

April 8, 1969

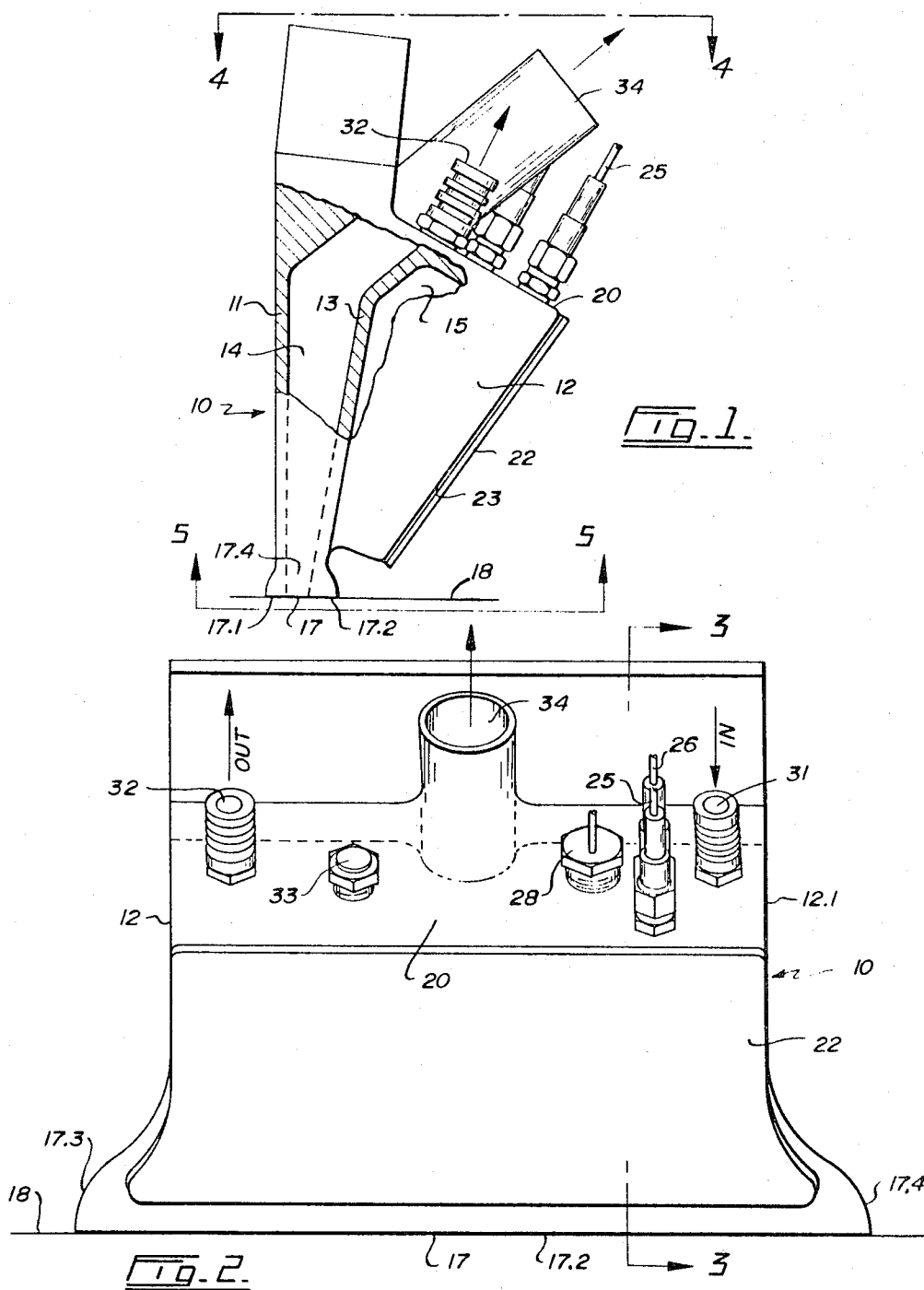
W. H. WISDOM

3,436,787

STEAM AND VACUUM NOZZLE

Filed May 16, 1967

Sheet 1 of 4



WILLIAM H. WISDOM,
Inventor

by  Agent

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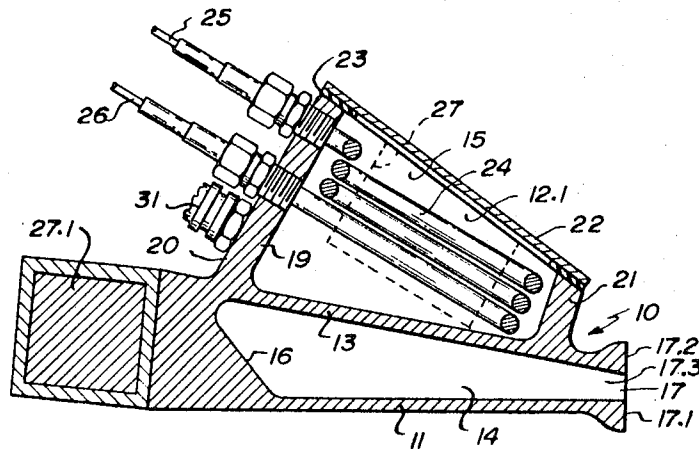


Fig. 3.

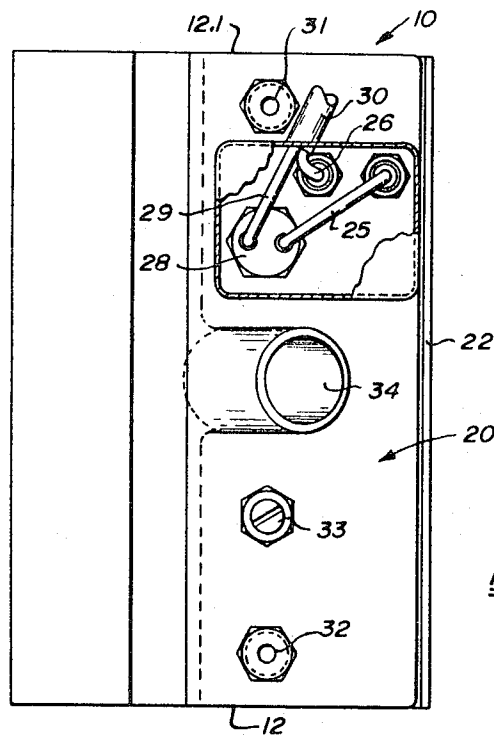


Fig. 4.

WILLIAM H. WISDOM,
Inventor

by *Cherry*
Agent

April 8, 1969

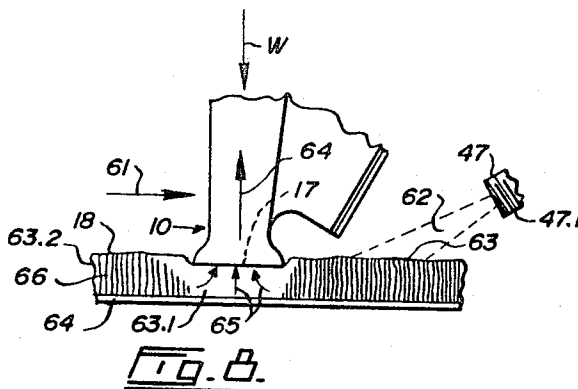
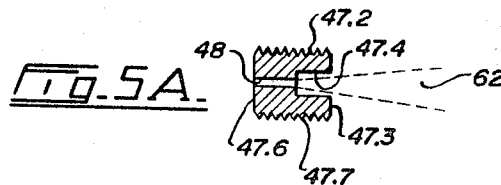
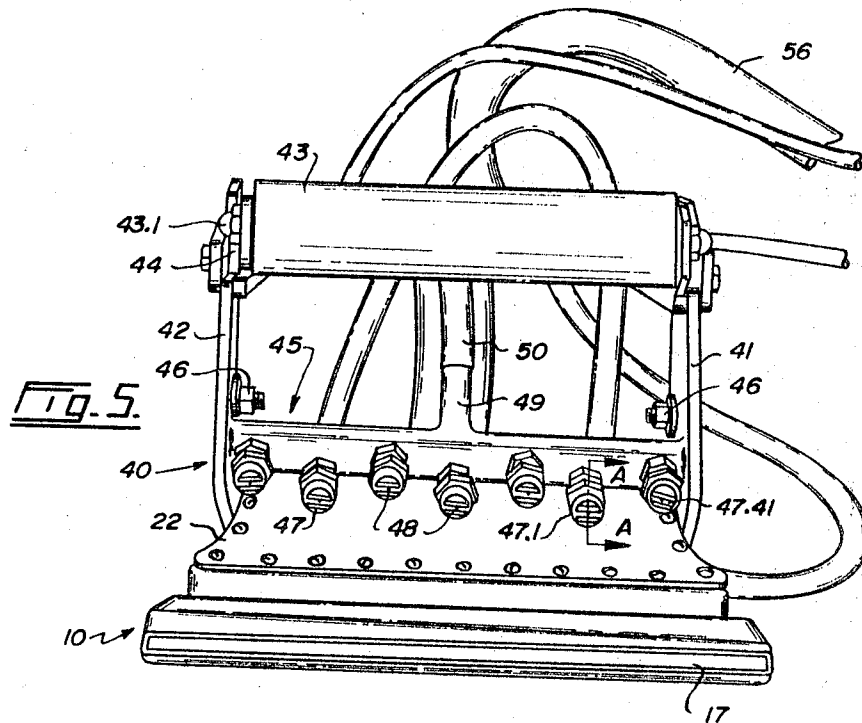
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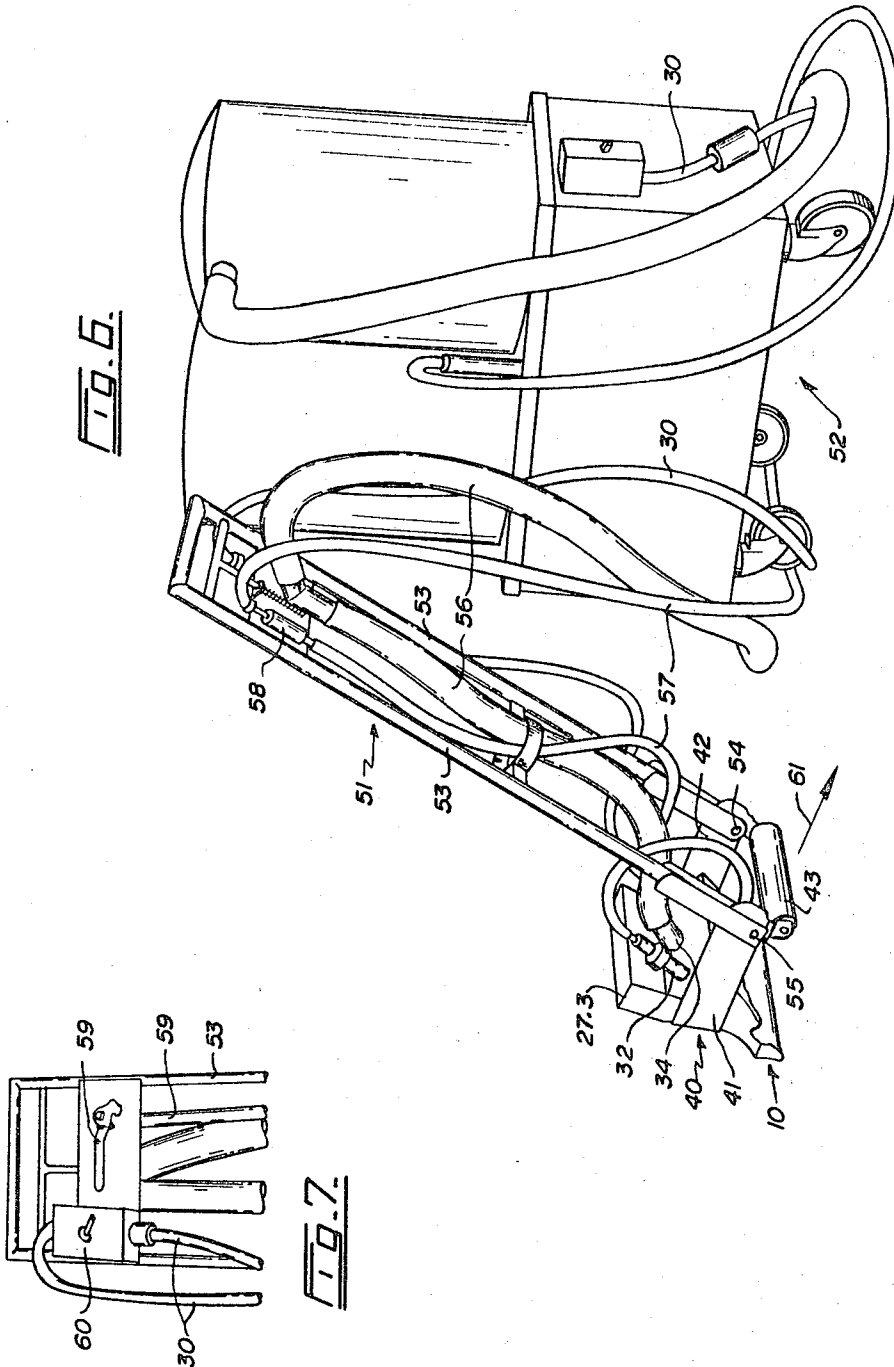
W. H. WISDOM

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Sheet 4 of 4



WILLIAM H. WISDOM,
Inventor

by *Chase*
Agent

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3,436,787

STEAM AND VACUUM NOZZLE
William H. Wisdom, 9806 Van Dyke Drive,
Dallas, Tex. 75218

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13 Claims

ABSTRACT OF THE DISCLOSURE

Cleaning head assembly to be used with a common wet vacuum and source of cleaning solution, an integral head heating and steam generating means discharging a long narrow spray of steam and solution, and a heated vacuum nozzle passing over the sprayed material.

RELATED APPLICATION

A co-pending application filed in the United States Feb. 11, 1964, Ser. No. 344,085, now abandoned, for Portable Rug Drying Machine and Method names John A. Thompson and the present applicant William H. Wisdom 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 dyed, 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.

BACKGROUND OF THE INVENTION

The present invention relates to the cleaning of rugs, carpets, and the like. U.S. Patent 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 supplying 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 Patent 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.

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 cleansing fluid under pressure.

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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 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, 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 apparatus to be employed in a fixed cleaning apparatus such as in a cleaning plant, the 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. It is preferred to use 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 fluid and steam under pressure impinging 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, so that 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 which assists 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 will vary 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 will be operable without such rolling means, as well as an obvious result of greater ease of control, it has been found that subjecting the carpet nap to pre-rolling as above provides better cleaning and drying, together with less wicking.

The apparatus 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 desirable within limits stated later in this disclosure.

DESCRIPTION OF THE DRAWINGS

FIGURE 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.

FIGURE 2 is an elevation view of FIGURE 1.

FIGURE 3 is a section on 3—3 of FIGURE 2.

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

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

FIGURE 5-A is a detail showing only a jet of a jet nozzle, sectional on line A—A of FIGURE 5.

FIGURE 6 is a perspective of the head assembly showing ancillary equipment, and means connecting the head thereto.

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

FIGURE 8 is a diagram illustrating a jet discharge pattern.

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 FIGURES 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 FIGURE 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 FIGURE 3 to an elongated narrow suction nozzle opening 17, defined by long parallel side walls 17.1, 17.2, and short end walls 17.3, 17.4. In the working position shown in FIGURE 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 FIGURE 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 desig-

nated 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 FIGURE 3. A cavity weight 27 indicated in FIGURE 3 in broken outline for convenience of illustration, is disposed within the heating element coil, and is obviously secured in position.

Referring particularly to FIGURES 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 output port 32 of the deck 20 provide for 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 FIGURE 1 communicates with the suction chamber 14.

As seen in FIGURE 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 FIGURE 1.

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

Each of the jet outlet nozzles 47, 47.1 has a central nozzle element as seen in section in FIGURE 5-A. A jet element 47.2 as shown in section in FIGURE 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.

FIGURE 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 (FIGURE 2) to the equipment 52, a fluid control valve 58 being provided to control flow of fluid. As seen in FIGURE 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 FIGURE 6 by way of example, includes a vacuum pump to which an end of the vacuum hose 56 remote from the head vac-

uum 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 (FIGURE 1).

OPERATION

The following description refers particularly to FIGURES 6, 7, and 8, the whole apparatus being connected as shown in FIGURE 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 (FIGURE 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 FIGURE 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 thickness 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 the 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 FIGURE 5, adjustably spaced from the nozzle opening 17, so that the jets 47, 47.1, FIGURE 8, are spaced from the nozzle opening and as shown are oriented to direct the spray discharge 62 towards the nozzle opening to impinge the surface 18 at an acute angle, suitably 20° to 40°. Thus, rather than driving embedded soil downwards 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 FIGURE 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 FIGURE 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 USE

Referring to FIGURE 8, it is convenient to describe the use 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 a 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 osmosis and gravity. This penetration continues until the area 63 reaches the nozzle 17 when it is substantially simultaneously subject to downward pressure as indicated by an arrow W, FIGURE 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, considering an individual unit strip 63 it is seen that the steps are successive.

In the description related to FIGURE 3, mention was made of a weight 27 within the cavity 15. An additional weight 27.1 FIGURE 3 can also be used, this weight being disposed above the nozzle 17 as shown. Additionally, an auxiliary weight 27.3 shown in FIGURE 6 only can be added, the weight being disposed as shown, thus the weight W, FIGURE 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 27.3. 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.

The actual weight will vary 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 an apparatus according to the present invention, it is found that wicking, and the adverse effects thereof, are materially reduced.

DESCRIPTION OF FIGURE 5-A

Reference is now made to FIGURE 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, FIGURE 8) is long and narrow. The width can be increased by skewing the

nozzle unit slots, in FIGURE 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 FIGURE 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 maybe convenient to use a discharge tank such as shown in FIGURE 6, including a de-sudsing unit, simpler equipment may 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.

I claim:

1. A floor tool head assembly for use with ancillary equipment including a vacuum source and a source of fluid under pressure; the head assembly including:

- (1.1) a generally hollow nozzle unit having an inner partition wall defining, with walls of the unit, a suction chamber and a cavity,
- (1.2) the suction chamber having; an elongated narrow suction nozzle opening defined by parallel side walls and end walls, the walls aforesaid being adapted to be maintained in contact with an upper surface being cleaned; and a suction port adapted for connection to a hose of the vacuum source,
- (1.3) the cavity having; a fluid inlet port adapted for connection to a hose supplying fluid under pressure from the source and a fluid outlet port; and heating means adapted to heat the nozzle unit and fluid within the cavity,
- (1.4) a jet tube having a hollow interior, the tube being secured in spaced relation to the nozzle unit, an inlet port of the jet tube being connected to the cavity fluid outlet port, a jet outlet nozzle of the jet tube being adapted to discharge the fluid to impinge upon the surface adjacent a suction nozzle side wall.

2. Structure as defined in claim 1, the jet outlet nozzle having a jet element including a front wall, a deep groove in the front wall, a bottom wall of the groove having a hole extending through the jet element communicating with the hollow interior of the jet tube, adapted to discharge a spray, formed to a fan shape by side walls of the groove aforesaid.

3. Structure as defined in claim 2, having a plurality of jet outlet nozzles including jet elements aforesaid,

adapted to discharge a long spray of small thickness generally parallel to, and in spaced relation to, a suction nozzle side wall, the spray impinging upon the surface at an acute angle thereto.

4. Structure as defined in claim 3 the jet outlet nozzles being aligned.

5. Structure as defined in claim 4, a jet element being threaded for screwing into a threaded opening of the jet nozzle, so that the groove may be adjusted to be oriented as required in relation to the suction nozzle side wall, to provide means to adjust the thickness of the long spray.

6. Structure as defined in claim 5, wherein the aligned jet outlet nozzles are disposed in spaced rows.

7. Structure as defined in claim 3, wherein the jet outlet nozzles are disposed in spaced rows.

8. Structure as defined in claim 1, having roll means secured to the nozzle unit spaced from and generally parallel to the nozzle opening side walls, the roll being adapted to maintain the side walls and end walls of the nozzle opening in contact with the material surface as aforesaid, and weight means urging the assembly against the surface.

9. Structure as defined in claim 1, having adjustable means securing the jet tube to the nozzle unit for adjustably selecting a position, and an acute angle, at which the fluid impinges as aforesaid upon the surface.

10. Structure as defined in claim 6, having adjustable means securing the jet tube to the nozzle unit for varying the spaced relation aforesaid, and for varying the acute angle of impingement from about 20° to about 40°.

11. Structure as defined in claim 1, and a weight within the cavity maintaining the suction nozzle walls in contact with the surface as aforesaid.

12. Structure as defined in claim 10, a weight within the cavity maintaining the suction nozzle walls in contact with the surface as aforesaid, the heating means being an electrical heating unit disposed within the cavity.

13. Structure as defined in claim 11, the heating means being an electrical heating unit disposed within the cavity and an auxiliary weight securable to the head assembly.

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ROBERT W. MICHELL, *Primary Examiner.*

U.S. Cl. X.R.

15—322

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,436,787

April 8, 1969

William H. Wisdom

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 16, "osmosis" should read -- capillary --.

Signed and sealed this 31st day of March 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents