April 17, 1973 B. M. CANNAN 3,728,075

METHOD OF SHAMPOOING CARPET ON LOCATION

Filed April 13, 1971

Fig. 1

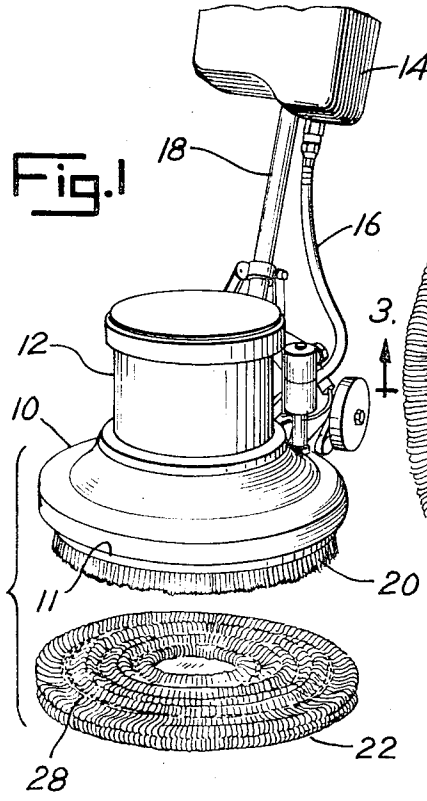


Fig. 2

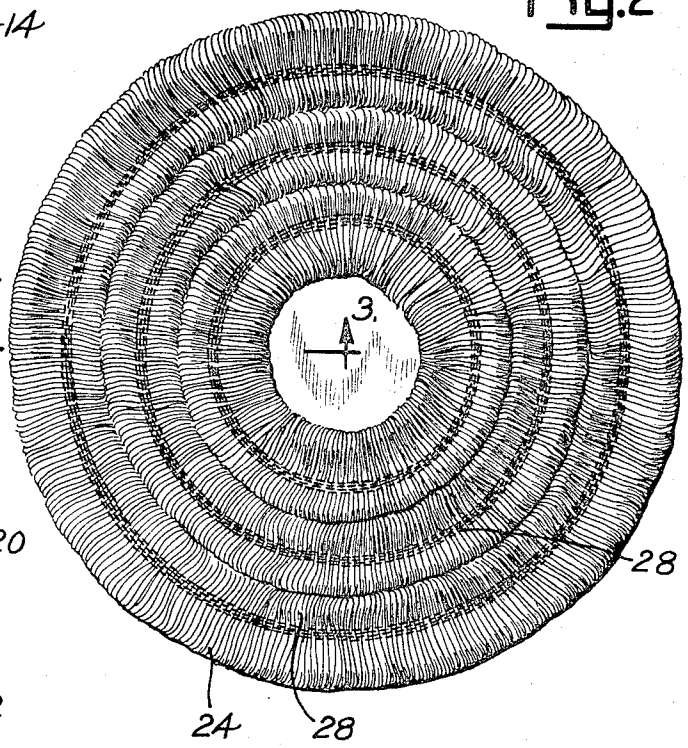


Fig. 3

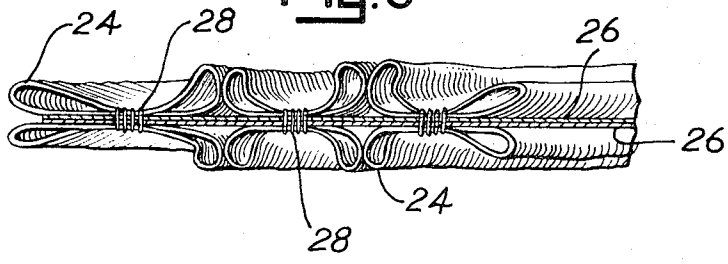
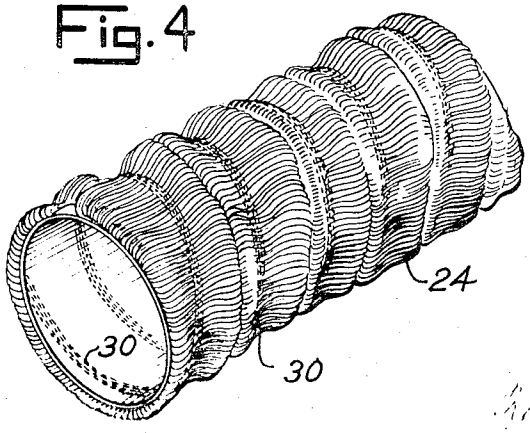


Fig. 4



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METHOD OF SHAMPOOING CARPET ON LOCATION

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ABSTRACT OF THE DISCLOSURE

Shampooing pile carpets on-location using mopheads made from a combination of seventy percent nylon, twenty percent cotton and ten percent rayon yarns. The looped yarns are aligned transversely to the direction in which the mop travels. The mop configurations are either circular, for use with rotary carpet shampoo devices or cylindrical for use with revolving drum type shampoo devices. In using either of said devices a liquid detergent in predetermined quantities is applied to the carpet, and the mophead is mechanically moved over the wetted area to shampoo the pile. The resilient nylon fibers sustain the weight of the device and provide an aggressive scrubbing action helping to release the soil from the fibers. The absorbent cellulosic yarns in the mop soak up the soiled liquid detergent.

THE PRIOR ART

On-location carpet cleaning is the series of processes applied to a permanently placed carpet which removes soil accumulations while preserving the color and fiber characteristics, restores the pile to an upraised condition consistent with the original pattern; all within the limits of previous usage, care, installation, age factors, at the same time keeping the soiling rate equal to or less than that of the carpet when newly placed.

The term *carpet cleaning* generally refers to carpet care methods employing liquids as compared to maintenance routines which are limited to dry soil extraction methods such as vacuuming, pile lofting and incidental treatment of localized spots and stains. These latter maintenance routines are incomplete in that they remove the loose dry soils while leaving behind the film-forming soils which are attached to the fibers. Carpet cleaning methods, on the other hand, remove both the loose dry soils and the attached soil films. This series of processes involves introducing a liquid with deterging and dissolving characteristics for these latter type filming soils. In addition, while the carpet pile fibers are in a damp and lubricated state, they can be caused by pile lofting and combing to be reoriented (even more so than in the previous day agitation) from a crushed and traffic distorted state to a uniform state more near their original configuration. This reorientation causes even more soil previously trapped among these tangled fibers to be freed and capable of removal either during the shampoo process or later, when the carpet has dried, by a dry vacuuming process.

One of the restricting factors in all care routines in on-location carpet maintenance is that any process and apparatus must be applied from the upper at-surface face of the pile and any soil withdrawn from the depths of the pile must be taken up through the pile and removed from the at-surface level. In carpet cleaning, where liquids are introduced, they too must be introduced from this at-surface level, worked down into the pile and then withdrawn along with the loosened soil residues back up through and away from this top pile face. The soil removal processes for reaching deep down into the pile are many times multiplied in difficultiy in proportion to the actual depth of the pile. In the actual present state of the art the practical techniques for reaching this deep-down soil are imperfect and approach impracticability

when the difficulties are compounded by backing materials in the carpet which are absorbent and porous and allow soil and liquids to penetrate below the backing face into the cushion or onto the floor surface below. Thus, any liquids which are introduced into a carpet pile, be they water-based detergents or solvents, must have the characteristic of drying to a state where they will not form a tacky film residue which will attract and hold onto soil as it reaccumulates, either by traffic walk-off or from the atmospheric condition.

The carpet cleaning methods most commonly used are outlined below:

(1) Rotary brush shampoo method

An effective practical method in widespread use today involves pile lofting and dry vacuuming of loose soils prior to shampooing. The shampooing is done with a water-base detergent wherein a shampoo machine with a rotary nylon brush is used to speread the shampoo liquid fed from a tank affixed to the machine, mechanically agitate the fibers and loosen the soil film. The upper pile fibers in contact with the brush bristles are actually scrubbed by the bristles. Those fibers below and out of direct contact with the bristles are caused by the flexing action of the resilient bristles ot wipe against each other and thus assist the detergent in loosening and capturing the soil. Upon evaporation of the water and other possible volatile solvents, the suspended soil and detergent residues are vacuumed away as dry soil. A second pile brushing or lofting while the carpet is still damp and lubricated realigns fibers and yarns into an upraised state which restores the carpet to a near normal and pleasing appearance and also serves to speed drying. It also causes trapped soil to be freed for removal during the vacuuming process after the carpet is dry. Liquid shampoos are applied at rates ranging from 8/10 gallon per hundred square feet to 15/10 gallon per hundred square feet under average residiental type soil conditions on which this method is considered to be effective and practical. Drying time (a function of ambient humidity/temperature conditions and fiber type) can vary from four hours to sixteen hours. Vacuuming after shampooing while the carpet is still mostly damp can remove already dried detergent/soil residues (termed "soil crystals" by some) at or near the pile surface, but the main "soil crystal" removal is accomplished after a thorough drying period, usually of twenty-four hours minimum.

(2) Drum type "dry foam" methods

Another carpet cleaning method involves a carpet shampoo machine with a drum-type nylon brush which is operated in straight line paths back and forth over a carpet. The soil removal processes are similar to that of the rotary brush type machine described before. Typically the carpet is first vacuumed with an upright vacuum to remove loose soil. Then the shampoo process is begun. The typical machine is fitted with a detergent storage tank and a foam generating assemblage, usually a small air compressor and a carburetor which intermixes air and detergent with especially high foaming characteristics. The pregenerated foam is applied to the carpet from the revolving brush as it is moved over the carpet and the pile fibers agitated and the foam worked over and into the pile. Some machines have a vacuum attachment to accumulate foam from the pile surface. This is done in a separate pass. The detergent is applied at rates ranging from 1/10 gallon to 3/10 gallon per hundred square feet. Because of this very light application the carpet can be dry in one hour. The soil conditions for which this method is effective must be restricted to the at-surface level. More

deeply soiled carpets treated with this method appear streaked and irregular in appearance. As in the rotary brush method the dried detergent/soil residue must be in a powdery "soil crystal" from and be vacuumed away after the carpet is thoroughly dry. The method, although slow and less effective than the rotary brush method, requires less skill and judgment and experience by the operator, and can be operated by said inexperienced personnel with less chance of damage to carpet surfaces.

(3) Hand sponging methods

A carpet cleaning method offered by some professional carpet maintenance companies does not employ powdered equipment in the shampoo process but makes use of natural sponges manually worked by the operator from a hands and knees position. The carpet is first vacuumed, usually with an upright type vacuum cleaner, and may be prelofted when considered necessary by the operator. A detergent liquid is placed in a foam generating machine which intermixes air with the water-base detergent. This lather is manually spread over a small section of the carpet by a hand held and directed scoop. The operator has a bucket of warm, clear rinse water into which he immerses the sponge, squeezes it out manually and works the foam over the pile surface. From time to time he rerinses the sponge in the water, transferring loosened soil he has accumulated. The pile is vacuumed, combed and brushed to a uniform appearance while still damp. As in the first two cleaning methods discussed the dried, loosened soil/detergent residues remaining are vacuumed away when the carpet has dried. The actual amount of detergent applied is subject to much latitude and operator judgment. It can range from 2/10 gallon per hundred square feet to approximately 1 gallon per hundred square feet. The carpet can be dry in from two to twelve hours. The method is effective on lightly soiled carpet. More deeply soiled carpets appear irregular and uneven in appearance.

(4) Wet vacuuming

This carpet cleaning method typically referred to in the trade as "steam cleaning" involves removing both loose and film-type soils by introducing proportionately larger quantities of water-based detergents into the pile of the carpet and almost simultaneously withdrawing them along with the thus captured soil by means of vacuum suction through a narrow slot drawn over the pile surface. Typical "steam" equipment comprises a wheel mounted dolly containing a liquid storage reservoir and a soiled residue accumulating receiver. This unit also contains a pump, a detergent mixture heating element and the vacuum-producing pump or fan assembly. The operating head is attached by hoses to the dolly. The head itself has a row of spray nozzles arranged parallel and within two or three inches of the vacuum intake slot. The spray nozzles are directed so that the liquid is jetted into the pile surface at an angle and in the direction of the vacuum slot so that the uprushing air may immediately entrain these droplets and loosened soil before they fall down and away from that part of the pile where the air has sufficient velocity to keep them airborne, or to strip them and any soil they have loosened or entrained off at the fibers on which they have impinged. Liquids sprayed outside of this active air zone in the pile remain behind. The detergents are of the low or non-foaming type and are largely made up of water conditioners, typically one or more of the polyphosphates which may be in the moderately high alkaline area, ranging from pH 9.5 up as high as pH 11.5. The operating head, which can weigh up to 50 pounds, is drawn by the operator in parallel paths across the carpet. He controls the feed rate by an adjusting valve in the handle section. Quantities of 5 to 12 gallons per hundred square feet are introduced. Depending on operator technique, fiber characteristics and carpet construction from 1½ to 4 gallons per hundred square feet may remain behind in the lower levels of the pile and below the backing. Drying may take from 8 hours to 24 hours, and sometimes longer under circumstances of highly absorbent carpet (such as heavy wool pile) and high humidity. The high wetness provides conditions for shrinkage for those carpets with low dimensional stability to moisture. Some typical detergent residues do not have the properties of drying to a crystalline state and have been known to increase soiling. The machinery requires a high electrical input over and beyond the limits of standard circuitry and requires seeking out two separately fused circuits.

THE INVENTION

The present invention provides a method similar to those described in (1) and (2) above, but instead of using shampoo brushes and permitting all of the loosened soil detergent mixture to dry to the powdered crystalline state, much of it is adsorbed and removed from the carpet as liquid in a wet mop assemblage. In the instance of the rotary carpet shampoo machine this is accomplished by using an adsorbent circular mop-like disc made from particular yarns as an agitator or scrubber rather than the nylon bristle shampoo brush. In the instance of the drum-type carpet shampoo machine, this is accomplished by using a drum to which is fabric made in a mop-like construction of particular yarns as an agitator or scrubber is attached, rather than using the usual drum-type brush. Both of these machines can operate on electrical circuits fused for residential or commercial standard wall outlets.

The fiber materials from which the mop is made are critical. The fibers must be capable of soaking up and retaining a large quantity of soiled detergent solution; they must be sufficiently stiff when in a wet state to maintain an open and elastic consistency when subjected to the full weight of the rotary machine or the drum machine, and of sufficient aggressiveness to provide a scrubbing action to the carpet pile surface; they must be sufficiently elastic to cause the pile yarns to compress and relax in such a way as to wipe against each other, thus setting up their own self-scrubbing action, loosening the soil films attached and embedded in and among the fibers; and they must have non-ravelling and non-frying consistencies to withstand both the agitation of the fibers against the carpet pile surface and repeated launderings to free them of the adsorbed soil and detergent residues. I have found that the mop should be made from looped yarns, 30% to 90% by weight of which are nylon, with the remainder cellulosic, namely cotton and/or rayon. Cotton may comprise all of the cellulosic material present in the mop, but preferably it constitutes from one-half to three-fourths of the cellulosic fibers, with the remainder being rayon. Rayon will absorb about twice its weight of water while cotton absorbs about one and a half times its weight. Rayon also releases the adsorbed soil more readily than cotton. The wet strength of rayon is not sufficient to withstand the abrasion resulting from the scrubbing of the mop against the pile of the carpet. Consequently I prefer that at least one-half of the cellulosic fibers be cotton, because it has excellent wet strength, although its ability to absorb liquid is somewhat less than that of rayon.

The nylon yarns are incorporated to impart elasticity and resiliency to the wet mop so that the yarns can better conform to the pile contours of the carpet pattern, and can loosen the soil uniformly over the irregular surface. The elasticity also provides a continuous compression and decompression of the pile fibers below the contact surface, causing them to work against each other. Cellulosic fibers tend to compact when set to form a felt-like mass which does not have this resiliency or elasticity to penetrate downwardly into the pile. Nylon yarns do contribute somewhat to the adsorptive properties of the

mop, the liquids being held primarily by adhesion to the surface of the fibers.

In a preferred mop composition, I use seventy percent nylon, twenty percent cotton and ten percent rayon formed in loops from at least a two-ply yarn. The yarns are distributed uniformly over the face of the porous fabric backing so as to blend the properties of the several fibers over the entire area of the mop in contact with the carpet. I have tested other synthetic fibers as replacements for nylon but found them to be wanting. For example, polyester fibers lose their resiliency after being subjected to continuous flexing during the shampooing operation and during laundering. Polyacrylonitrile fibers are too weak. Polyolefin fiber yarns lose their original elastic configuration if the mop is dried at elevated temperatures, which is the procedure usually followed after laundering to remove the soil. Vinyl fibers contain plasticizers which leach out upon contact with the detergent solutions, and are also sensitive to heat damage during drying after laundering.

The backing fabric is also important to the proper functioning of the wet mop assembly, especially in the circular configuration for use with the rotary shampoo machine. The fabric must be porous to allow free flow of shampoo liquids through from the topside of the wet mop as it is applied from the storage tank mounted on the machine. It must be strong to secure the mop yarn stitching from being torn away from the scrubbing or from laundering. It must be dimensionally stable when wetted to maintain the original circular dimension, both in use with shampoo liquids and during laundering. It must be dimensionally stable to the drying temperatures normally used following laundering operations. In the preferred configuration I prefer a non-woven nylon or polyester fiber spun-bonded fabric, reinforced with parallel stitchings of nylon or polyester thread.

The stitching threads used to form the yarn assemblage and the threads used to secure this assemblage to the backings and the threads used to stitch the two opposing faces of the circular mop configuration together must have wet strength characteristics and be resistant to dimensional change or weakening by wetting and shampoo detergents and laundry detergents. The threads must also be resistant to loss of strength from drying temperatures, and must be sufficiently strong to hold the various assemblages together well beyond the projected life of the mop yarn faces. I prefer that either a nylon thread or a polyester thread be used for this purpose.

DETAILED DESCRIPTION

Referring now to the accompanying drawings:

FIG. 1 is a perspective view of a rotary shampoo machine showing the mop of the invention below the rotating disc.

FIG. 2 is a plan view of one form of a mop made in accordance with the invention.

FIG. 3 is a sectional view taken along the line **3—3** of FIG. 2.

FIG. 4 is a perspective view of a mop made in accordance with the invention which is adapted for use on a drum-type shampoo machine.

FIG. 5 is a view like FIG. 2 in which the loops are spirally disposed.

The rotary machine comprises a housing **10** enclosing a perforated rotating disc **11** driven by a motor **12**. A handle **18** extends upwardly from the housing **10** and carries a tank **14** containing liquid detergent. The detergent flows downwardly through the tube **16** is released through valve means **17** to the space above the rotary disc **11**. The detergent passes through the perforations in the disc **11** and the bristles of the brush **20**, secured to the disc, thus supplying cleaning solution to the surface of the carpet as the brush rotates. The apparatus described thus far is commercially available on the market. The mop of the invention is adapted to be interposed between the brush **20** and the carpet. The weight of the machine causes the bristles to become embedded in the fibers on the surface of the mop **22** so that they become coupled. When the brush **20** rotates, the mop rotates at the same speed because the friction between the brush and the surface of the mop is greater than the friction between the mop and the surface of the carpet. Although a close trimmed very dense brush **20** has been shown as the coupling means, any rough surface, such as a molded rubber disc having splines projecting therefrom, will serve satisfactorily to couple the mop to the rotating disc. If desired, the mop may be mechanically secured to the disc **11**.

Referring now to FIGS. 2 and 3, it will be noted that the mop is made from an assemblage of loops of yarn **24** secured to a backing material **26**, which is porous, such as a spun-bonded nylon fabric of 4 to 6 oz. weight. The mop yarn loop assemblage is secured to the backing **26** by means of threads **28** which are disposed midway between the ends of the loops and circumferentially on the face of the circular backing. In the particular construction shown in FIG. 2 there are three concentric rows of loops covering the face of the backing **26**. In place of concentric rows the loops may be stitched in a continuous spiraling pattern from an inner open circle ending in a fully closed circle at the ante circumference of the mop, is shown in FIG. 5. As indicated, in the preferred construction ten percent of the loops are rayon, twenty percent are cotton and seventy percent are nylon. The compositions may be varied to change the properties as desired within the specified ranges. It is not essential that every tenth fiber loop be rayon, for example, but it is desirable to locate the different fibers as uniformly as possible over the entire area of the circular fabric backing **26**. It is also possible to intermix the fibers prior to spinning so as to arrive at a single 3 ply yarn containing all three fibers in the prescribed blend such as the above preferred mixture of 70% nylon, 20% cotton and 10% rayon. I prefer that the fiber loops be disposed transversely of the direction in which the mop moves. I prefer that the fiber loops be disposed radially. The sides of the loops scrub against the pile of the carpet when the mop is rotated.

It will also be noted that the mop construction of FIG. 2 has loops on both sides of the double porous fabric backing **26**. This serves two purposes. First the bristles or fingers depending from the rotary scrubber have something to look into; and secondly, the mop may be turned over when it has become soiled on one side and the other side used to continue the shampooing operation until it has become soiled.

In FIG. 4, I have shown a modified form of mop in the shape of a sleeve which is adapted to fit over the drum of a drum-type scrubber. In this construction, the securing threads **30** run spirally of the circumference of the sleeve. Again, the loops of yarn are disposed transversely of the direction which the drum travels.

In using the apparatus of the invention to shampoo carpets, it is required first of all to preloft the pile and vacuum up the loose debris. After this has been done, a solution of liquid detergent may be sprayed on a limited area of the carpet to be cleaned. Alternatively, the solution can be added through the mop from the tank **14** on the rotary shampoo machine. The rotary machine is moved from side to side in one direction and then to and fro in the other direction over the same area to work the mop into the fibers. Alternatively, the motion may consist of over-lapping circles. Whatever the direction of motion, it is desirable that the mop make two passes over the same area in different directions. An important improvement attributable to the invention is the immediate removal of soil as it is released by the detergent action. And when the carpet has dried, a considerable amount of loosened soil formerly left behind, such as by a brush method, has already been removed. The dry vacuuming

operation serves to remove that soil which has been loosened by the mechanical movement of the fibers themselves against each other and which was not in direct contact with the mop.

A detergent solution suitable for use in connection with this invention contains an anionic surfactant, alcohol, brightener dye, formaldehyde bacteria stat, perfume and color. An alkaline builder/water conditioner may be used to adjust the pH to slightly above 7 to increase the rate at which the soil is loosened from the fibers. Modifications in the detergent solution may be made by adding other ingredients, such as brown stain-preventing materials and solvent builders, such as chlorinated hydrocarbons to assist in removing grease and resinous materials.

The intensity of the cleaning procedure is modified to be commensurate with the condition of the carpet. To pick up at-surface level soil accumulations, a relatively small amount of detergent solution is applied (i.e. 0.2 gallon per hundred square feet of carpet). This may be sprayed on the carpet, and within five minutes the rotary scrubbing machine having the mop of the invention is moved over the carpet. To obtain a deeper penetration, the amount of solution should be increased to from 0.5 to 0.8 gallon per hundred square feet. The detergent in these amounts is preferably applied through the face of the mop. For more heavily soiled carpets, the detergent must be applied in the range of 1.0 to 1.5 gallons per hundred square feet, and the rotary mop must be passed over the area a greater number of times to work the solution more deeply into the pile of the carpet. For a salvage operation where the carpet is very heavily soiled, it may be necessary to go to 2.0 to 3.0 gallons per hundred square feet and use a vacuum scavenger tool to remove as much of the soiled champoo solution as possible after shampooing with the rotary mop.

The mop of the invention is superior to a bristle brush in that it is capable of removing the soil immediately upon release from the carpet pile by the detergent, and additionally, it is less abrasive than the bristles of the brush and does not injure the fibers of the carpet. At the same time, because of the presence of the resilient nylon fibers, it has a strong flexing ability to cause the fibers down below the actual contact level to work against each other, providing a self-scrubbing mechanical agitation among themselves.

When the mop has become saturated with soiled solution removed from the carpet it is washed in clean warm water, wrung out and put back into use.

SPECIFIC EXAMPLE

A direct comparison was made between the process of the invention and a prior process using a bristle brush on a soiled wool carpet used in a residence. The pile was lofted and vacuumed over the entire area of the carpet to remove dry, loose soil. The soil removed was weighed and found to amount to about 1 ounce per 100 square feet. A diagonal line was drawn from one corner of the carpet to the other to divide it into two areas having a substantially equal degree of soil. The first area was shampooed with a rotary machine having a nylon bristle brush in contact with the carpet. Detergent solution was applied to the carpet through the bristles at a rate of about 1¼ gallons per 100 square feet. The machine was moved back and forth across the first area in one direction and then to and fro in a second pass over the same area but at right angles thereto.

After the carpet area was thoroughly dry which required about 6 hours, at 70 degrees F. and 40% R.H., the area was vacuumed to remove dry detergent and soil residue from the fibers. The amount of dry residue collected was about 0.2 ounce per 100 square feet.

The second area of the carpet was then shampooed using the same machine and the same detergent solution but the bristle brush was replaced with a round mop as described above having 70% nylon, 20% cotton and 10% rayon fibers. The detergent solution was applied at a rate of 1¼ gallons per 100 square feet through the mop. The machine was moved back and forth in one direction and then to and fro in a second direction to cover the same area in two passes. The mop was removed, rinsed in warm water, wrung out and put back on the rotary machine from time to time as the soil built up in the mop fibers. The rinse water was dark and discolored indicating that particles of fine sand, clay and carbonaceous material had been removed by the mop. After the carpet was completely dry, which required about 6 hours, the dry detergent and soil residue remaining on the surface of the fibers was removed by vacuuming. This amounted to about 0.5 ounce per 100 square feet.

Visual inspection of the first and second areas indicated that the second area was cleaner and more uniform in texture and pattern. Further, on close observation of the fibers along their entire length they appeared cleaner at the backing level depth and the feel was more like the original carpet than those in the first area. It was apparent that when the mop was removed and rinsed, a great deal of soil was removed from the carpet which is not the case when a brush is used. Little or no soil is picked up by the bristles of the brush. Consequently, in the brush method all of the loosened soil must be removed by vacuuming after the shampooing operation. The test data indicate that about 2½ times more soil is removed from the mop-shampooed rug than in the case where the brush is used. This is in addition to the soil removed to the mop rinse water. It appears that the wet mop, unlike the brush, loosens and frees soil which is trapped in the yarn bundles. It is apparent, therefore, that the method of the invention removes substantially more soil from the carpet than does the conventional method utilizing a bristle brush.

What is claimed is:

1. A method for shampooing carpets containing soil on location which comprises:
   (a) supplying detergent solution to the pile of the carpet;
   (b) scrubbing the pile with a rotating mop comprising a mixture of nylon yarns and cellulosic yarns in loop form on the front face of the mop to dissolve the soil on the carpet and cause it to be absorbed by the mop as it is released from the carpet;
   (c) washing the absorbed soil from the mop; and
   (d) repeating first two steps; said cellulosic fibers absorbing said soil and said nylon fibers providing resiliency to loosen the soil in the carpet.

2. The method of claim 1 in which said mop comprises about 70% nylon, 20% cotton and 10% rayon.

3. The method of claim 1 in which said mop comprises a circular porous fabric backing and said loops are secured to said backing at a point intermediate the ends of the loops and disposed radially of said backing.

4. A method for shampooing carpets containing soil on location which comprises
   supplying detergent solution to the pile of said carpet and simultaneously scrubbing the pile with a rotating mop comprising looped yarns on the front face of the mop containing from 30–90% nylon to provide resiliency to loosen soil in the carpet and from 70–10% cellulosic material to adsorb the loosened soil.

5. A method as in claim 1 wherein the rotating mop is a circular disc having yarn loops on both the front face and back face of the disc.

6. A method as in claim 5 which includes reversing mop faces when the front face is soiled.

7. A method as in claim 5 wherein the yarn loops on the back face of the mop are engaged with bristles of a rotary scrubber.

8. A method as in claim 4 wherein the rotating mop is a circular disc having yarn loops on both the front face and back face of the disc.

9. A method as in claim 8 which includes reversing the mop faces when the front face is soiled.

10. A method as in claim 9 wherein the yarn loops on the back face of the mop are engaged with bristles of a rotary scrubber.

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U.S. Cl. X.R.

15—98, 230.16; 134—6