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C. N. BROWN

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CELLULOSIC STRUCTURE AND METHOD OF MAKING THE SAME

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FIG. 1.

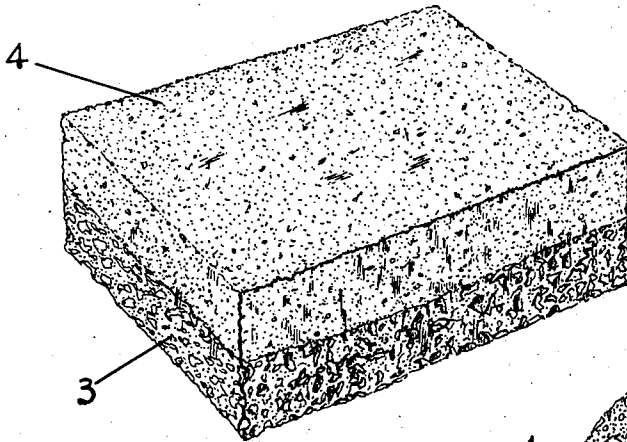


FIG. 3.

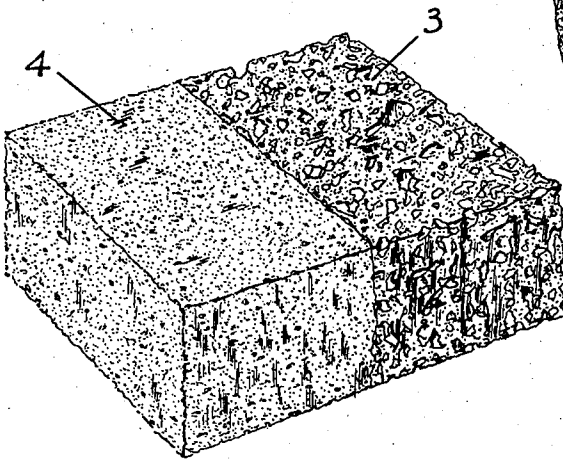
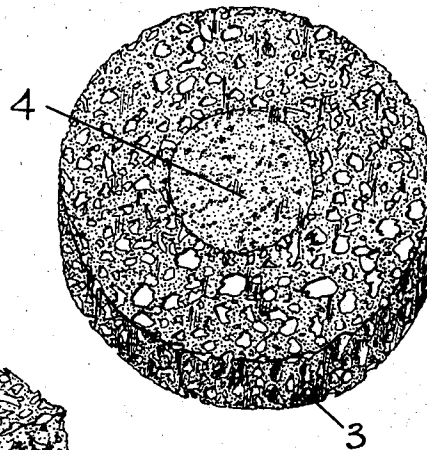


FIG. 2.

INVENTOR.
Charles N. Brown
BY *Charles F. Daly*
ATTORNEYS.

UNITED STATES PATENT OFFICE

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CELLULOSIC STRUCTURE AND METHOD OF
MAKING THE SAME

Charles N. Brown, Buffalo, N. Y., assignor to E. I.
du Pont de Nemours & Company, Wilmington,
Del., a corporation of Delaware

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6 Claims. (Cl. 18-48)

This invention relates to artificial porous materials made from cellulosic solutions such as viscose. More particularly, it relates to artificial cellulosic sponges having different characteristics in different parts thereof, such as different sizes of pores. The invention will be described in terms of the production of such masses from viscose by mixing viscose with a pore-forming material and then coagulating and regenerating the same, followed by the removal of the pore-forming material. It is to be understood, however, that this is to be considered as illustrative and not limitative.

In the common method of forming porous articles such as artificial sponges from viscose, a certain quantity of viscose from green or unripened alkali cellulose is mixed with a solid pore-forming material such as sodium sulfate decahydrate, together with a suitable quantity of reinforcing material such as hemp, sisal, cotton or other fibrous material. The pore-forming material supplied may be of various sizes, according to the use to which the sponge is to be put. For example, in the washing of cars or other large objects subject to the roughening influences of dirt and weather, a sponge with large size pores is desired. On the other hand, in the polishing of silver or for photographic or other precision purposes, a sponge with extremely fine pores is desired. For other purposes, it is often desired that at one particular stage a fine pored sponge be used and at another stage a coarse pored sponge be used or that both be used simultaneously. Up to the present time, in order to accomplish this result, it has been necessary to have a plurality of sponges on hand, with the resultant expenditure of time and effort in changing from one sponge to another. On occasion, users of such sponges have been known to sew or tie together sponge sections having different sized pores. Such an expedient is obviously imperfect. It secures union only at isolated points, tends to come apart upon merely slight usage, and of course is only loose in nature.

In order to overcome these difficulties, it has been suggested to cement sections of sponges of different sized pores by means of suitable adhesive compositions. This procedure is also subject to the disadvantage that the so-united sponge sections tend to come apart upon hard

usage, partly because adhesive contact in many cases is secured only at meeting edges, or where an edge meets with a face, and partly because an adhesive joint is usually not as strong as the base materials which it unites. If a larger quantity of adhesive substance is used, so that better adhesive union than would otherwise be obtained is secured, an inflexible impervious layer is apt to be secured between the two porous layers of different pore size. This, for many purposes, is objectionable. Furthermore, the union obtained when a foreign substance is used as the cementing agent cannot be as strong as the sponge structure itself. Finally, the chemical nature of the adhesive used may be such that it has a harmful effect on the cellulosic structure, or be detrimental to the articles on which the sponge is used.

It is therefore an object of this invention to produce artificial porous objects of cellulosic material having a plurality of different characteristics in different sections thereof, called hereinafter a "composite" sponge. It is a further object to produce artificial cellulosic sponges having sections of different pore fineness in different parts thereof. It is a still further object to produce such sponges without the aforementioned disadvantages. Other objects will appear hereinafter.

The objects of this invention in general are accomplished by forming a plurality of cellulosic masses having pore-forming material therein, said masses having different characteristics, such as different average particle size of the pore-forming material, bringing said masses into juxtaposition, and subsequently coagulating and/or regenerating the composite mass thus formed.

In the drawing, Figure 1 illustrates a rectangular porous article or sponge in accordance with this invention. Figure 2 shows a modified form of sponge according to this invention. Figure 3 shows a cylindrical sponge having a center portion of different average pore size than the peripheral portion.

In the practice of this invention, a plurality of different batches of sponge forming material is made up in well known fashion. For convenience, the invention will be described in terms of the manufacture of sponges having pores of two different average sizes. Two portions of a

suitable viscose containing fibrous strengthening material such as hemp are separately and thoroughly mixed with a pore-forming material such as sodium sulfate decahydrate. In one portion the pore-forming material may be of a size sufficient to form pores comparable in size to those occurring in natural sponges. In the second portion the pore-forming material may be of such a size as to form pores of considerably less than a pin head in average size. In the first portion, for example, the average size of pore-forming crystal will preferably exceed 6 millimeters in diameter while the average size of the pore-forming crystal in the second portion will preferably be less than 4 millimeters in diameter. After mixing is completed, a quantity of sponge-forming material from one portion is introduced into a rectangular mold and smoothed out into a uniform layer. A quantity of sponge-forming material from the other portion is then superimposed upon the first layer, and smoothed as before. The process may be repeated by alternating material from first one portion and then the other, or the mass may be subjected to the following step after the introduction of the second layer. In any case, the mass is subjected to pressure for a short period, in order to eliminate bubbles, etc. The mass is then ready for coagulation and regeneration, which may be accomplished in any of the well known methods, such as by means of boiling salt solution, steam, heating by means of electrical resistance, etc. After being suitably washed, purified, and, if necessary, treated with other ingredients such as a softener for example, glycerin, the sponge mass is dried and cut up into a plurality of individual blocks. These blocks may be cut up in such a way that all of the sponges formed therefrom will have both fine and coarse pored material in the same sponge, or some of the individual blocks may contain only fine pores and others only coarse pores. These factors, of course, may be suitably adjusted, according to the size of the sponge and the thickness of the layers introduced into the mold. If it is desired to have a large number of small size composite sponges, more than two layers may be introduced into the mold. One of the sponges produced by this method is shown in Figure 1 of the drawing, in which 3 is the coarse pored part and 4 the fine pored part.

As an alternative to the above procedure, the sponges may be formed continuously and cut off into individual sponges and forced through a die into a heated tube. The die, for example, may be concentrically divided so that fine pored material is forced through the inner portion and coarse pored material through the outer portion, or vice versa. Coagulation and regeneration is accomplished by heating the tube or by heating the mass by means of electrical resistance, so that the sponge mass emerges from the end thereof completely coagulated and regenerated. A sponge formed by this method is illustrated in Figure 3.

The bulky nature of the material operated upon renders it necessary that the coagulation and regeneration of the mass occupy a considerable period of time, for example, 1 to 12 hours. It is therefore somewhat surprising that during this period of time the separate portions of sponge forming material do not intermingle, especially in the interior, where the coagulating and regenerating action is longest in taking effect. It has been found, however, that due to the high viscosity of the masses, this inter-

mingling takes place to a very slight extent only, and the lines of demarcation are therefore sharply defined.

Example

The following example illustrates one preferred method for carrying out the invention. A sponge-forming mass is made up of the following mixture:

	Pounds
20% cellulose viscose.....	160
Vegetable fibers.....	16
Glauber's salt having an average particle size of 10 millimeters in diameter.....	1200

A second sponge-forming mass is made up of the following mixture:

	Pounds
20% viscose.....	160
Vegetable fibers.....	16
Glauber's salt having an average particle size of 2 millimeters in diameter.....	1200

A sufficient quantity of the first mass of sponge-forming material is introduced into a rectangular mold to form a layer one inch thick in the bottom thereof, and is then smoothed to a uniform thickness. A sufficient quantity of the second mass of sponge-forming material is then introduced onto the top of the first mass to form a layer an inch and half thick, and smoothed as before. Additional layers alternately from the first and second masses are added until the mold is full. The composite mass is then subjected to pressure for a short period, in order to remove air bubbles, etc. It is then introduced into a vat containing a hot or boiling solution of sodium sulfate in order to coagulate and regenerate the mass. After a period of about 12 hours, it is withdrawn therefrom, washed with water, treated with acid, again washed with water, bleached, again washed with water, impregnated with glycerin, and dried. After drying, the sponge mass is cut up into a plurality of blocks similar to Figure 1 of the drawing.

The invention has been described generally with reference to a porous article having pores of two different average sizes. It is to be understood, of course, that the difference in characteristics may be other than in pore size, such as color, strength, flexibility or softness, or any combination of these. For example, a red sponge-forming mass having large pores might be united to a blue sponge-forming mass having small pores. Furthermore, more than two sponge-forming masses may be united in this fashion, such as to form a red, white and blue sponge. Additionally, the separate batches may be imperfectly mixed before coagulation and regeneration whether the separate batches be of different pore size or different color or other different characteristics. For example, a sponge having mottled effects might be produced by imperfectly mixing batches of different colors. Finally the line of division may not be approximately straight as in the above example but may be curved or circular as in the modification shown in Figure 3. The line of division may extend along the long axis, as in Figure 1, or the short axis, as in Figure 2, of a rectangular sponge, according to the use to which it is put. For example, it may be desired to use a sponge of fine and coarse pores in which both are used simultaneously over different portions of the surface to be treated. For example, if it is desired to rub a surface with a coarse pored sponge followed by a fine pored sponge, this could be done in a single operation by forcing a sponge

as illustrated in Figure 2 across the surface with the coarse portion being pushed in advance of the fine portion.

Such a sponge has many other uses. The coarse pored side, for example, could be used for washing an object and the fine pored side for drying it by rubbing the sponge over the surface of the object. A sponge having a plurality of pore sizes of successively diminishing size can be used as a composite filtering material so that the larger particles could be removed by the coarser-pored portion and the smaller particles by the finer pored material without impeding the passage of the liquid being filtered.

The invention has been described in terms of the making of porous objects from viscose. It is to be understood, of course, that other cellulosic solutions are equally applicable such as lowly etherified and lowly esterified cellulose ethers and esters, for example, lowly etherified glycol cellulose, lowly etherified methyl cellulose and others.

Since it is obvious that various changes and modifications may be made in the above description without departing from the nature and spirit thereof, it is understood that the invention is not to be limited thereto except as set forth in the appended claims.

I claim:

1. An integral, absorbent, porous article of cellulosic material, said article comprising two parts of different average pore sizes united along a single meeting face.

2. An integral, absorbent, porous article of cellulose regenerated from viscose, said article comprising two parts of different average pore size united along a single meeting face, said parts being formed by bringing into juxtaposition along a single meeting face two viscoses containing solid pore-forming materials of different average particle sizes and then coagulating and regenerating.

3. An integral, absorbent, porous article of cellulose regenerated from viscose, comprising a first part having pores of a relatively large average size, and a second part having pores of a relatively small average size, said parts united along a single meeting face and being formed by bringing into juxtaposition along a single meeting face a mixture of fibrous strengthening material and

viscose containing a solid pore-forming material having an average particle size of at least 6 millimeters in diameter with a mixture of fibrous strengthening material and viscose containing a pore-forming material having an average particle size of less than 4 millimeters in diameter, and coagulating and regenerating the composite mass thus formed.

4. The method of forming absorbent, porous articles comprising forming a mixture of a solid pore-forming material and a coagulable cellulosic solution, forming a second mixture of a solid pore-forming material and a coagulable cellulosic solution, the pore-forming materials in said two mixtures having different average particle sizes, bringing said mixtures into juxtaposition along a single meeting face, coagulating said mixtures into the form of a unitary mass, purifying and drying said mass, and sub-dividing said mass into a plurality of individual units, at least some of said units comprising porous material from both of said mixtures.

5. The method of forming absorbent, porous articles comprising forming a mixture of viscose and a solid pore-forming material, forming a second mixture of viscose and a solid pore-forming material of different average particle size than said first mentioned pore-forming material, bringing said mixtures into juxtaposition along a single meeting face, coagulating and regenerating said mixtures into the form of a unitary mass, purifying and drying said mass, and sub-dividing said mass into a plurality of individual units, at least some of said units containing pores of both large and small size.

6. The method of forming absorbent, porous articles comprising forming a mixture of viscose and a solid pore-forming material having an average particle size of less than 4 millimeters in diameter, forming a second mixture of viscose and a solid pore-forming material having an average particle size of at least 6 millimeters in diameter, bringing said mixtures into juxtaposition along a single meeting face, coagulating and regenerating said mixtures into the form of a unitary mass, purifying and drying said mass, and sub-dividing said mass into a plurality of individual units, at least some of said units containing pores of both large and small size.

CHARLES N. BROWN.