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COATED ABRASIVE PRODUCTS

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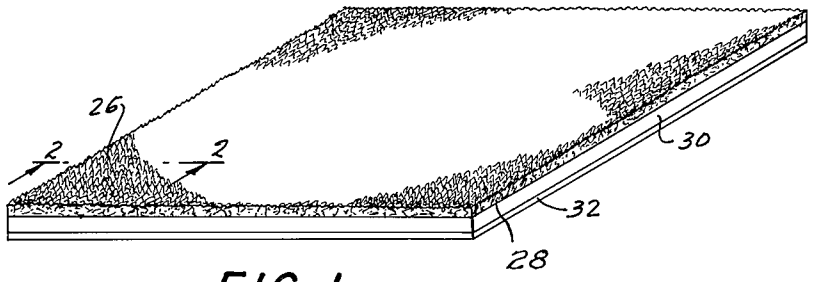

FIG. 1

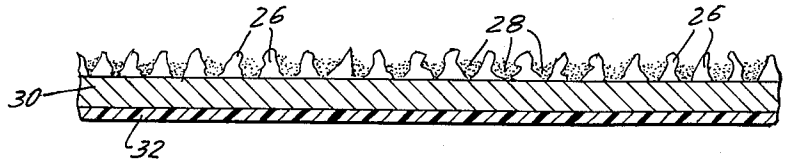

FIG. 2

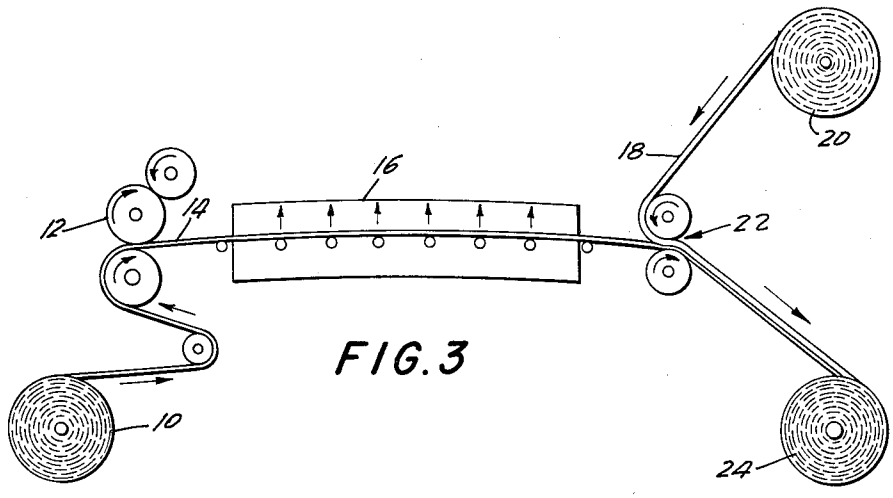

FIG. 3

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COATED ABRASIVE PRODUCTS

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This invention relates to coated abrasive products in the form of sheets, disks and the like.

Coated abrasive products are available commercially that are provided with a flexible backing element made from a woven fabric web or a non-woven paper or vulcanized fiber web. While such products satisfy many commercial needs and usages, they have been found disadvantageous for a number of specialized applications. For example, the small abrasive disks provided with relatively stiff paper backing elements so popular in the dental trade are hazardous to use because of the danger of tearing or breaking and thereby causing injury to the patient. Vulcanized fiber disks are also used for this purpose but are not suitable because of the excessive thickness required to obtain adequate strength. For general use the available paper backed coated abrasive sheets are too weak and easily torn to be efficiently useful. In certain finishing applications that require a thin abrasive sheet, problems of strength and heat resistance are encountered which are ill satisfied by the commercially available products. Known fabric backed coated abrasive sheets are found to be too thick and inflexible to satisfactorily finish contour work.

The prime object of my present invention pertains to the provision of a coated abrasive product which may effectively serve in the mentioned specialized applications for which known flexibly backed abrasive products are generally deficient, and one which is also efficiently useable for general applications.

More specific objects of the invention are the provision of a coated abrasive sheet provided with a tough, flexible tear-resistant backing; the provision of a plastic backed coated abrasive sheet having improved heat resisting properties; the provision of thin flexible coated abrasive products used for finishing and polishing which are strong, tough and tear-resistant; and the provision of relatively stiff but flexible coated abrasive products which combine the properties of tear-resistance and heat-resistance.

To the accomplishment of the foregoing objects and such other objects as may hereinafter appear my invention relates to the coated abrasive products as sought to be defined in the appended claims and as described in the following specification taken together with the accompanying drawings in which:

FIG. 1 is a perspective view of a coated abrasive product embodying the structure of the present invention;

FIG. 2 is an enlarged view thereof taken in cross-section in the plane of the line 2—2 of FIG. 1; and

FIG. 3 is a schematic view depicting the manner of making a Mylar film-fibrous web lamina for use in making the coated abrasive product of the invention.

I have found that a tear-resistant but thin flexible coated abrasive product in the form of a sheet or disk possessing suitable heat resistance may be made by using a backing element for the product composed of a fibrous web layer laminated to a Mylar polyester film. Mylar is a polyester film made from polyethylene terephthalate—the polymer formed by the condensation reaction between ethylene glycol and terephthalic acid. The fibrous web layer may be, for example, rag paper, rope paper, kraft paper or glass fibre. The fibrous web layer serves as the carrier for the layer of abrasive grains which latter are resin embedded and bonded, the bonded abrasive layer being united by the maker or bond resin to the fibrous web. The fibrous web is laminated to the Mylar film by a thermoplastic or modified thermoplastic resin adhesive. The fibrous web then also serves the purpose of insulating the thermoplastic adhesive on the Mylar film from frictional heat in use. The Mylar film imparts the property of tear-resistance to the abrasive product.

The thinness of the fibrous web-Mylar film laminate is selected in accordance with the degree of stiffness desired in the abrasive sheet. A desirable tear-resistant but thin and flexible product with suitable heat resistance can be made by using a backing element composed of a fibrous web, which may be as thin as 2 mils or as thick as 20 mils, laminated to a film of Mylar having a thinness of from 0.5 to 3.0 mils. The adhesive for uniting the fibrous web to the Mylar film may be any suitable thermoplastic resin or modified thermoplastic resin (i.e. one combined with a thermosetting type resin) that adheres well to the plastic Mylar film, such as an alkyd or modified alkyd resin or an acrylonitrile-phenolic resin.

The maker or binder resin for embedding the abrasive grains and uniting the same to the fibrous web, where an optimum heat resistant product is desired, is a heat-hardened thermosetting resin such as phenol-formaldehyde, urea-formaldehyde or melamine-formaldehyde resin. Where an abrasive product of greater flexibility and suppleness is desired, the maker resin may comprise a urethane elastomer as described in the copending application of Joseph N. Kuzmick, S.N. 739,933, filed June 4, 1958, such urethane elastomer comprising the non-foaming group of polyol isocyanate products in solid or liquid phase, which, for example are made from diisocyanates and a linear polyester such as ethylene glycol adipate. When such a urethane elastomer is used as the maker or binder resin, the fibrous web consists preferably in a stretchable paper such as the extensible kraft paper made by the so-called Clupak process.

Referring now more in detail to the drawings and having reference first to FIG. 3 thereof wherein is depicted schematically a method of making the laminate employed as the backing element for the abrasive coated product, the Mylar lamina is shown fed from the supply roll **10** into and through a reverse roll-coater **12** for the application of an adhesive to the top surface of the Mylar sheet or film **14**, the adhesive coated Mylar film then being fed through an air drying oven **16** (to remove solvents), the coated film being thereafter bounded to a fibrous web **18** delivered from a supply roll **20**, the fibrous web and the Mylar film being laminated at the nip of the bonding rolls **22** after which the laminate is fed to and reeled on the take-up roll **24**.

The laminate thus produced is then coated on its fibrous web side with the maker or bonding resin for the abrasive grains after which the abrasive grains are sprinkled on the surface of the binder and the product is then subjected to the usual heat curing cycle. The resulting product comprises, as shown in FIGS. 1 and 2, the coated abrasive sheet which comprises a layer of abrasive grains **26** embedded in the maker resin **28** and united to the flexible backing sheet which consists of the fibrous web or layer **30** adhesively laminated to the Mylar polyester film **32**, the abrasive grain layer being bonded to the fibrous web by the maker resin.

The following are typical specific examples of practising the present invention.

Example I

As an example of the practice of the invention I take a Mylar polyester film one or two mil thin. As aforesaid Mylar is a polyester film made from polyethylene terephthalate—the polymer formed by the condensation reaction between ethylene glycol and terephthalic acid.

Mylar polyester film manufactured by Du Pont is an excellent example, as this film is extremely strong and tear resistant, can be deformed and even stretched, and is resistant to water and many solvents and is serviceable at temperatures up to 350° F. The fibrous web layer may be of rag paper that is relatively thin, dependent upon the amount of stiffness desired in the product; and in this example the rag paper is 7 mils thick. On the surface of the fibrous web layer of the Mylar-paper laminate there is spread a phenol aldehyde resin of the character hereinabove described; and following the spreading of this binder abrasive grain, such as silicon carbide, alumina, flint or garnet is sprinkled on the surface of the binder. The motion of the abrasive coated product thus produced is continued over suitable supporting rolls, inverted to permit excess abrasive above that attached to the surface by adhesion to the binder to fall off, and the coated film is moved through a tunnel oven heated at 300° F., the product being thereby subjected to the usual heat curing cycle. The product thus produced is subsequently cut into sheets, disks, or belts to provide the desired end product.

The mesh size of the abrasive grains may be varied depending upon the thickness of the end product desired and a range of mesh size may include the fine #500 mesh screen to the coarse #80 mesh screen size. As is customary in making coated abrasive products employing a heat-hardened resin as the maker or binder resin, a barrier coat may first be applied to the fibrous web prior to applying the maker resin coating thereto. The thickness of the maker resin layer may be varied from ½ mil, dried film basis (for fine grit) to 3 mils, dried film basis (for coarser grit). The abrasive layer thickness is controlled by the viscosity and film thickness of the applied maker resin. With a thin maker resin coating the abrasive grit may deposit only one particle thick. With greater amounts of resin the number of abrasive layers will increase to several particles thick. The abrasive layer thickness will depend on the wetting quality of the resin. A nominal thickness of fine 400 grit abrasive may be 2 or 3 mils. For 100 grit the abrasive layer may be 5 to 15 mils thick. The time-temperature heating cycle may be varied as is customary depending upon the character of the thermosetting heat hardenable resin employed.

As a variant of this example the fibrous web lamina may be a thin sheet of rope paper in which a 4 mil thick rope paper is used. Another type of fibrous web that may be employed is kraft paper; it may be pointed out that except for the low grade flint coated type of sandpaper, kraft paper would not for ordinary applications be considered suitable for a coated abrasive product. By the method of the present invention a film of Mylar to which is laminated kraft paper produces a backing element that has the desired physical properties of strength, toughness and flexibility that could not otherwise be obtained wtihout costly specialized manufacturing processes.

Example II

This example illustrates the application of the invention to the making of an abrasive product of increased flexibility and suppleness. For this purpose the maker resin comprises a urethane elastomer, in this instance a product sold as Adiprene manufactured by Du Pont. This urethane elastomer is compounded or mixed with 12% by weight of a cross-linking agent dichlorobenzidene. Adiprene is a liquid urethane elastomer reaction product of diisocyanate and a polyalkylene ether glycol. Following the spreading of the binder, a #200 mesh silicon carbide abrasive is sprinkled on the surface of the binder. The operations as described in Example I are carried through, the curing cycle being at 250° F. for a period of 30 minutes. In this example the fibrous web is an extensible kraft paper made by the Clupak process; the stretch properties of this type kraft paper makes it particularly desirable to use as a lamina for making an extremely flexible and tear-resistant coated abrasive product.

The coated abrasive products of the present invention and the manner of making the same and their functioning in various abrasive applications will it is believed be apparent from the above description thereof. It will be further apparent that many changes will be made without departing from the spirit of the invention as defined in the following claims.

I claim:

1. A thin flexible coated abrasive product combining the properties of tear resistance and heat resistance consisting as the essential elements of a layer of abrasive grains deposited onto and embedded in a synthetic maker resin, said maker resin coated onto and united to a tough flexible tear resistant backing sheet, said backing sheet consisting of a fibrous web adhesively laminated to a polyester film of polyethylene terephthalate, the abrasive grain layer being united to the fibrous web side of said backing sheet and being bonded by said maker resin to the fibrous web of said backing sheet.

2. The coated abrasive product of claim 1 in which the abrasive grain embedding resin is a thermosetting heat-hardened resin.

3. The coated abrasive product of claim 1 in which the abrasive grain embedding resin is a non-foamed polyurethane elastomer.

4. The coated abrasive product of claim 1 in which the laminating adhesive is a thermoplastic resin.

5. The coated abrasive product of claim 1 in which the abrasive grain embedding resin is a thermosetting heat-hardened resin and the laminating adhesive is a thermoplastic resin.

6. The coated abrasive product of claim 1 in which the fibrous web comprises a fabric selected from the class consisting of rag paper, rope paper, kraft paper, extensible kraft paper and glass fiber.

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