foam.

Figure 1 is a perspective view of a cleaning pad according to the invention.

Figure 2 is a cross-sectional view of the cleaning pad of Figure 1.

Figure 3 is a cross-sectional view of the cleaning pad with abrasive.

Referring firstly to Figures 1 and 2, in making the first preferred embodiment of the cleaning product of the invention a web 10 is provided of an appropriate resilient cellular backing materials in the form of flexible polyurethane foam sheet, for instance of thickness up to six or seven centimetres. Web 10 is coated with adhesive as indicated diagrammatically at 11 and has applied directly to it by electrostatic deposition a multiplicity of thin nylon fibres 12, for example from 3.0 to 4.5 mm in length. The adhesive is then cured to anchor the upstanding fibres 12 firmly to the web 10 by passage of the assembly through a curing oven.

After curing, the assembly is passed beneath spraying nozzles from which polymerisable acrylic resin droplets 16 are applied to the fibres 12 by spraying. Care is taken to ensure that the viscous condition of the resin and its manner of spraying is such that discrete droplets encounter and become deposited on the fibres 12 and that the quantity and distribution of the droplets 16 is such that there is no significant coalescence of droplets 16 on the adjacent fibres. The acrylic resin is polymerised in a heated oven. The droplets are preferably from 0.5 to 1 mm in length.

The resultant sheeting is then cut up into cleaning pads of any desired practical size or shape. These pads have various uses, for example, in the dry condition they may be used for example for renovating suede leather garments, brushing upholstery and for like purposes. In the wet condition, the product can be used for a wide range of cleaning operations, for example, the washing of crockery or cooking utensils, cleaning of paintwork, and the cleaning of chrome, silver and plastics surfaces. The action of the product is to emulsify grease, dirt and the like adherent to the surface being cleaned, so as to separate it from said surface. There is no scratching or other spoiling of the surface because the fibres 12 flex as the product passes over the surface and there is no gouging or tearing action due to the globular or bead like particles 16 on the tips of the fibres 12.

Figure 3 illustrates a modification of the cleaning product which includes the additional step after having applied the droplets 16 to the fibres 12, of depositing thereon highly abrasive particles 18, such as grit, sand, emery, silica or aluminium oxide of any selected size from very fine to very coarse, so as to become adhered to the tips of the fibres 12 by passing the web 10 with the attached fibres 12 and the applied resin droplets 16 beneath a sprinkling head before passing the resultant combination through the heated oven.

This modified cleaning product is particularly advantageous for practical applications where a surface finish is to be achieved by removal of material deposited on the surface and of course because the web 10 is resiliently flexible, the product can be caused to conform to any of the contours of the work-piece being abraded. The spaces between the fibres 12 in the product minimise the possibility of clogging of the product in use, and, of course, any accumulated abraded material can be readily washed out from between the fibres 12.

DOCUMENT C

1/1

FIG. 1

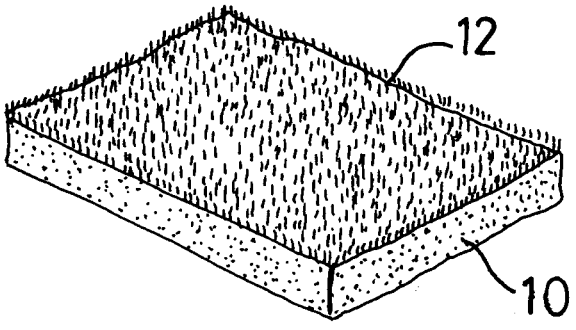


FIG. 2

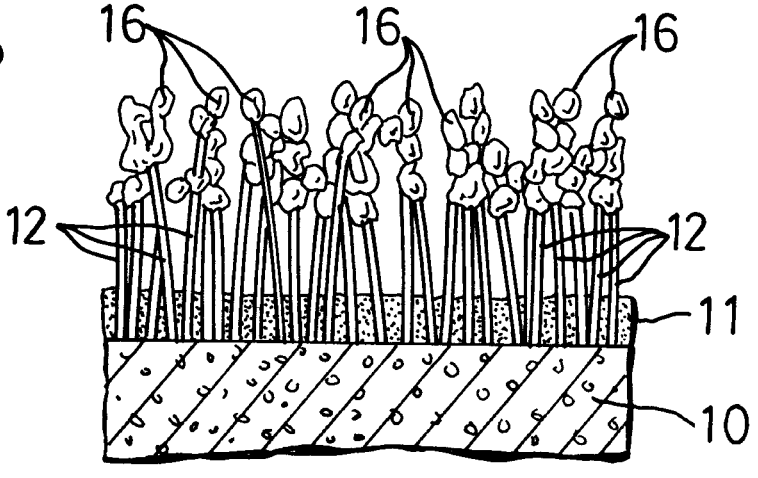
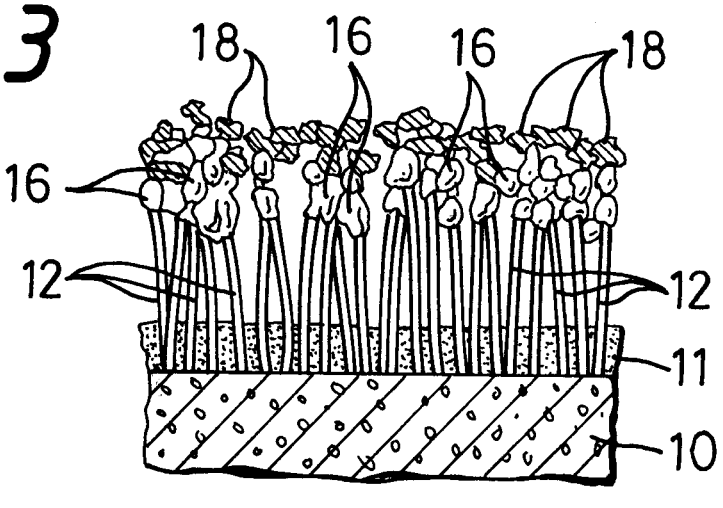


FIG. 3



Abrazosphere

www.abrazospheres@uk.com

We supply cleaning bodies for cleaning the interior of heat exchanger tubes. We have a variety of products for different purposes from steel balls to latex chips and now we are introducing a new product which is the most advanced technology available in the UK. The new cleaning bodies are made of a sponge rubber body with an adhesive film on its surface and an abrasive layer formed of granular abrasive elements fastened to the sponge rubber body by the adhesive film. The cleaning bodies come in a range of sizes with diameters from 1 mm to 5 mm (reference no. SB2). The sponge rubber bodies always have a diameter D no greater than 10x the average linear dimensions of the granular abrasive elements.

Figures 1 to 3 below show the unique construction of our cleaning bodies. For maximum cleaning ability the cleaning bodies are deformable in terms of the sponge rubber body and by packing the granular abrasive elements loosely on the surface adhesive film.

Figure 1 is a cross-sectional view of a typical cleaning body. The sponge rubber bodies (1) can be made of natural or synthetic rubber and preferably they are of the open pore type and substantially spherical. There is an adhesive film (2) in which abrasive elements (3a, 3b) are packed loosely (4) with a statistical distribution of the abrasive elements in the form of a one layer packing so the abrasive elements can be deformed with respect to each other like the links in a fine chain. Therefore, the deformity of the cleaning element is determined by the deformity of the sponge rubber body. The abrasive elements are grains of corundum or of a synthetic material such as short plastic monofilament sections (3b). The plastic can be any relatively hard plastic such as polyurethane or polyethylene.

The cleaning bodies shown here are specifically for cleaning the interior of heat exchanger tubes, especially tubes or condensers of steam power plants and is applicable for use in a cleaning method where the cleaning body rotates and the pressure between the input and output water chambers of the power plant condenser is sufficient to drive the bodies through the tubes.

FIG.1

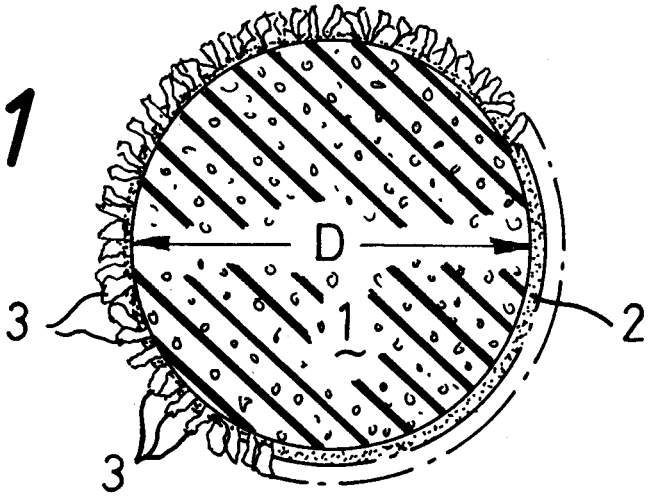
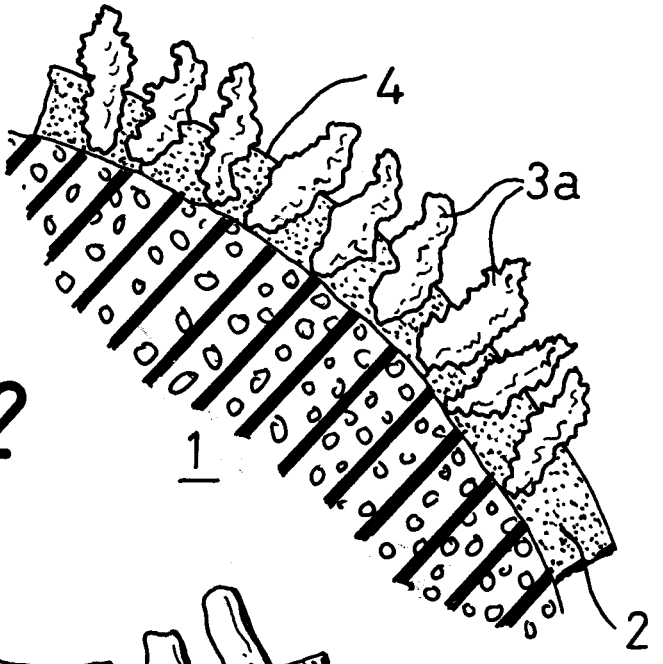


FIG.2



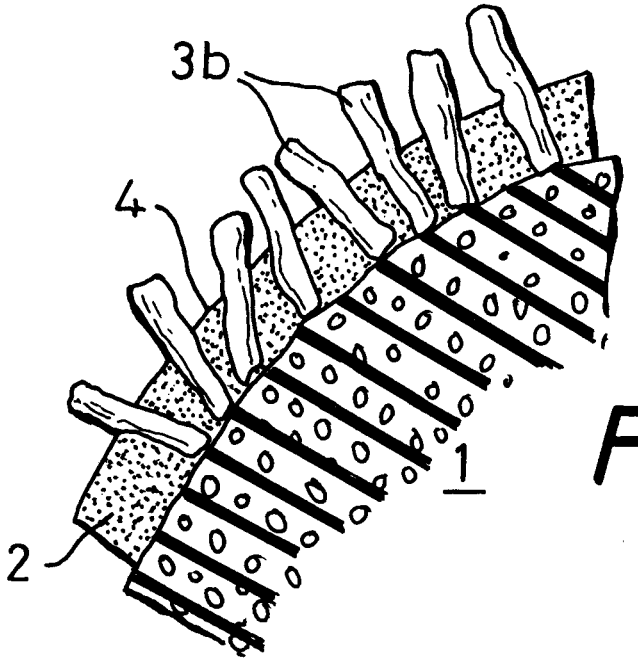


FIG.3