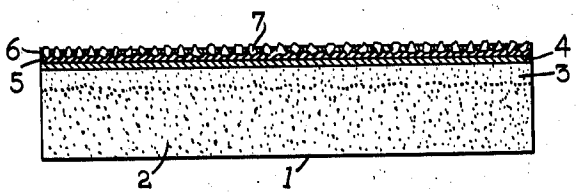
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ABRASIVE

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ABRASIVE

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This invention relates to the art of abrasives and more particularly it relates to articles of this class having improved compositions to hold the abrasive in place on the paper or fabric base.

Various materials have been used for this purpose. Where resistance to water is not important, glue or any other water soluble binder can be used to strengthen the paper and hold the abrasive in place. For water resistant paper and fabrics, heat treated drying oils and oleo resinous varnishes have been used. Various varnishes containing asphalt are sometimes used to give the sandpaper a standard backing color.

In the manufacture of waterproof sandpaper, it is customary to apply the coating by means of rollers. The following system is typical:

The paper is coated on both sides in one operation with what is known as a back-size and a pre-size. The former consists of an emulsion of a long oil varnish containing a small quantity of water, and asphalt coloring matter, which saturates the paper and gives it strength. The latter consists of waterproof varnish sealer which serves as a base for the application of the binder. The binder, also applied by means of a roller, is a flexible oleo resinous varnish. The abrasive material is sprinkled on the wet binder coat and the excess shaken off. The finishing coat is known as a sandsize and is applied to the abrasive material itself, after partial drying of binder coat containing abrasive, serving to hold the grits in place and bind them firmly to the binder coat.

These materials are applied, according to the prior practice, at a relatively high temperature, varying from 110° F. to 165° F., resulting in a thin coat application, due to low viscosity of the varnish at the higher temperatures. The varnish is applied at high solids content to insure a thin, even coat of abrasive material and thereby a uniform, more flexible sheet of sandpaper. The varnishes are bought by the customer at a solids content up to 90% and thinned for application by an amount depending upon the size of the abrasive material to be bound to the paper and also upon the weight of the paper.

There are numerous disadvantages with the system of waterproof sandpaper commonly used as outlined above. They sometimes lack sufficient flexibility to allow the paper to conform readily to the surface on which it is used and the paper cracks after it has been used for a short time. If satisfactory in flexibility, the binder may lack sufficient hardness and strength to hold the grits firmly in place. There is also a tendency for the binder and sandsize to be thermo-plastic and gum up with the dust which is cut from the surface being abraded. In wet sanding operations, most varnishes become soft due to the action of the water.

This invention has as an object an abrasive system having an improved coating for holding the abrasive material on the base. Another object is an improved sandpaper having a binder system which shall have satisfactory flexibility and at the same time shall be relatively hard. Another object is to improve the water and oil proofness of the sandpaper. Another object is to provide a binding material which shall be relatively free from gumminess and which shall not collect the dust that is cut from the material being abraded. A further object is to provide a binding material which dries in a shorter time thereby decreasing the cost of production. A still further object resides in the method of making our improved abrasive.

These objects are accomplished by the following invention, which consists in using certain oil modified polyhydric alcohol-polybasic acid resins as the binding materials in one or both of the two last coats in a system such as outlined above in connection with the prior art.

The single figure of the drawing showing a cross section of sandpaper is illustrative of the preferred embodiment of our invention.

The numeral 1 designates a paper base impregnated for strength. The backsize impregnation, indicated by the numeral 2, is an impregnating emulsion of long oil varnish and asphalt color. During the operation in which the backsize is applied, a presize consisting of a waterproof varnish sealer is applied to the other side of the paper. This sealer composition not only impregnates the paper from the side applied, as indicated by the numeral 3, but also may form a thin coating on the impregnated base as designated by the numeral 4. A binder coating 5 consisting of an oil modified polyhydric alcohol-polybasic acid resin is now applied. The sand, or other abrasive, or polishing material 7 is then sprinkled on, or otherwise suitably applied, to the binder coating while it is still wet. The paper is then baked for a short period of time. A sandsize coating 6, consisting of an oil modified polyhydric alcohol-polybasic acid resin, more fully referred to hereinafter, is then applied over the binder coating 5 which has the abrasive material anchored or embedded therein. The product is then baked until the desired hardness of the system is obtained.

For the finer grades of sandpaper the best re-

sults are obtained when one of the resin coatings designated by the numerals 5 and 6 is somewhat flexible and the other coating is comprised of a hard strong resin. The methods of making polyhydric alcohol-polybasic acid resins having the desired characteristics are illustrated in the following four examples. The preferred binder system from which we have secured the greatest advantages consists of a coating of a resin of the approximate composition indicated in Example I and a coating of a harder resin of the approximate composition indicated in Example II.

Example I

This resin containing the equivalent of 40% glyceryl tri-phthalate, 30% China wood oil, and 30% linseed oil, may be made from the following ingredients:

	Percent
Phthalic anhydride	29.35
Linseed oil acids	26.60
China-wood oil acids	26.60
Glycerol (dynamite grade)	17.45
	100.00

This resin solution is made as follows: The above mentioned ingredients are put into an ordinary varnish kettle and brought to a temperature of about 437° F. in about one hour. The kettle contents are held at that temperature until a 60% solution of the material in Hi-flash naphtha (an aromatic solvent with 150–200° C. distillation range) has a viscosity of about "O" on the Gardner-Holdt scale. This takes about three hours after reaching temperature. The kettle is then removed from the fire and 22.5 parts, by weight, of Hi-flash naphtha and 0.9 part, by weight, of a concentrated solution of manganese linoleate drier, are added. Before use, this solution will require the addition of further amounts of Hi-flash naphtha or other thinner, depending upon the remaining materials in the abrasive system.

Example II

This resin containing the equivalent of 49% glyceryl tri-phthalate, 20% China-wood oil, and 31% linseed oil, may be made from the following ingredients:

	Percent
Phthalic anhydride	35.70
Linseed oil acids	27.35
China-wood oil acids	17.65
Glycerol (dynamite grade)	19.30
	100.00

The resin solution is prepared as follows: The above mentioned ingredients are placed in the usual type of varnish kettle and brought to a temperature of 392° F. in about an hour. The contents of the kettle are held at this temperature until a 45% solution of the resin in Hi-flash naphtha has a viscosity of "S" on the Gardner-Holdt scale. This requires about 4½ hours at this temperature. The kettle is then removed from the fire and 22.5 parts of Hi-flash naphtha and .75 of the concentrated solution of manganese linoleate drier, are added. This solution, like that of Example I, may require some further thinning before application.

Another suitable binder system may be obtained from the resins set forth in Examples III and IV, one resin being used as the binder coating and the other as the sandsize coating as in the system referred to above.

Example III

This resin containing the equivalent of 54% glyceryl tri-phthalate, 15% China-wood oil, and 31% linseed oil, may be made from the following ingredients:

	Percent
Phthalic anhydride	39.55
Linseed oil acids	27.50
China-wood oil acids	13.85
Glycerol (dynamite grade)	19.10
	100.00

The resin solution is prepared as follows: The above mentioned ingredients are placed in the usual type of varnish kettle and brought to a temperature of about 437° F. in about an hour. They are held at this temperature until the acid number of the material is about 39. This takes about 4½ hours at temperature. The kettle is then removed from the fire and 22.5 parts, by weight, of Hi-flash naphtha and 0.7 part, by weight, of a concentrated solution of manganese linoleate drier, are added. This solution, like the others, may require further thinning before application.

Example IV

This resin containing the equivalent of 32% glyceryl tri-phthalate, 51% linseed oil, and 17% China-wood oil, may be prepared from the following ingredients:

	Percent
Phthalic anhydride	23.65
Linseed oil acids	45.95
China-wood oil acids	15.95
Glycerol (dynamite grade)	14.45
	100.00

The resin solution is made as follows: The above ingredients are placed in the usual type of varnish kettle and brought to a temperature of about 437° F. in about an hour. They are held at this temperature until the viscosity of a 67% solution in Hi-flash naphtha is "G" on the Gardner-Holdt scale. This requires about six hours at 437° F. The kettle is then removed from the fire and 22.5 parts, by weight, of mineral spirits and one part, by weight of a concentrated solution of manganese linoleate drier, are added. This solution is appropriately thinned in the same way as those of Examples I, II and III.

Although the examples given above show the preparation of these resins from the drying oil acids only, they may also be prepared from the oils themselves as described in the co-pending application of Paul Robinson, Serial No. 370,727, filed June 13, 1929. In this method the oil and glycerol is heated until the two phases merge into a single phase, and the glyceride so formed heated with phthalic anhydride until resinification occurs. Other methods now in use for the preparation of resins of the same composition as those described in the foregoing paragraphs, are also applicable. It is to be understood, therefore, that the reference to oil modified resins in the claims is intended to include resins made as above described either with the oils or with the equivalent amount of the corresponding oil acids.

As shown by the examples, the drying oil (the oil acids for convenience being hereinafter referred to simply as oil to indicate either the oil

acids or equivalent amount of oil) is a mixture of China-wood oil and linseed oil. The use of a mixture of China-wood oil and drying oil other than China-wood oil is of peculiar importance in the practice of the present invention. The China-wood oil causes the film to dry rapidly and yield a hard film, this latter property being modified by the other drying oil, as linseed, perilla or fish oil, to the degree required to produce a film having the optimum characteristics desired in a binder for the abrasive material on sandpaper or similar products.

When the resins are made from glycerol, as the polyhydric alcohol, and phthalic anhydride as the polybasic acid, the limiting quantities of the component parts of the resin expressed in terms of glyceryl tri-phthalate, China-wood oil and drying oil other than China-wood oil, may be given as follows: The more flexible component resin of the adhesive system may comprise from about 40% glyceryl tri-phthalate and 60% of mixed oils to about 32% glyceryl tri-phthalate and 68% of mixed oils. For any given amount of glyceryl tri-phthalate, the China-wood oil content may vary from about 25 to about 50% of the mixed oil. The limits on the other component resin, which dries to the harder and somewhat less flexible film, are from the equivalents of about 55% glyceryl tri-phthalate and 45% mixed oil to about 45% glyceryl tri-phthalate and 55% mixed oil. For any given content of glyceryl tri-phthalate, the mixed oils may contain from about 32.6% to about 44.4% of China-wood oil. In the case of either the binder resin or the sandsize resin, it is not necessary that the China-wood oil vary in any particular way with the variations in the glyceryl tri-phthalate content as long as it is kept within the limits specified. However, when the content of glyceryl tri-phthalate of one resin in the system is reduced by a definite amount from the maximum limit, the content of the other resin should be raised by about that amount to obtain the desired hardness of the system. The binder coat, in the case of lower content of phthalic glyceride, preferably should be dried for a longer initial period for the same reason. As will be understood by those skilled in the art, glyceryl tri-phthalate as such does not exist in the resin, the mixed esters of phthalic acid and linseed oil acids being present rather than the pure glyceride of phthalic acids. Due to the difficulties encountered in determining the resin composition in terms of its actual constituents, it is more convenient to express the composition of these resins in terms of drying oil (or the corresponding amount of drying oil acids), and the glyceryl tri-phthalate capable of being formed by the phthalic anhydride and glycerol used in making the resin.

In the manufacture of the coarser grades of sandpaper in which the grits range from about one thirty second of an inch to one eighth of an inch, it is essential to use the harder drying compositions for the binder coating to obtain the required hardness and adhesion. A hard drying resin suitable for the binding system in such paper may be comprised of about 50% oil, consisting of from 12% linseed oil and 87½% China-wood oil to 35% linseed oil and 65% China-wood oil, the remainder of the resin consisting of glyceryl tri-phthalate. The resin may be made by any of the methods previously indicated. Flexibility is of less importance in the coarser grades of sandpaper.

While it is preferred to make the resins from phthalic acid or phthalic anhydride as the polybasic acid and glycerol as the polyhydric alcohol, it will be apparent that we may use suitable resins made with other polybasic acids and polyhydric alcohols. In making the resins with glycerol and phthalic anhydride it is desirable in some instances to replace part of the glycerol with another polyhydric alcohol such as ethylene glycol and to replace part of the phthalic anhydride with another polybasic acid such as adipic acid.

We have found that the incorporation of any of the oxidation inhibitors commonly used in coating compositions such as creosole, guaicol, hydroquinone, eugenol, etc. into the resin coatings in small amounts, as from ½% to 1%, increases the hardness and strength of either or both members of the system and makes possible the application of thicker coats than could otherwise be used. The effect produced by the incorporation of an oxidation inhibitor into the resins of the type disclosed in Examples I and III which dry to a flexible film is of especial importance inasmuch as the harder drying of the flexible resinous film which is brought about by the oxidation inhibitor makes possible the use of a flexible coating for both the binder coating 5 and the sandsize coating 6. An abrasive system made in this manner is highly advantageous for many purposes because of the excellent flexibility coupled with high durability.

Our invention is applicable to the manufacture and production of a paper, fabric, or other suitable base coated with abrasive materials intended for use in grinding, polishing, and related operations.

By the use of these oil modified polyhydric alcohol-polybasic acid resins as the binding material in the various coats of a system such as the one outlined herein, it is possible to make coated papers and fabrics which are sufficiently flexible to readily conform to the surface which is being abraded or polished. The coatings possess such unusual hardness and strength that the abrasive or polishing material is held firmly in place. This is not true to the same degree with the binders made from the ordinary type of oleo resinous varnishes unless they are baked excessively, which is injurious to the flexibility and life of the sandpaper. In order to obtain a flexible coating with the previously used systems, it is necessary to bake the material in the drying operation for a long time at a relatively low temperature. If rapidity of drying is secured by raising the temperature, brittleness results. Prolonged baking of our improved compositions has less detrimental effect than on those now in use. By means of the present invention, rapid drying is secured at relatively low temperatures, making it possible to carry out the operations of manufacture in a shorter time than is required for the compositions now in use. The materials used in this invention are relatively not gummy and collect less dust from the abraded material than those now in common use. A sandpaper made from the system of resins described in connection with the resins of Examples I and II has, on standard manufacturing equipment, shown the following advantages over other waterproof sandpapers now on the market: Superiority in waterproofness, marked superiority in oil proofness, and improved cutting power, the latter possibly due to minimized gumminess. The production advantage of reducing the total

drying schedule to about one-half the usual time, was also secured.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that we do not limit ourselves to the specific embodiments thereof except as defined in the appended claims.

We claim:

1. A flexible sheet of abrasive material comprising a base, abrasive material and a coating on said base comprised of a resinous mixed ester of polyhydric alcohol with polybasic acid and a mixture of fatty oil acids containing the acids of China-wood oil and the acids of a fatty oil other than China-wood oil.

2. A flexible sheet of abrasive material comprising a base, a binder coating on said base, abrasive material anchored in said binder coating, and a sandsize coating over said binder coating, one of said coatings comprising an oil modified glyceryl phthalate resin having a composition, when expressed in terms of drying oil and glyceryl tri-phthalate, of about 40% glyceryl tri-phthalate, 30% China-wood oil and 30% linseed oil, the other of said coatings comprising an oil modified glyceryl phthalate resin having a composition, when expressed in the above mentioned terms, of about 49% glyceryl tri-phthalate, 20% China-wood oil and 31% linseed oil.

3. A flexible sheet of abrasive material comprising a base, a resin coating on said base, and a coarse grade abrasive material anchored in said coating, said resin coating comprising, when expressed in terms of drying oil and glyceryl tri-phthalate, approximately 50% glyceryl tri-phthalate and 50% of a mixture of oils of which mixture 65% to 87½% is China-wood oil, and the remaining 35% to 12½% of the mixture is linseed oil.

4. A flexible sheet of abrasive material comprising a base, abrasive material, and a coating on said base comprising an antioxidant and a polyhydric alcohol-polybasic acid resin modified with a mixture of drying oils, one of which is China-wood oil.

5. The abrasive material set forth in claim 4 in which the resin is a glyceryl phthalate resin.

6. A flexible sheet of abrasive material comprising a base, a binder coating on said base, a sandsize coating over said binder coating and abrasive material anchored in said binder coating, said coating comprising an oil modified polyhydric alcohol-polybasic acid resin, and the other of said coatings comprising an oil modified polyhydric alcohol-polybasic acid resin containing an antioxidant.

7. The abrasive material set forth in claim 6 in which the resin is a glyceryl phthalate resin.

8. A flexible sheet of abrasive material comprising a base, a binder coating on said base, a sandsize coating over said binder coating and abrasive material anchored in said binder coating, each of said coatings comprising an oil modified polyhydric alcohol-polybasic acid resin containing an antioxidant.

9. The abrasive material set forth in claim 8 in which the resin is a glyceryl phthalate resin.

10. The abrasive material set forth in claim 1 in which the fatty oil acids other than China-wood oil acids are linseed oil acids.

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