

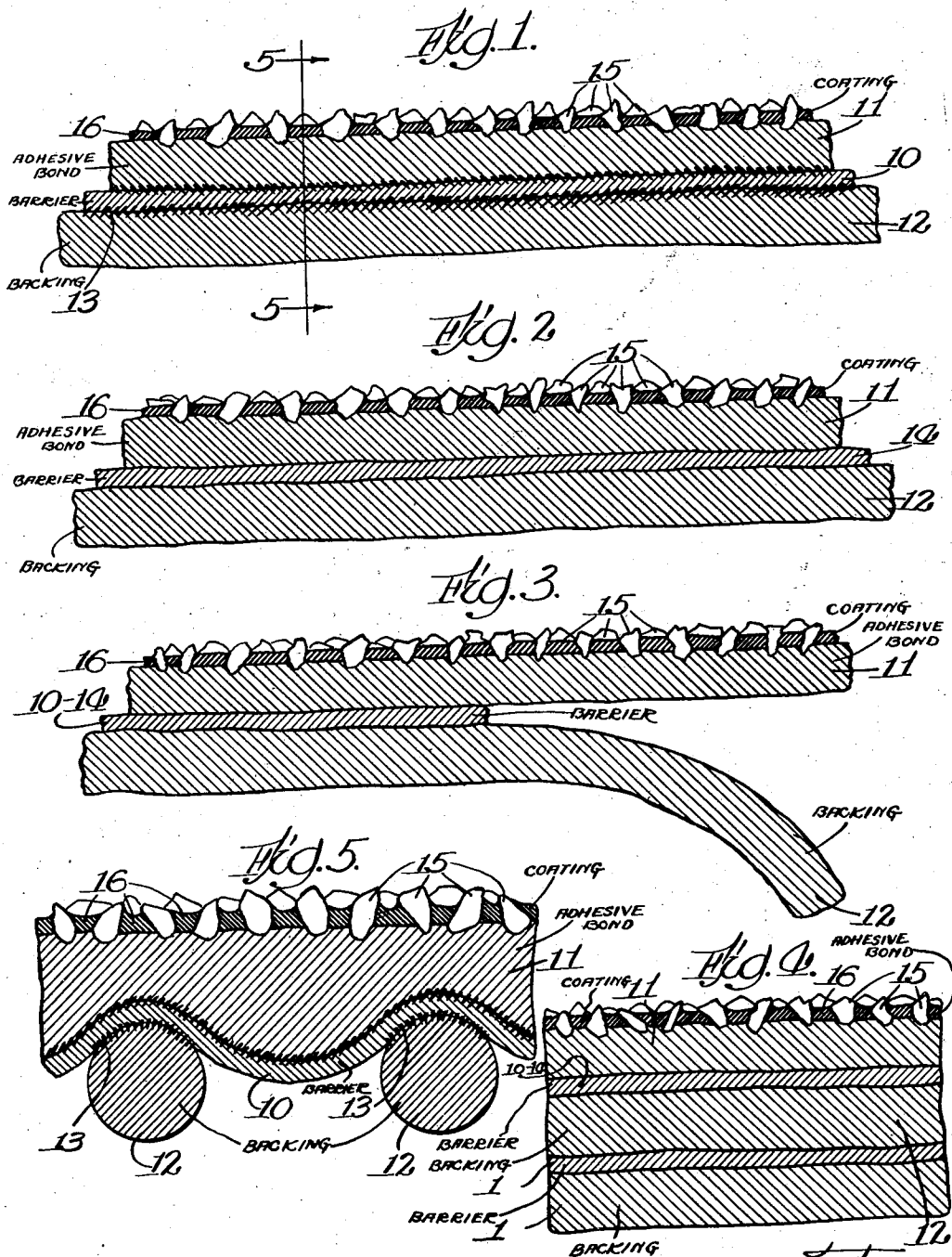
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FLEXIBLE ABRASIVE SHEET MATERIAL

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FLEXIBLE ABRASIVE SHEET MATERIAL

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In the accompanying drawing exemplifying this invention there is illustrated a flexible abrasive material constructed in accordance with the principles of this invention, in which

Figure 1 is a sectional view on a greatly enlarged scale of one form of the invention.

Figure 2 is a sectional view on a greatly enlarged scale of another form of the invention.

Figure 3 is a detail sectional view on a greatly enlarged scale, showing the backing partially stripped from the grit holding adhesive.

Figure 4 is a sectional view on a greatly enlarged scale of still another form of the invention.

Figure 5 is a detail sectional view on an enlarged scale, taken on line 5—5, Figure 1.

There are two types of abrasive paper, commonly termed "sandpaper". One is the ordinary sandpaper with a water soluble adhesive grit-holding material and the other is of the "waterproof" variety which is generally used for what is known as wet or "water" sanding operations.

The waterproof variety is made with a paper backing and an adhesive (bond coat holding the abrasive grit) and chemically treated as to render the finished sheet of sandpaper insoluble in water.

When manufacturing such a product of the waterproof variety in the past, the waterproof adhesive, (sometimes termed the "bonding coat") which anchors the grit to the paper backing, is of such a nature that it penetrates into the paper backing, directly contacting and waterproofing the fibres of the backing, to the extent of such penetration. Some of the processes claim to regulate the extent of this penetrativeness, and this point has heretofore been particularly stressed as an important feature in the method used.

It has been found that an adhesive to properly hold the grit grains firmly, should be tough and hard. While such toughness and hardness are essential qualifications for an efficient adhesive material of this nature, it has also been found where such an adhesive material is spread thinly on a flexible base material, such as paper or cloth, that there is a tendency for the adhesive material, when dry, to become brittle, and if the paper or cloth is then bent or folded the adhesive material will crack or break. Therefore, to overcome this brittleness it is customary to add a plasticizing agent to the adhesive solution in volume sufficient to overcome the brittleness, yet not enough to impair the bonding qualities of the adhesive material, which would become more or less elastic if an excessive quantity of the plasticizer were used. Therefore, the quantity of the plasticizing agent must be carefully regulated to attain the required degree of plasticity.

If a waterproof adhesive bonding material without the plasticizing agent incorporated

therein, but possessing the necessary tenacity and hardness for firmly holding the grit grains, penetrates into the backing on which it is coated and which it impregnates to a certain extent, by such penetration, there would be a tendency for those fibres or threads so contacted, to be coated with the adhesive bond material and to take on the physical properties of the adhesive bonding material, and become equally as stiff and hard as the adhesive bonding material itself, thereby destroying to a certain degree, the natural pliability of such fibres which existed before such penetration and impregnation took place.

It has been found that in adhesive bond coatings of which oils, gums and resins are constituent parts, that the vehicle penetrating into and impregnating the backing material on which the adhesive bond coat is applied, carries fine, minute particles of the solids of such coatings, into the mass fibres or threads with such impregnation which coats the fibres or threads themselves, so contacted. Thus, it is evident as claimed, that the physical properties of the adhesive bond coat are imparted to the structure of the backing material so effected.

In a finished product of abrasive paper, of the waterproof variety, flexibility and pliability are valuable features, therefore, any means or methods used to increase such pliability and flexibility is of distinct importance and advantage and constitute an improvement in the art.

Heretofore, the means employed for producing pliability in a sheet of abrasive material, of the water resistant type, has been the use of an extra thin or lighter weight backing material for the forming base of the abrasive paper, or by the addition of oils and other materials incorporated in the formulas and treatments of, and administered to the abrasive paper.

The present invention, however, employs a separate and distinct layer, coating or application of flexible material to produce pliability in the finished sheet of abrasive paper. This is distinguishably and materially different from the usual method of including an ingredient in the formula, with other materials, in the adhesive bonding coat, or in the waterproofing processing of the product, to obtain pliability.

It has also been found that a superior type of water-resistant sandpaper can be made by a process eliminating the impregnation of the backing with the waterproof adhesive bond, which latter acts as a combination adhesive and waterproofing means.

It is one of the objects of the present invention to retain the maximum natural pliability possessed by the backing of paper, or cloth. To that end there is applied a coating, layer or application of a flexible material which is of a nature to prevent the adhesive bond from directly

contacting the fibres or threads themselves, of the backing 12, and which former may or may not be hygroscopic. Another purpose of this application 10, is to produce pliability in the finished product.

One such material which has been found to be satisfactory for this purpose is gelatine, but it is to be understood that it is not desired to be limited to gelatine, as other coatings or applications of materials possessing the desired or necessary qualifications may be employed, such as suitable types of resins of the phenol formaldehyde condensation, or the glycerole phthalic anhydride products.

If an application 10, of gelatine is employed, it will penetrate into and impregnate the backing material 12 (Fig. 1), as at 13, to a certain degree, but the gelatine, being highly flexible and hygroscopic will not interfere with the flexibility of the backing 12 even though the penetrated portion 13 of the backing should take on or assume the physical characteristic of the gelatine coating 10 used, which latter should be of an exceptionally pliable type.

However, as illustrated in Figure 2, other coating materials may be employed which will not penetrate the backing but will become attached to the backing by surface adhesion only. Such a non-penetrating coating, or application 14, suitable for this purpose might be nitro-cellulose or cellulose acetate solutions of the proper types, or sheet material such as those mentioned, and also cellulose xanthate, but it is not desired to be limited to these materials for such a purpose as other materials having the same qualities or characteristics, comparatively speaking, may be employed. These coatings or applications 10-14, will hereafter be referred to as a "flexible barrier application" because it also serves as a barrier to prevent the grit-holding adhesive bonding material from directly contacting or coating the fibres or threads themselves of the backing material, and produces pliability in the finished product.

Another material which may be employed for forming the "flexible barrier application", which will penetrate a portion of the backing, similar to the gelatine coating, is a solution of polymerized vinyl compound dissolved in ethylene dichloride or other solvents or solvent mixtures.

The nitro-cellulose compound application acts closely in the same capacity as the gelatine coating, previously referred to, in the fact that it will not permit the adhesive bonding coat to impregnate the backing material, thereby preserving the natural pliability of the backing material and imparting the pliability of the nitro-cellulose compound application to the finished abrasive sheet.

That the nitro-cellulose compound acts as a barrier, and does not allow the adhesive bonding coat to directly contact or coat the fibres or threads themselves, of the backing material, is proved by the fact that the finished sheet of abrasive material of this invention treated with a solvent for the nitro-cellulose compound will cause the nitro-cellulose compound to soften or dissolve, thereby permitting the backing material to be stripped away from the adhesive bonding, as shown in Fig. 3, with the grit remaining embedded in the adhesive bonding material, but not dissolving, nor materially affecting the adhesive bonding material, aside from the removal of its base, or backing material's support. This is rendered possible by reason of the fact that the

flexible barrier coating forms a clearly defined zone between the backing material and the adhesive bond coating, thereby maintaining the backing against penetration by the adhesive bond.

It has been shown that the method of making some of the sandpapers now on the market, consists in applying a plurality of waterproof coatings to one side of a backing material, and applying to the side of the backing material remaining uncoated, an application of some material as a means of waterproofing the back of the backing material, to prevent disintegration of the backing when it is used in water.

It has been found that these plurality of coatings, regardless of the sequence of their applications, or the fact that each coating was permitted to dry before the application of a subsequent coat, were miscible when contacted one with the other. This actually resulted in these plurality of coatings practically commingling into one continuous coating extending from the grit side of the sandpaper down to, and in some instances, through the backing material. The object being to prevent disintegration of the backing when it was used with water.

In the present invention the various applications are not miscible with the others. The immiscible barrier application prevents the coatings on one side of the barrier application from coming into commingling relation with the coating on the opposite side of the barrier application. Being immiscible with the other applications, it is possible to completely dissolve the barrier application by a suitable solvent, without dissolving the coatings between which the barrier application was interposed. Thus, the barrier application has established a clearly defined zone between the coatings mentioned, and the object of its use is clearly shown.

Thus, it is evident, if the adhesive bonding material directly contacted the fibres or threads themselves of the backing material, it could not be stripped off the latter because, the solvent used, while a solvent for the nitro-cellulose compound, is not a solvent of the adhesive bonding material hereinafter referred to, to be employed as the grit-holding adhesive bonding material.

It has been found when this same test was administered to other abrasive papers, where the waterproof grit-bonding coat penetrated the backing, that no separation could be made between the backing and the grit-bonding coat because the latter had penetrated the backing and coated the threads or fibres themselves, contacted thereby. The only method by which a separation might be made was through the use of a solvent dissolving the material which had impregnated the backing, but, inasmuch as that portion which had impregnated the backing, and the waterproof grit-bonding coating were one and the same, naturally the solvent also dissolved the waterproof grit-bonding coating with the grit embedded therein. Furthermore, this proved that the plurality of waterproof coatings and the adhesive bonding coating were miscible, and, after drying had become practically one continuous penetrative material, whereas, in this invention the plurality of coats are not miscible but separable. This is one of the main differences between the present invention, in which the adhesive bonding material does not directly contact the fibres or threads themselves of the backing, and an abrasive material which has its backing impregnated by the waterproof grit-bonding

coating which does directly contact and coat the fibres and threads themselves, of the backing.

If the gelatine is employed for the "flexible barrier application" as referred to, it may also be dissolved and the backing material stripped from the adhesive bonding material, which latter holds the grit.

It is to be understood that the stripping off of the backing material from the adhesive bonding material, described herein, does not occur during an ordinary sanding operation in which this invention is employed, but is disclosed herein merely for the purpose of having it clearly pointed out that there is no penetration of the adhesive bonding material into the backing material under this invention. And, that this invention is therefore radically different from any abrasive material heretofore disclosed in the art.

It has also been found, where the backing material used with this invention is of a woven fabric in which the weave or mesh between the network of threads, is open, or the fibres loose, the flexible barrier application 10, as indicated in Figure 1, will contact and coat fibres or threads themselves of the fabric, permitting the spaces or mesh, in between the network of the threads, in some instances, to remain open or unfilled. When the adhesive bonding coat 11, is then applied over the surface of the flexible barrier application 10, the former will be prevented from directly contacting, or penetrating into, any of the fibres or threads themselves of the woven backing material 12. However, some of the adhesive bonding material may be forced into the spaces constituting the meshes, or between the network of the threads, or about the fibres, caused by pressure when it is applied on the backing, without however, penetrating into, or impregnating or directly contacting the fibres or threads themselves, of the backing material. It has also been found, where such woven material is used for the backing, and after the flexible barrier application, together with the backing material, have both been separated and stripped from off the adhesive bonding material, (hereinbefore described as the test for ascertaining if there is any direct contact by the adhesive bonding material) that the surface of the adhesive bonding material opposite to that with the grit remaining imbedded therein, revealed under microscopic examination, small imprints, points or spikes on the surface of the adhesive bonding material which contacted, or adjoined the flexible barrier application, showing the adhesive bonding material had been forced into the above mentioned openings through the network of the threads, but these imprints, points or spikes were found to be individual and separate, revealing they had been so formed and imprinted by the cross threads in the network or weave of the threads in the material previously coated by the flexible barrier application, which further substantiated the fact there had been no penetration of the adhesive bonding material into the backing material's fibres or threads, or direct contact therewith.

Naturally, where a backing material of a closer weave, or texture, is employed there are no openings in the weave or network of threads sufficiently large for the adhesive bonding material and flexible barrier application to so engage, and a microscopic examination, such as referred to, reveals only slight imprints made by the outline of fibres, threads or the close weave.

Over the exposed surface of, or adjacent to the "flexible barrier application" 10-14, is applied

the adhesive bonding material 11 in which the grit 15 is to be embedded, and which adhesive bonding material will not penetrate into, or dissolve the "flexible barrier application". The natural pliability of the backing material is thereby retained.

It is submitted, and it is desired to emphasize the fact, that a waterproofing solution, such as those disclosed in the formulas used for manufacturing abrasive papers in the past, cannot properly be construed as constituting the flexible barrier application of this invention, primarily, because the waterproofing solution referred to, is usually intended to be, or designated as being miscible with the adhesive bonding coat interposed between the backing material (previously waterproofed) and the abrasive grit.

While the flexible barrier application of this invention may impregnate or penetrate into the backing material and contact and coat the fibres or threads themselves, none of the solvents of the adhesive bond coating, applied over the top of the flexible barrier application, effect the latter. Furthermore, to prevent the possibility of any direct contact by the adhesive bonding coat with the threads or fibres themselves, of the backing material, the flexible barrier application is unbroken or continuous over the surface of the backing and the adhesive bond coat and such barrier coating are not miscible.

Where the waterproof agent and the adhesive bond coat, under the conditions of application as used in the waterproof abrasive paper now sold, are intended to respectively cause waterproofing and bonding action, it is clear that either may be applied before the other, and there is no necessity for sequence in the order of their application, because their miscibility will be unaffected by whether either of the coats is applied before the other and, in view of the claim that the "peculiar properties and virtues of the adhesive and water-proofing agents will be independently manifested by either in the absence of the other".

The fact is the reverse in this invention. Inasmuch as the flexible barrier application is an independent application for procuring pliability through itself and its protective or barrier features, it must necessarily be applied first to the backing material, or before the adhesive bond coat is applied, and the latter must be applied on top of, or over the flexible barrier application. It is thus easily observed that if the adhesive bond coat were applied first it would directly contact and coat some of the fibres or threads of the backing material. However, the flexible barrier application of this invention is a separate, distinct and individual application from the adhesive bond coat, and one of its objects is to act as an effective barrier to the latter if the former is applied first. And another object of the flexible barrier coating is to procure and impart pliability to the finished product, and not as a waterproofing agent.

The complete and absolute impregnation of a sandpaper backing material with waterproofing materials and processes, is wholly unnecessary. Pliability and flexibility in a sheet of sandpaper is of far greater import than the life or endurance of the backing itself, when the latter does not completely disintegrate for a period constituting the usefulness of the sheet of sandpaper. For instance—the average life of a sheet of sandpaper, standard size, 9 x 11 inches, (waterproof) when used for a regular water sanding operation on an

automobile body, during production, which work constitutes its largest use, does not exceed 20 minutes of actual use. Therefore, it can be readily observed that a grade of paper backing, untreated, aside from a thin back surface-coating of a water resistant solution, can be used which will retard the penetration of the water for this period of time, or, at least until the sheet of sandpaper has served its usefulness.

Another of the objects of the present invention is to supply an abrasive sheet material, with its intermediate "flexible barrier application", which will offer a very pliable sheet of sandpaper and one which will bend and conform to many irregular surfaces such as moldings, corners of windows, and the hinges on automobile bodies. Sanding over and around these places usually causes sandpaper to crack or break if it is not sufficiently pliable.

To increase the life or endurance of the paper, or the backing on sandpaper, to a point beyond its usefulness is neither logical nor advantageous to users and it is therefore not the object of this invention to provide a sheet of abrasive material processed and protected so as to render the finished material absolutely insoluble in water, or to make it waterproof in the full meaning of that term. It is another object of this invention to produce, by a process differing from those formerly used, a superior sheet of flexible abrasive material which is water, oil and gasoline resistant and possessing natural pliability of its backing material aided by its interposed "flexible barrier application". Also, having its adhesive bonding or grit-holding coat, fastened to the fabric backing material by protruding or extending in and about some of the fibres or threads of the fabric backing material, without the grit-holding adhesive bond material directly contacting or coating the fibres or threads themselves, of said fabric backing material.

The flexible abrasive sheet material constituting the subject matter of this invention differs in other ways from the waterproof material heretofore referred to. In the present invention one (or more) applications of a semi-plastic adhesive bonding material is applied to a forming base, or backing material, previously treated with a flexible barrier application, hereinbefore described. The semi-plastic adhesive material recommended for the invention described herein, although it is not desired to limit the invention to the use thereof, because of other materials which may be used, is however, different from the materials used for grit adhesive bonding purposes which have been employed in many of the prior or disclosed formulas for use in the manufacture of other sandpapers, in the fact principally, that this one in question is a derivative, or an isomer of rubber material. It has been particularly described in applicant's application bearing Serial Number 413,679, filed December 12, 1929. It may be further described as (a) a homogeneous thermoplastic artificial isomer of undissolved rubber having a less chemical unsaturation than rubber, or (b) a new composition of matter, the product of reaction, under the influence of heat, of p-phenol sulfonic acid dispersed through a mass of undissolved rubber. This adhesive material must not be classed with vulcanized rubber as it is an entirely different material.

While the said semi-plastic adhesive bonding material is yet in a tacky state, and before it

dries, the abrading grit is applied in the usual manner known to the art. The material is then dried by evaporation of its solvents. This may be done without the use of heat. However, for hastening the manufacturing processes, evaporation of the solvents may be accelerated by the application of heat to the required temperature, preferably not in excess of 125 degrees Fahrenheit. The usual method is to pass the abrasive material, treated as thus described, through a room, compartment or chamber with the temperature at approximately the degree specified.

After drying, there is applied a solution 16, (preferably of a different material than that of the adhesive bonding material) to the face of the abrasive grit so as to render the grit-holding surface resistant to oil and gasoline and in the specification and claims where the term "liquid resisting" is employed in describing such coating, the same shall be construed to mean gasoline or oil resisting. This material will not penetrate the adhesive bonding material holding the grit, nor into the flexible barrier application material.

The adhesive described, made from the isomer of rubber, is inherently water resistant, but it is not impervious to the action of oil and gasoline, which are some of the lubricants used in the various sanding operations instead of water. For example—when sanding filler coats on automobile bodies water is the lubricating agent used with the sandpaper. When sanding lacquers or varnishes on certain types of wooden furniture, oil is the lubricant employed in lieu of water, to prevent injury to the glued veneer. Some metal fillers are also sanded with gasoline as the lubricating agent. Therefore, when the isomer of rubber is the adhesive bond used for holding the abrasive grit, the last mentioned coating over the surface of the grit, is applied as a gasoline and oil resistant protective coating. The use of this coating as a waterproofing means is unnecessary because in this invention the isomer of rubber material as stated, is inherently water resistant, and if additional waterproofing were the objective of this coating it would be recommended that this additional waterproofing solution be composed of the isomer of rubber but carrying less solid content than the first, or adhesive grit bond coating. But, for the gasoline and oil resistant coating it is recommended that the principal basic constituent elements be of a phenol formaldehyde condensation product, (b) in combination with polymerized vinyl compound or (c) one made from polymerized vinyl compound without the former. Either of the three mentioned is to be dissolved in any solvent best suited for the type used, with the solid content of either solution under 25% of the volume. If preferred, solutions for this purpose may also be made with natural or synthetic gums or resins, which are found to be gasoline or oil resistant.

Emphasis should be given to the fact that this last named coating applied over the grit surface, is not intended for increasing the bond between the backing and the grit. If there were danger of "starving the bond" between the backing material and the grit, an auxiliary bonding coat applied in the same manner might be necessary, but it must be remembered particularly, that there can be no so-called "starving" of the adhesive bond employed in this invention, because there can be no absorption of the adhesive or bond coat, by the backing material, as the

"flexible barrier application" material is the barrier to any penetration of the bonding coat into the backing or the forming base material used.

It may therefore be observed that not only will this invention described herein, be a water resistant abrasive sheet material but, it will possess the advantages of also being oil and gasoline resistant.

As shown in Figure 4 a plurality of layers or applications of backing materials 17 and "flexible barrier applications" 18 may be superposed when extra coarse grit grains are employed, to give greater strength to the backing, and yet retain pliability and flexibility, and the backings and "flexible barrier applications" are alternately arranged.

What is claimed as new is:

1. As an article of manufacture, an abrasive sheet material consisting of a flexible backing, an adhesive bonding material, abrasive grit grains embedded in said adhesive bonding material, said flexible backing material being non-metallic, and a layer of material between said backing and said bonding material, said layer being hygroscopic and immiscible with the adhesive bonding material.

2. As an article of manufacture, a flexible abrasive sheet consisting of a flexible backing, an adhesive stratum serving as a bonding component, abrasive grains embedded in said adhesive bonding component and a layer of material between said backing and bonding component, said layer being immiscible with the adhesive bonding component, said bonding component comprising a synthetic plastic compound having water insoluble properties comprising a rubber isomer, said layer serving as a barrier between the bonding component and the backing, preventing starving of the material of said component into the backing.

3. As an article of manufacture, an abrasive sheet in accordance with claim 2 in which a sizing of a phenol aldehyde condensation resin imparts "liquid resisting" properties to the abrasive face of the article.

4. As an article of manufacture, an abrasive sheet in accordance with claim 2 in which a sizing of a polymerized vinyl compound, imparts "liquid resisting" properties to the abrasive face of the article.

5. As a new article of manufacture, a flexible abrasive sheet consisting of a flexible backing, an adhesive stratum serving as a bonding component, abrasive grains embedded in said adhesive bonding component, and a layer of material between said backing and bonding component, said layer being hygroscopic and immiscible with the adhesive bonding component, said bonding component comprising a synthetic plastic compound having water insoluble properties comprising a rubber isomer, said layer serving as a barrier between the bonding component and the backing preventing starving of the bonding material of said component into the backing.

6. As an article of manufacture, an abrasive sheet in accordance with claim 5 in which a sizing of a phenol aldehyde condensation resin imparts "liquid resisting" properties to the abrasive face of the article.

7. As an article of manufacture, an abrasive sheet in accordance with claim 5 in which a sizing of a polymerized vinyl compound, imparts

"liquid resisting" properties to the abrasive face of the article.

8. As an article of manufacture, a flexible abrasive sheet consisting of a flexible backing, an adhesive stratum serving as a bonding component, abrasive grains embedded in said adhesive bonding component and a layer of material between said backing in bonding component, said layer being a glue base material immiscible with the adhesive bonding component, said bonding component comprising a synthetic plastic compound having water insoluble properties comprising a rubber isomer, said layer serving as a barrier between the bonding component and the backing, preventing starving of bonding material of said component into the backing.

9. As an article of manufacture, an abrasive sheet in accordance with claim 8 in which a sizing of a phenol aldehyde condensation resin imparts "liquid resisting" properties to the abrasive face of the article.

10. As an article of manufacture, an abrasive sheet in accordance with claim 8 in which a sizing of a polymerized vinyl compound imparts "liquid resisting" properties to the abrasive face of the article.

11. As an article of manufacture, a flexible abrasive sheet consisting of a flexible backing, an adhesive stratum serving as a bonding component, abrasive grains embedded in said adhesive bonding component, and a layer of material between said backing and bonding component, said layer being fibreless cellulosic material immiscible with the adhesive bonding component, said bonding material comprising a synthetic plastic compound having water insoluble properties comprising a rubber isomer, said layer serving as a barrier between the bonding component and the backing, preventing starving of the bonding material of said component into the backing.

12. As an article of manufacture, an abrasive sheet in accordance with claim 11 in which a sizing of a phenol aldehyde condensation resin imparts "liquid resisting" properties to the abrasive face of the article.

13. As an article of manufacture, an abrasive sheet in accordance with claim 11 in which a sizing of a polymerized vinyl compound, imparts "liquid resisting" properties to the abrasive face of the article.

14. As an article of manufacture, a flexible abrasive sheet consisting of a flexible backing, an adhesive stratum serving as a bonding component, abrasive grains embedded in said adhesive bonding component and a layer of material between said backing and said bonding component, said layer being a glycerol polybasic acid resinous compound immiscible with the adhesive bonding component, said bonding component comprising a synthetic plastic compound having water insoluble properties comprising a rubber isomer.

15. As an article of manufacture, an abrasive sheet in accordance with claim 14 in which a sizing of a phenol aldehyde condensation resin imparts "liquid resisting" properties to the abrasive face of the article.

16. As an article of manufacture, an abrasive sheet in accordance with claim 14 in which a sizing of a polymerized vinyl compound imparts "liquid resisting" properties to the abrasive face of the article,

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