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E. HURST

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ABRASIVE ARTICLE AND METHOD OF MAKING

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Fig. 1.

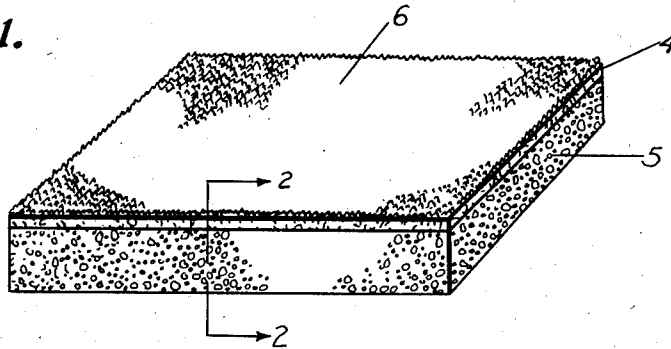


Fig. 2.

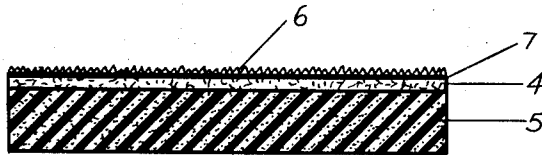
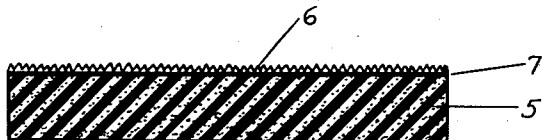


Fig. 3.



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ABRASIVE ARTICLE AND METHOD OF MAKING

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8 Claims. (Cl. 51—297)

This invention relates to abrasive articles and to methods of making them. More particularly, it is concerned with a flexible abrasive coated material embodying porous or sponge rubber as an element of the backing and to abrasive articles such as belts, discs, pads and other shapes made therefrom.

Abrading operations run the entire gamut from heavy duty grinding or cutting operations such as the snagging of foundry castings and the like to the lightest of scouring operations where the primary function is that of cleansing a surface of dirt, corrosive bodies or other adhering foreign matter. In the heavier duty grinding operations no particular attention is paid to the surface of the article being abraded since the purpose is almost entirely one of stock removal. However, in many of the lighter grinding or cutting operations as well as in all polishing operations, considerable thought is given to the uniformity of finished surface, that is, the freedom from scratches caused by harsh gouging of the surface by the particular abrading device or material used in the abrasive operation. Also, in the scouring of objects for the purpose of cleansing or renewing the original surface it is desirable that the surface of the object itself be not harmed by the scouring action. It is also desirable in both polishing and scouring objects of uneven contour that the abrasive or scouring action reach all portions of the surface with a functional action as closely uniform as possible so that the article will be evenly polished or renewed over its entire surface.

It is an object of the present invention to provide a new and improved abrasive material which can be utilized in numerous forms to effectively and satisfactorily perform as a polishing or scouring medium.

It is a further object to provide a new and improved abrasive material which, when cut, punched, or otherwise fabricated to the desired size and shape, is usable in conjunction with conventional abrading devices such as belt or disc sanders or polishers and the like.

It is a still further object to provide a new and improved abrasive material which, when cut, punched, or otherwise fabricated to the desired size and shape, can be used manually for sanding, polishing or scouring purposes with a high degree of facility.

Other objects and advantages of the present invention will become obvious as the description proceeds.

The present invention provides a line of resiliently backed coated abrasive products in which the backing may be of any desired thickness and degree of resiliency and is highly flexible and pliant in use. In fact, the products of the present invention have a controlled resiliency and pliability, and the backing, which constitutes a part of the abrasive article itself, is of such yieldable character that the abrasive coated material can be mounted on various sanding or polishing devices without the need of any other cushioning or supporting means and when mounted conforms to the contour of the supporting surface and satisfactorily performs with a smoothness and

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evenness, so that the abrasive surface of the product is uniformly presented to the objects being polished or sanded. The controlled resiliency and yieldability of the cushion backing element, especially when used in combination with the non-laminated fibrous fabric which I prefer, in products of the present invention provide the products with a smooth, even polishing action not shown by other abrasive coated products. Also, when the products of the present invention are used manually, the backing can be made of suitable thickness to not only provide a satisfactory, yieldable and resilient character to the polishing or scouring action, so as to eliminate any harshness, but can also be such that the article can be easily gripped and held in use.

I cannot stress too strongly the fact that abrasive products made according to the present invention have a high degree of controlled resilience of a type far different from that to be obtained by the use of conventional abrasive-coated paper and cloth materials of the prior art, regardless of how those materials may be supported. Conventional paper and cloth backed materials in use fail to conform to sharply irregular surfaces, and even when used in conjunction with various types of resilient supporting pads are unable to enter crevices or otherwise sharply reentrant surfaces to permit the abrasive grains of the product to effectively perform their abrading function. Although conventional paper and cloth backed products may work with some degree of satisfaction in polishing articles of mild contour it is impossible to use such products in any way which will permit them to get down into grooves or sharp hollows without puncturing the cloth or paper backing, regardless of how resilient or yieldable the backing pad used in conjunction with the abrasive coated product may be. In contrast, the dimensional characteristics of the articles of the present invention are such that the abrasive coated surface is allowed to rise or fall, stretch lengthwise or sidewise, to such an extent that the material is permitted to follow extremely sharp contours and perform a highly uniform and effective polishing or scouring action. By controlling the thickness of the sponge rubber backing, and the amount of solids in the sponge rubber layer, it is possible to obtain any set of desired characteristics of resiliency over a wide range. The controlled resiliency provided in the present products is of a type which permits each individual abrasive particle to move freely in all directions with the result that the material can be subjected to localized areas of tension or compression or torsion without rupture and with a minimum of resistance to the changes of shape or contour brought about by such forces. Such type of resiliency in far more than the simple yieldability to be obtained by the use of resilient supporting pads beneath the conventional types of abrasives.

In polishing many objects it is desirable for the abrasive material to closely conform to the contour of the surface being finished. For example, the reflectors of automobile head lights require a high polish prior to plating. The material of the present invention when fabricated in the form of discs is highly satisfactory for such use since in accordance with the explanation offered above the inner portion of the disc which would be subjected to compression and the outer portion of which would be subjected to tension would yield to those forces of compression and tension to permit a perfect fit of the abrasive disc against the working surface to provide a uniform and even effective polishing action.

In accordance with the present invention, flexible abrasive coated material having a high degree of resiliency and yieldability is produced in which porous or sponge rubber is embodied as an element of the permanent backing. According to preferred practice, particu-

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larly when the article is to be used in conjunction with disc or belt sanding or polishing devices, the backing in products of the present invention comprises a layer of fabric having a layer of sponge rubber of the desired thickness secured to one side of the fabric with the abrasive particles adhesively attached to the opposite side of the fabric. One fabric which I have found highly satisfactory for such use, and which in combination with a layer of sponge rubber is particularly effective in permitting movement of the individual abrasive grains of the abrasive coated surface so as to follow the contours of sharply contoured surfaces, is a substantially non-laminated fibrous web composed of a plurality of carded cotton fibrous membranes held together and compacted by a suitable adhesive binder of resilient character such as a latex base bond. However, other paper or cloth fabrics, either woven, carded or felted, composed of various textile or paper fibers, can be used in conjunction with a layer of sponge rubber as the backing for making products in accordance with the teaching of the present invention. However, the fabric element for the backing should preferably be one which will not interfere or destroy to any marked extent the property of yieldability obtained by the presence of the sponge rubber layer. The fabric layer also should be one to which the abrasive particles can be securely held by suitable adhesive binders selected on the basis of the type of fabric used in the backing and the particular product being made. For some purposes, especially where the article being made is intended for manual use for various polishing or scouring purposes, the fabric element of the backing can, if desired, be dispensed with so that the sponge rubber layer constitutes the sole element of the backing. Also, if desired, the fabric layer can be attached or bonded to the underside of the sponge rubber layer as a reinforcing or strengthening member with the abrasive particles secured directly to the sponge rubber layer or secured to a second layer of fabric which is in turn bonded to the other side of the sponge rubber layer.

One fabric which I have found especially satisfactory for use in carrying out the present invention is the non-laminated fibrous web material made in accordance with the teachings of U. S. Patents Nos. 2,055,410 and 2,055,411, granted September 22, 1936 to Edward Hurst and Myrick Crane, and to Edward Hurst, respectively. The carded membranes which make up the fibrous sheet materials disclosed in those patents are formed webs of loosely adhering individual fibers and may consist of any animal, vegetable, mineral or synthetic fibrous material capable of being carded or garneted into web form. Such materials include natural fibers such as cotton, wool, jute, flax and the like, or any of the newer synthetic fibers such as glass fibers, resinous or synthetic rubberlike fibrous materials. Any one of these fibrous materials may be used singly or two or more may be mixed in any desired proportion. Cotton fibers have been found to be highly satisfactory in this process and have been most generally used.

The sponge rubber element of the backing can be made in continuous sheet form and where a fibrous or fabric backing is used can be bonded thereto by various ways known to the art. For example, one method of forming a continuous layer of sponge rubber material bonded to a suitable fabric, and which may be used in carrying out the present invention is that disclosed in detail in U. S. Patent No. 2,163,289, issued on June 20, 1939 to Jean Pennel and Joseph Flipo.

In order that the invention may be more clearly set forth and understood, reference is made to the accompanying drawings, in which

Figure 1 is a perspective view of a polishing pad made in accordance with the present invention;

Figure 2 is a vertical sectional view taken through the line 2:2 of Figure 1; and

Figure 3 is a vertical sectional view, similar to that

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of Figure 2, showing a modified form of the present invention wherein the sponge rubber layer is used alone as the backing element of the abrasive coated article.

As illustrative of the manner in which the present invention can be practiced, flexible abrasive coated material such as that shown in Figures 1 and 2, suitable for cutting, punching or otherwise fabricating into various shapes such as belts, discs and pads, can be made as follows:

Example I

A cotton fibrous web material made in accordance with the teachings of the Crane and Hurst, and Hurst patents referred to hereinabove and consisting of a substantially non-laminated web of interlocked cotton fiber membranes held together by a rubber latex binder is coated with a layer of sponge rubber approximately $\frac{1}{8}$ " thick. One manner of coating the fabric, as already mentioned, is that set forth in the aforesaid Pennel and Flipo Patent No. 2,163,289. However, other processes of coating the fabric with a layer of sponge rubber of the desired thickness which may be more or less than $\frac{1}{8}$ " thick may be used. The rubber layer applied to the fabric is either one which contains, interspersed throughout the mixture, a sufficient amount of adequately dispersed gas to render the material when set of suitable porosity or sponginess or one which contains dispersed ingredients which, when heated, generate the gas to provide the necessary porosity or sponginess in the coagulated or set layer after it is applied to the backing and subjected to heat.

Having made a composite backing composed of sponge rubber and a layer of fabric, the fabric side of the resulting composite backing is then coated with a suitable adhesive in any conventional manner and a layer of abrasive particles applied to the adhesively coated surface while the adhesive is still tacky, and the abrasive coated material dried or heat treated, depending upon the character of the adhesive used, to harden or set the adhesive and secure the abrasive particles to the backing. The resulting material is then ready for cutting, punching or otherwise fabricating into articles such as belts, discs and the like of suitable size and shape for intended use. For example, the abrasive polishing pads shown in Figures 1 and 2 made as above described are composed of a fabric layer 4 bonded to a sponge rubber layer 5 which together constitute the yieldable backing. The layer of abrasive grain 6 is adhesively secured to the backing by means of a suitable adhesive 7 such as animal glue.

Example II

An abrasive coated product particularly adapted for use in lighter abrasive operations such as manually conducted polishing processes or as an instrument for scouring and cleansing, can be made according to the article shown in Figure 3 wherein the fabric layer is eliminated and the sponge rubber layer 5 constitutes the sole backing element for the abrasive grains 6 which are adhesively secured to the sponge rubber by means of the adhesive 7. In making articles in which the sponge rubber is used alone as the backing, a rubber composition similar to that in Example I can be used but instead of applying the rubber composition to the surface of a permanently attached sheet of fabric, the rubber composition can be applied to a temporary supporting drum or belt upon which the rubber composition is supported until it is coagulated or set after which it is removed in the form of a continuous layer or sheet. The resulting layer of sponge rubber material is then coated directly with a suitable adhesive such as a latex-resin adhesive or a latex-casein adhesive and a layer of mineral particles suitable for polishing or scouring purposes is applied. A suitable latex-resin adhesive is one in which the latex and the resin are mixed in such proportions as to provide an adhesive composition, 100 parts by weight of which con-

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tains 20 parts by weight of resin and 20 parts by weight of latex solids. A satisfactory resin is a low viscosity, liquid phenol-formaldehyde condensation product. Likewise, a suitable formula for a latex-casein adhesive is one in which 100 parts by weight contains 20 parts by weight of casein solids and sufficient latex to provide 20 parts by weight of latex solids.

In practicing the invention any of the abrasive materials in common use can be employed, such as silicon carbide, fused aluminum oxide, flint, corundum, emery, rouge and similar substances. The size of the abrasive particles may vary from the finest polishing or buffing powders to the coarser grit sizes used in abrasive operations. Also, when the resulting articles are to be used for the lighter polishing operations or for scouring and cleansing purposes such materials as finely divided pumice, diatomaceous earth, fine sand or other mineral particles may be used as the granular coating.

Where reference is made herein in the specification or in the claims to the applying of a layer of abrasive grains to the flexible backing or reference is made to the presence of a single layer of abrasive grains adhesively secured to a backing, it is intended to be limited in accordance with the figures of the drawing to a thin flexible layer of abrasive grains substantially one grit size in thickness similar in thickness to the abrasive coatings found on conventional sandpaper or like coated abrasive products of the same abrasive grit size and to exclude therefrom such thicker layers of abrasive grain having such thickness as to resemble a bonded abrasive body in appearance and properties.

Having described the invention it is desired to claim:

1. An abrasive article comprising a flexible backing and a single layer of abrasive grains substantially one grit size in thickness adhesively secured thereto, said flexible backing comprising a non-abrasive layer of sponge rubber of sufficient thickness to impart yieldability and resilience to the article bonded to a layer of interwoven and adhesively combined fibrous material.

2. An abrasive article comprising a flexible abrasive coated material comprising a single layer of abrasive particles substantially one grit size in thickness adhesively secured to a flexible backing comprising a non-abrasive layer of sponge rubber of sufficient thickness to impart yieldability and resilience to the article bonded to a fabric reinforcing layer.

3. An abrasive article comprising a sheet of fabric having a non-abrasive layer of sponge rubber of sufficient thickness to impart yieldability and resilience to the article adhesively attached to one side of said fabric and a single layer of abrasive grains substantially one grit size in thickness adhesively secured to the opposite side of said fabric.

4. An abrasive article comprising a sheet of interwoven fibrous material, a non-abrasive layer of sponge rubber of sufficient thickness to impart yieldability and

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resilience to the article adhesively attached to one side of said interwoven fibrous material, and a single layer of abrasive grains substantially one grit size in thickness adhesively secured to the opposite side of said interwoven fibrous material.

5. An abrasive article comprising a flexible abrasive coated material comprising a single layer of abrasive particles substantially one grit size in thickness adhesively secured by means of an adhesive selected from the group consisting of an animal glue, a latex-resin adhesive, and a latex-casein adhesive to a flexible backing comprising a non-abrasive layer of sponge rubber of sufficient thickness to impart yieldability and resilience to the article and a fabric reinforcing layer, said fabric reinforcing layer being adhesively bonded to said layer of sponge rubber.

6. An abrasive article comprising a flexible abrasive coated material comprising a single layer of abrasive particles substantially one grit size in thickness adhesively secured by means of an animal glue to a flexible backing comprising a non-abrasive layer of sponge rubber of sufficient thickness to impart yieldability and resilience to the article and a fabric reinforcing layer, said fabric reinforcing layer being adhesively bonded to said layer of sponge rubber.

7. An abrasive article comprising a flexible abrasive coated material comprising a single layer of abrasive particles substantially one grit size in thickness adhesively secured by means of a latex-resin adhesive to a flexible backing comprising a non-abrasive layer of sponge rubber of sufficient thickness to impart yieldability and resilience to the article and a fabric reinforcing layer, said fabric reinforcing layer being adhesively bonded to said layer of sponge rubber.

8. An abrasive article comprising a flexible abrasive coated material comprising a single layer of abrasive particles substantially one grit size in thickness adhesively secured by means of a latex-casein adhesive to a flexible backing comprising a non-abrasive layer of sponge rubber of sufficient thickness to impart yieldability and resilience to the article and a fabric reinforcing layer, said fabric reinforcing layer being adhesively bonded to said layer of sponge rubber.

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