Nov. 26, 1968 T. J. ARGIRO 3,413,106

METHOD OF REDUCING FRICTION ON COATED ABRASIVE CLOTH AND ABRASIVE PRODUCT

Filed March 16, 1966

FIG. 1

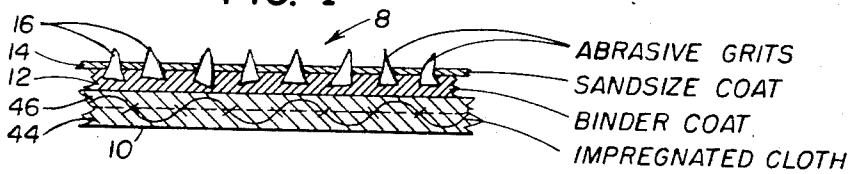


FIG. 2

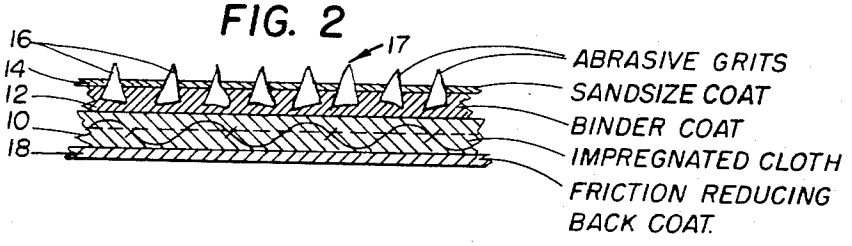


FIG. 3

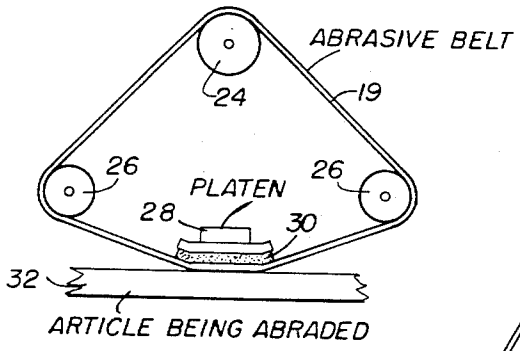
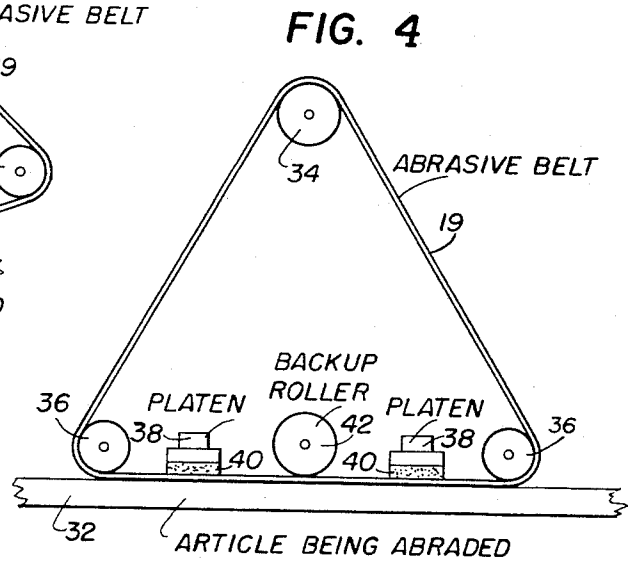


FIG. 4



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METHOD OF REDUCING FRICTION ON COATED ABRASIVE CLOTH AND ABRASIVE PRODUCT

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ABSTRACT OF THE DISCLOSURE

Coated abrasive cloth is provided with a friction reducing back coat of a wax lubricant including a paraffin base wax and preferably a minor proportion of carnauba wax, and an insoluble alkyd resin binder. The back coat is provided by application of an organic solvent solution of the lubricant and a curable soluble alkyd resin, followed by evaporation of solvent and curing of the resin.

This invention relates to a method of reducing friction on the back of coated abrasive cloth wherein a friction reducing back coat is provided thereon, and to the resulting abrasive product.

In using coated abrasive cloth for abrading or sanding various articles, the cloth is held or urged against the work by backup members as it traverses the work. Thus, for example, sanding machines and the like employ an abrasive cloth belt which travels over the work at high speeds and is held against the work by platens and rollers in contact with the back side of the belt. There is considerable friction between the belt and the backup members, which wears the members and the belt, causes heat buildup to deleterious temperatures, and increases the power requirements.

An important object of the present invention is to reduce friction on the back of coated abrasive cloth so as to reduce wear on the backup members and the cloth, reduce the operating temperature of the belt and extend the useful life, and reduce the power requirements.

A more specific object is to reduce friction on the back of coated abrasive cloth by providing a friction reducing back coat thereon that is readily applied, permanently bonded and not objectionable to handle, and long lasting.

Another object is to provide a friction reducing back coat on coated abrasive cloth that increases the resistance to heat buildup and the tensile strength of the cloth.

An additional object is to provide a simple, economical and reliable method of reducing friction on the back of coated abrasive cloth.

A still further object is to provide an abrasive product including coated abrasive cloth and a friction reducing back coat thereon having the foregoing advantages.

A particular object is to provide a method and abrasive product accomplishing the foregoing objects, which employ a wax lubricant and an alkyd resin binder for providing a friction reducing back coat.

A more particular object is to provide a method of reducing friction on the back of coated abrasive cloth belts and the like, and a reduced friction abrasive belt product.

These and other objects, advantages, and functions of the invention will be apparent on reference to the specification and to the attached drawings illustrating a preferred embodiment of the invention and the embodiment in use, wherein:

FIGURE 1 is a diagrammatic sectional illustration of a coated abrasive cloth which may be provided with a friction reducing back coat according to the invention, the dimensions being exaggerated for illustrative purposes;

FIG. 2 is a view like FIG. 1 but illustrating a finished abrasive product of the invention, wherein the coated abrasive cloth of FIG. 1 is provided with a friction reducing back coat; and

FIGS. 3 and 4 are, respectively, diagrammatic illustrations of the manner in which abrasive belts made from the abrasive product of FIG. 2 are employed in sanding machines and the like.

In accordance with the invention, a method of reducing friction on the back of coated abrasive cloth is provided which comprises providing a friction reducing back coat of a wax lubricant and an insoluble alkyd resin binder thereon. A new and improved abrasive product is provided, which includes the coated abrasive cloth and the friction reducing back coat thereon.

Referring to the drawings, FIG. 1 illustrates a conventional coated abrasive cloth **8** such as may be provided with a friction reducing back coat according to the invention. The abrasive cloth includes an impregnated cloth or backing layer **10**, a binder coat **12** on the cloth layer, a sandsize coat **14** on the binder coat, and abrasive grits **16** embedded in the binder coat and the sandsize coat, and projecting therefrom. The grit side of the coated abrasive cloth is referred to as the front side, and the cloth side is referred to as the back side. Referring to FIG. 2, an abrasive product **17** of the invention further includes a friction reducing back coat **18** on the impregnated cloth layer **10**, on the back side of the coated abrasive cloth.

The abrasive product **17** illustrated in FIG. 2 is especially suited for use in abrasive belts constructed of long strips of the material. FIGS. 3 and 4 illustrate an endless belt **19** constructed of a strip of the abrasive product **17** joined together at its ends in a conventional manner. The manner in which the belt is used in wood sanding machines is diagrammatically illustrated in the views.

In the machine of FIG. 3, the belt is trained over a drive roller **24**, two idler rollers **26**, and a platen **28**. The platen includes a graphite backup pad **30**, which is in contact with the back side of the belt, bearing the friction reducing back coat **18**. The front side of the belt, bearing the abrasive grits **16**, faces outwardly for contacting the work. An article **32**, which may be a wood panel, is fed to the belt beneath the platen, and the belt is driven at high speed, e.g., 4000 to 6000 feet per minute.

When a belt constructed of the conventional abrasive cloth **8** of FIG. 1 is employed in the sanding machine, the frictional contact of the back side of the belt with the graphite backup pad **30** rapidly wears the backup pad and also wears the belt. The frictional heat generated scorches the belt. Employing as the belt material the new abrasive product **17** having the friction reducing back coat **18**, as illustrated in FIG. 2, there is much less wear on the backup pad **30**. The life of the pad is as much as double the prior life of the pad. The belt wears less, runs cooler, requires less power for tracking, and has greater tensile strength. The improved results are obtained throughout the life of the belt, i.e., so long as the belt contains sufficient grits **16** to provide a satisfactory abrasion.

The abrasive belt **19** is employed with similarly improved results in the sanding machine illustrated in FIG. 4. This machine includes a drive roller **34** and two idler rollers **36**. The belt is backed by two platens **38** each having a graphite backup pad **40**, and by a backup roller **42**. The article **32** being abraded is in contact with the belt over an extended portion of the article. Friction between the back side of the belt and the backup pad **40** and roller **42** members is effectively reduced employing the abrasive product **17** of FIG. 2 for constructing the belt.

Coated abrasive cloth such as illustrated in FIG. 1 is made from woven cotton fabric of selected weights.

The abrasive cloth is made with various impregnants, binders, sizes, and abrasive grits. The impregnants, binders and sizes may be glue, phenolic resin, epoxy resin, alkyd resin, urea-formaldehyde resin, vinyl resin, ethyl cellulose, and other polymeric materials, as conventionally employed. The abrasive grits may be such materials as silicon carbide and aluminum oxide. It is contemplated that the invention may be applied to coated abrasive cloth of the various compositions.

In the illustrative preferred practice of the invention, the fabric employed in the impregnated cloth layer **10** is X-weight cotton cloth, or cotton drill. In one method of manufacture, the back side of the cloth is sized with glue, which may or may not contain a filler such as calcium carbonate. The glue penetrates the cloth in a manner such as represented by the broken line in the layer **10**, providing a glue layer **44** extending into the cloth from its back side. The front side of the cloth is sized with a phenolic resin, which may contain a filler, to provide a resin layer **46** extending into the cloth from its front side. Thereafter, a phenolic resin binder coat **12**, which may contain a filler, is provided on the front side of the impregnated cloth.

Silicon carbide or aluminum oxide grits **16** are electrostatically and/or gravity deposited on the binder coat and embedded therein. The binder coat is heat cured sufficiently to secure the grits for application of the sandsize coat. The sandsize coat is applied over the binder coat and heat cured. The product then is post cured at elevated temperatures and for an extended period of time, e.g., at temperatures up to 275° F. for 3–4 days, to produce the coated abrasive cloth **8**. The cloth is moistened by spraying with water and is flexed over a bar, to prepare it for use in belts. The foregoing procedures are well known in the art.

In the preferred practice of the invention, the friction reducing back coat **18** is applied to coated abrasive cloth **8** prepared as described above, in making the new abrasive product **17**. It will be understood, however, that variations in the sequence of manufacturing steps may be permissible, depending upon such factors as curing conditions, compatibilities, and manufacturing convenience.

Conventional coated abrasive cloth **8** such as is prepared in the above-described manner may be treated with various dressings to reduce friction on the back side of the cloth. Thus, waxes, polyglycols, graphite and combinations thereof when applied to the cloth reduce friction and wear on the cloth and back up members. However, such materials remain on the cloth only temporarily, and some of them are messy.

Proceeding according to the invention, a coating composition containing a combination of a wax lubricant and an alkyd resin binder is readily prepared and applied to the abrasive cloth. The composition is cured to provide a permanent back coat **18** on the abrasive product, serving to reduce friction and increase the durability and tensile strength of the product over the useful life of the abrading surface. The objectionable characteristics of belt dressings are obviated.

It is preferred in the invention that the wax be predominantly a paraffin base wax or the like, such as paraffin wax and petroleum wax. It is further preferred to employ a mixture of a paraffin base wax and a minor proportion of carnauba wax. Various other waxes might be employed, although their performance characteristics at times are not so advantageous under severe conditions. It is generally preferred that the wax have a solidification point in the range of about 125–200° F., more preferably 135–165° F.

The alkyd resin initially is a soluble resin that is curable or convertible to insoluble state. A drying type resin is employed, preferably of the rapid air dry or low bake type. It is preferred that the resin have a high aliphatic solvent tolerance. Such resins are well known, being prepared, for example, from drying oils, phthalic anhydride and the like, and polyols, preferably glycerine and/or pentaerythritol, and combinations thereof with glycols such as ethylene glycol. Preferred resins which are fast drying and have high aliphatic solvent tolerance are modified with rosin or rosin and an oil-soluble phenolic resin.

The alkyd resin is employed in an amount sufficient to bind the wax lubricant to the abrasive cloth. It is generally preferred that the weight ratio of alkyd resin to wax be in the range of about 2:1 to 10:1. Employing the preferred resins and waxes, it is further preferred that the ratio be about 3:1. In this connection, while the alkyd resin is employed as a binder, it also toughens the belt and increases its tensile strength, as noted above. The resin may additionally function in the combination to reduce friction, supplementing the lubricating quality of the wax. In any event, problems due to friction are greatly reduced employing the combination of wax and alkyd resin.

The friction reducing back coat **18** is provided on the abrasive cloth **8** by application of a fluid coating composition of the wax and alkyd resin components, for covering and penetrating the porous back surface of the cloth. Preferably, the ingredients are applied in organic solvent solution, for ease of application, penetration of the cloth, and application of a thin homogeneous coat on the surface of the cloth.

The organic solvent preferably is an aliphatic hydrocarbon, including mixtures of hydrocarbons, such as naphthas and mineral spirits. The aliphatic hydrocarbons have good solvent power for waxes and alkyd resins, they are economical, and they are readily removed by evaporation. Alternatively, aromatic hydrocarbons and mixtures of aliphatic and aromatic hydrocarbons might be employed. The aromatic hydrocarbons include toluene, xylene, mixed aromatic fractions, and aromatic naphthas. The organic solvent preferably boils below about 550° F., preferably in the range of about 200–400° F.

The organic solvent is employed in an amount sufficient to provide a solution of the wax and alkyd resin which is suitable for application of desired amounts of the solid ingredients by the selected method of application under the conditions of application. It is generally preferred to use a substantial excess of solvent over the amount required to dissolve the ingredients, in order to dissolve the ingredients rapidly in compounding the coating composition. Thus, for example, 75% or more of the weight of the coating composition may be solvent. The solvent is economical and is readily evaporated in the process of drying the abrasive cloth coated with the composition.

The coating compositions preferably include a drier, as conventionally employed for curing alkyd resins. Depending upon the specific resin and upon the drying conditions, whether air dry or bake, the drier may be a compound of a metal such as cobalt, lead, manganese, calcium, and zinc, for example. The drier is incorporated in the composition in a fractional weight percent, calculated as metal based on resin solids. Employing the preferred alkyd resins, it is preferred to employ a cobalt compound such as cobalt octoate and cobalt naphthenate in a proportion of about 0.4% of cobalt by weight of resin solids.

The coating composition is compounded by mixing the wax, alkyd resin, and solvent in a vessel and heating to obtain a complete solution. The ingredients may be added in any order. The mixture is heated to a temperature preferably in the range of about 145–175° F., more preferably 160–170° F., with the preferred compositions. The drier may be incorporated in the composition at any time prior to application.

The coating composition is applied to the back side of the coated abrasive cloth **8** by any convenient method, such as spraying, knife coating, or roller coating. The solution may be adjusted to a viscosity most suitable for

the manner of application, by varying the proportion of solvent. Thus, the composition desirably is more viscous for knife and roller coating than for spraying. The composition preferably is applied while warm, to maintain complete solution. It is preferred to apply the composition at a temperature of about 110–140° F.

Belting prepared from abrasive cloth such as illustrated in FIG. 1 may be coated as it is unwound from a roll or "jumbo" of belting. In one manner of application, the back of the belting is sprayed with the coating composition as the roll is unwound, and the coated product is conveyed to a drying and curing oven. The coating composition is applied at a rate which will provide preferably about 0.02–0.07 ounce of solids per square foot of cloth. About 0.035–0.05 ounce per square foot is applied to belts for use as illustrated in FIGS. 3 and 4, and about 0.02–0.03 ounce per square foot is applied to smaller, thinner belts used for sanding brake shoes, for example. More or less of the composition may be applied for other specific uses, and more than one application of the coating composition may be made to build up a coat in a plurality of layers.

Following application of the coating composition, the product is dried and cured. Drying and initial curing preferably is conducted at an elevated temperature of about 150–250° F. After a short period of time at such temperature, e.g., about 10 minutes, the product is further cured by storing at ambient conditions for an additional period of time, and preferably about 24 hours.

After curing, it is advisable to moisten or humidify the product in order to avoid stresses in use. The product may be placed in a humidity chamber, or subjected to a spray mist over the back coating to provide a film of moisture thereon, which is absorbed by the cloth. Lengths of the product are joined at their opposite ends to form belts for use as described above and illustrated in FIGS. 3 and 4.

The invention is illustrated by the following examples. It will be understood that the invention is not limited to the examples or to the materials, proportions, conditions, and procedures set forth therein, which are merely illustrative.

EXAMPLE 1

A coating composition is prepared from the following wax and alkyd resin compositions:

Wax composition

Material:	Proportion, percent by weight
Paraffin wax, M.P. 135–153° F.	10.11
Paraffin wax, M.P. 159–163° F.	2.24
Petroleum wax, M.P. 207–214° F.	8.15
Carnauba wax, M.P. 180–183° F.	0.82
Polyethylene anti-slip agent [1]	1.00
Dye and deodorant	0.19
Mineral spirits [2]	46.67
Naphtha [3]	30.82

[1] Average molecular weight, 2000; melting point, 219–226° F.; average viscosity at 140° C., 180 centipoises.
[2] Flash point, 112–116° F.; Kauri-Butanol value, 32–36; distillation range, 320–395° F.
[3] Flash point, 105–110° F.; Kauri-Butanol value, 33–34.5; distillation range, 310–360° F.

Alkyd resin solution

Material:
- Glyceryl phthalate alkyd resin—(proportion) 60% by wt.
  - Minimum phthalic anhydride, 14%
  - Soya oil, 23%
  - Modifiers, 26%, including:
    - Ester gum, 90–95%
    - Phenol formaldehyde resin, 10–5%
- Solvent—(proportion) 40% by wt.
  - L.D. naphtha, 84%
  - VM&P naphtha, 16%

Properties: Gardner-Holdt viscosity at 25° C., Z_5–Z_6. Acid value of solids, 20–30. Very rapid air drying.

The compositions are mixed with additional solvent and a drier is added in the following proportions:

Material	Proportion, percent by weight		
	Total	Solids	Solvent
Wax composition	23.0	5.18	17.82
Alkyd resin solution	25.5	15.30	10.20
High flash VM and P naphtha	51.5	----------	51.50
	100.0	20.48	79.52

Drier: Cobalt naphthenate, 6% cobalt, 1 lb./100 lbs. alkyd resin solution (0.4% cobalt by weight of resin solids).

The materials are mixed in a mixing tank at 145–175° F. until solution is complete. A 300-pound charge is heated and mixed for about 1 hour.

A roll of belting formed of the coated abrasive cloth illustrated in FIG. 1 and described above is sprayed on its back side with the coating composition at 110–140° F. as the roll is unwound. The belting is sprayed with about 0.17–0.23 ounce of composition per square foot of cloth, equivalent to about 0.035–0.048 ounce of solids per square foot, and about 22 feet of belting is sprayed per minute.

The coated product is conducted at the same rate through an oven heated to a temperature of about 225–250° F. The residence time in the oven is about 10 minutes, after which the product emerges and is rolled. The rolls are allowed to stand for 24 hours at room temperature. Thereafter, the rolls are unwound and the back coating thereon subjected to a spray mist to provide a film of moisture, which is absorbed by the belting. The ends of appropriate lengths of belting are joined to produce finished belts, which may be used as illustrated in FIGS. 3 and 4 and described above.

EXAMPLE 2

A coating composition is prepared from the alkyd resin solution of Example 1 and Original Simoniz wax composition. The wax content of the wax composition is predominantly paraffin base wax and includes a minor proportion of carnauba wax. The wax composition includes 76% naphtha and mineral spirits, by weight. The alkyd resin and wax compositions are mixed with additional solvent and a drier is added in the manner of Example 1, to produce a solution having a viscosity at 140–160° F. of about 10–20 centipoises. The proportions are as follows:

Material	Proportion, percent by weight		
	Total	Solids	Solvent
Wax composition	23.0	5.52	17.48
Alkyd resin solution	25.5	15.30	10.20
High flash VM and P naphtha	51.5	----------	51.50
	100.0	20.82	79.18

Drier: Cobalt naphthenate, 6% cobalt, 1 lb./100 lbs. alkyd resin solution (0.4% cobalt by weight of resin solids).

Belting is coated with the coating composition, dried, cured and finished as described in Example 1.

The invention thus provides a method for reducing friction on the back of coated abrasive cloth and a low friction abrasive product. A friction reducing back coat is provided on the abrasive product that is permanently bonded, long-lasting, clean and dry. Use of the product in an abrasive belt reduces the wear and extends the life of sanding machine members. The belt runs cooler, power requirements are reduced, and the belt is stronger and more durable.

It will be apparent that various changes and modifica-

tions may be made in the invention within the spirit and scope thereof. It is intended that such changes and modifications be included within the scope of the appended claims.

I claim:

1. An abrasive product comprising coated abrasive cloth and a friction reducing back coat thereon, said back coat comprising a wax lubricant and an insoluble alkyd resin binder, said lubricant comprising a mixture of a major proportion of a paraffin base wax and a minor proportion of carnauba wax, and said binder being present in an amount sufficient to bind said lubricant to said cloth.

2. A product as defined in claim **1** wherein said lubricant has a solidfication point in the range of about 125–200° F.

3. A product as defined in claim **2** wherein said binder comprises a rosin-modified drying oil alkyd resin.

4. A product as defined in claim **1** wherein the weight ratio of said binder to said lubricant is in the range of about 2:1 to 10:1.

5. A product as defined in claim **4** wherein said back coat is applied at the rate of about 0.02–0.07 ounce of solids per square foot of cloth.

6. An abrasive product comprising coated abrasive cloth including a glue backsize, and a friction reducing back coat thereon, said coat comprising a wax lubricant and an insoluble rosin-modified drying oil alkyd resin binder, said lubricant comprising a mixture of a major proportion of a paraffin base wax and a minor proportion of carnauba wax, and the weight ratio of said binder to said lubricant being in the range of about 2:1 to 10:1.

7. A product as defined in claim **6** wherein said lubricant has a solidification point in the range of about 135–165° F.

8. A product as defined in claim **7** wherein said binder comprises an alkyd resin of about 14% minimum phthalic anhydride, 23% soya oil, and 26% modifier of about 90–95% ester gum and about 10–5% phenol formaldehyde resin, by weight, and said ratio is about 3:1.

9. An abrasive belt adapted for use in a sanding machine or the like and comprising a strip of coated abrasive cloth and a friction reducing back coat thereon, said back coat comprising a wax lubricant and an insoluble alkyd resin binder, said lubricant comprising a mixture of a major portion of a paraffin base wax and a minor proportion of carnauba wax, and the weight ratio of said binder to said lubricant being in the range of about 2:1 to 10:1.

10. A method of reducing friction on the back of coated abrasive cloth which comprises providing a friction reducing back coat of a wax lubricant and an insoluble alkyd resin binder thereon, said lubricant comprising a mixture of a major proportion of a paraffin base wax and a minor proportion of carnauba wax, and the weight ratio of said binder to said lubricant being in the range of about 2:1 to 10:1.

11. A method as defined in claim **10** wherein said back coat is provided by application of an organic solvent solution of said lubricant and a curable soluble alkyd resin, followed by evaporation of solvent and curing of the resin.

12. A method as defined in claim **10** wherein said cloth includes a glue backsize.

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