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TREATED BRUSH AND BRUSH TREATING COMPOSITION

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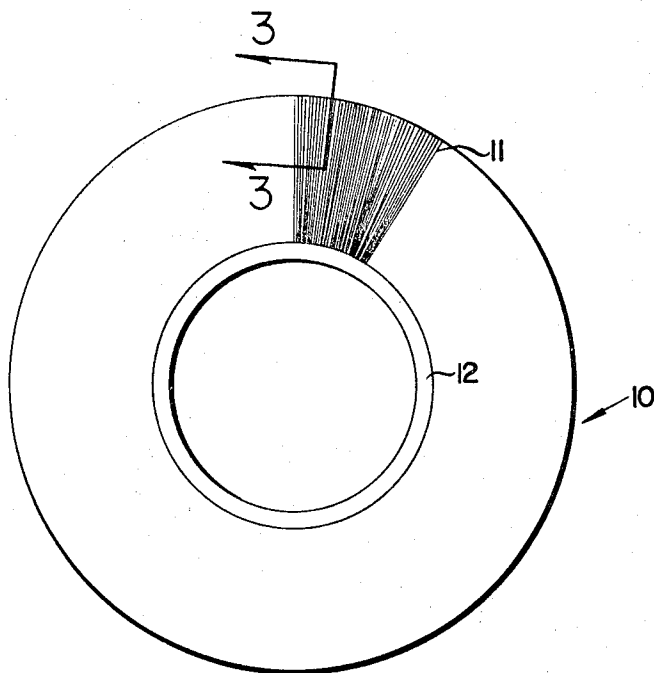


FIG 1

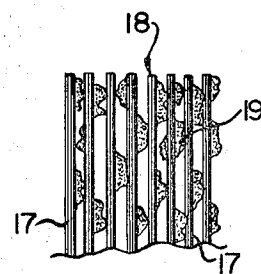


FIG 3

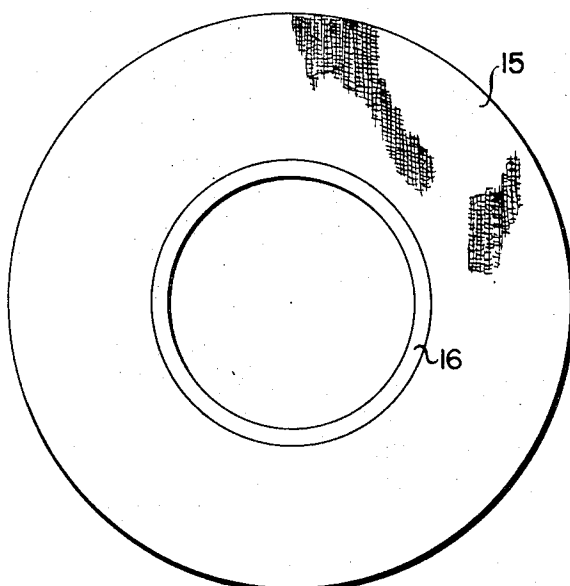


FIG 2

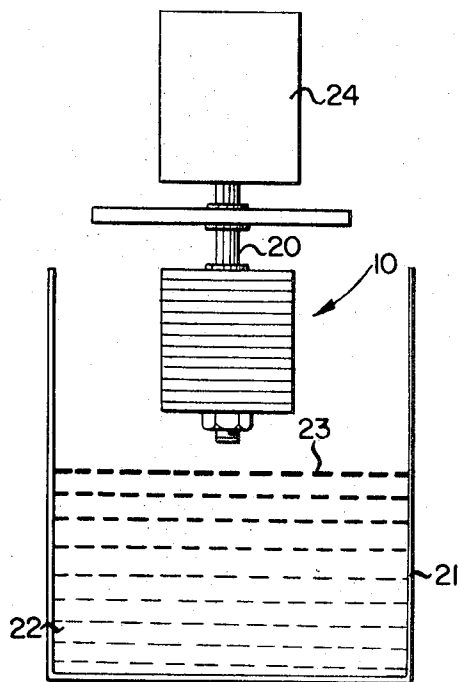


FIG 4

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3,556,752

TREATED BRUSH AND BRUSH TREATING COMPOSITION

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Continuation-in-part of application Ser. No. 74,832, Dec. 9, 1960. This application Nov. 5, 1963, Ser. No. 332,321

Int. Cl. B24d 11/00; C08g 51/12
U.S. Cl. 51—295

18 Claims

ABSTRACT OF THE DISCLOSURE

A two-phase brush treating composition capable of withstanding high temperatures and of retaining abrasive particles formed from a film forming resin in continuous phase and a dispersed phase of small particles of tackifier resin which is incompatible with the film forming resin.

This application is a continuation-in-part of my copending application, Ser. No. 74,832, filed Dec. 9, 1960 and now abandoned.

This invention relates generally, as indicated, to a treated brush and a pressure sensitive adhesive brush treating composition. More particularly, this invention relates to a treating composition suitable for treating rotary brushes or buffs to produce a tacky coating thereon for the purpose of adhering abrasive compounds thereto.

Heretofore, numerous difficulties have been encountered in the development of a treating composition which would satisfy the necessary conditions for the proper operation of a rotary brush or buff when an abrasive compound is applied to the face thereof by contacting the abrasive compound to the face while such brush or buff is rotating at, for example, 1750 r.p.m. A grease stick or the like may be employed to apply the abrasive compound to the tool face.

The treating composition which would satisfy the necessary conditions for proper operation of treated rotary brush or buff should meet several requirements. The treatment composition should have a strength of adhesion to the brush bristles sufficiently great to prevent such composition from transferring excessively to the object being brushed. The treatment should wear at substantially the same rate as the brush bristles for if during use the treatment wears faster than the brush bristle, the bristle tips at the face will become dry and when this condition occurs, the brush immediately loses the ability to hold abrasive compound. In addition, the strength of adhesion between the treating composition and the abrasive compound applied to the brush face must be sufficient to withstand the centrifugal force which normally would tend to throw the abrasive compound outwardly therefrom rendering the brush ineffective for shaping, cutting or producing the desired effect on the object being brushed.

Perhaps one of the most important and difficult to obtain physical properties is the exact softening point of the treating composition. Due to the high speed of rotation used with brushes or buffs, there is a considerable flexing and rubbing together of the bristles or buff material, and this generates heat sufficient to soften and to flow the treatment composition from the brush or buff during use.

It is therefore a principal object of the present invention

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to provide an adhesive brush treating composition which will have a high temperature soften point, i.e., in the range of 150 to 250° F.

Many brush treatment compounds heretofore have been based on semi-drying oils which are tacky as, for example, fish, soya and castor oils, but these, however, will dry over a period of time to a composition without tack, and therefore, render the brush treated therewith useless for adhering abrasive compounds thereto.

It is then another principal object to provide a brush or buff treatment composition which will not dry over a period of time to a composition without tack.

It is further a principal object to provide a brush treating composition having such non-drying characteristics providing sufficient adhesion between the composition and the abrasive material to prevent the same from being thrown outwardly by centrifugal force.

A still further principal object is to provide a treating composition of relatively high cohesive strength which will not transfer excessively from the brush bristle material to the object being brushed.

It is a further object to provide a composition which will wear at the same rate as the brush or buff material.

It is still another object to provide a superior rotary finishing tool by means of such treating composition, such tool having better cutting and wear characteristics.

It is yet another object to provide a unique method of treating a rotary finishing tool to obtain such improved performance.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features herein-after fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

FIG. 1 is an end elevation of a brush in accordance with the present invention;

FIG. 2 is an end elevation of a buff in accordance with the present invention;

FIG. 3 is a greatly enlarged fragmentary view of the brush face taken on the line 3—3 of FIG. 1 illustrating the abrasive material adhered to the brush bristle material; and

FIG. 4 is a somewhat diagrammatic view of apparatus for applying the treatment composition of the present invention to such rotary finishing tools.

In the present invention, it was observed that when a treating composition is made by blending certain percentages of a film-forming resin and a tackifier resin, the dried film is clear showing that the blended materials are compatible and the system is only one phase. In blending these materials, a high softening point was obtained only with a low percentage of tackifier resin in the blend. However, the tack or adhesive properties, while substantial, were yet insufficient with this type of system for the purposes of the present invention.

By blending the aforesaid materials in different percentages, it was discovered that a correlation existed between the tack or adhesive qualities and the softening point. The system was one in which, as tackifier resin

percentage was increased, the softening point decreased. A blend could not be achieved in which this effect was not apparent even though many different materials were tried. Many of these blends are suitable for such applications as coating of pressure sensitive tapes; however, they are not satisfactory for application to power brushes which must rotate at high rates of speed since they do not possess the necessary physical properties of a high temperature softening point and a high degree of tack.

A system was then discovered where a film-forming resin and a tackifier resin could be blended so as to form a two-phase system (a system which is separated by a definite bounding surface into two homogeneous, physically distinct parts, a continuous phase and a dispersed phase). The continuous phase is comprised of film-forming resin alone or saturated with a small quantity of tackifier resin depending upon the degree of incompatibility of the resins used, while the dispersed phase is comprised of small particles of tackifier resin, which constitutes that amount of tackifier resin which is excess over that which may be soluble in the film-forming resin. It is to be understood that the tackifier resin can be completely incompatible, i.e., insoluble, in the film-forming resin or can be partly soluble therein. It has been observed that the more insoluble the two resins, the greater the tack which the composition possesses.

This two-phase system is unique in that high tack is realized by the dispersed tackifier phase while, at the same time, the film-forming resin acts as a carrier for the dispersed phase of small tackifier resin particles. The continuous film-forming resin phase produces high cohesive strength and a high softening point in the composition. In this system, the film-forming phase is the controlling part of the system, governing the over-all softening point of the composition. With the present invention, it becomes possible to gain tack at a lower concentration of tackifier resin in the system, and also the tackifier resin can have a lower softening point without affecting the softening point or cohesive strength of the entire system, since the continuous phase is the controlling component for these properties in the two-phase system.

This produces a system which is very useful therefore as a brush treating composition since the composition has a high softening point and also is sufficiently tacky to retain abrasive grains on the face of a brush. Such a composition is formed by the selection of a high strength film-forming resin followed by the selection of a tackifier resin which is incompatible with the film-forming resin. If a proper selection of film-forming and tackifier resin is made, the resulting composition will comprise two distinct phases and will possess these desired properties.

A plasticizer can be added to the above system, if desired, in order to produce a greater degree of incompatibility in the two-phase system. The plasticizer is selected so that it will force that amount of tackifier resin which is soluble in the film-forming phase out of solution in the film-forming phase and into the dispersed phase, thereby increasing the tack of the composition. The selection of a plasticizer has to be made very carefully, since it has been found that some plasticizers render the system compatible, i.e., tend to dissolve the tackifier resin thereby rendering the composition ineffective for the treatment of brushes.

When a plasticizer is added to the two-phase system, the continuous phase is comprised of film-forming resin saturated with tackifier resin and plasticizer. The dispersed phase of the system is comprised of small particles of tackifier resin, that amount of tackifier resin which is insoluble in the film-forming resin and plasticizer.

In the preferred form of the two-phase composition described, a plasticizer is included, since the plasticizer,

in addition to increasing the incompatibility of the system, also produces a greater degree of flexibility in films formed from these compositions. Similarly, a suitable solvent is generally included in the preferred embodiment of the treating composition in order to make the composition easier to apply to a rotary buff or brush. The solvent should be one which evaporates very readily so that films which are formed from this composition will dry to the extent desired (i.e. a tacky film) in a relatively short period of time. Illustrative examples of suitable solvents are the aromatic hydrocarbons, such as toluene and xylene, methyl, ethyl, and butyl alcohol, butyl acetate, methyl, ethyl, and butyl Cellosolve, etc. Combinations of various solvents may also be used as, for example, toluene and ethyl alcohol which has produced very satisfactory results. This combination is especially advantageous in that it evaporates very readily but does not produce condensation on the film.

It should be understood that the ranges and proportions of the various ingredients of this composition can vary to a considerable extent. The particular proportions employed will necessarily vary depending upon the particular ingredients which are selected. The only limitation upon the selection of ingredients and the quantities of such which are used is that they must combine so as to produce a two-phase composition which possesses a high softening point and also remains sufficiently tacky upon drying to be capable of retaining abrasive material on the face of a power brush.

The following plasticizers have been found suitable for employment with the present invention:

Diocetyl adipate
Dibutyl phthalate
Diocetyl phthalate
Di-isooctyl phthalate
Mixture of 50% by wt. of dioctyl phthalate and di-isooctyl-phthalate, Di-n-actyl decyl phthalate
Methyl abietate

The following film former resins have been found suitable for employment with the present invention:

Ethyl cellulose
Nitro cellulose
Cellulose Acetate
Polyvinyl acetate
Cis-polyisoprene (natural rubber)
Polychloroprene (neoprene)
Polyisobutylene
Butadiene styrene copolymer
Butadiene acrylonitrile copolymer

The following tackifiers have been found suitable for employment with the present invention:

Pentaerythritol ester of abietic acid
Methyl ester of abietic acid
Diethylene glycol ester of abietic acid
Pentaerythritol ester of hydrogenated abietic acid
Glycerol ester of hydrogenated abietic acid
Triethylene glycol ester of hydrogenated abietic acid
Glycerol ester of polymerized abietic acid
Polyvinyl ethyl ether
Coumarone-indene resin
Terpene resins

Especially good results have been obtained with the following preferred composition for the treatment of brushes and buffs:

Example I

Film-forming resin—16 lbs. ethyl cellulose having an ethoxyl content between 47.5% and 49%,
Plasticizer—42 lbs. diisooctyl phthalate,
Tackifier—42 lbs. pentaerythritol ester of rosin,
Solvent—120 lbs. toluene, 30 lbs. ethyl alcohol

The above formulation is given below in percentages by weight:

	Percent
Film-forming resin	6.4
Plasticizer	16.8
Tackifier	16.8
Solvent	60.0

This preferred treating solution may preferably be manufactured by placing 150 pounds of solvent (a mixture of 120 lbs. of toluene and 30 lbs. of ethyl alcohol) in a suitable mixing tank with high shear agitation. The 16 lbs. of ethyl cellulose is added and allowed to mix until a clear solution is obtained. The 42 lbs. of diisooctyl phthalate is then added, followed by 42 lbs. of the pentaerythritol ester of rosin. The solution continues under agitation until an apparently clear solution is formed. It must be understood, however, that the solution formed is not a true solution, but a solution which contains dispersed particles.

Other formulations for the preparation of a suitable composition for the treatment of brushes and buffs may be as follows:

	Parts by wt., lbs.	Percent-ages
Example II:		
Film former: Ethyl cellulose.....	8	4
Tackifier: Glycerol ester of abietic acid.....	51	25.5
Plasticizer: Dioctylphthalate.....	41	20.5
Solvent: Toluene.....	100	50.0
Example III:		
Film former: Nitrocellulose.....	20	10
Tackifier: Diethylene glycol ester of abietic acid.....	40	20
Plasticizer: Diisooctylphthalate.....	40	20
Solvent: Toluene.....	100	50
Example IV:		
Film former: Ethyl cellulose.....	16	8
Plasticizer.....	42	21
Tackifier Mixture:		
Pentaerythritol ester of abietic acid.....	42	26
Glycerol ester of abietic acid.....	10	-----
Solvent Mixture:		
Toluene.....	80	45
Ethyl alcohol.....	10	-----

Referring now to the annexed drawing and more particularly to FIG. 1, there is illustrated a brush 10 which may be treated in accordance with the present invention. Such brush has radially extending bristle fill material 11 extending from an annular channel-form ring 12 in which such bristle material is secured by a locking ring or the like. (Cf. Patent No. 2,288,337 to William S. Whittle.) Although the treatment composition for the present invention is especially suitably adapted for use with tampico brush fill material, other brush fill material, as nylon, wire and mixtures of bassine, tampico and palmetto may equally well be employed. Also, other plastics as well as natural fibers such as horsehair may be employed. A preferred form of brush in which the present invention may be employed is a brush manufactured and sold by The Osborn Manufacturing Company of Cleveland, Ohio and known to the trade as the Monarch brush. The size of such brushes may range in outside diameter from 6 to 18 inches and in inside diameter from 2 to 9 inches. Also small brushes such as the well-known Ringlock and large Heli-Master brushes, also manufactured by The Osborn Manufacturing Company of Cleveland, Ohio may be employed with such treating composition. The larger brushes are treated by spraying with a conventional spray gun whereas the smaller brushes are treated by placing a quantity in a wire basket and then dipping and spinning the basket in such treating material.

Referring now to FIG. 2, a buff is illustrated wherein the buff material 15 extends from a channel-form annulus 16 in which it is secured. Such buff material may comprise a plurality of layers of flat fabric material stitched together and pierced centrally for the mounting of the hub or annulus 16. Some well-known buff materials that

may be used in such buffs are flannel, canvas, sheepskin, muslin, sisal, paper or felts. Reference may be had to Peterson patent 2,658,315 for an example of a rotary buff that may be employed with the present invention.

FIG. 3 illustrates various individual bristles 17 extending radially from the brush hub presenting a brush face 18 to which abrasive compound having abrasive granules 19 is applied. Such abrasive compound then adheres to the brush bristle material which is coated with the treatment composition of the present invention. Such abrasives as tripoli, amorphous silica, crystalline silica, vienna lime, aluminum oxide, rouge, emery or pumice are generally employed in rotary finishing tools such as brushes and buffs.

Referring now to FIG. 4, in the treating of intermediate size wheel brushes, ten 12" O.D. brush sections may be placed on an arbor 20 supported for vertical movement above a tank 21 containing a quantity of treating solution 22 of the suitable or preferred formulation. The treating system may be automatically actuated and the brushes are preferably rotated at 16 r.p.m. and vertically lowered into the composition 22 until completely submerged therein. Rotation is continued for approximately one minute and then the brushes move vertically until free of the solution surface 23, but still within the tank. At such time, the arbor speed is increased to, for example 865 r.p.m. and excess treating composition is centrifuged from the brushes during a five second time cycle at that r.p.m. The brush sections are then unloaded from the arbor and placed on racks for drying in a conventional hot-air oven at 200° F. for two hours. The arbor 20 may be driven by a variable speed motor 24 although it will be understood a motor and speed change transmission may equally well be employed. The above-described dipping cycle may be made completely automatic with the employment of suitable controlling timing devices.

A preferred finishing tool is formed in which the weight of the treating composition in the brush is 0.5 times the weight of the brush bristle fill material in any size brush, although, it should be understood, that the proportion of treatment composition to the weight of the brush fill material can vary from 0.1 to 1.0 times the weight of such fill material, with 0.5 times being the preferred proportion. Accordingly, the timing cycle for treating a brush is determined by first weighing a dry brush and then following the described procedure in treating and weighing the finished brush to determine if the treated brush has the desired weight of treatment composition. By trial and error this procedure is repeated with adjustments of the timers controlling the dip and spin out cycle until the solution weight meets the preferred specification of 0.5 times the weight of the fill material in the particular brush being treated.

In a 12" O.D. and 4 1/4" I.D. brush, the tampico fill weight is 400 grams. Therefore, the treatment composition weight is 0.5 times 400 or 200 grams. Since the brush is preferably treated with a dispersion approximately 40 percent by weight of solids in a solvent, the treatment composition remaining on the brush after drying is 80 grams. The terminology "solids" as used is intended to define that portion of the brush treating composition which is not solvent, i.e., the film-forming resin and tackifier resin, or film-forming resin, tackifier resin, and plasticizer as the case may be. The timing cycles can vary from one to two minutes on the dip and two to ten seconds on the 865 r.p.m. spin cycle.

When the treated brush (containing 0.5 times the weight of the fill material of treating composition in the preferred embodiment) is dried, all of the solvent which was present in the treating composition will be removed. Thus, the drying procedure will remove substantially all but the solids (the 40 percent by weight solids of the solvent-solids dispersion) of the brush treating composition. When using the preferred composition, a brush,

after treatment and drying, will contain approximately 16 weight percent ethyl cellulose, 42 weight percent pentaerythritol ester of rosin, and approximately 42 weigh percent diisooctyl phthalate.

The treatment composition of the present invention has been found advantageous on fine wire brushes in addition to the above-mentioned tampico brush since after the brush has been treated, abrasive compound can readily be adhered to the brush face while the brush is in operation.

Comparative tests were run between brushes subjected to the treatment composition of the present invention (abrasive grains were, of course, incorporated into the brush after the treating composition was applied and before the tests were conducted) and brushes subjected to the standard treatment, as, for example, that described in Peterson Patent 2,388,867, and the following results were obtained.

TABLE NO. 1.—4 HOUR CONTINUOUS TEST

	Cutting rate, total grams	Total wear of brush, grams	Initial dia., in.	Final dia., in.
Standard brush (old treat- ment)-----	29	603	12	10
Standard brush (new treat- ment)-----	44	443	12	11

It can now be seen that a brush treating composition and finishing tools employing such composition have now been disclosed which will readily retain abrasive material in the face of such tool and thereby produce an overall superior finishing tool product.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. A two-phase brush treating composition having a high softening point and sufficient tack to retain abrasive material firmly adhered to brush fill material comprising a film-forming resin and a tackifier resin which is incompatible with said film-forming resin, said two phases comprising a continuous phase formed of said film-forming resin and a dispersed phase formed of small particles of tackifier resin.

2. A two-phase brush treating composition having a high softening point and sufficient tack to retain abrasive material firmly adhered to brush fill material comprising a film-forming resin, a tackifier resin which is incompatible with said film-forming resin, and a plasticizer which increases the dispersed phase of the composition by rendering said tackifier resin and said film-forming resin further incompatible, said two phases comprising a continuous phase formed of said film-forming resin saturated with plasticizer and a dispersed phase formed of small particles of tackifier resin.

3. The two-phase brush treating composition of claim 2 in which said film-forming resin, said incompatible tackifier resin, and said plasticizer are blended in a solvent capable of dissolving said film-forming resin and said plasticizer.

4. The two-phase brush treating composition of claim 3 in which said film-forming resin is ethyl cellulose, said tackifier resin is pentaerythritol ester of rosin, and said plasticizer is diisooctyl phthalate.

5. The two-phase brush treating composition of claim 4 in which the quantity of said ethyl cellulose is approximately 6.4 percent by weight, said pentaerythritol ester of rosin is approximately 16.8 weight percent, said diisooctyl phthalate is 16.8 weight percent, and said solvent is approximately 60 percent by weight.

6. The two-phase brush treating composition of claim 5 in which said solvent comprises toluene and ethyl alcohol.

7. In combination, a rotary brush having brush fill material and a two-phase pressure sensitive adhesive brush treating composition adhered thereto having a high softening point and sufficient tack to retain abrasive material firmly adhered to such brush fill material comprising a film-forming resin and a tackifier resin which is incompatible with said film-forming resin, said two phases comprising a continuous phase formed of said film-forming resin and a dispersed phase formed of small particles of tackifier resin.

8. In combination, a rotary brush having brush fill material and a two-phase pressure sensitive adhesive brush treating composition adhered thereto having a high softening point and sufficient tack to retain abrasive material firmly adhered to such brush fill material comprising a film-forming resin, a tackifier resin which is incompatible with said film-forming resin, and a plasticizer which increases the dispersed phase of the composition by rendering said tackifier resin and said film-forming resin further incompatible, said two phases comprising a continuous phase formed of said film-forming resin saturated with plasticizer resin and a dispersed phase formed of small particles of tackifier resin.

9. The combination of claim 8 wherein said film-forming resin is ethyl cellulose, said incompatible tackifier resin is pentaerythritol ester of rosin, and said plasticizer is diisooctyl phthalate.

10. The combination of claim 9 wherein said ethyl cellulose is 16 weight percent, said pentaerythritol ester of rosin is 42 weight percent, and said diisooctyl phthalate is 42 weight percent.

11. The combination of claim 10 wherein said ethyl cellulose has an ethoxyl content between 47.5 percent and 49 percent.

12. A rotary finishing tool having radially extending finishing material and a two-phase pressure sensitive adhesive brush treating composition in said finishing material having a high softening point and sufficient tack to retain abrasive material firmly adhered to such finishing material comprising a film-forming resin and a tackifier resin which is incompatible with said film-forming resin.

13. The rotary finishing tool of claim 12 in which said treating composition includes a plasticizer which increases the dispersed phase of the composition by rendering said tackifier resin and said film-forming resin further incompatible.

14. The combination of claim 8 wherein said brush fill material comprises brush bristles in closely packed generally parallel side-by-side relationship.

15. The composition of claim 2 wherein said continuous phase comprises film-forming resin saturated with tackifier resin and plasticizer.

16. The combination of claim 8 wherein said continuous phase comprises film-forming resin saturated with tackifier resin and plasticizer.

17. A two phase brush treating composition having a high softening point of from about 150° F. to approximately 250° F. and sufficient tack to retain abrasive material firmly adhered to brush fill material comprising a film-forming resin selected from the group consisting of ethyl cellulose, nitro cellulose, cellulose acetate, polyvinyl acetate, cis-polyisoprene, polychloroprene, polyisobutylene, butadiene-styrene copolymer and butadiene-acrylonitrile copolymer, and a tackifier resin which is incompatible with said film-forming resin, said tackifier resin being selected from the group consisting of pentaerythritol ester of abietic acid, methyl ester of abietic acid, diethylene glycol ester of abietic acid, pentaerythritol ester of hydrogenated abietic acid, glycerol ester of hydrogenated abietic acid, triethylene glycol ester of hydrogenated abietic acid, glycerol ester of polymerized abietic acid, polyvinyl ethyl ether, coumarone indene resin and terpene resins, said

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two phases comprising a continuous phase formed of said film-forming resin and a dispersed phase formed of small particles of tackifier resin.

18. The brush treating composition of claim 17 in which said composition includes a plasticizer which increases the dispersed phase of the system and is selected from the group consisting of dioctyl adipate, dibutyl phthalate, dioctyl phthalate, di-isooctyl phthalate, a mixture of 50% by weight of dioctyl phthalate and di-isooctyl phthalate, di-n-octyl decyl phthalate and methyl abietate.

References Cited

UNITED STATES PATENTS

2,340,504	1/1944	Beatty	51—295
2,890,136	6/1959	Vaughan et al.	51—298

10

3,053,646	9/1962	Roth	51—303
2,920,947	1/1960	Burk et al.	51—298
2,933,469	4/1960	Depew	260—27
3,015,638	1/1962	Sergi	260—27
3,051,670	8/1962	Grantham	260—27
3,058,930	10/1962	Samour	260—27
3,102,010	8/1963	Lang	51—298
3,126,355	3/1964	Birten et al.	260—47

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