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ANTI-SKID COMPOSITIONS AND CONTAINER MATERIAL COATED THEREWITH

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Fig. 1.

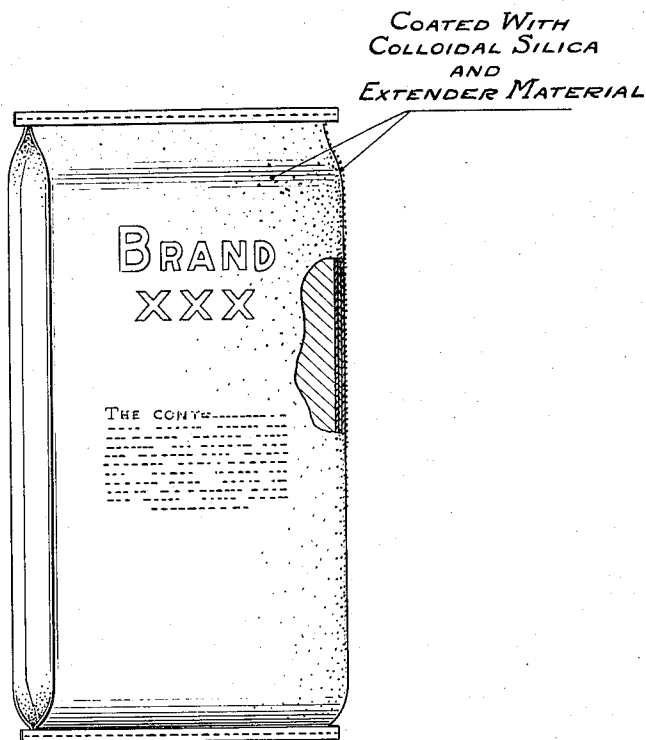
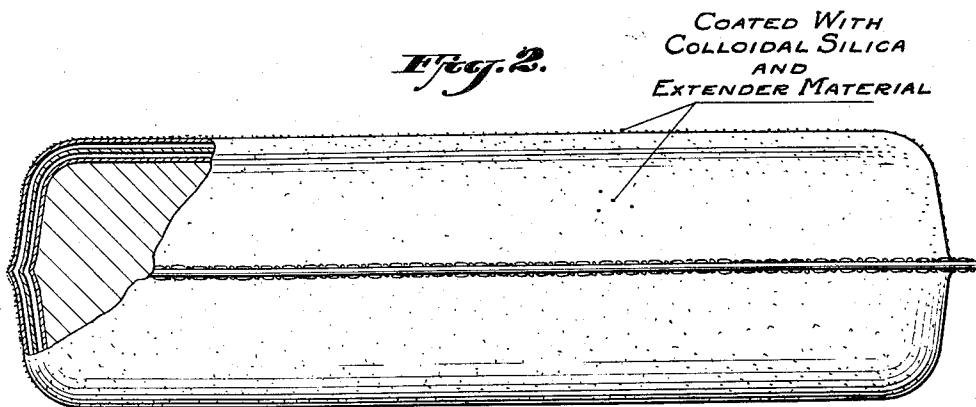


Fig. 2.



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ANTI-SKID COMPOSITIONS AND CONTAINER MATERIAL COATED THEREWITH

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Application November 9, 1956, Serial No. 621,349

7 Claims. (Cl. 229—3.5)

This invention relates to non-skid or anti-slipping compositions for application to container materials, particularly cellulosic paper materials, including kraft bag stock, paperboard and the like. It also relates to cellulosic containers and container materials of the above paper type having outer surfaces coated with said compositions. This application is a continuation-in-part of my application Serial No. 552,961, filed December 13, 1955.

While the novel compositions of the present invention are suitable for treating a wide variety of paper container materials to enhance the surface frictioning qualities thereof, for reasons of simplicity the following description and discussion of prior art is directed to its use in connection with kraft paper bag material. In describing the container material product of improved slip resistance, reference is also made to kraft paper. It is to be understood, however, that the present invention is not so limited, but is applicable to similar paper materials such as paperboard, etc.

In the accompanying drawing, Fig. 1 is a perspective partly in section of a multiwalled cellulosic packaging container bearing printed matter, the outer wall of which is coated with discrete particles of the anti-skid composition of the present invention. Fig. 2 is an enlarged end view of a similar bag with a section thereof cut away to illustrate multiwalled construction, and with the exterior surface of the outer wall coated with the anti-skid composition of the present invention.

Perhaps the simplest approach to the manufacture of a paper which has more than average resistance to slipping upon itself is the formulation of a rough finish paper. For many applications, however, such a rough finish paper is not entirely satisfactory. For example, in the case of large multiwall bag containers, the surface of the rough finish paper was not sufficiently slip resistant to prevent toppling of bags piled upon themselves in transit as well as in storage. Obviously, the lower the density of the contents of such a large bag, the greater the likelihood of skidding and slipping when the bags are stacked. Although rough paper may be satisfactory in some instances, its surface has very poor printing characteristics, e. g., the rougher the finish, the more blotting or irregular spreading upon application of the ink, which results in printed matter unpleasant to the eye. Development of special inks to solve the spreading problem has met with only limited success. The frictioning qualities of the rough finish paper have been still further improved by the use of non-skid inks, but printing characteristics are not much improved.

Because of its lack of resistance to slipping, smooth kraft paper, although presenting an excellent surface for the acceptance of printing ink, is not ideally suited for multiwall bags. Recently, treatment of smooth kraft paper with dilute aqueous colloidal silica in the form of a sol has resulted in a measurable improvement in its slip resistance. If the paper is printed, the aqueous colloidal silica is generally applied following drying of the

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printing ink. Treatment with an aqueous sol containing 3% by weight or less colloidal silica is not satisfactory, since the slip resistance of the finished bag tube is not superior to that of rough paper printed with non-skid ink. At concentrations of 6% by weight silica in the aqueous sol, a paper having an acceptable non-skid surface is possible, but at the expense of considerable sticking in the paper rolls, and in the case of multiwall bag stock, the interior tubes have been found to stick together in the tubing machine. This sticking is due to penetration of the treated layer of paper by the aqueous silica sol. Application at concentrations above 6% by weight silica in the treating sol, caused opposed similarly treated surfaces of kraft paper to turn white when rubbed together. Furthermore, at concentrations above 6% by weight the silica has an adverse effect upon the ink, changing the color thereof, for example, green ink is turned yellow. At these higher silica concentrations sticking is considerably more pronounced.

The use of sodium silicate solutions results in undesirable penetration of the paper with resulting sticking, without appreciably improving the surface frictioning qualities. In fact, solutions of sodium silicate are not as effective in the latter respect as sols containing about 6% colloidal silica, and sticking is more pronounced.

In view of the foregoing limitations upon the use of colloidal silica and particularly its property of penetrating the layer of paper treated rather than depositing silica only upon the surface, compositions containing colloidal silica alone leave a great deal to be desired in the preparation of a paper of improved resistance to slipping. The present invention provides novel coating compositions which overcome the above difficulties, permit deposition of silica upon the surface of the paper and provide a container material of improved slip resistance.

More specifically, there are now provided novel compositions containing colloidal silica as an active ingredient capable of imparting skid resistance to the surface of paper superior to that produced by the application of a composition containing colloidal silica alone. Smooth kraft paper surfaces treated with the present compositions are also more resistant to slipping than rough finish paper printed with non-skid ink. The novel coating compositions contain as essential ingredients a continuous phase, which is preferably water, and disperse solids in the weight ratio of about 3 to 16 parts of water to one part of solids. The solids comprise colloidal silica and a material hereinafter designated as an "extender," with the silica and extender each present in amounts between about 3 and 15% by weight of the composition. The extender is a very finely divided material or powder which is chemically inert with respect to silica and the container material to be treated. It comprises clay (hydrated aluminum silicates) talc, diatomite, insoluble carbonates, insoluble magnesium salts and any of the naturally occurring materials employed as fillers or extenders in the printing ink and pigment arts, as well as mixtures thereof. Because of their abundance and ready availability, clays will usually be employed.

The extender acts as a vehicle for carrying the silica particles to the sheet or material treated, while also preventing any objectionable penetration by the silica of the paper being treated, whereby the silica and extender are very largely retained on the surface. Furthermore, the presence of the extender provides a composition especially well suited for roller application to the finished paper or container stock. It has been found that a constant flow of the novel composition can now be maintained regardless of machine speed when applied by the roller, thus assuring a uniform coating on the paper. With colloidal silica alone, great difficulty is encountered in maintaining a uniform flow in roller application. While

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the present compositions may also be applied by spraying either to unshaped container material or to the finished container as a paperboard box or bag, the resulting coating will generally be found to be less uniform. In addition, necessary screening precautions may be required to eliminate occupational hazards from breathing air containing a high percentage of colloidal silica particles and finely divided extender. Following application of the novel composition the treated surface is suitably dried or allowed to dry before the material is rolled or otherwise contacted with itself.

When the composition is applied to a web by a roller, with the web running at the usual speed of a web as fed into a bag tubing machine, the roller, traveling at a circumferential speed equal to that of the travel of the paper, can be made to pick up from a pan sufficient of the material and apply it to the web in contact therewith whereby the desired amount per unit area will be distributed over the sheet. Furthermore, with the present compositions, the unexpected result is obtained that the coating applied to a printed web adds substantially to the luster of the printed areas, and despite the presence of the clay or the equivalent, the legibility of the printing is in no way interfered with. Furthermore, the clay is adequately retained in place so that even when two sheets bearing the coating are rubbed firmly together, there is no "chalking" or whitening, such as would indicate removal of the silica and clay from the paper.

The novel compositions of the present invention are

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Container material surface-treated with the compositions of the present invention not only possess surface frictioning or anti-slip properties superior to treated materials heretofore available, but also the colloidal silica and extender deposited upon the surface of the material enhance its resistance to soiling, provide a surface of improved printing characteristics, add luster to the paper and to the ink, and afford a substantial measure of resistance to ink rub.

In order to establish improved slip resistance, tests were conducted on unprinted and printed smooth finish kraft paper. The angle of slip was similarly determined in each instance by measuring the angle of inclination at which uniformly loaded sheets of paper started to slide upon themselves. The angle was determined for opposed unprinted, printed to unprinted and opposed printed to printed sheets before and after treatment with the composition of the present invention. The tests were carried out employing a treating composition having the following analysis by weight:

	Percent
Water	89
SiO ₂	6
Clay	5

The paper sheets were coated uniformly and the coated surface allowed to dry.

The following table shows the improvement in resistance to slipping of the treated paper:

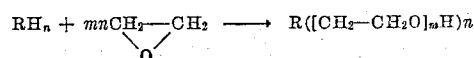
Angle of slip (degrees)

Paper	Untreated			Treated		
	Unprinted to Unprinted	Printed to Unprinted	Printed to Printed	Unprinted to Unprinted	Printed to Unprinted	Printed to Printed
Regular Kraft Unprinted	24.6			30.3		
Regular Kraft Printed	24.2	25.0	26.7	31.9	29.0	28.5

preferably prepared by diluting to the desired degree a colloidal solution of hydrated silica or a polymerized form of silicic acid, which does not contain any significant quantity of free alkali. In this latter respect at least the starting silica material is to be distinguished from alkali metal silicates for example, which are not employed. The silica is usually in the form of an aquasol, or an organo-aquasol. An aqueous product particularly well suited to the preparation of the compositions of the present invention is "Ludox" manufactured by the E. I. Du Pont de Nemours & Company containing about 30% by weight colloidal silica, and having an Na₂O content between about 0.09 and 0.11%. "Syton," the aqueous colloidal silica of approximately the same concentration manufactured by Monsanto Chemical Company may also be employed. Following dilution of the sol with water, the finely divided extender material is dispersed with agitation throughout the resulting sol, thus forming the anti-slipping composition. As indicated above, the solids in the treating composition, amounting to about 6 to 30% of its weight, comprise about 3-15% by weight colloidal silica and about 3-15% by weight finely divided extender. The exact ratio of water to solids in the final composition, as well as the proportions of silica and extender in the solids is determined by the surface characteristics, thickness and the type of paper or other container material which is to be treated. In the case of smooth kraft paper, the formula which produces the lowest acceptable increase in slip resistance is: water about 92%, colloidal silica about 3% and extender material (clay) about 5%. For optimum improvement in slip resistance of this paper, compositions containing about 85 to 90% water, about 6 to 9% colloidal silica, and about 4 to 6% clay have been found quite satisfactory.

The novel compositions containing colloidal silica and the extender material, which is preferably very finely divided clay, as indicated above, may be applied to printed or unprinted paper either by spraying or by means of a roller. However, for high speed roller applications to a heavily printed kraft paper web as the same is fed into a bag tubing machine modification of the coating compositions is desirable. Due to their nature, most inks resist wetting by water with the result that the aqueous composition is disposed at random in small droplets on the inked surface, and deposition of silica and extender is thus restricted to the areas covered by these drops. In order to increase the slip resistance of the paper surface, it is essential that a coating of silica and extender material be deposited substantially uniformly on the surface, whether the same be inked or not. Accordingly, it is within the scope of the present invention to reduce the surface tension of the composition in order that the inked areas may be covered uniformly. This is accomplished by means of a wetting agent.

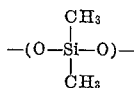
Extensive tests indicated that a wide variety of inks, including those having a very oily base, were most easily and quickly wetted when the coating composition contained small quantities of non-ionic wetting agents, particularly the complex polyalkylene ether wetting agents. These compounds are in general prepared by reacting a water-insoluble hydrocarbon having one or more reactive hydrogens with an alkylene oxide, for example, ethylene oxide, as set forth below,



where n is the number of reactive hydrogens of compound R and m is the number of alkylene oxide groups

required to react with n number of hydrogens. The wetting agents which are preferred are the complex non-ionic polyethylene ethers, or polyethenoxy compounds, present in amounts between about 0.25 and 2% by weight of the total composition. A particularly effective wetting agent of this type is "Neowet" which is manufactured by Royce Chemical Company, Carlton Hill, New Jersey.

While incorporation of a wetting agent of the above type permitted rapid wetting of the inked surface and resulting deposition of silica and extender uniformly on the ink surface, a great deal of foaming was encountered when the tuber was run at its normal high speed for prolonged periods. High roller speeds produced considerable agitation of the composition, causing it to foam and run over the sides of the press, even when only a very small quantity of wetting agent was employed. In order to counteract this undesirable characteristic of the wetting agent, the present invention contemplates the addition of a foam suppresser or defoaming agent to the coating compositions. Materials particularly well suited to this application are the silicones, and more particularly the less viscous, e. g., about 1 to 1500 centistokes, fluid dimethyl polysiloxanes having the generic formula



These materials are highly effective in eliminating foaming when present in the wetting agent-containing compositions in very low concentration, for example, between about 1 and 100 parts per million. Because of the difficulty of adding such small amounts, the polysiloxanes are often present in excess of 100 parts per million. The excess does not appear to be detrimental. Since the dimethyl polysiloxanes are immiscible with water, an emulsifier is necessary when they are employed in the present aqueous compositions. Suitable dimethyl polysiloxanes are available commercially as concentrated aqueous emulsions, and Dow-Corning's "Antifoam AF" has proved very successful when added to the compositions of the present invention. The latter material consists of about 30% by weight dimethyl polysiloxane, about 12 to 14% of an emulsifier (glyceryl monostearate and a polyoxyethylene monostearate), with the balance of the composition being water.

The wetting agent and the foam suppresser are added to the aqueous colloidal silica-extender composition in such small quantities that the water content of the compositions aforementioned for optimum improvement in slip resistance is not altered appreciably. A preferred composition, in percentages by weight, for high speed roller application, without foaming, to kraft bag stock having a large printed area on its surface is as follows:

Water	86.9
Colloidal silica	7.5
Finely divided clay	0.5
"Neowet"	0.5
"Antifoam AF" emulsion	0.1
	100.0

The above formulation may of course also be applied to an unprinted web, although the wetting agent and foam suppresser are not necessary, since the problem of wetting an inked surface does not exist.

Kraft paper bag material treated with the novel compositions will upon drying contain from about 0.1 to 2.5 weight percent silica and from about 0.1 to about 2.5

weight percent extender based upon the weight of the paper treated. However, it is difficult to speculate upon the weight percent solids which will be deposited upon lighter or heavier container material. It is safe to say that the silica and extender are uniformly disposed upon the surface treated in a weight ratio very nearly equivalent to their ratio in the aqueous treating compositions.

I claim:

1. A composition for application to the surface of cellulosic container materials for imparting slip resistance thereto consisting essentially of about 3 to 15% colloidal silica, about 3 to 15% finely divided extender material, a non-ionic, polyalkylene ether wetting agent, an emulsified dimethyl polysiloxane foam suppresser, and the balance substantially water.

2. A composition as set forth in claim 1, wherein the finely divided extender material is selected from the group consisting of clays, talc, diatomite, insoluble carbonates, insoluble magnesium salts and mixtures thereof.

3. A composition as set forth in claim 2, wherein said wetting agent is a polyethylene ether and is present in amounts between about 0.25 and 2% by weight of the composition.

4. A composition for application to the printed surface of a kraft paper for imparting slip resistance thereto consisting essentially of about 3 to 15% colloidal silica, about 3 to 15% finely divided clay, about 0.25 to 2% of a non-ionic polyethylene ether wetting agent, at least 1 to 100 parts per million of an emulsified dimethyl polysiloxane foam suppresser, and the balance substantially water.

5. A smooth finished kraft paper bearing printed matter upon which there has been applied an aqueous composition consisting essentially of about 3 to 15% by weight colloidal silica, about 3 to 15% by weight of finely divided extender material selected from the group consisting of clays, talc, diatomite, insoluble carbonates, insoluble magnesium salts and mixtures thereof, a non-ionic polyalkylene ether wetting agent, an emulsified dimethyl polysiloxane foam suppresser, and the balance substantially water.

6. A composition for application to the surface of cellulosic container material for imparting slip resistance thereto consisting essentially of about 3 to 15% colloidal silica, about 3 to 15% finely divided clay, about 0.25 to 2% by weight of a non-ionic wetting agent, at least 1 to 100 parts per million of a silicone foam suppresser, and the balance substantially water.

7. A cellulosic container material of improved slip resistance for use in the manufacture of cartons, single wall bags, the outer wall of multiwall bags, and the like upon which there has been applied a composition consisting essentially of about 3 to 15% by weight colloidal silica, about 3 to 15% by weight of finely divided clay, about 0.25 to 2% by weight of a non-ionic wetting agent, at least 1 to 100 parts per million of a silicone foam suppresser, and the balance water.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,872,094

February 3, 1959

Elmer E. Leptien

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 57, for "Finely divided clay ----- 0.5" read -- Finely divided clay ----- 5.0 --; column 6, line 28, for "polythylene" read -- polyethylene --.

Signed and sealed this 19th day of May 1959.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents