

[54] **COATED ABRASIVE MATERIAL AND MANNER OF MANUFACTURE**

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[58] Field of Search **51/295, 296, 298, 298.1, 51/294**

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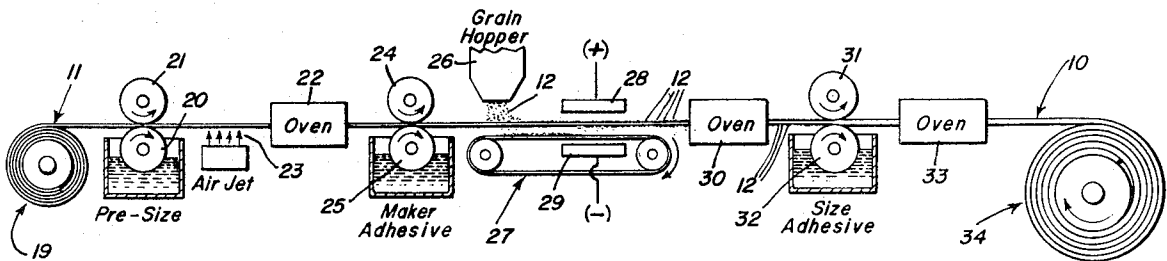
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[57] **ABSTRACT**

An open mesh coated abrasive material is provided which substantially retains its initially excellent tear strength and flexibility characteristics during use regardless of whether the grinding application involves wet or dry conditions. Such a retention of physical properties in the abrasive material is made possible by providing on the abrasive material fabric backing member, intermediate the backing member and the maker adhesive, a coating which is not only water insoluble but also water resistant. The preferred invention also incorporates a maker adhesive of controlled friability characteristics.

8 Claims, 3 Drawing Figures



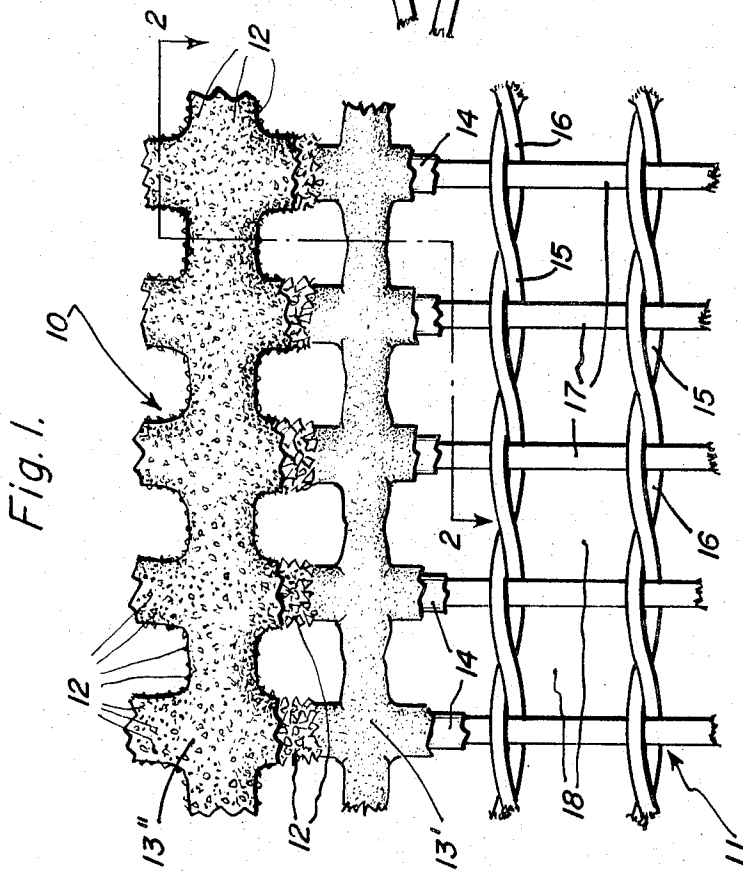


Fig. 2.

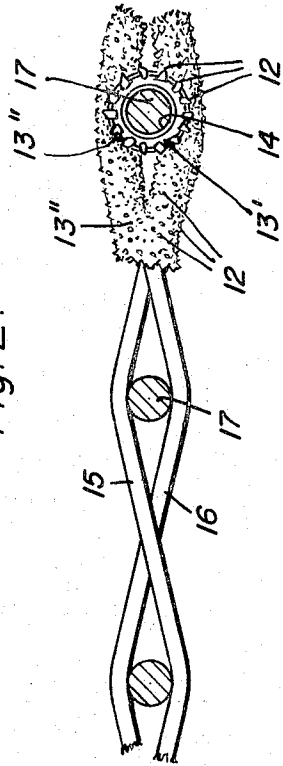
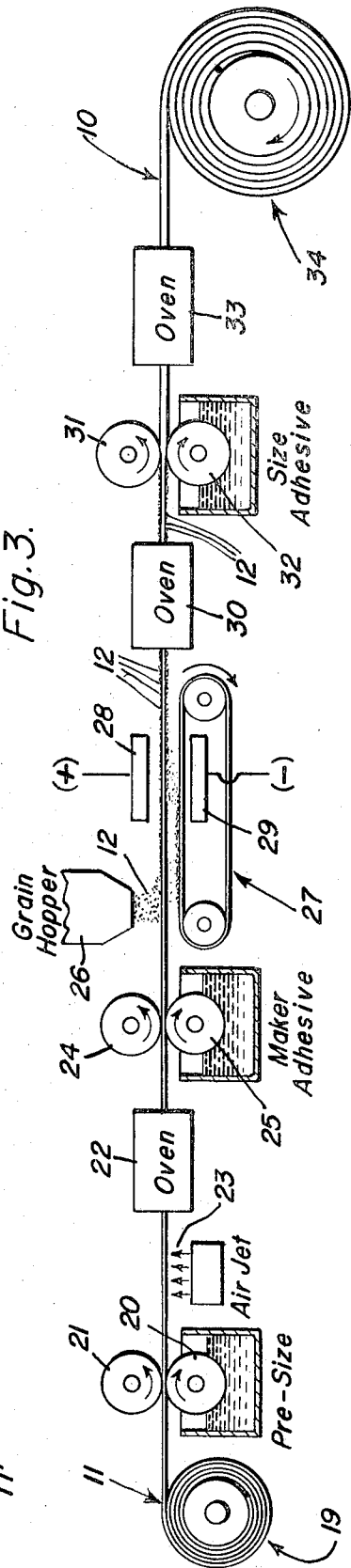


Fig. 3.



COATED ABRASIVE MATERIAL AND MANNER OF MANUFACTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to coated abrasive material and its method of manufacture and to the coated abrasive articles manufactured from the abrasive material. In particular, the invention relates to coated abrasive material that is conventionally termed "open mesh" cloth coated abrasive material.

2. Description of the Prior Art

Open mesh cloth or foraminous coated abrasive material has been disclosed and used commercially for a number of years. Exemplary of the prior art disclosing this kind of abrasive material, and its manner of manufacture, are U.S. Pat. Nos. 2,123,581; 2,740,239; 2,740,725; and 2,984,052. Among other applications, this type of abrasive material is used in the finishing of auto bodies paint or sealer coats and, in some instances, both. Such an application, as will be readily appreciated by those skilled in the art, requires the abrasive material to have high tear strength, to be suitably flexible throughout the life of the abrasive material, and to conform readily to the automobile body surface being finished.

In more recent years the design of automobiles has necessitated that the above-mentioned properties of the abrasive material be even further improved. Of necessity, moreover, these properties must be retained whether the application for the abrasive material involves wet or dry finishing conditions.

As tear strength is an important desired physical property in open mesh fabric abrasive material, there has been a trend, over the years, toward use of stronger fabric backing members. Thus, the use of fabrics of man-made fibers, e.g., high tenacity rayon and nylon, has been widely practiced. It is expected now, with the declining manufacture of rayon, that fabrics of nylon yarns will be even more widely used.

The use of nylon fabrics has, as might be expected, certain advantages over the use of rayon fabrics. However, there are also certain disadvantages associated with the use of such a fabric. One major disadvantage is the fact that nylon fabrics are subject to degradation by the phenol formaldehyde adhesives systems conventionally used in manufacturing coated abrasive material. This results in, inter alia, decreased tear resistance in the backing member. Thus, it has been found necessary heretofore, where a nylon fabric backing member is to be used, to protect it from the degrading effects of the phenolic bonding adhesives. This is accomplished by impregnating or pre-sizing the backing member with some suitable material which precludes direct contact between the adhesive system and the fibrous backing member. These impregnants, as will be seen hereafter, serve a dual function.

The adhesive bonding system for the abrasive grain in coated abrasive material is conventionally a relatively rigid, hard, brittle, resinous material. This being the case, these same properties would be imparted to the fabric backing member in the event of penetration by the adhesive material into the backing member. After impregnation with a relatively flexible pre-size material, however, the fibrous yarns of the fabric backing member are non-absorbent and are not penetrated by the adhesive bond material. Thus the open mesh

abrasive material remains somewhat flexible and permits a much higher degree of flexibility in the final abrasive product than would be possible if the adhesive material impregnated the yarns.

In the prior art there is disclosed a number of impregnating materials for use in the manufacture of open mesh cloth coated abrasive material. Those materials found most suitable, which for desirable reasons are necessarily water insoluble, have not been found, at least as far as we are aware, sufficiently water resistant to prevent disadvantageous changes during use, in applications where, e.g., water is used as a grinding aid, of the physical properties of the coated abrasive article being used. Thus, for example, polyvinyl acetate which has been conventionally used as a pre-size material in the manufacture of open mesh abrasive material absorbs water to such an undesirable degree that the initially good flexibility characteristics in the backing material provided with its use as an impregnant are drastically impaired in abrasive applications. The result is that, after prolonged soaking in water in wet grinding applications, there is a tendency for the abrasive material to become too flexible, in fact, relatively limp. Limpness, or lack of suitable stiffness, allows the abrasive material, e.g., an abrasive disc thereof, to fold on itself if it is unsupported temporarily during use. When this occurs, the abrasive grain sheds relatively rapidly resulting, in many instances, in rather low performance life for the abrasive article.

SUMMARY OF THE INVENTION

In accordance with our invention there is provided an open mesh cloth coated abrasive material of improved physical properties, in particular flexibility, comprising an open mesh fabric backing member coated with a water insoluble and water resistant pre-size material and abrasive grains adhered thereto by means of an adhesive binder. In the preferred aspect, the adhesive binder provides controlled friability. Such an abrasive material provides coated abrasive articles of unique physical characteristics.

The abrasive material of our invention in its basic aspects incorporates a pre-size material which because of its resistance to wet grinding conditions, as well as its insolubility in water, results in abrasive material of less variation in use in its flexural characteristics. Thus, quite advantageously, an abrasive article manufactured from abrasive material of the invention is subject to essentially no variation in fold resistance between its dry and water-saturated condition. The abrasive material finds rather wide application and can be used by operators under widely varying degrees of exposure to water.

In addition to the above desirable consistency in flexural characteristics and fold resistance, the pre-size composition used in this invention, which has excellent adhesion to both nylon yarns and phenolic resins, provides coated abrasive material of excellent tear resistance.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood if reference is made to the drawing in conjunction with reading the specification. In the drawing:

FIG. 1 is a plan view of a portion of open mesh fabric cloth coated abrasive material in accordance with the invention showing an open mesh fabric cloth backing

member found particularly useful in the practice of the invention;

FIG. 2 is a view in cross-section taken at lines 2—2 of the abrasive material shown in FIG. 1; and

FIG. 3 is a diagrammatic view showing the manufacture of open mesh fabric cloth coated abrasive material according to the invention.

DETAILED DESCRIPTION OF THE INVENTION AND THE PREFERRED EMBODIMENTS THEREOF

Turning now to the drawing, there is disclosed in FIG. 1 thereof an open mesh fabric coated abrasive material 10 which comprises, in its basic aspects, an open mesh woven fabric backing member 11, abrasive grains 12 adhered to the backing member by means of an adhesive binder 13, and a water insoluble and water resistant coating 14 encapsulating the interlaced yarns of the backing member.

Fabric backing member 11, as shown in the drawing, is a plain leno weave fabric comprising pairs of warp yarns 15, 16 twisted on each other at each fill yarn 17 together with a plurality of fill yarns 17 passing between pairs of twisted together warp yarns 15, 16. The manufacture of leno weave fabrics is well understood and is believed to require no detailed explanation herein. However, as two warp yarns are twisted together in such a construction, it is preferred that, in general, the leno weave fabric be made with warp yarns of lesser diameter than the fill yarns. The square arrangement, formed by the interlaced warp and fill yarns, as shown in the drawing, is most desired and is achieved in using twice as many warp ends as fills. Other leno weave constructions than that shown in FIG. 1 may be used and, in fact, a so-called one-half reverse leno weave fabric is the more preferred construction for a backing member to be used in the practice of this invention.

One of the chief characteristics of a leno weave fabric construction which makes such a fabric construction desirable in the manufacture of open mesh coated abrasive material is that such a weave produces a suitable open mesh or foraminous backing material, i.e., one having mesh or openings 18 of a desirable size. Most importantly, however, the open character of the weave is stabilized and is maintained during manufacture of the abrasive material and the use of abrasive products manufactured from the abrasive material.

Although a leno weave fabric is the most preferred backing member, it is possible to use a simple plain or twill weave open mesh fabric. These fabrics are not only less expensive to manufacture, but may be formed with more even surfaces than cloth of leno-woven construction. Consequently, coated abrasive products having fewer surface irregularities due to unevenness of the fabric may be produced when using a plain or a twill weave fabric.

In plain weaving each fill yarn passes over and under alternate ends or warp yarns across the width of the cloth, alternate fill yarns passing over the odd and under the even warp yarns and under the odd and over the even warp yarns, respectively. The twill weave differs from the plain weave principally in that each filling yarn interlaces from two to four warp yarns and on each successive pick the filling yarn moves the design one step to the right or left, thus forming a diagonal. A twill fabric in which each filling yarn passes over two

warp ends and then under two ends and repeats this sequence across the width of the fabric, is known as a "two and two" twill. It is also classified as an "even" twill since an equal number of warp yarns and filling yarns are in the recurring design. "Even" twills, other being "three and three" and "four and four" twills, are alike on both sides and are uniform except for the diagonal that is characteristic of the twill weave.

Open mesh fabrics having either a plain weave or an even twill weave are preferred as backing members over uneven twills and satin or sateen weaves. These constructions are less desirable since they are different on opposite sides. Moreover, satin and sateen woven fabrics are less satisfactory because of their characteristic long exposed yarns or floats which tend to make an open mesh fabric extremely flimsy. It should be noted, however, that fabrics with doubled warp yarns may be employed in some cases. A plain weave fabric of this type having two small, closely adjacent, warp yarns, the two together being approximately equal in size to the filling yarn used, are picked as one yarn. This results in a flatter, more uniform fabric.

Where fabric backing member 11 is not of a leno weave construction, it may be found necessary to stabilize the fabric construction on the loom. Thus, the pre-size composition, as hereinafter further disclosed, will be applied while the fabric is on the loom. The result being that the interlaced yarns will be adhered together at their cross-over points.

In general, the fabric backing member should be of high strength textile fibers whereby a great resistance to tearing of the fabric is provided. This property is then imparted, in accordance with our invention, to the coated abrasive material manufactured using the backing member. Obviously, the backing member can be of various fibrous materials; however, we prefer that the backing member be of continuous nylon, desirably nylon-66, filamentary yarns.

The warp and filling yarns in the backing member are preferably of the same material; however, it is possible that, in some instances, continuous filament nylon yarns can be used in the warp and polyester or other yarns used in the fill direction. Yarns of different materials, it should be recognized, may cause undesirable differences in strength of the finished fabric.

Although monofilament yarns may be used in the practice of the invention, it is preferred that the yarns be multifilament. Except when using doubled warp yarns in the manner mentioned above, the warp and filling yarns chosen are preferably of such a size that when woven the strand widths will be, as shown, substantially the same.

The particular size yarns employed will, of course, depend upon several factors such as the size of the abrasive particles to be used, the strength of the yarns and the thread or cloth count desired in the fabric backing member. The cloth or thread count of the open weave fabric backing member employed in the invention can obviously vary over a considerable range. Where an abrasive product is to be used for heavy duty grinding applications, coarser yarns will, in general, be used in manufacture of the backing member material. Such a fabric will also most preferably be made with larger mesh or openings 18. On the other hand, where the abrasive article is to be used in fine polishing applications, finer yarns will be preferably employed in the manufacture of the backing member.

A balanced fabric backing member, that is, one having the same cloth count in each direction and in which the warp and filling yarns have substantially equal widths, is desirable since directional effects in the resulting flexible abrasive material will be lessened. However, in some cases where a directional effect is not objectionable or is desired, the fabric backing member may be somewhat unbalanced. Care must be taken, of course, to avoid having the cloth count so high in one direction or the other that, when the yarns of the woven backing are given their coating, the mesh openings are substantially blocked.

As shown more clearly in FIG. 2 of the drawing, the water insoluble and water resistant pre-size coating 14 impregnates the fabric backing member 11 and surrounds and encapsulates yarns 15, 16, and 17. It is preferred to use a sufficient amount of the impregnating or pre-size composition to leave a film or coating on the surfaces of the yarn. Thus, the fabric backing member openings 18, in addition to being stabilized by the leno weave construction are further made dimensionally stable in that the yarns are adhered together at their cross-over points.

Although various materials may be water insoluble and water resistant, they will not be found satisfactory in the practice of this invention, unless adequate adhesion with the maker adhesive and to the fabric fibers is provided. Moreover, there must be freedom from any chemical reaction which would cause deterioration with the fabric backing member or the maker adhesive.

The pre-size material which has been found most satisfactory is the reaction products of a composition comprising in admixture a terpolymer of ethylene, vinyl chloride, and acrylamide, and an aminoplast. Such a terpolymer and its manner of manufacture is disclosed in U.S. Pat. No. 3,632,425. It is preferred that the interpolymer contains from about 5 per cent to about 70 per cent ethylene, 30 per cent to about 95 per cent vinyl chloride, and from about 1 per cent to about 5 per cent acrylamide. Even more preferably, the interpolymer will contain from about 19 to 23 per cent ethylene, about 74 to 78 per cent vinyl chloride, and from about 2 to about 4 per cent acrylamide.

An interpolymer meeting the above requirements is available commercially in a milky white emulsion (47% total solids) from Monsanto Company, Organic Chemicals Division and is sold under the trademark Monflex 4514. The polymeric material has a glass transition temperature at 14°C and a specific gravity of 1.23. The liquid viscosity (No. 2 spindle, 6 RPM) is 25-200 cps. It has a pH of 8.0±0.5 and an anionic particle charge.

The acrylamide monomer in the terpolymer, as disclosed in the above-mentioned patent can be, if desired, replaced in part with some other polar monomer such as acrylonitrile, N-methylol acrylamide, acrylic acid, etc. However, the acrylamide generally should constitute at least about 50 per cent by weight of the third monomer of the interpolymer.

Various aminoplasts will be found which suitably react with the amide groups of the above-disclosed terpolymer. The most preferred is melamine-formaldehyde; however, urea-formaldehyde resins will also be found satisfactory. One such resin found highly satisfactory is a melamine-formaldehyde resin available commercially in liquid form from American Cyanamid under the trademark Aerotex M-3. Aerotex M-3 is a

clear viscous syrup (80% solids) having a pH of 8.5-9 and weighing about 10 lbs./gal.

Various combinations of these two components can be used in the practice of the invention; however, in general, the less melamine-formaldehyde resin, the less crease resistance in the coated backing member. Satisfactory results will be obtained where the ratio of aminoplast is from about 5 parts by weight (pbw) to about 25 pbw to 180 pbw of the terpolymer. Preferably, the ratio will be 15-20 pbw aminoplast to terpolymer. Where a less crease resistance abrasive product can be tolerated, however, the aminoplast can even be left out of the presize composition.

The abrasive bond which completely surrounds and encapsulates pre-size layer 14 and at least partially surrounds each of the abrasive grains 12 so as to bond them to backing member 11 must adhere well to the pre-size material. The adhesive bond, as is conventional in the manufacture of coated abrasive material, comprises a maker adhesive layer 13' and a so-called "size coat" layer 13'', the latter being applied after deposition of the abrasive grain. In at least the outer surface, the adhesive bond is provided with a controlled degree of friability so that when the abrasive material is used, i.e., rubbed against a surface under pressure, the bond will break into small particles not more than a few times larger in average diameter than the individual abrasive grains. This is in contrast to materials conventionally used as adhesive bonds which normally fracture into particles at least 10 times larger than so-called "fine" abrasive grains.

Controlled friability is obtained in heat hardenable phenolformaldehyde resins, the most preferred adhesive material, in altering the resins ability to cross-link. This can be accomplished in various ways; however, one way is to incorporate with the resinous condensation product, prior to final cure, a component of sufficient molecular size to interfere with formation of cross-links. Such a component should be, in general, larger by at least about 50% than the average distance between cross-links in a phenol-formaldehyde resin without the component in a final stage cure.

Although a number of materials will obviously meet the above requirement, e.g., a phenol with three carbocyclic rings each having six carbon atoms, very satisfactory results will be obtained in the use of a complex organic amine. One such compound is available from Hercules Chemical Corporation under the trade-name Rosin Amine D, a high molecular weight stabilized abietylamine, predominantly dihydroabietylamine, derived from pine resin acids. The extent and degree of friability in the adhesive bond will, of course, depend upon the ratio of organic amine to the phenolformaldehyde resin. Satisfactory results will be obtained, depending on the grinding application, over a relatively wide range, e.g., 5-30 pbw per 100 pbw phenol-formaldehyde. The more preferred range, however, is from about 10-20 pbw, organic amine/100 pbw phenol-formaldehyde resin condensation product.

Similar good results can be obtained, however, by providing that the phenol-formaldehyde resin condensation product has a smaller number of potential cross-link sites. Thus, the heat hardenable resin can be made using, e.g., o-cresol in combination with phenol.

The abrasive grain employed in the invention can be any of these conventionally used in the manufacture of coated abrasive material whether of natural or manu-

factured abrasive material or a mixture thereof. This includes, of course, silicon carbide, alumina, garnet, fused polycrystalline material such as zirconia-alumina, and the like. Obviously the abrasive grains used must be smaller in size than the mesh openings of the fabric backing member.

In the manufacture of abrasive material (See FIG. 3) in accordance with the invention, an open weave fabric backing member 11 is forwarded from a roll 19 thereof to a coating station where the pre-size composition is applied thereto. This may be accomplished in accordance with any of the conventional coating techniques; however a two roller coater comprising a bottom roll 20 and a top roll 21, as shown in the drawing will be found quite suitable. The bottom roll 20, as is conventional, rotates in the composition to be applied and the fabric backing member 11 to be coated passes through the nip formed by this roll and roll 21.

In preparing the pre-size composition, the Aerotex M-3 resin is added to a mixture of the terpolymer and anti-foaming agents while stirring to avoid its setting to the bottom of the mixing vessel. Where this occurs, one can only redispense the Aerotex M-3 resin with some difficulty. Once the two components are mixed together, curing commences and the liquid mixture sets to a firm gel in from about eight to twelve hours. The exact time depends somewhat on storage temperature, the higher the temperature, the shorter the pot life of the pre-size composition.

The wet coated backing member, in the preferred practice of the invention, is then passed into an oven 22 where the pre-size composition is dried and cured. Prior to the oven, however, the coated web, which is being transported by means of a tenter frame (not shown), is subjected laterally across the web on the underneath side with a jet 23 of air. In this way, the openings or meshes 18 in the backing member are cleared of any pre-size composition which may have bridged over the openings.

The pre-size composition can be dried and, in the case where the preferred composition is applied, cured, under a wide range of conditions. In general, however, the lower the temperature, the longer the time before drying or curing is accomplished.

After curing, the maker adhesive composition can be immediately applied to the coated backing member. This can be accomplished in a manner similar to application of the pre-size composition, i.e., by means of a two roll coater comprising rolls 24, 25. The adhesive composition can be a liquid "A" stage phenol-formaldehyde condensation product, as is conventionally used in the manufacture of coated abrasive material. However, as previously disclosed, the maker adhesive composition can be one, if desired, which will result in a more friable adhesive bond.

In any particular instance, the amount of adhesive composition applied to the backing member will depend, of course, upon a number of factors. These include, among other things, the size of the yarns employed in the backing member, fabric count, and the amount and size of the abrasive material to be applied. Obviously, the optimum amount for any particular abrasive material can be readily determined by those skilled in the abrasive art.

It may be desirable, in fact necessary, to again unbind mesh openings 18 of the fabric backing member by puncturing any film of adhesive which extends across

or fills the mesh. This can, of course, be accomplished by means of air jets, as before described, or the adhesive coated web can be passed over a rotating brush (not shown) of short, stiff bristles that intrude into the openings. Such a brush will be located across the entire width of the coated backing member at a location prior to the abrasive grain deposition.

Afterwards, and before curing of the maker adhesive composition, abrasive grain 12 is deposited on the adhesively coated backing member. The abrasive grain is fed evenly across the backing member from abrasive grain hopper 26 and is deposited on the top and sides of the yarns. In general, abrasive grain is preferred which is smaller in diameter than the backing member yarns, this size grain being less likely to be so readily dislodged from the backing member during use of the abrasive material. The abrasive grain that does not attach itself to the adhesive coated backing member falls through openings 18 onto conveyor 27 located below the backing member. These abrasive grains are then caused to embed themselves in the adhesive layer on the underneath side of the backing member as the adhesive coated backing member passes between electrodes 28, 29. Thus, abrasive grains 12 are brought into contact with and deposited on both the top and bottom surfaces of the adhesive coated open mesh fabric backing member 11.

After deposit of the abrasive grain on the yarns of the adhesive coated backing member, the backing member is transported into oven 30 wherein the adhesive composition is dried and cured, as desired. The curing conditions, i.e., the temperature - time relationship required to obtain the desired degree of cure or drying will, of course, vary with the particular adhesive composition employed. Optimum conditions for any particular adhesive composition can readily be determined by those skilled in the art.

Next, the size composition is applied to the abrasive grain adhesive coated backing member, this being accomplished by means of rolls 31, 32 rotating in the direction indicated by the arrows. The closeness of the rolls, i.e., the openness of the nip, is adjusted in accordance with usual techniques to provide the desired amount of size composition on the backing member. The amount of size composition deposited will be, in general, considerably more than the amount of maker adhesive composition deposited, e.g., or the order of 3-6 times as much on a dry weight basis.

The size composition and the maker composition, as before disclosed, constitute the adhesive bond for the abrasive grain. Although the two compositions may be of different materials, it is generally preferred that they are the same composition but for application purposes of different viscosity. The viscosity of the size composition to be applied is, in general, less than the maker adhesive composition.

Curing of the size composition is accomplished in passing the wet coated backing member through an oven 33 after which the abrasive material is wound up into a roll 34. The abrasive material is then ready to be manufactured into discs of various sizes, abrasive belts, and other forms conventionally found suitable for open mesh abrasive material.

Although abrasive material 10 is seen in the drawing, particularly in FIG. 2, to involve essentially a single layer of spaced apart abrasive grains 12, it will be obvious that this is done for sake of clarity in disclosure. In

actuality, abrasive grains 12 will be relatively closely spaced together and lie one on top of the other in several layers, e.g., three layers or more of abrasive grain. The abrasive grains in the bottom-most layer will, of course, be more or less anchored in the maker adhesive. However, those in the outer layers will be anchored to the backing member by means of the size coat which, as before disclosed, is applied to the abrasive grains already deposited on the maker adhesive layer. In fact, at least some of the abrasive grains, particularly those in the middle layers, will be essentially anchored by grain-to-grain contact with the abrasive grains in its immediate surroundings.

The coated abrasive material thus formed will be found to have at least the following beneficial characteristics (1) high resistance to tearing, imparted by the backing member fibers and important in one of the principal uses of open mesh abrasive products; i.e., the finishing of automobile bodies at intermediate stages in their manufacture and finish treatment during which the surfaces may possess rough projections that can readily tear weak abrasive discs; (2) consistency of performance in all states of moisture content, imparted by the water insoluble and water resistant pre-size layer and important because of the wide variety of moisture conditions present during various uses; (3) a long finishing life, imparted by the resistance to tearing and by the controlled friability of the adhesive bond which allows dulled abrasive grains to fall harmlessly out of the surface as wear proceeds, thus exposing sharp abrasive grains from a lower portion of the abrasive grain coating; and (4) nearly total freedom from breaking off of larger pieces of the abrasive grain - resin coating which can easily be caught in the mesh or openings in the abrasive article and act effectively as very large abrasive grains producing deleterious large scratches in the surface being finished.

The following examples will, it is believed, better illustrate our invention.

EXAMPLE 1

An open mesh leno weave fabric (44 inches wide, 18 × 18 thread count, two - 210 denier high tenacity continuous filament nylon warp yarns, 420 denier high tenacity continuous filament-nylon fill yarns), available commercially from Warwick Mills, New Ipswich, New Hampshire under the trade designation Style No. 1122, was coated with a pre-size composition having the following composition:

| COMPONENT | PARTS BY WEIGHT |
|---------------------|-----------------|
| Monflex 4514* latex | 180 |
| Acrotex M-3** | 18 |
| Foamkill 608*** | 1 |
| Witco LPA*** | 1 |

* an aqueous dispersion (47% solids) of a terpolymer of ethylene (19.23%), vinyl chloride (74-78%) and acrylamide (2-4%), available commercially from Monsanto Company.

** a clear, viscous, melamine-formaldehyde syrup (80% solids in water) having a weight of 10 lbs./gal. and a pH 8.5-9 available from American Cyanamid.

*** anti-foaming agents available from Crucible Chemical Company and Witco Chemical Co., respectively.

Coating was accomplished by means of conventional roll coating techniques, a sufficient amount of the pre-size composition being applied to the fabric backing member to result in, on drying, an add-on weight of from 2.0-3.0 lbs./sandpaper maker's ream. The wet

coated backing member was then dried by passage through an oven at 225° F for about 1 minute. On visual examination, the pre-size composition is seen to have encapsulated the yarns of the fabric backing member. The yarns are also observed to be penetrated to some degree.

The dried coated backing member was then roll coated with an adhesive composition (maker adhesive) which, when dried and cured, results in unique friability characteristics. This composition comprises the following:

| COMPONENTS | PARTS BY WEIGHT |
|--|-----------------|
| phenol-formaldehyde resol resin, caustic catalyzed, formaldehyde: phenol ratio, 0.94:1, solids content 78.4% | 100 |
| Rosin Amine D* | 15 |

* high molecular weight stabilized abetylamine derived from pine resin acids, predominantly dihydroabetylamine, available commercially from Hercules Chemical Corporation.

On the adhesive coated backing member (gravity coat top side — electrostatic coat bottom side) aluminum oxide abrasive grain (grit 360) was then deposited in amount sufficient to give 20-30 lbs./sandpaper maker's ream. Afterwards, the adhesive layer was dried and cured (350° F - 1 ½ min.), the amount adhesive composition applied giving an add-on (dry weight) of about 2.0-3.0 lbs./sandpaper maker's ream.

Next, a size composition, the composition being the same as that of the maker adhesive composition but of lesser viscosity was applied. Afterwards, it was dried and cured in the same manner as the maker adhesive layer. A sufficient amount of size composition was applied to result in, on drying, an add-on weight of about 10.0 lbs. per ream (sandpaper maker's).

The thus formed abrasive material was then ready to be cut into appropriate abrasive articles, e.g., abrasive discs, for use in, in particular the finishing of auto bodies paint and sealer coats.

In use abrasive discs in accordance with our invention are found to possess improved tear resistance and much better overall flexibility characteristics. This can be readily observed from the following comparative test.

Strips (1 × 6 inches) were cut in both the warp and fill direction from abrasive material as above manufactured and from an open mesh coated abrasive material in commercial use prior to our invention. The latter material, while having a suitably friable maker adhesive does not encapsulate the backing member in a water resistant material as is done by us.

The abrasive strips (dry) were equilibrated in a 50% relative humidity room for 24 hours after which they were each supported on a horizontal surface so that 5 inches of each strip was unsupported. The angle made by the unsupported portion of the abrasive strip with the horizontal was measured when conditions became stable, these data being set forth in the table below.

The abrasive strips were then soaked in water for 12 hours and the angles made by the strips with the horizontal determined as before.

| EXAMPLE | DRY ANGLE | WET ANGLE | DIFFERENCE |
|------------|-----------|-----------|------------|
| Prior Art: | | | |
| (1) Warp | 27° | 48° | 21° |
| (2) Fill | 9° | 48° | 39° |
| Invention: | | | |
| (1) Warp | 16° | 30° | 14° |
| (2) Fill | 7° | 25° | 18° |

One can readily see from the data that much improved flexibility characteristics are provided in abrasive material of our invention over that of the prior art. Smaller changes in the drape angle indicates clearly, it is believed, the less likelihood of undesirable folding and creasing occurring in abrasive products manufactured from abrasive material of the invention than with those from prior art abrasive material.

EXAMPLE 2

Abrasive material was manufactured as in Example 1 except that the adhesive was a caustic catalyzed resinous condensation product of the following basic composition:

| COMPONENT | PARTS BY WEIGHT |
|--------------|-----------------|
| phenol | 80 |
| o-cresol | 20 |
| formaldehyde | 180 |

The above composition was provided in aqueous solution, 72% solids, pH 8.6, water tolerance 145, gel time 10.5. The viscosity (5,500 cps) was adjusted, as is conventional, for application, both as a maker adhesive and as a size coat.

Abrasive articles manufactured from this abrasive material have been found to have an extremely desirable friable adhesive bond, as well as much improved flexural characteristics and tear resistance.

As many different embodiments of this invention will occur to those skilled in the abrasive art, it is to be understood, of course, that the specific embodiments disclosed herein are by no means limiting but are merely intended by way of illustration of the inventive concept, the limitations thereon being determined only from the appended claims.

What we claim is:

1. Open mesh coated abrasive material comprising in

5 combination an open mesh woven fabric backing member of interlaced warp and fill yarns, an adhesive binder composition comprising a resinous condensation product of a composition comprising phenol and formaldehyde coating said yarns, and having a controlled degree of friability in at least the outermost surface thereof such that the adhesive bond will break when the abrasive material is rubbed against a surface being ground into small particles not more than a few times larger in average diameter than the individual abrasive grains, abrasive grains adhered to the yarns by means of the adhesive binder said abrasive grains being smaller in size than the mesh openings of the open mesh fabric, and a water insoluble and water resistant coating intermediate said adhesive binder and the yarns of said open mesh fabric backing member, said coating comprising an interpolymers comprising from about 5 to 70% by weight ethylene, from about 30 to 95% by weight vinyl chloride, and from about 1 to 5% by weight of a polar monomer of which at least about 50% by weight is acrylamide said coating impregnating the yarns and encapsulating them whereby a coated abrasive material is provided that substantially retains its initial tear strength and flexibility characteristics whether used in wet or dry grinding applications.

2. Coated abrasive material according to claim 1 wherein said open mesh fabric backing member comprises a leno weave construction.

3. Coated abrasive material according to claim 2 wherein said open mesh fabric backing member comprises nylon continuous filament yarns.

4. Coated abrasive material according to claim 1 wherein the adhesive binder is a composition comprising in combination phenol formaldehyde resin and an organic amine.

5. Coated abrasive material according to claim 4 wherein the organic amine is stabilized abietylamine.

6. Coated abrasive material according to claim 5 wherein the stabilized abietylamine is dihydroabietylamine.

7. Coated abrasive material according to claim 1 wherein said water insoluble and water resistant coating includes an aminoplast reactive with said polar monomer said aminoplast being present in the composition in the ratio of from about 5 to 180 parts by weight of the terpolymer.

8. Coated abrasive material according to claim 7 wherein said aminoplast comprises melamine-formaldehyde resin.

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