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PROCESS FOR CLEANING RUGS

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This invention relates to an improved process for cleaning fabric floor coverings, and in particular wool-pile and wool texture rugs and carpets.

In the past, fabric floor coverings during cleaning have customarily been subjected to shampooing treatments with soap solutions preceded by vacuum and beating treatments and followed by cumbersome rinsing and drying steps. One of the greatest disadvantages experienced with such processes has been the difficulty of causing proper loosening and eventual complete removal of the adhesive dirt held at the base of the pile by soot and other greasy materials which collect in such a fabric with constant use. A further major difficulty has been involved in the complete elimination of the soap solution from the rug and particularly from the base of the pile after shampooing. In spite of copious rinsing, satisfactory removal of soap from a pile fabric is seldom accomplished. As a result of failure to completely remove the soap it remains as a coating on the fibers, thus increasing the tendency of dust particles to adhere to the fiber in such a way that ordinary cleaning methods including the use of vacuum cleaners fail to remove such adhering dirt. In addition, the soap residue frequently becomes rancid, thus preventing the pile from regaining its fresh, springy appearance.

In the process of the present invention, which is characterized by its simplicity as well as economy of operation, such difficulties are either not encountered or are largely overcome. In accordance with my invention, the fabric floor covering to be cleaned is treated with an aqueous solution formed by dissolving in water a stable calcium hypochlorite, sodium carbonate in excess of that necessary to react with all of the calcium present, and a synthetic organic water soluble detergent salt which does not produce an insoluble precipitate in the presence of calcium ions. An acid salt, for example, sodium bicarbonate, in predetermined quantity to produce a solution of desired pH may advantageously be added to this solution. The use of such cleansing solutions is particularly advantageous in the cleansing of wool-pile and wool texture rugs or carpets or the like. By the term "rug" as used herein I intend to refer to fabric floor coverings included within these just mentioned classifications.

My process consists essentially in the treatment of a rug with an aqueous solution having dissolved therein the above-listed constituents. In the cleaning of certain types of rugs, and in particular pile rugs, increased efficiencies are

obtained by the use of a two-step treatment which comprises treating the rug on its reverse side with a quantity of the referred to solution, and then treating the right side or pile side of the rug with a further quantity of the same solution. Due to the increased wetting and penetrating power of the solutions used in my process, when applied to the reverse side of the rug, the solution penetrates to the base of the pile and hydrolyzes the greasy, wax-like deposits which are there deposited, thus freeing dirt particles and facilitating the emulsification and removal of such particles during the subsequent cleaning step on the right or top side of the rug.

The solution which I employ in the process of my invention may be prepared for use by dissolving predetermined proportions of the dry salt constituents in water, or it may with advantage be prepared by dissolving in water a proportion of a dry stable salt mixture which contains the above-mentioned solid materials. Dry stable salt mixtures which may be used for this purpose are described in my copending application Serial No. 197,867, filed March 24, 1938.

The calcium hypochlorite which I prefer to use in the cleaning process of my invention is one which is a stable product high in available chlorine and low in calcium chloride. Characteristically this hypochlorite contains upwards of 50% available chlorine and with particular advantage upwards of 60%. The free lime content is preferably maintained at a low value. The calcium hypochlorite referred to herein as useful in my process is not to be confused with the conventional bleaching powder or chlorinated lime from which it differs materially, both as to chemical constitution and in its exceptionally high content of available chlorine. As examples of calcium hypochlorite products suitable for use in the process of the present invention may be mentioned the products whose preparation is described in United States Patents Nos. 1,481,039, 1,481,040, 1,713,650, 1,713,654, 1,713,668 and 1,713,669. The term "calcium hypochlorite" as used herein refers to a product having the properties just described.

The material above-referred-to as a synthetic organic water soluble detergent salt may be chosen from a wide variety of organic compounds having strong detergent and wetting action. The organic or non-polar groups of these detergent compounds include a wide variety of organic groups. In addition to carbon, hydrogen and oxygen, these groups may contain sulfur or nitrogen, or other elements commonly associated with

them in organic compounds. Such groups include saturated, or unsaturated, hydrocarbons, ethers, thioethers, primary and secondary alcohols, thioalcohols, ketones, thioketones, and esters. These groups may furthermore contain aromatic or heterocyclic ring structures. The polar groups contained in the detergents used in my invention are more limited in number. They are in most cases di-, or, poly-basic acids of sulfur or phosphorus; the sulfur containing acid groups occurring usually as sulfate or sulfonate. The cations which form the salts with the acid groups in these compounds include the alkali metals, the alkaline earth metals and the ammonium ion as, for example, in a quaternary ammonium salt. The non-polar groups mentioned above usually form anions in solution, but the non-polar groups in quaternary ammonium compounds form cations in solutions. Salts of sulfated higher alcohols are generally useful as detergents in the herein described mixtures. An example of another class of satisfactory detergent compounds are the salts of sulfonated long chain compounds. These are distinguished from the referred to sulfates by the fact that the sulfonic group is attached directly to a hydrocarbon group, whereas the alcohol sulfates are in reality sulfuric acid esters of the alcohols. Specific examples of synthetic organic detergent salts useful in the composition of my invention are sodium lauryl sulfate, sodium lauryl sulfonate, sodium ethylene palmitate sulfonate, sodium ethylene methyl lauramide sulfonate, and palmityl trimethyl ammonium chloride. Soaps react alkaline in water solution and form insoluble compounds with the alkaline earth metals. Under the same conditions the water soluble detergents of the present invention do not form such insoluble compounds. They produce substantially neutral aqueous solutions, apparently owing to the fact that their solubilizing groups are more strongly acidic than the carboxyl group in soap with the result that their metallic salts are more nearly neutral. These detergent compounds therefore do not contain the carboxyl group as such, but may contain it in a "muzzled" form, for example as an ester grouping. By the phrase "synthetic organic detergent salt" as used in this application and in the claims, I refer to a detergent compound of the above-referred to type, and I intend to exclude organic compounds which may be classified as soaps which give a strong alkaline reaction in aqueous solution and which precipitate insoluble compounds with the alkaline earth metals.

The cleaning solutions of this invention may contain as solutes the referred to calcium hypochlorite, sodium carbonate, acid salt and a synthetic organic detergent in varying proportions. The amount of each constituent present is governed to some extent by the amount of cleaning which must be accomplished and by the properties of the material to be cleaned. In the treatment of many fabrics the quantity of salt mixture, exclusive of the synthetic organic detergent, which is dissolved in a given quantity of water may remain approximately constant, while the amount of this synthetic detergent is altered in accordance with the detergent and solution penetration requirements of the particular fabric cleaned. In most cases, a quantity of total salt mixture between about 1 lb. and 3 lbs. dissolved in 50 gallons of water will provide a satisfactory cleaning solution. For example, one pound of organic detergent salt and one pound of a mix-

ture of calcium hypochlorite, sodium carbonate, and sodium bicarbonate dissolved in 50 gallons of water produces a solution particularly advantageous for the cleaning of the majority of pile rugs by the described two-step method. In certain cases, however, other salt ratios in which for example the synthetic organic detergent comprises about $\frac{1}{3}$ to $\frac{1}{2}$ the weight of the remainder of the dissolved salts are preferred. The relative proportions in which the various inorganic components are added to the solution or are present in a previously prepared dry salt mixture are also determined with reference to the degree of detergency necessary and with reference to the properties of the rug to be cleaned. When the salt mixture is dissolved in water the calcium of the hypochlorite is precipitated as insoluble calcium carbonate. The clear solution may then be decanted and supplied to the cleaning operation. Since an amount of carbonate equivalent to the calcium ion present is removed from the solution by this precipitation, the amount of soda ash present in the original mixture should be in excess of an amount equivalent to the calcium hypochlorite present. In this way an excess of sodium carbonate will remain in the solution imparting thereto valuable detergent properties. In many cases it is desirable to have the solutions used in a lower pH range than that resulting in a solution containing any substantial excess of soda ash. The pH value imparted to the solution by excess sodium carbonate may advantageously be lowered to a desired value by adding to the solution a predetermined proportion of an acid salt, such as, for example, sodium bicarbonate.

The difficulties hitherto experienced in the cleaning of rugs by shampooing with soap referred to above are overcome by the process of my invention and many independent improvements attained. The loss of substantial proportions of cleansing agent accompanied by the precipitation of insoluble soaps when hard waters are used is avoided since the synthetic organic detergent salt used in my process does not produce a precipitate in the presence of calcium ions. The increased wetting and penetrating action of the solutions used in my process result in increased efficiency of soil removal and time of reaction as compared to the results obtained by the use of soaps. All of the salts used in my process are readily soluble thus facilitating the removal of the reagents from the rug and eliminating extensive rinsing operations. This property eliminates the disadvantages resulting from the soap which adheres to the fiber of the rug in spite of extensive rinsing. In the case of rugs having a "sheen" finish, the original sheen of the rug is restored without adversely affecting the color of the rug. The colors of the rug are in fact freshened and the design, if there be one, clarified. Stains are removed and the rug is efficiently and completely deodorized and disinfected.

The following will serve as illustrative examples of the use of my process in specific instances of rug cleaning.

Example I.—A wool-pile rug from which loose dirt had been removed in an automatic dust beating machine was laid face down on the floor and wet with water. A cleansing solution was prepared by dissolving 1 lb. of a synthetic organic detergent salt mixture consisting essentially of sodium lauryl sulfate with small proportions of sodium myristyl sulfate and sodium palmityl sul-

fate, and 1 lb. of a mixture consisting of 25 parts by weight of a stable calcium hypochlorite containing approximately 74% available chlorine, 37 parts of sodium carbonate and 37 parts of sodium bicarbonate in 50 gallons of water at approximately 72° F. The solution was thoroughly stirred and the precipitated calcium carbonate allowed to settle. The clear solution was fed by gravity into the center of a mechanical rotary brush with which the rug was scrubbed in a lengthwise and crosswise direction. The rug was then rinsed, turned over and scrubbed on the pile side with a further quantity of the above-described detergent solution. It is preferable that the right side of the rug be squeegeed both before and after treatment with the detergent solution. Following this treatment the rug is passed through a wringer and dried in a conventional manner.

Example II.—An alternative procedure to the "floor method" of Example I involves the use of an automatic feeder machine. The rug to be cleaned was fed into a device having arranged therein rows of flat brushes which vibrate alternately across the entire width of the rug, each row of brushes being made up of several individual brushes. The rug is passed through the machine twice; in the first passage the brushes positioned above the rug thoroughly scrub the reverse side of the rug which is uppermost, and in the second passage, after rinsing of the back of the rug, the right side is scrubbed. The detergent solution is applied to the rug just prior to its contact with the horizontally vibrating brushes. The solution used in this example was the same solution as was employed in Example I.

While increased efficiencies are attained in the cleaning of rugs by first treating the reverse side and then the right side of the rug in accordance with the process of my invention, it is frequently desirable to clean rugs under circumstances where the two-step process, including the necessary turning and rinsing, is impractical, such as, for example, when rugs are to be cleaned in the home. Treatment with a single solution in accordance with my process results in marked advantages over the methods hitherto employed under such conditions. The following detailed cleaning treatment for a rug or carpet without removing it from the location where it is normally used will serve to illustrate the application of the process of my invention under such circumstances.

Example III.—The rug in its normal position on the floor is treated with a strong vacuum. It is then sprinkled with a cleansing solution, such as was employed in the processes of Examples I and II, until the rug is well wet with solution but not saturated, and then scrubbed with a soft rotary brush. As much of the soiled detergent solution as possible is removed by the vacuum, the rug sprinkled with fresh water and this, in turn, removed with the vacuum. In drying, the nap is brushed in one direction and the rug permitted to stand until completely dry.

In cleaning rugs which are particularly fragile it has been customary to use a dipping process in which the rug must be dipped a number of times in various treating solutions. By my process, such a rug may be completely cleaned by a single dipping thus eliminating the use of large volumes of liquid, and effecting considerable saving in the time of working.

I claim:

1. A process for cleaning rugs which com-

prises treating the rug with an aqueous solution formed by dissolving in water a stable calcium hypochlorite, sodium carbonate in excess of that necessary to react with all of the calcium present, and a synthetic organic water soluble detergent salt which does not produce an insoluble precipitate in the presence of calcium ions, and rinsing the thus treated rug.

2. A process for cleaning rugs which comprises treating the rug with an aqueous solution formed by dissolving in water a stable calcium hypochlorite, sodium carbonate in excess of that necessary to react with all of the calcium present, sodium bicarbonate, and a synthetic organic water soluble detergent salt which does not produce an insoluble precipitate in the presence of calcium ions, and rinsing the thus treated rug.

3. A process for cleaning rugs which comprises treating the rug with an aqueous solution formed by dissolving in water a stable calcium hypochlorite containing upwards of 50% available chlorine and which is substantially free of calcium chloride, sodium carbonate in excess of that necessary to react with all the calcium present sodium bicarbonate, and a synthetic organic water soluble detergent salt which does not produce an insoluble precipitate in the presence of calcium ions, and rinsing the thus treated rug.

4. A process for cleaning rugs which comprises treating the rug with an aqueous solution formed by dissolving in water a stable calcium hypochlorite containing upwards of 50% available chlorine and which is substantially free of calcium chloride, sodium carbonate in excess of that necessary to react with all the calcium present, sodium bicarbonate, and a water soluble detergent sulfate salt of a higher alcohol selected from the class consisting of the alkali metal alcohol sulfates, the alkaline earth metal alcohol sulfates and ammonium alcohol sulfates, and rinsing the thus treated rug.

5. A process for cleaning rugs which comprises successively treating first the reverse side and then the right side of a rug with an aqueous solution formed by dissolving in water a stable calcium hypochlorite, sodium carbonate in excess of that necessary to react with all of the calcium present, sodium bicarbonate, and a synthetic organic water soluble detergent salt which does not produce an insoluble precipitate in the presence of calcium ions, and rinsing the thus treated rug.

6. A process for cleaning rugs which comprises successively treating first the reverse side and then the right side of a rug with an aqueous solution formed by dissolving in water a stable calcium hypochlorite containing upwards of 50% available chlorine and which is substantially free of calcium chloride, sodium carbonate in excess of that necessary to react with all of the calcium present, sodium bicarbonate, and a water soluble detergent sulfate salt of a higher alcohol selected from the class consisting of the alkali metal alcohol sulfates, the alkaline earth metal alcohol sulfates and ammonium alcohol sulfates, and rinsing the thus treated rug.

7. A process for cleaning rugs which comprises treating the rug with an aqueous solution formed by dissolving in water a stable calcium hypochlorite containing upwards of 50% available chlorine and which is substantially free of calcium chloride, sodium carbonate in excess of that necessary to react with all the calcium present, sodium bicarbonate, and a water soluble salt of a sulfonated organic compound of

high molecular weight having detergent properties which does not produce an insoluble precipitate in the presence of calcium ions, and rinsing the thus treated rug.

8. A process for cleaning rugs which comprises treating the rug with an aqueous solution formed by dissolving in water a stable calcium hypochlorite, sodium carbonate in excess of that necessary to react with all of the calcium present, and a synthetic organic water soluble detergent salt which does not produce an insoluble precipitate in the presence of calcium ions, said detergent salt being present in an amount of

about $\frac{1}{3}$ to $\frac{1}{2}$ the weight of said other dissolved salts, and rinsing the thus treated rug.

9. A process for cleaning rugs which comprises treating the rug with an aqueous solution formed by dissolving in water a mixture comprising one part of a synthetic organic water soluble detergent salt and one part of a mixture consisting of about 25% by weight of a stable calcium hypochlorite, about 37% by weight of sodium carbonate, and about 37% by weight of sodium bicarbonate, and rinsing the thus treated rug.

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