

[54] METHOD AND APPARATUS FOR CLEANING TEXTILE FLOOR COVERING

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134/172; 239/101, 380; 68/205 R, 355; 8/158

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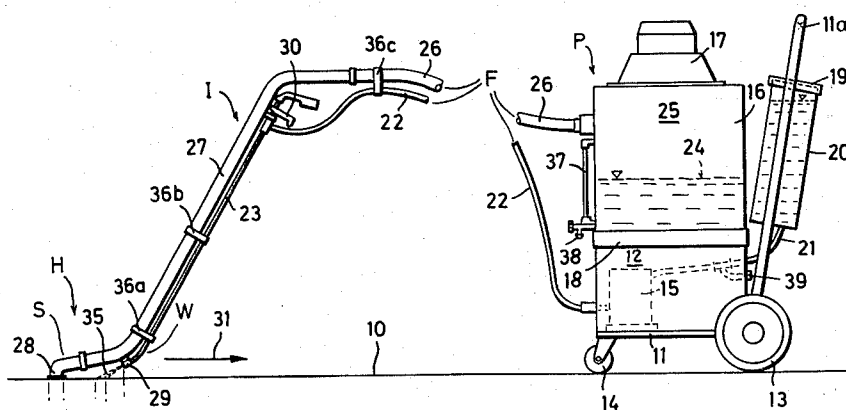
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[57] ABSTRACT

Laid carpeting is hydromechanically cleaned in place by traversing successively adjacent areas with obliquely directed high-pressure, and high-frequency, low-amplitude pulsed, jet sprays of cold or luke-warm water, with or without a dissolved non-foaming cleanser, and simultaneous suction pick-up of dirt-laden water immediately after application to remove the greater part of applied water; optionally followed by warm air current drying or residual moisture. A clean water reservoir tank, dirty water tank, electric motor driven high pressure double acting piston pump and electric motor-suction fan unit, carried on a wheeled cart form a portable cleaner unit power-cord-connectable to local electric mains but independent of fixed water supply and drain services; which through flexible hoses delivers the pulsating high pressure water to and draws dirty water from respectively a jet nozzle array and suction pick-up nozzle separately mounted on a stick type hand implement including user manipulated controls.

3 Claims, 5 Drawing Figures



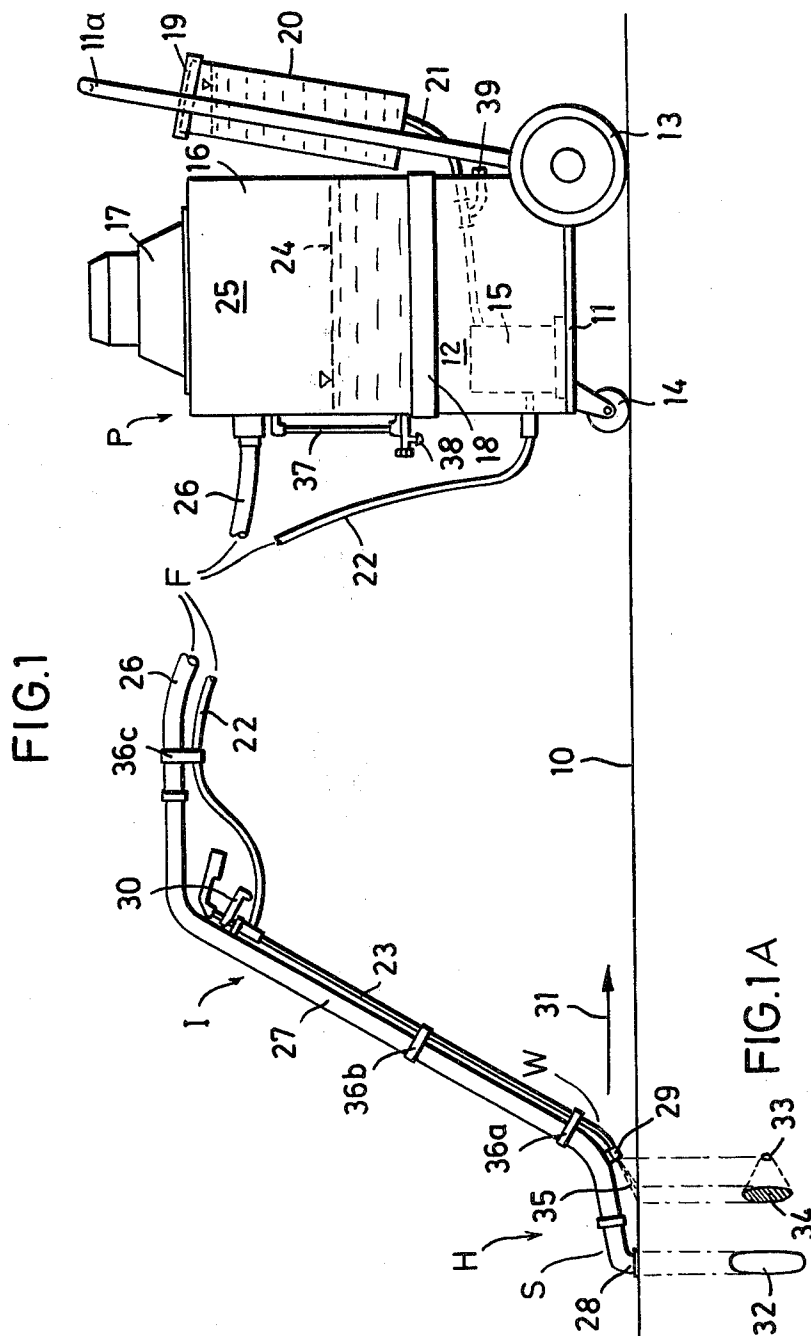


FIG. 2

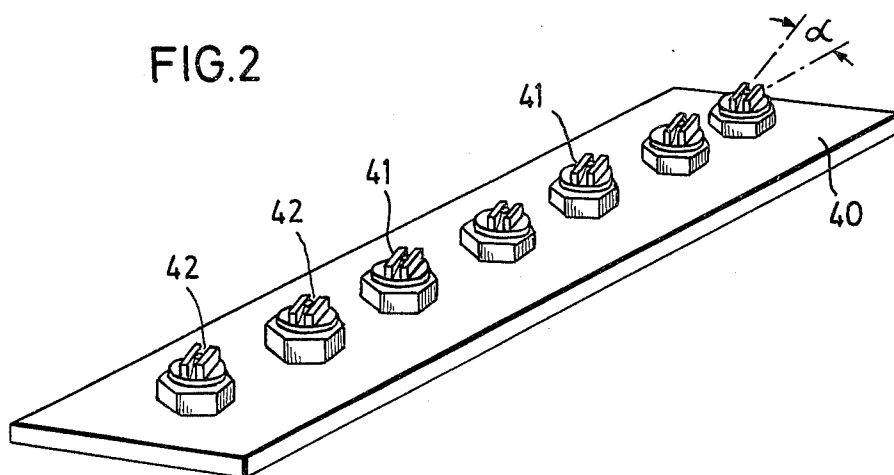


FIG. 3

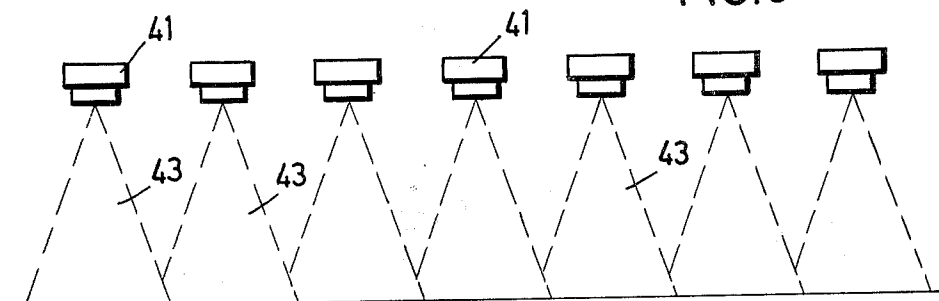


FIG. 4



METHOD AND APPARATUS FOR CLEANING TEXTILE FLOOR COVERING

The present invention relates to a method and apparatus for cleaning textile floor covering such as carpets, and especially wall-to-wall carpeting as secured in place.

The hitherto known methods of cleaning carpeted floors entail various disadvantages, including operating difficulties and limited cleaning effect. For mechanical carpet cleaning, there are available shampooing machines which, however, operating mainly on the carpeting surface with a rotating brush, leave much dirt and dust entrapped in the carpeting threads or fibres, and thus do not clean thoroughly enough even properly to preserve the textile fibres from trapped dirt particle damage.

Carpet cleaning by means of quite hot pressurized water or steam involves the risk of dissolving or at least softening the adhesives by which the carpet is secured to the floor, or of altering the internal structure of the carpet, especially the fibre structure where the carpeting is made entirely of synthetic material. On the other hand, if the water is heated only to a safe temperature, then the merely mechanical action of the machines used is inadequate for proper cleaning.

It is the purpose of the present invention to avoid these disadvantages by providing a simple yet effective method for cleaning textile floor covering, (hereinafter referred to generally as "carpeting"), especially as secured in place as floor covering, though of course useable on carpeting laid out for cleaning.

To attain this objective, the present invention in broader aspect proposes that water, at a high pressure of from about 6 to 36 atmospheres, be jet sprayed on the carpeting to be cleaned and then be immediately sucked off again by vacuum. The high-pressure water jet penetrates into the textile material to dissolve and loosen the dirt from the fibres very quickly and thoroughly down to the bottom of the textile structure, for simultaneous removal with the water which is then immediately sucked out again.

In this cleaning method of the present invention, the carpeting is left almost dry by the suction removal of the dirt bearing water; but thereafter the carpeted floor can be additionally dried by subjection to a warm air drying operation.

By means of a nozzle head, the high-pressure water is split up into one or several broad thin jet sprays; and by a special feature of the invention, the jetted water is delivered under pressure shocks pulsating with a high frequency which thus increases the dirt loosening effect; but the intensity of pressure shocks, generation of which will be explained below, is not so great as to incommode the person handling a cleaning implement applying the high-pressure water jet to the carpeting. The sprayed water may be cold, that is, unheated, usually resulting in a brighter cleaned carpet; though if desired warm water may be used up to a temperature of about 60°C or of course to a lower maximum where the particular carpeting material characteristics so dictate; and a soft detergent may be added to the fresh water to be sprayed. For typical operations, the water may be sprayed at a rate of, for example, 3 l/min (=0.66 gallons/min).

In the new hydromechanical carpet cleaning method, a narrower preferred high-pressure range for the water jet action is from about 11 to 36 atmospheres, particu-

larly good cleaning results being obtained at about 31 atmospheres.

Furthermore, the invention enables provision of a simple, easily operable and low-priced cleaning apparatus for carrying out the new method. According to the present invention, such a cleaning apparatus comprises a fresh water tank with a motor-operated high-pressure piston pump, preferably a double piston pump, supplying high-pressure water at an operating pressure of preferably 31 atmospheres to a water nozzle on a hand-manipulated rigid high-pressure tube; and a motor-operated vacuum suction fan device sucking the dirty water from the carpeting through a suction nozzle, carried on a rigid hand-manipulated suction tube behind the high-pressure water nozzle, for delivery to a dirty water receiving tank. As a compact portable and easily operable cleaning apparatus, the high-pressure spray water supply and pumping components, and the vacuum suction producing and dirty used water receiving tank with other minor components on a common wheeled support as a constructional unit represent a hand moved and dirigible cart.

As an operator manipulated cleaning implement, the nozzle bearing high-pressure and suction tubes are detachably connected side-by-side parallel to each other by releasable clamps; both tubes being operatively controlled by hand, both in the implement as a unit or when detached for separate use. The arrangement is such that when the apparatus is operating and the implement in use with the orifice of the orifice face of the suction nozzle sliding on the carpeting and the working face of the high-pressure nozzle at the end of the high-pressure tube somewhat spaced from the carpet, the water nozzle discharge direction is at an acute angle to the plane of the carpet surface, and preferably aimed toward rather than away from the suction nozzle.

To assure full mobility of the suction tube and the high-pressure tube, when used separately, as well as of the cleaning implement constituted thereof, the rigid tubes are connected by respective flexible tubes or hoses with the vacuum chamber of the used dirty water tank and the pressure side of the high pressure pump. Cleaning operations in the regions of corners, near to walls, and on staircases, are facilitated by the detachability of the water tube and nozzle from the suction tube and nozzle which allows the two principal steps of the process to be carried out separately.

As the described portable unit includes fresh water supply and dirty water collecting storage tanks, the particularly described cleaning apparatus is operable for appreciable periods independently of fresh water feed as well as from dirty water drain-off pipe connections. However, an option is provided for the high-pressure pump to draw fresh water from either the fresh water tank or from a building supply pipe connection; and also for a continual used water tank drainage through a hose to a building drain connection. This is useful where large carpeting areas are to be cleaned and especially where the water supply and drainage service connections are conveniently available in the working environment.

For convenient flow adjustment of the high pressure water jet, a hand-operated valve such as a stop cock or plug valve is provided on the implement at the upper end of a high-pressure tube. A pulsation damper or limiter is included in the apparatus, preferably at the cart, which conveniently may take the simple form of a U-

shaped high-pressure pipe connected at the pressure side of the high-pressure piston pump. As the intensity of the pulsating water pressure shocks generated by the high-pressure piston pump are thus reduced, the person handling the implement or the high-pressure tube is not 5 discomforted by the pulsations. Such pulsation, though reduced, reinforces the hydromechanical dirt-detaching effect of the high-pressure water jet action.

The general object of the present invention is to provide an improved simple but effective method for 10 cleaning of carpeting, especially carpeting in place, capable of convenient performance by apparatus which in turn is simple and of low cost both in construction and operation.

A further object is to provide a hydromechanical carpet cleaning method and apparatus capable of cleaning carpeting, even in place, without need of heated water, and having improved effectiveness in removal of textile-destructive dirt particles.

A further object is to provide a portable apparatus 15 appliance for carrying out the invention method which requires merely an electrical power cord connection to building environment for its actual operation.

A still further object is the provision of a carpet cleaning method and apparatus utilizing high-pressure, high frequency pulsating jet spray water flow to free various types of dirt from the carpeting fibres and textile structure and then immediate suction removal of the water with entrained, suspended or dissolved dirt 20 from the carpeting.

Other objects and advantages will appear from the following description and the drawings wherein:

FIG. 1 is a side elevational view of the one form of apparatus carrying out the method of and incorporating 25 apparatus aspects of the present invention;

FIG. 1A associated with FIG. 1 may be considered a quasi-schematic bottom plan view of an operating head portion of a cleaning implement in the apparatus;

FIG. 2 is an isometric view of the discharge side of a water jet producing nozzle head for the hand manipulated cleaning implement portion of the apparatus;

FIGS. 3 and 4 are schematic diagrams of the water jet pattern, respectively in elevation and in plan at the carpet surface, produced by the device of FIG. 2.

In the drawing, FIG. 1 at about 1:10 scale shows one form of a readily transportable and easily operable cleaning apparatus for carrying out the carpet cleaning method of the present invention, as comprising a hand-manipulated cleaning implement I, including as an operating cleaning head H, a suction head S with suction orifice or operating face sliding on the carpeting surface 10 and a high-pressure water jet spray nozzle head W projecting water back toward S, at an acute angle to and into the carpeting, to be suctioned of by the trailing head S; a portable pulsating clean water pressure generating and dirty water removing suction generating unit P; and flexible hosing F connecting the implement I to the water pressure generating and suction producing sections in unit P; with other components and relations to be hereinafter described in detail.

As the implement I is moved by the operator to the right (arrow 31) along a cleaning path, water at a high-pressure of, for example, 31 atmospheres, is penetratingly sprayed on and into the textile of carpeting 10 by water nozzle head W, and then immediately sucked off 65 again by the vacuum nozzle.

The portable suction and pressure generating cleaning apparatus unit P includes a mobile frame or chassis provided by a preferably rectangular base plate 11 to which is connected an inverted U-shaped handle 11a; two like wheels 13 and a swivelling caster wheel 14 supporting the base; and a rigid housing 12 on the base. The wheels 13 are large enough for the apparatus conveniently to be moved up or down on staircases. Above or on base plate 11 within housing 12, there is mounted a high-pressure double piston pump and its associated electric driving motor generally designated as a unit 15.

Above and on housing 12 there is located and supported the totally enclosed dirty water receiving and storing tank 16, on the upper wall of which is mounted 15 a vacuum or suction producing, electric motor suction fan or blower unit 17; the bottom of tank 16 being surrounded by a securing element 18 in the form either of an upward peripheral flange of housing 12 or a tank skirt dependent to embrace the housing top end. The U-shaped handle 11a serves as a support bracket for a rectangular fresh water tank 20 provided with a removable cover 19 and mounted between the bracket legs with its bottom at a level above the suction side or inlet of the high-pressure pump to which it is connected by a conduit or tubing 21.

The pressure or outlet side of the water pump, through a flexible high-pressure pipe or hose 22, is connected with a rigid high-pressure tube element 23 in implement I; and in a similar way, the vacuum chamber space 25 in tank 16, above the used dirty water level 24, is connected with the top end of a rigid suction tube element 27 of the implement I through a flexible pipe or hose 26, the ends of the hoses and the connection points therefor on the unit P and implement I being 35 provided with conventional cooperative mating connection elements, preferably of quick-connect-disconnect forms.

The upper end portion of tube 27 is bent at a angle to form a convenient hand grip portion for that tube and the implement as a whole; while a hand grip element preferably is secured to the top end of tube 28 for convenience in separate use of the latter.

At the lower end of the suction tube 27, the working face of the suction nozzle 28, sliding on the carpeting, has an elongated mouth or orifice; while the nozzle 29 on lower end of the high-pressure tube 23 has its orifice spaced at a short distance above the carpet 10, and aimed to direct its jet at an acute angle to the carpet surface. The upper end of the high-pressure tube 23 is equipped with a pistol grip type handle and therebeneath a manually operated plug valve or the like as a shut off device 30, by which the high-pressure jet of water may be turned off and on. A relief valve is provided on the water pump discharge side within housing 12 to direct water back to the pump inlet line 21 when the nozzle is throttled or turned off.

The rigid tubes 23 and 27 are held together as a unit to constitute implement I, by the releasable clamp devices 36a, 36b, and the hoses 22 and 26 are similarly releasably held at one or more places by releasable clamps 36c, whereby the tubes and elements are detachable for separate use. However, slack is to be present to the extent of allowing considerable bowing, in a somewhat inverted U-shape, in hose 22, so as to form a pulsation dampening means.

By virtue of its fresh water supply tank 20 and its dirty water collecting tank 16, the cleaning apparatus

embodiment shown is independent of fixed supply and drain points for fresh and waste water. The capacity of the fresh water tank 20 amounts, for example, to about 10 liters, while the capacity of the dirty water tank 16 amounts for example to about 30 liters. The capacity of the high-pressure piston pump may for example be about 3 liters per minute in an apparatus for general use.

The apparatus, with hoses 22, 26 connected is quickly readied for operation, by simply removing the cover 19 to fill the tank 20 by means of a bucket with cold or warm fresh water, and then plugging the power cord into an appropriate outlet, for the 110 or 220-volt-operated motors of the high pressure piston pump and of the vacuum generator pump. With an operating pressure of about 31 atmospheres, a pulsating jet of water, split up by nozzle 29, is then discharged into the carpeting 10, while operator manually moves both tubes 23 and 27 to the right in the direction of the arrow 31; the cleaning apparatus P being also drawn to the right by cart handle bracket 11. By the trailing suction nozzle, immediately subsequently to the spraying on of water, the dirt hydromechanically detached from the textile fiber is, together with the water, immediately picked up and transported back into the dirty water collecting tank 16 through the hose 26 to tank 16 by the suction of the vacuum producer 17.

After both nozzles have passed over the wall-to-wall carpet, it is cleaned in depth and almost dry. Additional drying may be performed by a separately driven electrical heating ventilator directed on the floor.

In the drawing, the inverted-plan view of FIG. 1A, the elongated effective suction area 32 of nozzle 28 is seen to extend parallel to and over a wider extent than the oval hatched space 34 representing the instantaneous pattern or area on which the split-up water jet 35 is sprayed from the spray nozzle 29. Nozzle 29 is adjusted in such a way that it spreads the high-pressure jet of water into a fan shape of thin dimension finely divided. It is evident that the orifice 32 of the suction nozzle 28 covers sufficiently the carpet area 34 to be able to pass over it in a manner convenient for operator manipulation.

In order to facilitate floor cleaning at narrow places, as in corners and on staircases and so on, it is possible to perform separately the high-pressure spraying and the suction removal by simply detaching the suction tube 27 from the high-pressure tube 23 at their connection clamps 36a, 36b, and 36c.

The level indicating sight glass 37 on tank 16 is superfluous if the dirty water tank 16 or at least the vertical wall structure is made of transparent material. For periodic draining off of the accumulated dirty water as necessary the tank 16 has a drain cock 38 near its bottom.

On the housing 12 there is shown a separate fitting 39 communicating with the suction side on inlet side of the pump, which is provided for connection to a fresh water supply pipe, so that it would render the fresh water supply tank 20 superfluous in certain cases. However, preferably the fitting 39 is adapted to be closed when tank 20 is in use, but quickly connected to a fixed water supply point even by an extended flexible hose allowing mobility of P. Similarly the bottom of tank 16 may be provided with a fitting, or the drain valve fitting 38 may serve as such, for a hose connection to a drain

point in the environment.

A spray nozzle working head detail involving an elongated plate base 40 mounting a plurality of like nozzles 41 each with a respective discharge slot 42 is shown in FIG. 2 and explained in FIGS. 3 and 4. Here the individual nozzle elements 41 are commercially available items, each having a male-threaded rear body portion extending through a respective aperture in the plate and secured by a nut (not shown).

The elements 41 are arrayed in a series evenly spaced along a centerline of the base plate, and each having its respective discharge nozzle slit similarly turned by a small angle α from alignment with that plate centerline. Though exaggerated in the drawing, the angle in fact amounts to only about 5°. As an accessory to the apparatus, there may be included a template for resetting the nozzle slit directions after periodic or needed cleaning.

The several nozzles are individually connected to the end of tube 23 by respective smaller tubes and a junction fitting; or the plate 40 may be secured on the face of a manifold element on the end of 23.

The individual nozzles 41, as in the case of nozzle 29 in FIG. 1A, each produces a downwardly laterally spreading high pressure fan-shaped discharge, thin in transverse sense, e.g., of fine streams of water. The head spacing from the carpet, and successive nozzle spacings, are so chosen relative to the fanning out produced by the individual nozzles that the spray pattern of FIGS. 3 and 4 results; wherein the successive sprays do not interfere by touching, but overlap marginally in the sense of the stepwise contact pattern (FIG. 4) on the carpet, ensuring a complete coverage of the carpet position spanned by the nozzle head. Other patterns or dispositions are of course useable as long as these conditions are fulfilled.

As contrasted with the prior hot water spray methods, with a cleaning rate of 30 to 60 square meters per hour, the present method offers a cleaning rate up to 200 square meters per hour, carried out for example with apparatus as above described.

With typical double piston electric motor water pumps, the pulsation rate as readily available on the order of magnitude to 600 to 3,000 per minute.

In practice, the frequency lies within a range from 720 to 1440 pulsations per minutes.

What is claimed is:

1. A method for in situ cleaning carpeting or textile floor covering comprising the steps of high-pressure jet-spraying water at a pressure of from about 31 to 36 atmospheres on and thereby into the carpeting to be cleaned with the water jet flow being a rapidly pulsating flow, and immediately thereafter vacuum suctioning off from and out of the carpeting the major part of the applied water and dirt contained therein.
2. The method as described in claim 1, wherein the jet-sprayed water is split up into a plurality of fan-spread thin sprays, the water being pulsatingly delivered with a pulsation frequency of from 720 to 1440 per minute.
3. The method as described in claim 2, wherein the water is sprayed on the carpeting at a temperature below about 60°C.

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