

May 15, 1973

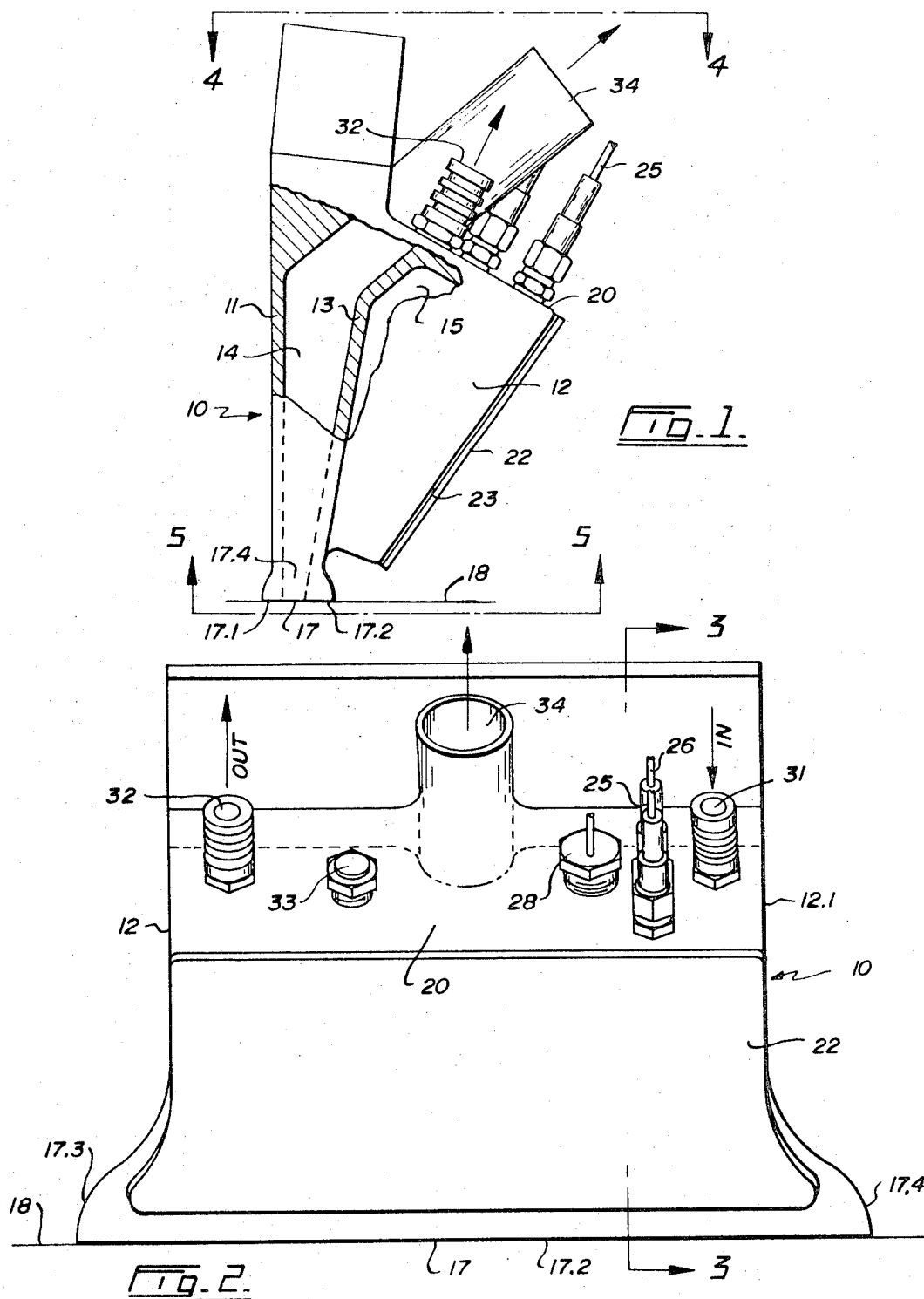
W. H. WISDOM

3,733,176

METHOD FOR CLEANING CARPETS AND LIKE MATERIALS

Original Filed Dec. 20, 1968

4 Sheets-Sheet 1



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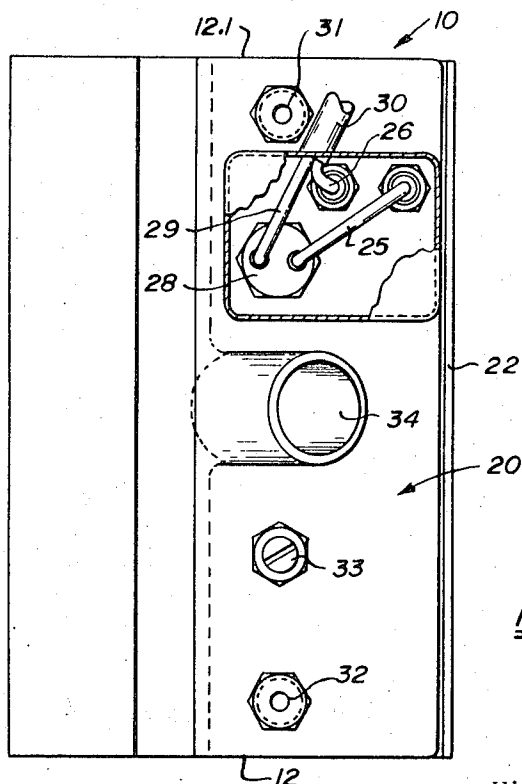
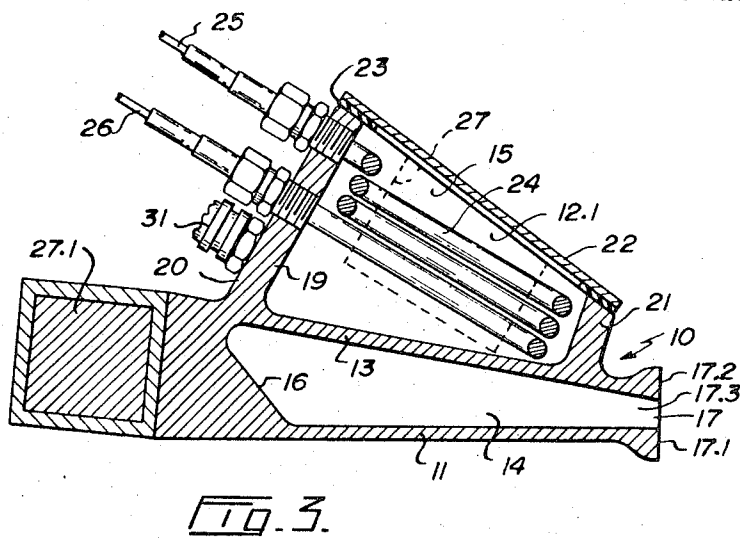
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4 Sheets-Sheet 2



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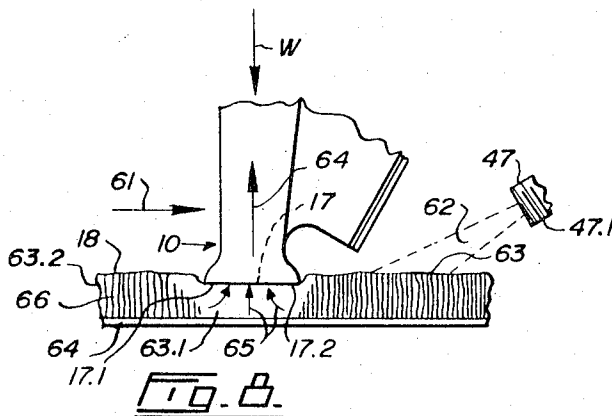
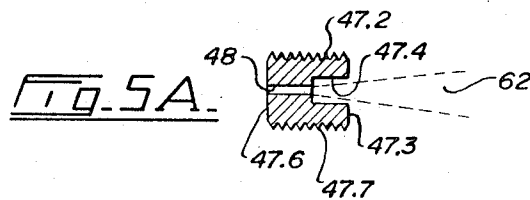
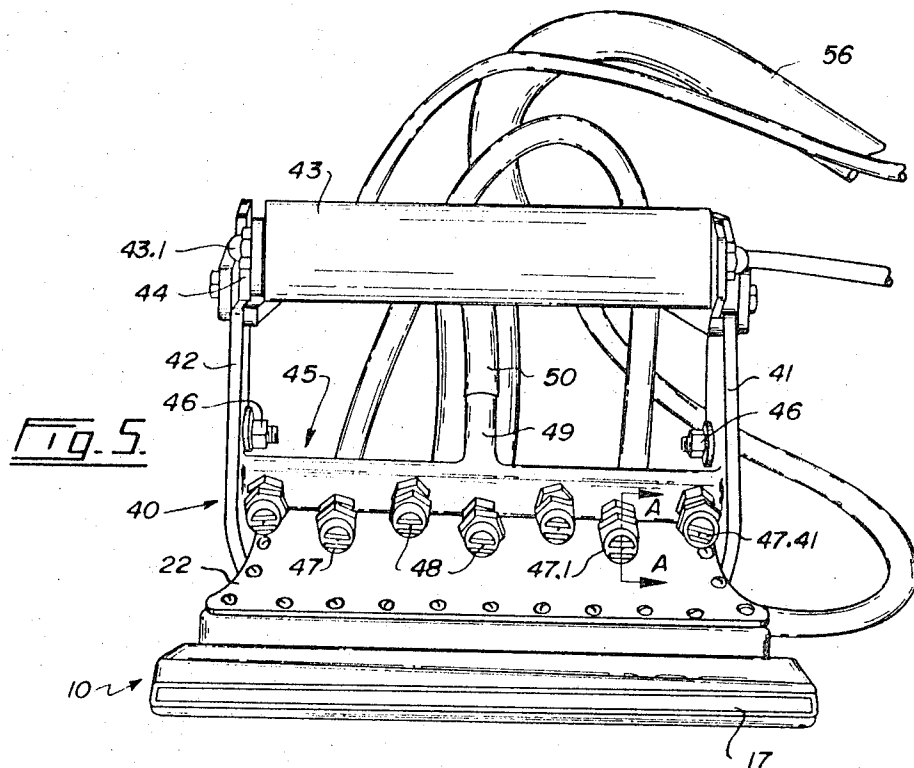
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METHOD FOR CLEANING CARPETS AND LIKE MATERIALS

Original Filed Dec. 20, 1968

4 Sheets-Sheet 3



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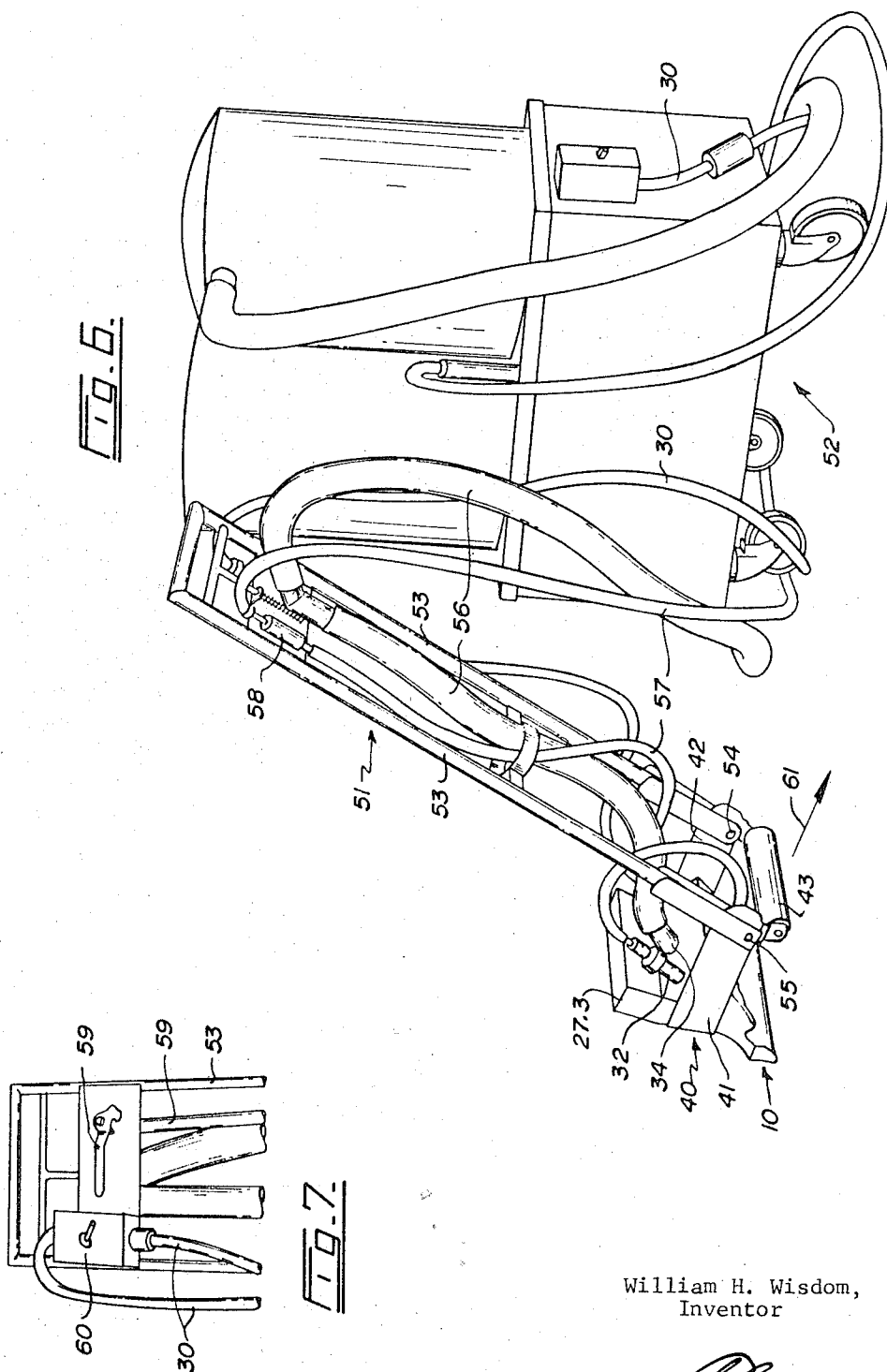
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METHOD FOR CLEANING CARPETS AND LIKE MATERIALS

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4 Sheets-Sheet 4



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3,733,176

METHOD FOR CLEANING CARPETS AND LIKE MATERIALS

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Continuation of abandoned application Ser. No. 795,767,
Dec. 20, 1968, which is a division of application Ser.
No. 638,890, May 16, 1967, now Patent No. 3,436,787.
This application Dec. 28, 1970, Ser. No. 102,221
Int. Cl. A471 7/00

U.S. Cl. 8—149.1

7 Claims

ABSTRACT OF THE DISCLOSURE

A carpet and rug cleaning method involving successive rolling, spraying, and nearly simultaneous exposure to vacuum and to heat. Method achieves faster drying than heretofore was common, with minimal wicking. Pre-rolling, spraying under pressure with the spray impinging the carpet at an acute angle so as to loosen rather than to imbed soil together with application of the vacuum, pressure, and heat, used to achieve the foregoing.

CROSS REFERENCES TO RELATED APPLICATIONS

This application is a continuation of Ser. No. 795,767, filed Dec. 20, 1968, now abandoned; which application in turn, is a division of co-pending application Ser. No. 638,890, now Pat. No. 3,436,787.

BACKGROUND OF THE INVENTION

Field of the invention

The invention relates to a method for cleaning rugs, carpets, upholstery and like fabrics and particularly, but not exclusively, to in-situ cleaning of these materials. Apparatus expressing the method forms subject matter of United States patent above.

Prior art

A co-pending United States continuation application Ser. No. 723,325 and a method division of the said continuation being application Ser. No. 751,634 together with a further divisional application of the continuation namely application Ser. No. 825,474 relate to portable rug dyeing machine and method, John A. Thompson and the present applicant William H. Wisdom being therein named as co-inventors.

The co-pending application teaches a boiler unit including a tank for holding hot dye and cleaning solution mounted on a portable, wheeled base. Means are provided for drawing off steam and hot solution from the tank and conducting it under pressure to a remote, hand operated applicator equipped with spray nozzle and a vacuum chamber. The applicator is moved over the surface to be dried, simultaneously spraying solution into the fabric and subjecting the sprayed fabric to a vacuum to prevent excessive wetting thereof. The foregoing process is used first, with a cleaning solution in the boiler unit for cleaning the fabric to be dyed. The cleaning solution is then replaced with a dye solution and the procedure is repeated.

The present invention relates to the cleaning of rugs, carpets, and the like. United States Pat. 3,262,146 issued July 26, 1966 to Fred E. Hays pertains particularly to a mechanism for supplying high pressure steam of a solvent containing solution to one chamber of a two-chamber cleaning nozzle, and simultaneously creating a vacuum in the other chamber of the nozzle, means being provided to condense and collect detergent vapour returned in a vacuum line from the nozzle. An object of this invention is to provide improved simplified two-tank mechanism for sup-

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plying under substantial pressure steam from a solvent bearing solution contained in one of the tanks, and for maintaining a controlled vacuum in the other tank.

There are many patents relating to apparatus of this general kind. For instance, British Pat. 486,500 granted to Frederick William Taylor in 1938 teaches selectively applying, by way of surface treating means moveable over it, at least one flowable medium from a plurality of fixed sources of supply of different flowable media, and applying suction to the article from a fixed suction producing means for removing waste matter from the article under treatment.

Prior patents include a head structure which may be complex, or may be relatively simple. Many variations in head structure are known and have been patented, as have been methods associated therewith.

Apparatus of the present invention deals only with a cleaning head, adapted for use with substantially any vacuum source of the type known in the art as a "wet vacuum," together with suitable means for supplying cleaning fluid under pressure. Method according to the invention is expressed in operation of the head.

SUMMARY OF THE INVENTION

Prior art apparatus and method, both for dealing with rugs and carpets in-situ and for cleansing and renovating at a cleaning plant, are capable of giving generally satisfactory, and in some cases excellent, results.

In the present state of the art employment of known methods and apparatus can cause what is known as wicking, adverse effects of which are well-known in the trade. Generally, the present invention provides a method and apparatus for the cleaning of rugs, carpets, and like material, such that adverse effects of wicking are reduced compared to effects obtained from prior comparable apparatus and method. As well, the invention provides a relatively simple cleaning head structure to effect cleaning by the method, and of reducing moisture content by vacuum and substantially simultaneous application of heat.

According to the present invention a cleaning head assembly is moved relatively to a surface of a carpet or like material being cleaned. Were the method to be employed in a fixed cleaning apparatus such as in a cleaning plant, rug or carpet can be moved relative to a stationary head, the relative motion being the same regardless of whether the head or the carpet be stationary. The head assembly includes a generally hollow nozzle unit with an inner partition defining a suction chamber and a cavity. The suction chamber has a long narrow suction nozzle suitably integral therewith, the nozzle itself being generally according to the prior art. Means are provided to heat the head assembly and the cavity. Exemplified apparatus uses an electrical heating element coil disposed within the cavity, but for instance gas heating means can be employed. Means are provided to introduce cleansing fluid under pressure to the cavity where the fluid is heated preferably to boiling point, the nozzle unit also being heated to attain about the same temperature. The suction chamber has a suction port for connection to a flexible hose of the vacuum source, which source is desirably a wet vacuum apparatus as before explained. A jet tube is secured in spaced relationship to the nozzle unit, the tube having nozzle outlets each being adapted to discharge a fan-like spray of steam and water vapor, or droplets, under pressure to impinge upon a strip of carpet generally parallel to and adjacent to the nozzle aforesaid. Thus impingement is at an acute angle to the strip surface, with advantages as later explained.

The head assembly is moved relative to a surface of the rug so that a surface element or strip is first sprayed with hot cleansing fluid and steam under pressure impinging

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thereon at an acute angle thus to penetrate the nap, and as the motion progresses the element is next subjected to a vacuum. When the nozzle reaches the wet element the fluid, now containing dirt particles in suspension together with loose dirt, is withdrawn passing outwards of the vacuum chamber to the vacuum hose aforesaid. As well as being subjected to vacuum which removes a substantial part of the moisture, the nozzle element itself is hot, so that heating also takes place so hastening the drying.

It is desirable that end walls defining the nozzle be urged against the surface, both for improved sealing and for better heat transmission. Accordingly, means are provided to load the nozzle and, while optimum loading varies with ambient temperature, humidity, and other parameters, I have found that a loading of the order of three to four pounds per lineal inch of nozzle is typically optimum for high nap carpets. When the loading is too little, improvement of cleaning and drying will result from increasing the loading. This can readily be detected by an experienced operator. When the loading exceeds the optimum, further improvement of cleaning and drying does not result and, since the head is moved manually by common handle means, too much loading will cause difficulty in manipulating the head. Thus, notwithstanding the loading may tend to be critical, optimum loading can readily be ascertained in any particular cleaning operation, whatever the nap height, by loading until no noticeable increase in effectiveness results from further loading.

To maintain the nozzle side walls in a proper position against the carpet, a roll is provided constructed and arranged so that, when the head assembly is moved, rolling of the carpet element occurs before spraying. While the head assembly is operable without such rolling means, as well as resulting in easier manipulation it has been found that subjecting the carpet nap to pre-rolling as above provides better cleaning and drying, together with less wicking.

It is thus seen that the method includes steps of: rolling a strip of carpet, then subjecting the rolled strip to a hot spray impinging the nap at an acute angle and penetrating so as to loosen the soil rather than to embed it, then substantially simultaneously subjecting the sprayed strip to a vacuum and to pressure and heat. In the method it will be seen that the vacuum and heating operation actually occurs in three discrete steps, first a leading edge of the heated nozzle comes into contact with the wet strip to heat it, then the wet strip after this first heating is subjected to a vacuum as the nozzle passes over it, and lastly the strip, after having been subjected to a vacuum as above, is again subjected to heat and pressure from a following edge of the nozzle. Hereinafter, a phrase such as, substantially simultaneous application of heat and exposure to a vacuum, is used in a meaning to include the discrete steps above.

The method is operable when the spray impinges at other than an acute angle, but full advantage of the invention is best obtained by means of acute angle spraying, the acute angle being within limits stated later in this disclosure.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation showing a nozzle unit in a working position relative to a surface of a carpet being cleaned, a part of a side wall being broken away to show interior construction.

FIG. 2 is an elevation view of FIG. 1.

FIG. 3 is a section on 3—3 of FIG. 2.

FIG. 4 is a plan of a deck of the head unit as seen from 4—4 of FIG. 1.

FIG. 5 is a perspective of the nozzle unit as seen from 5—5 of FIG. 1, additional structure forming a head assembly according to the invention being included.

FIG. 5-A is a detail showing a jet nozzle, sectioned on line A—A of FIG. 5.

FIG. 6 is a perspective of the head assembly showing

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ancillary equipment, and means connecting the head thereto.

FIG. 7 is a detail of an outer end of a handle assembly showing electrical and fluid control means.

FIG. 8 is a diagram illustrating a jet discharge pattern, shown on sheet 3 of the drawings.

DESCRIPTION OF PREFERRED EMBODIMENTS

There follows a detail description, related to the drawings, of embodiments of the invention given by way of example—the invention not being limited to the particular examples described and illustrated.

Referring to FIGS. 1, 2, and 3 a nozzle unit indicated generally by the numeral 10 is generally hollow having a back wall 11 and substantially parallel side walls 12 and 12.1. An inner partition wall 13, best seen in FIG. 3, divides the interior of the nozzle unit into a suction chamber 14 and a cavity 15. The suction chamber is defined by the back wall 11, the partition aforesaid, and an inner end wall 16, the partition wall 13 converging towards the back wall 11 as seen in FIG. 3 to an elongated narrow suction nozzle opening 17, defined by long parallel side walls 17.1, 17.2 forming following and leading edges of the nozzle, and short end walls 17.3, 17.4. In the working position shown in FIG. 1, the walls defining the nozzle opening 17 are maintained in contact with an upper surface 18 of e.g., a carpet being cleaned. It is to be noted that the back wall 11 is substantially at right angles to the said surface in the working position.

The cavity 15 is defined by the partition wall 13, the side walls 12 and 12.1 an inner surface 19 of a deck 20, a lower wall 21, and a closure 22. The closure 22 is removably secured by obvious bolt means (not shown in FIG. 3) to outer edges of the deck 20, the lower wall 21 and the side walls 12 and 12.1, a sealing gasket 23 being provided as shown.

An electrical heating element 24 is disposed within the cavity as seen, electrical connections thereto being designated 25 and 26. The heating element is coiled in a generally rectangular shape, the coils being disposed in spaced relationship to the cavity walls as seen in FIG. 3. A cavity weight 27 indicated in FIG. 3 in broken outline for convenience of illustration, is disposed within the heating element coil, and is obviously secured in position.

Referring particularly to FIGS. 2 and 4 the lead 25 is connected to one terminal of a thermostat 28, a second terminal of which is connected to a conductor 29 of a two conductor electric cable 30, the other conductor of which is the connector 26 aforesaid. Thus, the thermostat 28, which extends into the cavity 15, serves to control the temperature therein.

A fluid inlet port 31 and a fluid outlet port 32 of the deck 20 provide for a passage of fluid, as later will be explained, into and out of the cavity 15, and a safety valve 33 is also provided communicating with the cavity. The numeral 34 indicates a suction port which, as best seen in FIG. 1 communicates with the suction chamber 14. The port 32 is a vacuum hose connection, as is later explained.

As seen in FIG. 5, a floor tool head assembly generally indicated by the numeral 40 includes the nozzle unit 10, to the opposite side walls of which are secured outwardly extending members 41 and 42. A roller 43 is rotatable of a shaft 43.1 of adjustable securing means 44 at outer ends of the said brackets. The adjustment means 44 are obviously constructed and arranged so that when the roller is in contact with the surface of the carpet being cleaned, the nozzle unit 10 assumes the position indicated in FIG. 1.

A jet tube 45 nozzle opening, is adjustably secured by means 46 at inner ends of the brackets 41, 42, and the jet tube has a plurality of jet outlet nozzles 47 each having opening 48. The jet outlet nozzles are shown uniformly spaced from one another in a staggered arrangement as seen in FIG. 5, nozzles 47 being aligned in spaced relationship to an aligned row of nozzles 47.1 as shown.

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Each of the jet outlet nozzles 47, 47.1 has a central nozzle element as seen in section in FIG. 5-A. A jet element 47.2 as shown in section in FIG. 5-A has a front wall 47.3, a deep groove 47.4, rectangular in section, extends about half the depth of the unit. The opening 48 is disposed central of the groove extending from a bottom wall thereof through an inner wall 47.6, the unit being threaded as seen at 47.7 to be screwed into a threaded opening of each jet outlet nozzle. The longitudinal slots 47.4 of each jet outlet nozzle can be aligned, or can be misaligned as seen at 47.41 which misalignment will, as later be described, result in change in spray distribution.

The jet tube 45 has an inlet port 49 to accept a hose 50 connecting the said inlet port to the fluid outlet port 32.

FIG. 6 is a perspective showing the floor tool head assembly 40 and a handle assembly 51, the floor tool assembly and handle being shown in working position operatively connected to ancillary equipment indicated generally by the numeral 52.

The handle assembly has spaced side members 53 rotatably mounted, as seen at 54 and 55, at outer ends of the brackets 41 and 42. Known means can be provided selectively to lock the handle at one of several alternate positions. A vacuum hose 56 is shown extending from the vacuum hose connection 34 to the ancillary equipment, and a fluid supply hose 57 extends from the fluid inlet port 31 (FIG. 2) to the equipment 52, a fluid control valve 58 being provided to control flow of fluid. As seen in FIG. 7 only, the valve 58 has a control lever 59 placed in a position so as to be in convenient reach of a hand of an operator. A switch 60 is also provided in the cable 30.

The ancillary equipment 52 does not form a part of the present invention, and is therefore not described in detail. The particular ancillary equipment shown in FIG. 6 by way of example, includes a vacuum pump to which an end of the vacuum hose 56 remote from the head vacuum hose connection 34 is connected. The fluid supply hose 57 has an end remote from the head connected to a fluid tank supplying fluid to the cavity 15 (FIG. 1).

OPERATION

The following description refers particularly to FIGS. 6, 7, and 8, the whole apparatus being connected as shown in FIG. 6. Upon the valve 58 being opened, fluid under pressure will pass through the fluid supply hose 57 to enter the cavity of the nozzle unit, there to be heated to a temperature according to the setting of the thermostat 28 (FIG. 2) which setting is suitably 250° F. The heated fluid will be forced out through the jet outlet nozzles 47, 47.1 (FIG. 5) to be discharged against the surface 18 as a spray having an approximate length equal to that of the elongated nozzle opening 17. The cavity heating element will not only heat the fluid therein but also will heat particularly the walls defining the nozzle opening.

The thermostat setting being above boiling point, after initial heating the discharge will be steam and water droplets. Pressure in the cavity does not exceed fluid supply pressure, which however is maintained by the ancillary equipment to be sufficient for adequate forceful discharge through the jets. The temperature of the fluid in the cavity will, naturally, be its boiling point under the particular conditions. With the cavity dry, temperature of the assembly is controlled by the thermostat setting.

The cavity heater heats not only the fluid in the cavity but also heats the nozzle unit 10, the said unit being preferably of a metal having a high thermal conductivity, e.g. aluminum.

In cleaning for example a carpet, the floor tool assembly 40 is pulled by the handle 51 in a direction indicated by an arrow 61. Referring to FIG. 8, a long thin spray 62 will be discharged against the surface 18 to impinge upon an area element indicated by the numeral 63, which area has a length about equal to the length of the elongated nozzle opening 17, and a width according to the thick-

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ness of the spray 62. As the unit 10 moves in the direction of the arrow 61, it is seen that the nozzle 17 will reach the position 63 so that moisture and dirt will be sucked upwards through the nozzle opening 17 as indicated by arrows 65, the numeral 66 designating nap of the carpet, the carpet base or backing being indicated at 64.

The jet tube 45 is, as has been explained with reference to FIG. 5, adjustably spaced from the nozzle opening 17, so that the jets 47, 47.1, FIG. 8, are spaced from the nozzle opening and as shown are oriented to direct the spray discharge 62 toward the nozzle opening to impinge the surface 18 at an acute angle, suitably 20° to 40°. Thus, rather than driving embedded soil downward through the nap 66 towards the carpet base 64 as would be the case with a vertically impinging spray, acute impingement tends to loosen and dislodge embedded dirt and soil. There is further action with spaced jet rows giving two strikes of hot sprayed solution, the second strike appearing to lift the first strike so assisting in removal of dirt and moisture laden soil. Thus moisture, loose dirt, and dirt and soil in suspension, will be sucked from the nap 66 through the nozzle opening 17 passing through, see now FIG. 6, the vacuum hose 56 to discharge into a discharge tank of the ancillary equipment 52. The cleaning action is effected by passage of the fluid sprayed on the surface through the nap 66, and as well by suction.

In addition to the cleaning action, drying action is effected, first by sucking out the moisture as explained above, and secondly by heat from the nozzle. The nozzle opening width can suitably be a quarter of an inch, the nozzle side walls 17.1, 17.2 have wide lips as seen in FIG. 1, to enhance drying. In this way it has been found that the nap, while it may not be dry, is more nearly dry than after cleaning with comparable apparatus of the prior art. It is clear that if further drying is required, this can be accomplished by a second passage of the floor tool, this time with the fluid valve 58 closed, when additional drying would be effected by suction and by heat.

DESCRIPTION OF METHOD

Referring to FIG. 8, it is convenient to describe the method by considering the nozzle unit 10 and the spray 62 to be stationary, and that the carpet is moving relative to the nozzle unit and spray in a direction opposite to that indicated by the arrow 61, the relative motions being the same.

It is thus seen that the area element or strip of carpet 63 is first subjected to a spray of hot cleaning solution droplets and steam under pressure. Next, the hot solution penetrates the nap by the force of the jet, aided by a capillary effect and gravity. This penetration continues until a following edge 17.2 reaches the nozzle 17 when the strip is substantially simultaneously subject to a downward pressure as indicated by an arrow W, FIG. 8, to a vacuum and also to heat from the nozzle unit 10. As before explained, there are discrete actions of heating and vacuum, which are described as being substantially simultaneous. This action takes place when the strip 63 has moved to a position 63.1 beneath the nozzle opening 17. As the motion continues, the strip 63 reaches a position 63.2 clear of the nozzle unit 10. While the process is continuous cleaning a swath, considering an individual unit strip 63 it is seen that the method steps are successive.

In the description related to FIG. 3, mention was made to a weight 27 within the cavity 15. An additional weight 27.1 FIG. 3 can also be used, this weight being disposed above the nozzle 17 as shown. Additionally, an auxiliary weight 27.3 shown in FIG. 6 only can be added, the weight being disposed as shown, thus the weight W FIG. 8 is the weight of the floor tool assembly, plus the weight 27, plus the weight 27.1, together with the weight of the auxiliary weight 27.2. The magnitude W is important, since it affects seal of the nozzle opening against the nap, and heat transfer. It is found that W

should be, typically, about 3 or 4 pounds/lineal inch of nozzle when high nap materials are being cleaned. Lower unit loading is used with lower nap materials.

Optimum weight varies with the kind of carpet, temperature, humidity, and other factors. In practice, it is a simple matter for an experienced operator to tell whether he needs more or less weight. If the weight is too small, drying and cleaning are impaired. If it is too great, movement is difficult. The optimum weight is that beyond which increase does not materially increase cleaning and drying effectiveness. Thus the optimum weight is best ascertained and specifically defined as above, rather than in terms of unit load.

As is well-known in the trade, particularly in cleaning carpets of some kinds, wicking is a problem—the adverse effects of wicking being well-known both to the trade and to householders who have had carpets cleaned by in-situ methods. These effects are also troublesome in commercial cleaning establishments. Using a method according to the present invention, it is found that wicking, and the adverse effects thereof are materially, reduced.

DESCRIPTION OF FIG. 5-A

Reference is now made to FIG. 5-A, when all the grooves 47.2 are aligned, the width of the sprayed strip is as narrow as can be attained with the particular jet nozzle in use and the particular nozzle configuration.

It will be seen that fluid under pressure forced outwards through the opening 48 would, if unimpeded, form a conical discharge. Side walls of the deep groove confine the discharge from a single jet to a fan-like pattern so that the multiple discharge (62 FIG. 8) is long and narrow. The width can be increased by skewing the nozzle unit slots, in FIG. 5 the slot 47.41 is skewed to illustrate this adjustment means.

The fluid used is commonly water, with an added cleaning agent suited for the particular material being cleaned. The water may, or may not, be heated before entering the head cavity. Sophisticated equipment illustrated in FIG. 6 and designated by the numeral 52 is not necessary. Cold, or preferably hot, water with the cleaning agent being added by means of any common mixer device readily available, may be used.

The vacuum source can be a common vacuum producing device of adequate capacity, of the type known in the trade as wet, i.e. adapted for wet evacuation as here required. While it is convenient to use a discharge tank such as shown in FIG. 6, including a de-sudsing unit, simpler equipment can be substituted. As before explained, the present invention relates to the floor unit assembly described, which is suitable for use with a common wet vacuum and solution supply means.

What is claimed as new is:

1. A method of in-situ cleaning and drying of carpets and other materials having a nap, the method including continuous operations as follows:

- (a) rolling a strip of the material,
- (b) then substantially immediately thereafter subjecting the rolled strip to a spray of hot cleansing fluid and steam under pressure, the fluid impinging and penetrating the nap so as to loosen soil in the nap,
- (c) substantially immediately thereafter subjecting the rolled strip to discrete steps, the steps being applied by an applicator having a head having spaced end

walls made from a material having high thermal conductivity, the end walls terminating at a nozzle opening, the opening having a leading edge and a following edge, the head having a heater to heat cleansing fluid passing through the head and to heat the head, the head being exposed to a vacuum source; the steps including:

- (i) placing the heated applicator in contact with the nap, so that nap instantaneously under end walls of the nozzle is subjected to heat and pressure,
- (ii) moving the applicator so that the leading edge thereof comes into contact with the sprayed strip, heat from the side walls being conducted to the nap so as to expose the strip to heat and pressure,
- (iii) continuing movement of the applicator to expose the nap recently heated by the leading edge to vacuum so as to partially remove moisture and soil from the nap,
- (iv) partially drying the strip by passing the following edge of the applicator over the strip, heat from the following edge being conducted to the nap,

the discrete steps being substantially simultaneous so that the entire strip has been subjected to heat applied under pressure, and to vacuum.

2. A method according to claim 1, the spray impinging the nap at an acute angle of between twenty and forty degrees and being directed so as to drive the loosened soil towards the vacuum source.

3. A method according to claim 1, wherein the spray is long and narrow, having parallel spaced parts so that, from the motion as aforesaid, the strip is impinged by two strikes in succession.

4. A method according to claim 1, the pressure applied being an optimum according to kind of material temperature, humidity, and other factors, the optimum being defined as a value increase beyond which does not materially improve cleaning and drying effectiveness.

5. A method according to claim 4, the pressure being between three and four pounds per lineal foot of nozzle.

6. A method according to claim 4 characterized in that the heating of the applicator is augmented by the hot cleansing fluid.

7. A method according to claim 6, and an additional step of controlling temperature of the cleansing fluid as it heats the applicator to be above that of its boiling point at atmospheric pressure, and less than 250° F.

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U.S. Cl. X.R.

8—137, 149.3