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ABRASIVE ARTICLE AND METHOD OF MAKING THE SAME

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My present invention relates in general to the treatment of material, preferably in sheet form, and more particularly the treatment of material for the purpose of forming or attaining composite structures, of which well known forms of abrasives such as what is commonly known as sandpaper is an example. The present application is in part a continuation of my copending applications, Serial Nos. 541,248 and 541,249, filed March 4, 1922, 670,543, filed October 24, 1923, and 683,522, filed December 29, 1923.

Although I hereinafter disclose the practice of my invention in connection with abrasives such as sandpaper, it will be understood that my invention, or certain features thereof, have a wider field of utility.

Composite structures of the abrasive type, such as sandpaper or emery cloth, comprise generally (*a*) a base of sheet material, which may be felted as in the case of paper or woven as in the case of cloth, (*b*) a more or less finely comminuted resistant material having abrading properties, such as garnet or corundum, and (*c*) a binder generally in the form of a glue which serves to bind the abrasive to the base.

The abrasive products as produced at present have as incidents certain features among which are affinity for moisture rendering them substantially inutile in the presence of water or moisture, and cracking, with consequent exposure of the base, when bent.

The principal objects of my present invention are the provision of a binder which functions more efficiently than any known to me; the provision of an abrasive article having a binder characterized by flexibility without cracking or other undesirable effects; the provision of such an article having a binder characterized by extensibility and compressibility to accommodate itself to flexion of the base; the provision of such an article having a binder by means of which the desired adhesive action between it and the base is attained not only efficiently but also with a desirable degree of acceleration, and more particularly the provision of such an article having a binder in which the drying action will be effective from the contact surface between it and the base outwardly; the provision of such an article having a binder in which the drying action will be effective from the outer surface inwardly; the provision therein of a binder characterized by a drying action that permits of handling the product with a minimum of delay and more particularly such handling without impairment of the superficies of the material; the provision therein of a binder characterized by an accelerated drying action; the provision therein of a binder characterized by a limitation of its drying action; the provision of an improved moisture-proof material and especially material in a sheet form, and more particularly one having means for causing a moisture-proofing agent to penetrate into the material; the provision of a moisture-proof composite abrasive structure; the provision of a binder having moisture-proofing functions, and the provision generally of an improved composite abrasive structure and of a method of producing the same, together with such other objects and additional benefits and advantages as may hereinafter appear or be pointed out.

In the employment of my present invention for the production of sandpaper and the like suitable for employment in a water abrading operation, (which I cite for purposes of example), I use as the base a sheet of material (which may be paper) as will conveniently serve the employment contemplated, and as the abrasive such comminuted material (which may be crushed garnet) similarly adapted to serve the function in view.

As will presently appear, the fabric base, paper, cloth or the like may be waterproofed on one or both sides, or may be of a water-

proof material, or a paper or cloth treated to resist disintegration when employed in a water abrading operation. It is also pointed out that the abrasive device may be produced in a number of steps, such, for instance, broadly, by incorporating the grit in an adhesive material to form a composition which, when applied to a sheet of fabric, non-hygroscopic or otherwise, maintains the bonding effect in substantially full measure throughout the effective abrading life of the article even under sustained application of moisture and friction, such as when used in a water abrading operation. This incorporation of the grit in the adhesive material makes possible the production, in a simple way, of (*a*) finer grades of abrasive paper; (*b*) omits, for this purpose, one step in the manufacture, (*c*) in some cases permits omission of the auxiliary grit bonding coat and affords an even better article than if the auxiliary coat were used because each particle of grit is embedded and locked into the coating instead of being merely set into the binder, (*d*) in some such cases permits of omission of the step of application of pressure for forcing the grit into the adhesive; and (*e*) withal presents, particularly in the finer grades, a better article in certain respects than when an auxiliary coat is used because the article is thinner and, therefore, more flexible.

In somewhat heavier grades of sandpaper or the like the incorporation of the grit in the adhesive prior to application to the paper reduces the cost of manufacture by eliminating at least one step in the manufacture, and possibly in some instances two steps, both of which require time and a careful handling of the product.

The process employed may be adapted to the manufacture of various other analogous articles, and the materials employed may vary, but I find it to be desirable that the binder utilized have the functions and characteristics not only of great mechanical strength and of great binding strength, but also that it be non-hygroscopic, permeative, moisture resistant, easily worked, readily obtainable, inexpensive and facilely applied.

I have discovered that gums of such types as rosin are peculiarly adapted for the attainment of these ends, and ordinary turpentine rosin is preferred by me as best attaining the desired end, viewed from certain aspects. Other gums and resins, natural or synthetic, having the desired characteristics may also be utilized.

In preparing the binder for use, the gum is used in connection with a suitable vehicle which I prefer is of a type such as linseed oil, China wood oil, otherwise known as tung oil, Perilla oil or fish oil, or even a semi-drying oil such as soya-bean oil, for reasons which I will proceed to explain.

In applying a gum prepared with a vehicle such as China wood oil to one surface of a base of paper, for example I have found that the action of the vehicle involves a penetration of the base by the vehicle, for example, China wood oil or any similar drying oil or semi-drying oil.

This results in a moisture-proofing of the material even against the absorption of moisture through the surface opposite to that to which the binder is applied, without at the same time defacing or otherwise undesirably affecting such opposite surface.

The penetration by the vehicle, particularly when coupled with the use of the character of gum pointed out above, carries with it in such penetration a certain amount of finely divided gum so that a coating and binding action is secured between the fibres of elemental portions of the base which thus substantially retards, if it does not entirely prevent, disintegration of the material of the base by moisture, in addition to preventing access of moisture through the base to the plane of contact between the base and the main mass of the binder material.

The efficient action of the binder may be enhanced in the manufacture of sandpaper if the binder is applied to the base by the use of pressure, or the application of heat as the binder containing the more or less finely divided abrasive is thus applied in such a manner as to cause it to adhere most strongly to the base.

As will appear hereinafter, the applications of heat and pressure may be made simultaneously or separately, and may be made after one or each of the steps of the process.

In order to accelerate the adhesion between the binder and the base, I have discovered it desirable to use with the binder a modifying agent, the action of which is to cause a desiccation of the binder initiated at the contact surface of the binder with the base and effective outwardly.

In my experience I have discovered that there are a number of materials having a metallic base which are useful for my present purposes, that manganic oxides are peculiarly useful, and that borate of manganese best combinates siccative energy with the desirable susceptibility to fine grinding.

Due to the relatively slow drying of binders generally, difficulties are encountered in handling the structure, within a convenient period because of the soft and sticky character particularly of the exposed surfaces of the binder. This objection I mitigate by associating with the improved binder a substance, the action of which is to produce an accelerated drying action effective primarily at the exposed surface and working inwardly, and for this purpose I incorporate in the binder a modifying element peculiarly effective in its action as an oxidizing agent on

such vehicles as linseed, China wood or tung oil, and as a retarding agent with reference to the excess absorption of the vehicle by the base.

The substance I have discovered to be particularly adapted for this purpose is that well known to the trade obtainable in the open market and formed by a new electrolytic process white lead, and which, in my experience, is found to be more satisfactory than any other known form of carbonate of lead.

Whereas by itself the white lead adds but relatively little strength to the binder, in association in the binder with the borate of manganese it intensifies the action of the binder in holding the abrasive firmly against the base.

For intensifying the binding action of the binder and for intensifying the drying action of the dryers, and at the same time accomplishing such ends by the employment of a material which is efficacious in holding the mineral elements in suspension without loss of siccative energy or reducing the relative fluidity of the material, I have discovered that it is advantageous to employ as part of the binder a paste dryer. This may comprise such mineral substances as sugar of lead and borate of manganese suspended in a resinous vehicle, but I find it preferable to form the paste dryer so as to have the minerals contained therein in the form of sub-acetate or basic acetate of lead and resinate of manganese. I have found by experience that the past dryer should be somewhat in the nature of cheesy butter, rather softer, and of a light brownish grey color.

As an auxiliary in (1) accentuating the adhesion of the binder to the paper, (2) facilitating to a certain extent the spreading of the binder, and (3) modifying as desired the consistency of the binder as is useful in cases where it is desired to render it more fluid, I have discovered that the use of a japan dryer is desirable. Such a dryer as that which is free from rosin is convenient. One form of this contains shellac, red lead, litharge, manganese oxid, burnt umber, gum, linseed oil and turpentine q. a.

In order to give the binder the desired body volumetrically considered, I preferably employ a varnish consisting largely of Chinawood oil, linseed oil, Perilla oil, or fish oil, boiled until it approaches a solid state. As far as feasible this should be as free as possible from glycerides and fatty acids.

Though I have hereinabove disclosed certain forms of useful dryers having various characteristics, and likewise intensifiers, I have discovered that where it is advisable that the siccative action thereof be limited, or at least retarded, under certain conditions, or when producing material for certain purposes, that it is desirable to incorporate in the binder a non-drying oil such as castor oil or the like, for such purposes.

Sandpaper made in accordance with the disclosure of my present invention is characterized by great flexibility without any adverse effects, such as cracking of the binder or base, or loosening of one from the other.

The materials used by me as hereinabove described may be varied in character so as to vary the characteristics of the binder from the standpoint of adhesiveness, non-hygroscopy, and flexibility. Where such variation in the use of materials is employed to produce, for instance, increased adhesion between the binder and the abrasive, such increase may be attained though possibly at a certain expense in its characteristic of flexibility.

In my preferred practice with Chinawood oil and rosin, the adhesive applied is of approximately the following proportions by weight and percentages:

Chinawood oil (tung oil)	106 lbs.	53%
Hardened rosin	24 lbs.	12%
Linseed oil	20 lbs.	10%
Dryer	2 lbs.	1%
Thinner	say 48 lbs.	24%

One of the virtues of a waterproof binder of the present composition is that it not only penetrates the supporting base, rendering it waterproof, but also is of great utility as contrasted with organic glue (prepared from gelatinous matter) inasmuch as it may be used with oiled or waxed paper which has been waterproofed by treatment with so-called non-drying oil, such as castor oil, semi-drying oil, such as soya-bean oil, or even drying oil, such as linseed oil, or Chinawood oil, or fish oil, waxy compounds, such as paraffin, beeswax, carnauba wax etc., to which a glue bond will not adhere, but to which my improved binder readily adheres by virtue of its powers of permeation of the base and of commingling with such oiling, greasing or waxing agents. In practice I not only find it at times convenient to heat the binder to facilitate its application to the back, but also to increase its powers of penetration of the base, though in some cases it may be used cold.

After the adhesive and abrasive materials are applied, the paper is suitably forced dried (or partially "baked" as it is said), to the desired extent by subjecting it in the usual manner to a temperature which I prefer to control between 130° F. and 150° F., depending upon the degree of hardness desired, an average of say 140° F. being in my opinion the optimum, a suitable degree of humidity being maintained in the drying chamber to prevent the paper from becoming too crisp or brittle.

The binder of my present invention is noteworthy in that it not only penetrates the paper etc. of the backing or base, but pene-

trates, mixes with, or combines with various oils, greases and waxes that are commonly used as water-proofing agents for fabric, and this without weakening, breaking down, or other deleterious mechanical or chemical effects.

In cases where the surface of the fabric is not suitable for the application of a smooth coating of the binder, I have found it convenient to apply a filler to the base to facilitate such application. This may consist of any one of the known fillers having a clayey, silicon, or like base, or the filler may, in the process, be provided by treating the surface of the fabric with a material analogous to the binder of my invention for preventing disintegration of the fabric when used in a water abrading operation. One form of binder is shown in my Patents Nos. 1,365,027 and 1,365,028, issued December 8, 1925.

In the present invention and the process of making the same, where I employ a sizing coat, that is, an auxiliary or additional coat or one or a plurality of finishing coats, I find that a thinned composition similar to that disclosed herein as forming the binder itself, is satisfactory. As an example of the sizing coat, which also may be employed as a moisture-proof backing, I submit the following formula by weight:

(*A*)

Treated rosin or resin	2700
Chinawood oil	13962
Mineral dryers	79
Thinners	12611
	29352

An alternative formula for the same purpose may include the following ingredients by weight:

(*B*)

Treated rosin or resin	2700
Chinawood oil	8100
Mineral dryers	83
Thinners	8850
Linseed oil	2125

Any one of the formulæ above set forth may be employed, depending upon the results desired or the conditions under which the sizing coat is to be applied. The sizing coat, depending upon the result desired, may be applied under various conditions of the binding coat or abrasive carrying layer and at various times, for instance, I have applied the sizing coat herein designated "A" shortly after the abrasive and binder composition coating has been applied, or as late as a week or two weeks thereafter. It will be understood that, whether the sizing coat is applied shortly after the abrasive and binder or after the elapse of a considerable time interval and upon whether the sizing coat contains suitable solvents for the binder, depends the degree of penetration, if any, of the material of the sizing coat into the binder carrying the abrasive. For example, if the sizing coat is applied substantially immediately after a preliminary setting of the abrasive carrying binder has taken place, there will result a penetration of the abrasive carrying binder by the sizing coat, or a homogenizing of the binder coat and the sizing coat, but regardless of the length of time of set of the binder, when the sizing coat is applied it adheres very tenaciously to the binder.

Alternately, if a considerable time interval is permitted to elapse between the preliminary setting of the binder and the application of the sizing coat, and sufficient suitable solvents are included in the sizing coat composition a partial solving of the binder will result, and thus bring about homogenization to a degree of the material of the binder and the sizing coat.

While the primary binding and grit carrying coat has properties regulating the degree of its penetration of the base, yet in some grades of paper, the degree of penetration is such as to endanger the adequacy of the grit bond and may, in some instances, starve the bond. The auxiliary coat when applied to the back of the sheet serves to engage the sheet so as to limit penetration of the base by the grit bond or to lock the grit on the front of the sheet, and in either instance, the auxiliary coat compensates for the penetration of the sheet by the grit carrying bond.

In practice I incorporate the grit in an adhesive coating of a character to maintain the bonding effect in substantially full measure throughout the effective abrading life of the article when used in a water-abrading operation, this incorporated binder and grit composition I then apply to one side of a sheet of material which may be a flexible fabric normally subject to fluid penetration. About an hour after the adhesive coat with the incorporated abrasive material is applied, the sheet enters the drying room and remains there for approximately forty-eight hours, preferably in a temperature varying from 100 to 150 degrees F., partially cooling during the night when the heat supply is reduced or shut off. The paper or cloth abrasive sheet is then removed from the drying room and if it is convenient to apply the sizing coat, this is done so immediately. If not convenient to size at that time, the abrasive sheets are left on the rolls until it is so convenient to apply the sizing coat. The time which the abrasive sheet is left on the roll is, generally speaking, immaterial, though I may apply the sizing coat at a particular phase of the hardening of the abrasive carrying binder in order to enhance adhesiveness. Consequently, the sizing coat may be applied at a convenient time, which may be

as long as a week or two after the adhesive and abrasive have been applied, or at other times, depending on circumstances.

When the sizing is to be applied, the sheet is unrolled from the rack on which it is supported, and a moisture-proofing layer is applied to the back of the sheet, if desired, as for example, if that side or the entire body of the paper has not previously been waterproofed. This backing layer may be of the same composition as that of the sizing layer applied to the abrasive. The sizing for the abrasive side is then carried out, or may be done substantially simultaneously with the application of the backing sizing. Or, if desired, the back sizing or auxiliary coat may be applied substantially simultaneously with the application of the initial incorporated grit bonding coat. After each one of the coats or after all of the initial coat and the sizing or sizings have been applied the sheet is preferably again subjected to heat, if desired, as is found expedient for some purposes and under some conditions.

Satisfactory results are obtained during the forty-eight hours drying or setting by applying about 100 to 150 degrees F. for 10 hours of each of the two days, so that a total of approximately twenty hours of heat is applied, where artificial heating is desired.

The degree of penetration of the grit bearing adhesive by the sizing coat or whether there is any actual penetration, may not always be a vital factor in the production of a satisfactory moisture-proof abrasive sheet, because, as I have pointed out above, the sizing adheres quite tenaciously to the grit bearing adhesive coating, and while penetration and consequent homogenization of the binder with the sizing coat gives a more intimate joint, a purely surface junction between the binder and the sizing coat is all that is essential to the production of a satisfactory article, for some purposes, if the sizing coat is employed.

With further reference to the junction obtained between the adhesive and the sizing coat, I might explain that as the sizing coat is warm when applied to the grit bearing adhesive coating, there is produced a softening of the binder, which may result in penetration, depending upon the factors pointed out.

The following general alternative methods may be employed in producing the article of the present invention:

A quantity of adhesive material of the nature hereinbefore described is suitably mixed with a desirable proportion of grit, and after the grit is properly incorporated in the binder or adhesive, by agitation or otherwise, this is applied in a plastic or fluid state to the surface of a backing which may be a flexible sheet normally subject to permeation by fluid. A finished article having relatively great flexibility and thinness and a fine grade of grit not obtainable by any other method known to me, yet possessing a high degree of tenacity and resistance to deterioration when used in a water abrading operation, can thus be made.

An alternative method similar to that above described involves the employment of artificial heat for such a period as will properly finish the product in such a manner as to insure desired setting or tempering of the product.

A further alternative method involves, in the method described, the employment of a sheet of fabric which has (*a*) one or both of its surfaces treated, such as by auxiliary coatings to resist disintegration when used in a water abrading operation; (*b*) a sheet, the entire body of which has been waterproofed or is waterproof; (*c*) the employment of such a sheet having any of the above characteristics and the employment, if desired, of artificial heat for setting or tempering the article.

The auxiliary coatings may, for instance, be applied as follows as a process: (*a*) A waterproofing pretreatment of the back of sheet, and simultaneous or subsequent application of the grit bearing adhesive; (*b*) application of the grit bearing adhesive and subsequent application of the auxiliary bonding and waterproofing coat thereupon, and simultaneously or subsequently applying an auxiliary coat (third coat) to the back of the sheet. After one or each of the steps above, depending upon the grade of abrasive device desired, the necessity to hasten drying, etc., the article may be subjected to artificial heat.

The following formulæ by weight comprise additional materials which I find suitable for my purposes, and result each in the production of a highly moisture-proof, flexible and tenacious grit bearing binder and sizing coat for abrasive devices:

C-binder

Treated rosin or resin	2700
Linseed oil	1044
Chinawood oil	7584
Mineral dryers	135
Thinners	2040

C-sizing usually employed with C-binder

Treated rosin or resin	2700
Linseed oil	1044
Chinawood oil	7584
Mineral dryers	135
Thinners	22255

It will be observed that the formula designated C-sizing is similar in all respects to the composition of the C-binder with the exception that an increased proportion of thinner is employed.

The following formulæ by weight have also

been tried, but I have obtained markedly less satisfactory results with their use, and not only do not consider them practicable but quite inferior:

D-binder

Venetian red or white lead	900
Dissolved rubber	900
Venice turpentine	900
Treated rosin or resin: Proportions { Shellac 900 / Copal 1800 }	2700
Linseed oil	4716
Mineral dryers	90

D-sizing coat usually employed with D-binder

Venetian red or white lead	900
Dissolved rubber	900
Venice turpentine	900
Treated rosin or resin: Shellac 900 / Copal 1800	2700
Thinners	2000
Lniseed oil	4716
Mineral dryers	90

An alternative form of binder similar to that designated D-binder is as follows:

E-binder

Venetian red or white lead	1350
Venice turpentine	900
Treated resin (copal)	2700
Linseed oil	6407
Mineral dryers	135

E-sizing usually employed with E-binder

Venetian red or white lead	1350
Venice turpentine	900
Copal	2700
Thinners	2000
Linseed oil	6407
Mineral dryers	135

It will be observed here, as in the case of the C and D binders, that the sizing coat is of substantially the same materials as that of the binder or abrasive carrying coating, with the exception that thinners are added, or if already present, increased sufficiently to permit the top sizing coat to flow readily between and interlock the grains of abrasive which may project due to starving of the joint and also amalgamate with the binder or adhesive coat.

Within my experience, all formulæ containing both rubber and an oil are open to grave objections, in that these two substances are artipathetic, and under the action of the oil, any abrasive containing rubber known to me tends to premature disintegration.

I have also employed as a sizing coat both natural and so-called imitation or synthetic shellac cut in alcohol, and, alternatively melted or otherwise made fluid with oil and gum compositions, or so-called treated cellulose (cellulose nitrate, cullulose acetate, cellulose contagenate), or synthetic resins such as condensation products of which the so-called bakelite is a type.

The binding adhesive coats, both grit-bearing and auxiliary or secondary coats, may be composed of the synthetic resins, phenol-formaldehyde condensation products, such as bakelite or treated cellulose (nitrated cotton), the latter having many advantages when employed in the grit incorporating process herein disclosed.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. The process of manufacturing a stable waterproof abrasive article in the nature of sandpaper or the like, which includes incorporating a grit of comminuted abrasive particles in a waterproof adhesive material, applying such incorporated grit and adhesive material to and permitting same to penetrate the sheet for maintaining the bonding effect throughout the effective abrading life of the article when used in a water abrading operation, and compensating for such penetration of the sheet by simultaneously applying another coat to the back of the article as an auxiliary waterproofing and bonding agent.

2. The process of making a stable waterproof abrasive article in the nature of sandpaper or the like, which includes employing a sheet of fabric which has been treated to prevent disintegration in a water abrading operation, incorporating a grit of comminuted abrasive particles in a waterproof adhesive material, applying such incorporated grit and adhesive material to said sheet for connection thereto to maintain the bonding effect throughout the effective abrading life of the abrasive article when employed in a water abrading operation, and subjecting the article to heat after one of said steps.

3. The process of making a stable waterproof abrasive article in the nature of sandpaper or the like, which includes employing a sheet of fabric which has been treated to prevent disintegration in a water abrading operation, incorporating a grit of comminuted abrasive particles in a waterproof adhesive material, applying such incorporated grit and adhesive material to said sheet for connection thereto to maintain the bonding effect throughout the effective abrading life of the abrasive article when employed in a water abrading operation, and subjecting the article to heat after each of said steps.

4. The process of manufacturing a stable waterproof abrasive article in the nature of sandpaper or the like, which includes incorporating a grit of comminuted abrasive particles in a waterproof adhesive material, applying such incorporated grit and adhesive material to a sheet for connection thereto to

maintain the bonding effect throughout the effective abrasive life of the article when employed in a water abrading operation, and applying heat to the article.

5. The process of making a stable waterproof abrasive article in the nature of sandpaper or the like, which includes incorporating a grit of comminuted abrasive particles in a waterproof stable adhesive material, applying such grit and adhesive material to the front surface of a sheet, allowing the adhesive to penetrate the sheet to maintain the bonding effect throughout the effective abrading life of the article when used in a water abrading operation, and compensating for such penetration of the sheet by the adhesive by applying an auxiliary waterproofing and bonding coat to the back surface of the article, and applying heat to the article after one of said steps.

6. The process of making a stable waterproof abrasive article in the nature of sandpaper or the like, which includes incorporating a grit of comminuted abrasive particles in a waterproof stable adhesive material, applying such grit and adhesive material to a sheet, allowing the adhesive material to penetrate the sheet to maintain the bonding effect throughout the effective abrading life of the article when used in a water abrading operation, and compensating for such penetration of the sheet by the adhesive by applying another coat upon the incorporated grit and adhesive as an auxiliary bonding and waterproofing agent, and applying heat to the article after each of said steps.

7. The process of making a stable waterproof abrasive article in the nature of sandpaper or the like, which includes incorporating a grit of comminuted abrasive particles in a waterproof stable adhesive material, applying such grit and adhesive material to a sheet, allowing the adhesive material to penetrate the sheet to maintain the bonding effect throughout the effective abrading life of the article when used in a water abrading operation, compensating for such penetration of the sheet by the adhesive by applying another coat upon the incorporated grit and adhesive as an auxiliary bonding and waterproofing agent, and applying a third coat to the back of the sheet, and applying heat to the article after one of said steps.

8. The process of manufacturing a stable waterproof abrasive article in the nature of sandpaper or the like, which includes incorporating a grit of comminuted abrasive particles in a waterproof adhesive material, applying such incorporated grit and adhesive material to and permitting same to penetrate the sheet for maintaining the bonding effect throughout the effective abrading life of the article when used in a water abrading operation, and compensating for such penetration of the sheet by simultaneously applying another coat to the back of the article as an auxiliary waterproofing and bonding agent, and applying heat to the article after each of each steps.

9. The new article of manufacture in the nature of a stable waterproof sandpaper which includes a suitable backing, a layer of a flexible adhesive material applied to said backing and having incorporated therein beforehand and encompassed thereby a grit or layer of abrasive material, the adhesive being of a nature to penetrate the backing to an extent short of leaving said grit entirely exposed, and said adhesive being of a nature to maintain the bonding effect throughout the effective abrading life of the abrasive article when employed in a water abrading operation.

10. The new article of manufacture in the nature of a stable waterproof sandpaper which includes a suitable backing, a layer of a flexible adhesive material applied to said backing and having incorporated therein beforehand and encompassed thereby a grit or layer of abrasive material, the adhesive being of a nature to penetrate the backing to an extent short of leaving said grit entirely exposed, and said adhesive being of a nature to maintain the bonding effect throughout the effective abrading life of the abrasive article when employed in a water abrading operation, an auxiliary bonding coat applied over the coat containing the abrasive for compensating for such penetration of the backing thereby.

11. The process of manufacturing a stable waterproof abrasive article in the nature of sandpaper or the like, which includes the employment of a flexible sheet, incorporating a grit of comminuted abrasive particles in a waterproof flexible adhesive material, applying such incorporated grit and adhesive material simultaneously to and permitting the adhesive to penetrate the sheet for maintaining the bonding effect throughout the effective abrading life of the article when used in a water abrading operation, and compensating for such penetration of the sheet by applying another flexible coat as an auxiliary bonding and waterproofing agent.

In testimony whereof, I have hereunto signed my name.

FRANCIS G. OKIE.