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SOIL PROOFING

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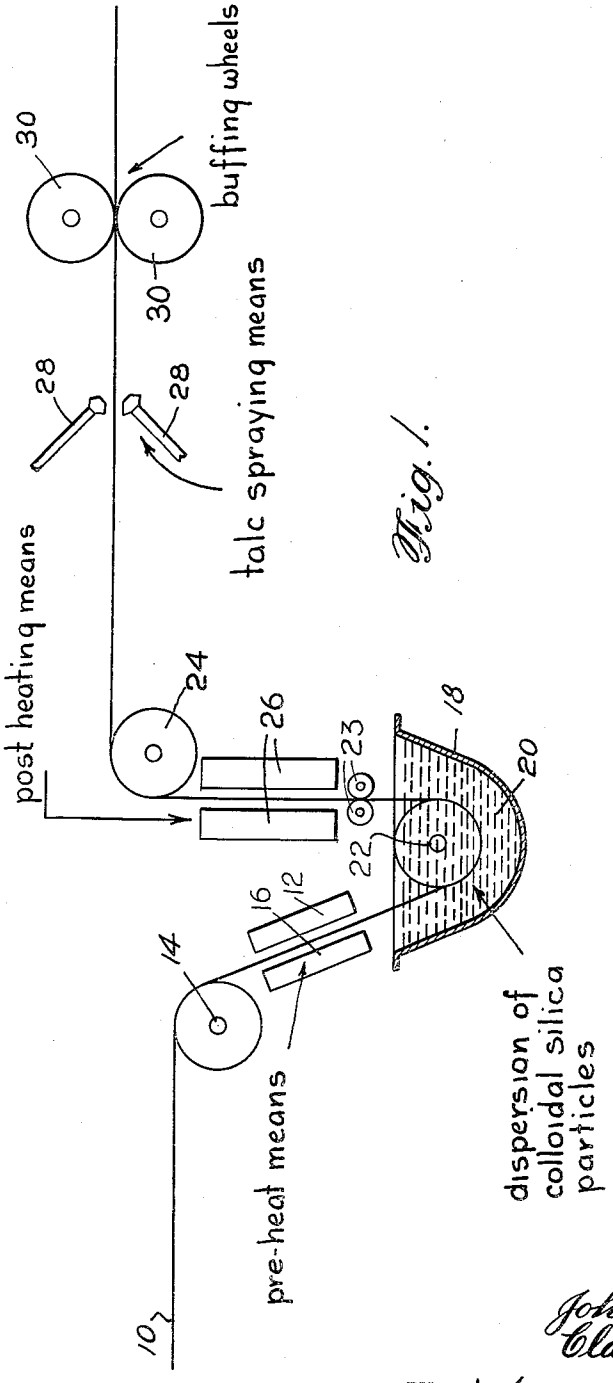


Fig. 1.

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SOIL PROOFING

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This invention relates to the soil proofing of macroscopically non-porous solid surfaces, and more particularly to a method of imparting resistance to permanent soiling to such surfaces by treatment with colloidal dispersions of silica.

This application is a continuation-in-part of Serial No. 570,451, filed March 9, 1956, now abandoned, entitled Soil Proofing.

Heretofore, it has been known that the application of colloidal dispersions of silica to various porous surfaces, such as rugs and carpets, fabrics, paper products, and other surfaces, has yielded an improved soil resistance to these surfaces. It has likewise been suggested that non-porous painted surfaces, such as the slats used in Venetian blinds, be coated with the colloidal dispersions of silica to impart soil resistance to the surfaces of the slats. The methods heretofore proposed for the application of the silica to surfaces, such as metal, metal coated with organic films, metal coated with inorganic films, ceramic surfaces, and glass surfaces, organic film surfaces, or any painted surfaces, have not resulted in a satisfactory product, since the surfaces to be treated are not porous, as are the surfaces of rugs, fabrics, paper and the like, and great difficulty has been experienced in uniformly coating such surfaces.

It is therefore an object of the present invention to provide a method of coating non-porous solid surfaces with an aqueous colloidal dispersion of silica.

It is a further object of the present invention to provide a continuous quick method of coating long strips of painted metal with aqueous colloidal dispersions of silica.

A still further object of the present invention is to provide an improved method of continuously and uniformly coating the surfaces of Venetian blind slats with an aqueous colloidal dispersion of silica to produce slats resistant to soiling.

A further object of the present invention is to provide an improved method of soil proofing the surfaces of long strips of painted metal followed by a lubrication step prior to the forming of such strips into Venetian blind slats.

A further object of the present invention is to provide a novel Venetian blind slat material that has been uniformly coated with colloidal particles of silica.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawing, wherein:

Fig. 1 is a diagrammatic side elevational view partly in section of apparatus for use in treating a plurality of continuous strips of material.

It has now been found that the above objects of the invention are accomplished by heating the surface to be soil proofed to a temperature of at least approximately 120° F., then applying to the heated surface an aqueous colloidal dispersion of silica, followed by heating the surface to a temperature above approximately 250° F., application of talc and then buffing. The resulting surface has been found to be uniformly coated and to yield a surface that is highly and uniformly resistant to soiling, and properly lubricated to enable subsequent forming operations to be performed thereon.

Although the first heating step can be accomplished by any suitable means, such as an oven, followed by coating by any suitable means, such as spraying, dipping or brushing, a highly efficient, fast, continuous method is illustrated in the drawing.

Referring to the drawing, an apparatus is shown for simultaneously treating the surfaces of a plurality of continuous lengths of painted metal strips **10**, such as Venetian blind slat material. The metal strips **10** are passed over a guide roller **14**, and thence between pre-heaters **12** and **16**. The pre-heaters may be a plurality of infra red lights or other heating means. The strips **10** are then immediately led into a tank **18** containing a colloidal dispersion of silica **20**. A guide roller **22** is immersed over half its diameter in the dispersion in the tank **18** and the metal strips **10** pass beneath the guide roller **22** through the colloidal dispersion and thence upwardly between a pair of rolls **23** and over a rubber coated roller **24**. The rolls **23** act as wringer or squeeze rolls to remove any excess of liquid thereon. The metal strips next pass through an oven **26**, or other heating means suitable for heating the coated strips to a surface temperature of over 250° F. The highest temperatures in both the preheating and postheating steps should not be high enough to discolor the painted surfaces. A pair of sprayers **28** are utilized to dust talc onto the heated strip after which the strips are passed between a pair of buffing wheels **30**. The strips may then be rewound for subsequent use. Venetian blind slat material may, however, pass directly to the subsequent forming equipment or be rewound for future forming as needed.

The strips **10** are thus seen to be heated initially on both surfaces by the infra red lights **12** and **16**, although for very thin strips, one set of lights would be sufficient. The preheated strips are immediately immersed in the colloidal silica dispersion and the heated surfaces are uniformly coated with the colloidal silica. Suitable rollers **23** are used to distribute the colloidal silica uniformly or to control the thickness of the deposit. The wetted surfaces are next heated by any suitable means to a surface temperature of over 250° F. This heating step has been found to dry the wet surfaces and to give an improved coated product. The talc is next dusted onto both surfaces of the strip, followed by a buffing operation. The buffing operation serves to rub in the talc and remove any excess. Instead of dusting the talc onto the metal surfaces directly, it can be dusted onto the buffing wheels and then buffed into the surface. It should be understood that a low speed wiping action could be substituted for the higher speed buffing. The strips of metal which have preferably been painted prior to the colloidal silica treatment, are then wound upon reels for storage, or passed directly to Venetian blind slat forming equipment. Any suitable talc may be used such as Indian talc or Italian talc, depending upon the character of the final surface desired, compounded with up to 3% of metallic stearates such as barium or zinc stearates.

It has been found that non-porous surfaces such as painted metal, glass, ceramic and other painted surfaces are not easily uniformly wetted by silica sol dispersions, and when the coating material is applied to such an unheated non-porous surface without subsequent treatment, an unsatisfactory non-uniformly coated product results even though the dispersion is itself heated. It has been discovered that the preheating step prior to the coating, followed by a post heating step, utilizing a suit-

able disperison, gives a uniformly coated product with resistance to scratching and suitable for use as a Venetian blind slat or the like.

Heretofore, metal strips which are to be formed have been treated with lubricants which are made up of oils or waxes or the like. Such lubricants have been found to be unsuitable for use with strips coated with colloidal silica particles, since these lubricants have been discovered to seriously impair the anti-soil properties of the resulting strips. In accordance with the present invention, powdered talc which may be compounded with up to 25% metallic stearates, such as barium or zinc stearates, preferably 3%, has been found to be an excellent lubricant during subsequent forming operations. When buffed into the previous coating, the talc not only acts as an excellent lubricant during the forming operations, but does not require its removal after the forming operations since the anti-soil properties of the slat are retained.

The following examples have been found to be suitable dispersions for treating such surfaces:

Example 1

	Percent by wt.
Colloidal silica	4.5
Wetting agent	.1
Water	95.4
	100.0

Example 2

Colloidal silica	3–30
Wetting agent	0.05–1
Water	Balance

It has further been discovered that improved coatings are obtained when the colloidal silica particles in the above dispersions have an average diameter of less than 10 millimicrons.

When the term colloidal dispersion of silica is used, it should be understood that minor amounts of Na_2O and Na_2SO_4 or other impurities may be present. The particles of silica in the dispersion are amorphous, dense, non-agglomerated, spherical particles preferably having an average diameter of less than 10 millimicrons. Some commercial dispersions now available contain approximately 30% silica and may be diluted with water, to the desired concentration. The silica particles give no evidence of crystallinity as determined by X-ray diffraction methods. Measurement of the surface area of the particles indicates that the particles are substantially free of pores penetrable by nitrogen. The spherical character of the particles and their average size can be observed by means of an electron microscope.

A suitable silica dispersion can be prepared by the process disclosed in Patent number 2,577,485 to Rule, issued on December 4, 1951.

There are a number of colloidal dispersions of silica available commercially. The most commonly known dispersion is Ludox, manufactured by Du Pont which contains approximately 30% silica and may be readily diluted with water, as desired. The particles of silica have a diameter in the order of 15 millimicrons. Although Ludox has been found to be usable, best results are obtained when the particle size is less than 10 millimicrons.

It has further been discovered that improved results are obtained when the colloidal silica dispersions are maintained at a pH of less than 5, a pH of about 3 being preferred. It has been found that at a pH between 5 and 8, the colloidal dispersion tends to agglomerate in the bath 18. The pH can be controlled by the addition of phosphoric acid or phosphate buffers to the dispersion.

An applicable buffer solution is a mixture of citric acid and disodium phosphate. The colloidal silica dispersion is first neutralized with phosphoric acid, and then a buffer solution of citric acid and disodium phosphate is added until the solution is .08 molar with respect to citric acid and .04 molar in disodium phosphate and a pH of 3 is reached.

A wide variety of wetting agents may be used in accordance with the invention. Particularly good results have been obtained using dioctyl sodium sulfosuccinate, sold as Aerosol OT, made by American Cyanamid Co. Other suitable wetting agents include alkyl aryl sodium sulfonates such as Alkanol WXN, alkyl arylpolyethoxy ethanol, known as X–45 Triton, made by Rohm & Haas Co., Santomerse #1 Flake, sold by Monsanto Chemical Co., sodium salts of alkylated benzene sulfonates, sodium lauryl sulfate, and the like. The wetting agent, if used, should be present in amounts varying from 0.05–1% by weight, of the dispersion. Care should be taken that the wetting agent used maintains its activity at the low pH under which the process operates, and is not hydrolyzed or decomposed too rapidly under these conditions.

Utilizing the apparatus illustrated, excellent uniform results have been obtained at speeds of up to 50 feet per minute of the strip material through the equipment. It was found that when fewer infra red bulbs are used in the preheating step, the speed should be decreased accordingly.

It should be understood that the present invention is not limited to the treatment of painted Venetian blind slat material, but is applicable to the treatment of any non-porous surfaces, painted or unpainted.

When no subsequent forming operations are envisioned the colloidal silica coated strip after the post-heating step can be wound onto a reel and used without the subsequent talc treatment and buffing.

Surfaces treated in accordance with the present invention have been found to be highly soil resistant, do not scratch during subsequent forming, and are found to be lubricated to enable the forming operations to proceed smoothly. This phenomenon of soil resistance can be readily demonstrated by treating only a portion of the surface in accordance with the present invention and leaving the remainder of the surface untreated. When the surface is dusted with carbon black and then blown off, the soil will not be retained by the treated area while the untreated area will soil severely. It is believed that this phenomenon is due to the extremely fine particle size of the silica particles which, upon drying, form a continuous film which excludes dirt retention on the surface so treated.

When the term metal surface is used in this specification and claims, it should be understood that the surface may be either a painted or an unpainted one. The invention is likewise applicable to other types of non-porous surfaces similar to metal which may be heated to temperatures of at least 120° F. without decomposition or melting.

It has thus been found, in accordance with the present invention, that an improved Venetian blind slat is obtained by this process which is resistant to soiling as well as to scratching. The use of colloidal silica particles having a diameter less than 10 millimicrons, the use of a pH of less than 5 in the dispersion, and the exposure of the treated strip to a surface temperature of over 250° F. all cooperate to yield this improved product.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. A method of treating a strip of painted metal to impart resistance to permanent soiling thereto and to lubricate said strip prior to subsequent forming operations which comprises heating said strip to a temperature of at least approximately 120° F. and yet not high enough to discolor the painted surface, applying an

aqueous colloidal dispersion of silica to said strip while in the heated state, heating said wet coated strip to a surface temperature of above approximately 250° F. and yet not high enough to discolor the painted surface, dusting talc onto both surfaces of said heated strip, and buffing the surfaces of said strip whereby the talc is rubbed in and the excess removed.

2. A method of treating a strip of painted metal to impart resistance to permanent soiling thereto and to lubricate said strip prior to subsequent forming which comprises heating said strip to a temperature of at least approximately 120° F. and yet not high enough to discolor the painted surface, applying an aqueous colloidal dispersion of silica to said strip while in the heated state, heating said wet coated strip to a surface temperature of above approximately 250° F. and yet not high enough to discolor the painted surface, dusting talc onto buffing wheels and buffing the surfaces of said heated strip therewith.

3. A strip of metal suitable for forming Venetian blind slats therefrom comprising a strip of metal painted on both surfaces, an evenly dispersed coating on said painted surfaces of particles of colloidal silica, said particles having been applied to the painted strip in colloidal dispersion while the strip was heated to a temperature of at least approximately 120° F. and yet not high enough to discolor the painted surfaces, said particles having been dried thereon at a temperature of above approximately 250° F. and yet not high enough to discolor the painted surfaces, and a coating of talc which has been buffed into said colloidal silica coating.

4. A method of treating a strip of painted metal to impart resistance to permanent soiling thereto which comprises heating said strip to a temperature of at least approximately 120° F and yet not high enough to discolor the painted surface, applying an aqueous colloidal dispersion of silica to said strip while in the heated state to form a wet coating thereon, heating said wet coated strip to a surface temperature of above approximately 250° F. and yet not high enough to discolor the painted surface.

5. A strip of metal suitable for forming Venetian blind slats therefrom comprising a strip of metal painted on both surfaces, an evenly dispersed coating on said painted surfaces of particles of colloidal silica, said particles having been applied to the painted strip in colloidal dispersion while the strip was heated to a temperature of at least approximately 120° F. and yet not high enough to discolor the painted surfaces, said particles having been dried thereon at a temperature of above approximately 250° F. and yet not high enough to discolor the painted surfaces.

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