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Young

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[54] **VERSATILE FLOW-THROUGH FOAM CARPET CLEANING APPARATUS**

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[52] **U.S. Cl.** **15/98,** 15/230

[51] **Int. Cl.** **A47l 11/12**

[58] **Field of Search** ..... 15/98, 50 R, 320, 230

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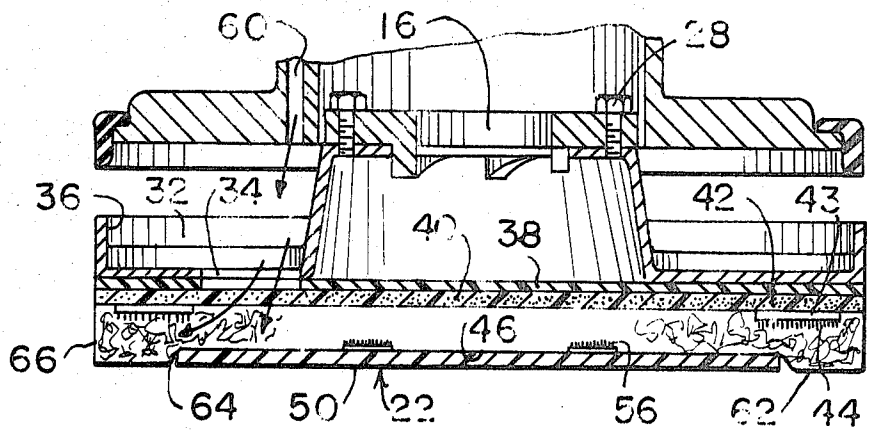
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[57] **ABSTRACT**

The versatility of flow-through carpet cleaning is greatly increased in an apparatus which provides means for passing foam-generating liquid through a driven surface working pad in combination with a smooth-faced stiff impervious pressure-plate positioned in the region below the liquid entry into the pad. The plate is in direct contact with the carpet. The pressure plate is smaller than the working pad so that the pad has a revolving margin between one edge of the plate and the corresponding edge of the pad.

5 Claims, 4 Drawing Figures



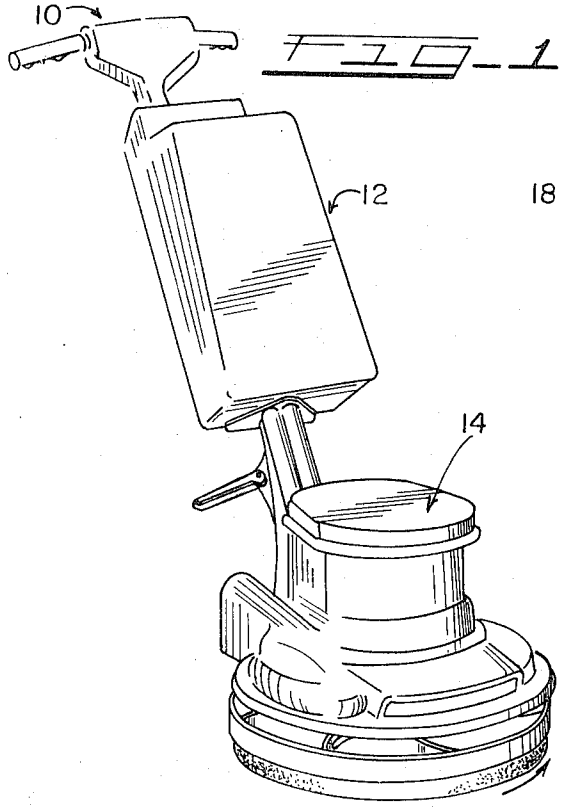


FIG. 1

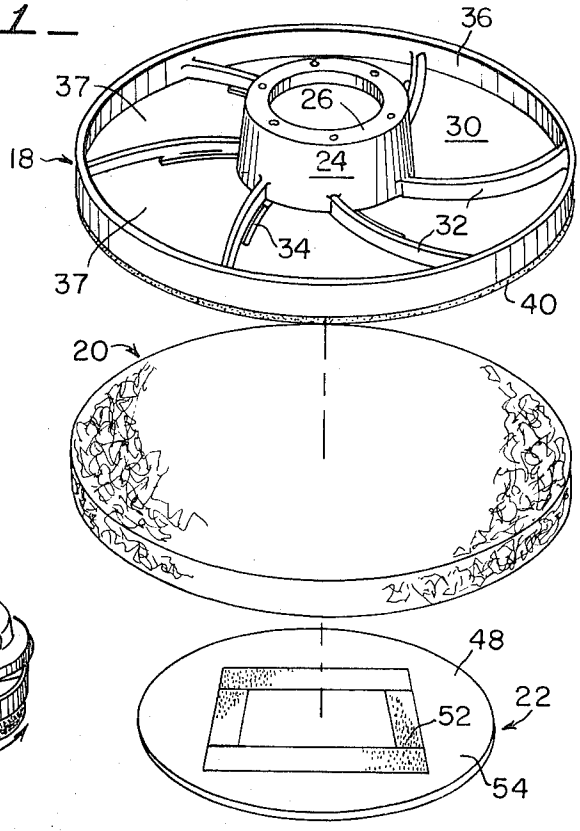


FIG. 2

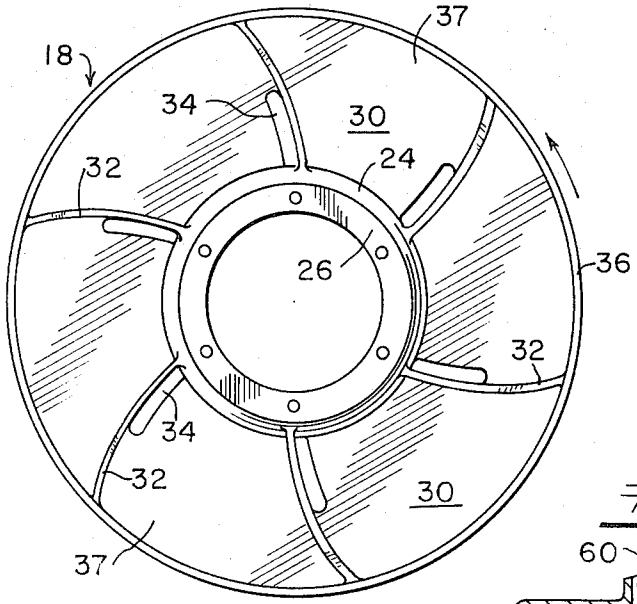
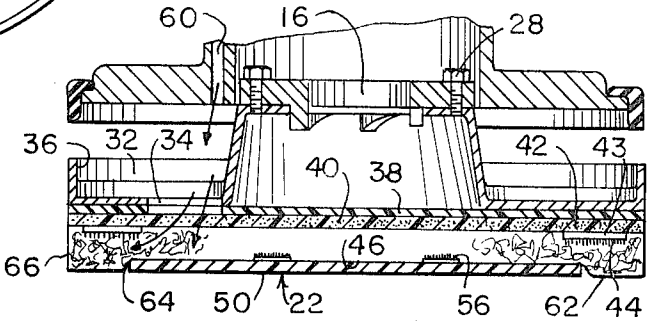


FIG. 4

FIG. 3



VERSATILE FLOW-THROUGH FOAM CARPET CLEANING APPARATUS

This invention relates to innovations and improvements in the use of rotary surface cleaning machines, and particularly any flow-through machines.

This invention greatly increases the versatility of flow-through carpet cleaning. Many proposals have been made regarding foam cleaning of carpets. For example, it has been proposed that light surface cleaning of carpets be accomplished with the use of a foam generated in an aerosol dispensing system. However, this method has many undesirable features, for example, the discharge of relatively large amounts of solvents and propellants into the atmosphere, and the relatively great expense connected with the aerosol can system. Also, many regard it as most desirable to incorporate dry cleaning type additives into the carpet or rug cleaning formulation, and it has been found to be very difficult to incorporate these additives into an aerosol formulation.

Flow-through carpet cleaning equipment has been available heretofore, but it has been impractical to attempt light surface dressing or light scrubbing with such equipment. Only relatively deep scrubbing with such machines has been practical with heretofore available equipment. A major advantage of the use of the flow-through rotary machines, for example, is the great economy of the operation of such systems since a relatively inexpensive liquid formulation of foam generating material is applied directly to the brush and carpet, and a cleansing foam is generated or developed by the action of the brush and carpet or rug.

Such deep cleaning of carpets involves wetting the carpet to such an extent that approximately 24 hours or more are required after each treatment in order to obtain practical drying of the carpet.

Another shortcoming of the flow-through carpet cleaning apparatus heretofore available has been the fact that it was possible, and in heavy scrubbing very likely, that a considerable portion of the foam-generating liquid would pass directly through the brush into the carpet being cleaned, rather than being converted into foam prior to its application into the carpet. This tends to leave a quantity of un-foamed liquid deep in the carpet or rug, in a condition in which it is difficult to remove.

It is an object of the present invention to provide an apparatus which can achieve deep cleaning, but which, moreover, can achieve light surface dressing in which only a small amount of liquid is applied, and in which only the upper or outer portion of the carpet is treated, as a result of which the carpet is dry to a practical extent in a quarter of an hour or so.

It is another object of the present invention to provide a surface working apparatus with which light scrubbing can be performed, that is, the carpet scrubbed and wetted only to such an extent that the carpet is dry, to a practical extent, within one to 2 hours.

It is another object of the present invention to provide a carpet cleaning system which has all the economic advantages of the flow-through carpet cleaning systems, and, moreover, a system which provides a uniform and controlled application of foam to the carpet while it is being cleaned.

It is another object of the present invention to provide a flow-through carpet cleaning apparatus which

prevents direct passage or short-circuiting of foam-generating liquid through the surface working element into the carpet being cleaned.

These and other objects which will be apparant hereinafter are all achieved in accordance with the present invention which is described herein with the aid of specific examples, and with the aid of the accompanying drawings in which:

FIG. 1 is a perspective view of a rotary flow-through surface cleaning machine.

FIG. 2 is an exploded perspective view of the driven surface working element in the machine shown in FIG. 1.

FIG. 3 is a fragmentary cross-sectional view of the lowermost element of the machine shown in FIG. 1.

FIG. 4 is a top view of the pad support plate shown at the top of FIG. 2.

Referring now to the figures, a floor machine is generally indicated by the numeral **10**. Floor machine **10** is of the type which is presently available but is modified in accordance with the present invention. Machine **10** includes a reservoir **12** for foam-generating liquid, and an electric power unit, generally indicated by the numeral **14** for driving a brush block **16** (FIG. 3).

A driving plate sometimes referred to as a driving disc, generally indicated by the numeral **18**, a surface working pad **20**, and a glide disc 22 (FIG. 2) are provided in accordance with the present invention and these elements are fixed with respect to each other and are secured to a conventional clutch plate which, in turn, is secured to a conventional transmission (not shown because conventional). Although glide discs, surface working pads, and driving discs have been described heretofore in my previous U.S. Pat. application Ser. No. 129,896, filed Mar. 31, 1971, and now U.S. Pat. No. 3,698,032, the glide discs **22**, surface working pads **20** and drive discs **18**, in accordance with the present invention, have a unique cooperating structural relationship with machine **10** by which all the objects of the present invention are achieved.

The driving discs **18**, in accordance with the present invention, include a central hub **24** having a flange **26** which is adapted to receive bolts **28** passing through clutch plate **16** to secure driving disc **18** to plate **16**. At the lower extreme of hub **24**, three sets of elements meet and extend radially outwardly from hub **24**: annular, flat radially outwardly extending flange **30**; arcuate vanes **32—32**; and passageways **34—34**, which are positioned at the leading edge of respective vanes **32** and extend generally radially outwardly parallel to vanes **32** from hub **24**. At the periphery of flange **30** and at the radially outward extreme of vanes **32—32**, annular rim **36** extends axially upwardly.

In the illustrated embodiment, there are six vanes **32—32** and six passageways **34—34**.

Rim **36**, vanes **32** and hub **24** provide lateral walls for six separated regions or open topped compartments **37** for which annular flange **30** constitutes the bottom. It will be appreciated from a consideration of FIGS. 2 and 4 that vanes **32** extend generally radially outwardly, but curve in a counter-clockwise direction as viewed from above as shown in FIG. 4. It is further noted that the direction of rotation of the driving disc, in the illustrated embodiment, is counter-clockwise, as indicated by the arrows in FIGS. 1 and 4. It is further noted that the passageways **34** lead the vanes **32** in the normal direction of travel of driving disc **18**. Whenever the driving

mechanism in a particular embodiment drives disc **18** in a clockwise direction, a different driving disc **18** would be provided since vanes **32** should curve ahead in the clockwise direction as they extend radially outwardly, and passageways **34** should be on the opposite side of the vanes from that illustrated in FIG. **4,** namely, along the leading edge of vanes **32** as they move in the operating (clockwise) direction.

Driving disc **18** is preferably an integral element cast from metal, or molded from plastic, but assemblies can be used.

Separate elements which are firmly secured to driving disc **18** are the circular, impervious, stiff plastic sheet **38** and circular, flexible element **40,** and a plurality of facing pieces **42.** Thus, stiff plastic sheet **38** can be secured to the underside of driving disc **18** by means of conventional contact adhesive and the flexible element **40** is adhered to the lower face of sheet **38** by adhesive or other conventional bonding material. Flexible element **40** provides a layer of spongy or resilient material of appreciable thickness, e.g. ⅜ inch to ¾ inch, and sponge rubber serves very well as the spongy or resilient layer **40.** Other resilient or spongy materials could be used, such as various foams of standard plastic materials which are commercially available. Preferably, the exposed surface of spongy layer **40** offers considerable friction, so that with the weight of the floor machine on it, layer **40** serves to grip and help to drive the floor pad **20.**

Circular plastic sheet **38** and flexible element **40** are identically perforated with passageways **34—34** being aligned to provide a continuous channel from the upper surface of flange **30** through flange **30,** circular plastic sheet **38,** and flexible element **40.**

To the exposed or lower surface of resilient layer **40,** a pattern of flexible facing material **42** is situated, preferably radially outwardly of passageways **34.** These flexible identical facing pieces **42** are formed so that the exposed surfaces thereof provide a multitude of projecting tiny resilient surface loops or hook elements **44.** Flexible facing strips, tape or other materials of this type are commercially available in various forms under the proprietary name "VELCRO." Various forms of such flexible facing materials and techniques for producing the same are disclosed in U.S. Pats. Nos. 2,717,437; 3,009,235; 3,083,737; 3,114,959; 3,138,026; 3,147,528; and 3,154,837. The protruding hooks are severed loops similar to hooks **44,** and are indicated as having a textile or fabric layer **43** from which the tiny hooks or severed loops protrude. The hooks or loops are generally arranged in rows extending transversely across the pieces of tape or facing materials **42.** The loops **44** are generally arranged in a row oriented in the same direction, each hook being out from the loop. It is highly desirable that on an overall basis, hooks or loops **44** be oriented in a plurality of directions. The pieces **42** are suitable adhered or bonded to flexible layer **40** in a permanent manner.

However, it is not essential that the filament have hooks because any adhering configuration will be satisfactory for use in accordance with this invention. For example, a facing material having extended filaments with knobs or balls at the end thereof will also serve to penetrate the open pads and to adequately engage the fibers thereof. Methods of providing knobs or balls at the tips of such filaments, e.g. as in a brush, are known and some include melting just the tips of secured filaments to form an integral bead at the tip of each filament.

The term "multitude" appears in the specification and claims with respect to the number of pad-engaging filaments. It is to be understood as signifying a number which is effective to secure or stick adjacent faces, bonded thereby, to each other with respect to forces exerted along the plane of the faces during use in carpet cleaning operations.

Other means can be employed to secure pad **20** to driving disc **18.** In FIG. **3,** a single surface working pad **20** is shown held in position by filament **44** on adhering backing member **42.** A co-patent application (Ser. No. 120,137, filed Mar. 2, 1971) by Edward G. Young and Howard W. Heggem, which application is assigned to a common assignee with this application, discloses the use of a number of working pads **20** stacked in pancake fashion, and such a stack of pads **20** is eminently satisfactory for use in accordance with the invention. Pads **20,** in the embodiment illustrated herein, are preferably nylon floor pads formed in uniform, lofty, open, nonwoven, three-dimensional web or bat material, formed of many inter-laced, randomly extending, flexible, durable, tough, resilient, bonded nylon fibers. It is to be understood, however, that pads **20** can be of the type referred to in the early part of the specification, and can be specifically fabricated to provide varying degrees of harshness for scrubbing operations.

Single surface working pad **20** is directly adhered to facing material **40** and is held in place by a loop or hook-shaped filament **44.** The tiny loop or hook-shaped or other-shaped adhering filament penetrates into the open lofty structure of floor pad **20** to serve to hook under, or otherwise adhere to, one or more of the various random interlaced fibers or filaments. The action of these filamentary hooks has been likened to that of a Burdock burr clinging to fabrics or animal fur or hair. The total force required to detach or shift a floor pad all at once in an axial direction from multitudinal hooks provided by facing material **40** or to slide pad **20** in a direction which is parallel to the face of the facing material **42** would be considerable. Nonetheless, it is possible to readily peel a floor pad **20** from one of the driving discs **18** simply by starting at one edge and gently peeling it therefrom, just as a piece of adhesive tape is peeled off, or removed from the skin.

In accordance with the preferred embodiment of this invention, a pressure plate generally indicated at **22** (see FIGS. **2** and **3**) is placed over the middle of the lower face **46** of the surface working pad **20** as indicated in FIGS. **2** and **3.** Pressure plate **22** includes a relatively thin rigid main body portion **48** having a smooth non-adhering lower face **50,** and a plurality of patches of facing material **52** permanently adhered to its upper face **54.** Patches of facing material **52** (e.g. "VELCRO" tape) can be substantially identical to facing material **42** described hereinbefore. In the illustrated preferred embodiment, facing material **52** is provided in the form of elongated strips permanently adhering to upper surface **54** of pressure-plate **22,** also referred to herein as glide-disc **22.** The action of hooks **56** facing material **52** is substantially identical to the action of hooks **44** on facing material **52** as described hereinbefore.

When the terms "upper" and "lower" are used in this specification, they are intended to refer to the relative

position of an element when machine 10 is in normal operating position, as shown in FIG. 1.

When the term "stiff" is used herein to describe pressure plate 22, it is intended to mean that plate 22 cannot be bent or folded by forces encountered in its use. Sheets of tough material which can be readily deformed are not suitable for use in accordance with this invention for pressure plate 22. However, plastic disc element 38 need not be as stiff as element 22 in view of the fact that it is bonded to rigid driving disc 18. The lower surface 50 of pressure plate 22 is smooth, hard, and non-adhering. Pressure plate 50 can be made of any stiff, smooth, abrasion-resistant material, e.g. a sheet of vinyl or nylon ⅛ inch thick. Also, this material is a preferred material for use as a plastic circular element 38. Composition board, metal, e.g. aluminum, plastics, or other materials and laminates, can be used to manufacture pressure plate 22 and plate 38, provided the main body of these elements, e.g. body portion 48 of pressure plate 22, is stiff as defined herein.

To continue in the description of the cooperative arrangement of the various elements of the floor machine 10 in accordance with the present invention, foam-generating fluid is conveyed from reservoir 12 through conduit 60 to release the foam-generating liquid at a controlled rate onto driving disc 18 (see FIG. 3). The rim 36 prevents liquid from being thrown off upper surface of flange 30 radially due to centrifugal force, and the generally curved configuration of vanes 32 urge the liquid radially inwardly to downwardly extending channels 34. It is essential, in accordance with the present invention, that the channels 34 be situated entirely axially above pressure plate 22 (see FIG. 3).

Foam-generating liquid is thus discharged through passageways 34—34 into surface working pad 20 in a plurality of regions which are axially upwards of pressure plate 22. Thus, it is impossible for foam-generating liquid to pass directly through the open structure of pad 20 onto a carpet or rug (not shown). When floor machine 10 is in operation, the surface working pad is subjected to a great deal of compression, vibrational action, flexing action, twisting action, and this working of the fibers of the open pad efficiently converts the foam-generating liquid into a cleansing foam. The continued generation of foam within surface working pad 22, and the centrifugal forces exerted due to the ration of the pad 20 urges the foam radially outwardly from the region of pressure plate 22. Also, channels 34—34 serve as air inlets, further facilitating the generation and radially outward flow of the cleansing foam. This radially outward flow of foam continuously flushes the surface working pad 20 to clean it while in operation.

Thus, instead of foam-generating liquid directly contacting a carpet, and instead of requiring that the foam-generating liquid be converted into a foam or otherwise be removed after it is deeply embedded within the carpet, substantially all of the foam-generating liquid, in accordance with the present invention, is first converted into a cleansing foam, and substantially only the foam is applied in an extremely controlled and uniform manner to the carpet, and is worked within and into the carpet, in the form of foam, by the action of the floor machine.

For example, in a preferred use of the floor machine of the present invention, the machine is moved back and forth transversely of a general line of a swath being cleaned, while the foam is automatically generated, applied, and worked in.

In its broadest concept, this invention comprises releasing, while the floor machine is in operation, foam-generating liquid into a surface working pad formed of open non-woven three-dimensional web material at a point above a thin, smooth-faced, stiff pressure plate adhered to the lower surface of the working pad in face-to-face relationship, wherein the surface working pad blocks the passage of the foam-generating liquid though the surface working pad into the carpet, and wherein the relative dimensions of the surface working pad and pressure plate leaves a margin of the pad exposed at the periphery for engaging the carpet or rug surface.

There are several variables that can be used to get the different types of adjustment and action. One is the overhang, that is, the width of the annular margin 62 between the edge 64 of pressure plate 22 and the edge 66 of surface working pad 20. A second variable, of course, is the type of pad 20. As indicated above, pads 20 are available in a variety of thicknesses, and with a variety of adhesion characteristics. A third variable is the thickness of pressure plate 22. In this connection, if a thicker pressure plate 22 is used, it still penetrates slightly into pad 20 (see FIG. 3) forcing a portion of pad 20 around edge 64 of pressure plate 22 as suggested in FIG. 3. In this connection, it is noted that, for a given nylon pad, pressure plate 22 penetrates slightly into the pad 20 the same distance even if pressure plate 22 is relatively thick. However, when pressure plate 22 is thicker, it tends to lift the annular margin 62 somewhat off the carpet or rug, thereby providing a somewhat more gentle action. A fourth variable is the rate at which the foam-generating liquid is released into the surface working pad 22. Conventional surface working machines of the flow-through type have flow-regulating means by which the relative rate of flow of liquid can be at least approximately controlled. However, it has been heretofore impossible to uniformly distribute the foam-generating material in the form of foam, only, on the carpet. However, in accordance with the present invention, even though the liquid flow cannot be precisely controlled or metered by conventional equipment, the relatively crude flow-control is more than sufficient for controlled uniform application of foam, as a consequence of the cooperation of the elements of the present invention, for example, to enable an operator to perform either light surface dressing, light scrubbing or deep cleaning with the same operation.

By adjusting the flow-control mechanism (not shown because conventional) to a relatively low rate, the flow-generating liquid is discharged through conduit 60 onto all of the regions 37—37, even though the liquid may tend to surge or pulse from conduit 60. The fact that the liquid first encounters a relatively large upper surface of flange 30, and is required to move along the upper surface of flange 30 to passageways 34—34, virtually eliminates any pulsing and surging and provides a relatively smooth and even flow of the liquid through the passageways 34—34, in spite of the pulsing or surging from conduit 60. Moreover, the foam-generating liquid is discharged at a plurality of spaced-apart points into surface working pad 20 (in illustrated embodiment) into six separated regions.

Under relatively slow-flow conditions, only a small amount of foam is generated, and the operator can use

the surface working machine **10** for the purpose of light surface dressing of carpets, rugs and the like, in which only the upper or outer portion of the carpet is treated and in which the carpet is dry, to a practical extent, in a quarter of an hour or so.

By adjusting the liquid-flow to an increased rate, light scrubbing can be performed in which the carpet is dry within 1 to 2 hours.

At relatively high foam-generating flow, deep cleaning of the carpet is practical, and the foam is worked heavily into the carpet to such an extent that approximately 24 hours or more are required after the treatment in order to obtain practical drying of the carpet.

It is also noted that as the janitor works over a wide-ranging working area with the surface working machine modified in accordance with the present invention, he can carry one or more pressure plates **22** with him for instantaneous conversion of the machine for cleaning carpets. When he encounters a piece of carpet or rug that needs cleaning, he simply tips the cleaning disc **18** and pad **20** away from the floor (not shown) and places pressure plate **22** centrally over the exposed surface of pad **20** as shown in FIG. **3.** When the working face **50** of pressure plate **22** and margin **62** of the pad are lowered to position on carpeting, the driving disc **18** and the attached element rotate, or otherwise move with disc **18.**

The present invention can be used for cleaning any type of carpet or rug ranging from indoor-outdoor carpets, which are in the nature of a felt, to shag rugs, etc. When cleaning a badly soiled indoor-outdoor carpet, it may be necessary to use a relatively more abrasive floor pad, e.g. the "stripper" type floor pad, and controlling the amount of foam provides even greater "fine-tuning" of the operation in accordance with the cleaning requirements. However, for most carpets or rugs, the floor pad of the "buffer" type is preferred for use in accordance with the present invention.

When it is desired that the carpet cleaning apparatus **10** of this invention be converted back to the conventional surface working condition, the user merely tips the disc **18** back away from the floor (not shown) to expose pressure plate **22,** and the operator engages a portion of the edge **64** of pressure plate **22** and peels pressure plate **22** away from the exposed lowermost surface **46** of the surface working pad **22.** The machine **10** is operated in a similar manner on a hard surface with pad **20** alone.

Also, although the floor pad **20** in the illustrated embodiment is circular, and although the equipment described hereinbefore is of the type which rotates the surface working pad **20,** the invention is not limited to the use of circular pads and circular pressure plates or to the use of rotating equipment. In general, a pressure plate **22** will have the same general shape of the surface working pad **20** to which it is adhered, except that the dimensioning of the relatively smaller pressure plate is such that a peripheral margin **62** extends beyond pressure plate **22.** Thus, surface working pad **20** and pressure plate **22** can be circular, square, rectangular, etc. However, for use in equipment in which the surface working pad is rotated, circular pressure plates **22** are preferred. Nonetheless, for use of square or rectangular surface working pads **20** and pressure plates **22,** in accordance with this invention, oscillating or vibratory equipment can be employed.

Although a continuous peripheral margin **62** is indicated in the illustrated embodiment, it is not essential that margin **62** be continuous in all embodiments of this invention. For example, it is contemplated that in combinations of this invention which utilize oscillating or vibrating equipment, and square or rectangular surface working pads, pads **20** and pressure plate **22** are square or rectangular. It is contemplated that some embodiments will utilize rectangular pressure plate **22** which extends completely across a square or rectangular surface working pad **20** so that a margin **62** is provided only at the front and rear edges of the surface working pad. In all preferred embodiments, however, an edge of the pressure plate **22** will be parallel to its associated edge of pad **20.**

Hence, in accordance with the present invention, the versatility of flow-through surfaces involving machines is greatly increased, permitting surface dressing, light scrubbing, and deep cleaning with the same equipment. Moreover, the flooding of liquid through the surface working element and into the carpet or rug is substantially eliminated, and the liquid is converted into a cleansing foam before it is applied to the carpet or rug.

I claim:

1. In an apparatus for cleaning carpets and rugs comprising: a relatively stiff backing member, a surface working pad formed of open non-woven three-dimensional web material fixed with respect to said backing member, and a smooth-faced, thin, stiff pressure plate secured to the lower surface of said surface working pad wherein the relative dimensioning of the surface working pad and the pressure plate provides a peripheral margin of the pad around the pressure plate; the improvement comprising: means for releasing foam-generating liquid into said surface working pad in a region axially above said pressure plate.

2. The apparatus of claim **1** wherein said means for releasing includes means for releasing said liquid in a plurality of said regions.

3. For use in a surface working machine in which the weight of the machine is utilized to apply pressure on a surface working element which is moved by the machine, and in which the machine includes means for releasing a foam-generating liquid into the surface working element, the combination wherein the surface working element includes a pad in combination with a pressure plate; the pad being an open non-woven three-dimensional surface working pad positioned to contact a surface to be worked, the pressure plate being positioned between said pad and said surface, said pressure plate comprising a relatively thin, stiff, smooth-faced disc having adhering means for adhering said plate to said pad, said plate being smaller than the pad to provide a working margin between the edge of the pad and an edge of said disc, which margin contacts the material to be cleaned; and wherein said means for releasing foam-generating liquid into said surface working pad are means for releasing said surface working liquid only axially above said pressure plate.

4. In an apparatus for cleaning carpets and rugs comprising a relatively stiff backing plate, a flexible backing member adhered to the underside of said backing plate, facing material adhered to the lower face of said backing member and a surface working pad formed of an open non-woven three-dimensional web material adhering to said facing material, said facing material including a multitude of pad-engaging filaments, thereby

providing an exposed face of the surface edge of surface working pad, a pressure plate including a thin stiff body portion having an exposed smooth abrasion-free face, and having attaching means including a multitude of pad-engaging filaments for releasably connecting said pressure plate to a portion of the face of the surface working pad; wherein the dimensions of the surface working pad and the pressure plate provide a peripheral margin of said pad around the plate; the improvement comprising: means for releasing foam-generating liquid into said surface working pad in a region axially above said pressure plate.

5. In combination:

a driving plate adapted for use on a surface working machine which has a power transmission adapted to receive said driving plate and rotate said plate about a substantially vertical axis, said driving plate comprising means for securing said plate with respect to said transmission, a flat radially extending element and a plurality of generally radially extending vanes dividing the upper surface of said flat element into a series of open-topped compartments, said vanes being positioned on the bias with respect to radii extending from said axis, and extending towards the direction of rotation, each of said compartments having peripheral wall means for retaining liquid within said compartments, each of said compartments having downwardly extending discharge opening means originating adjacent respective vanes and ahead of said vanes with respect to said direction of rotation, said discharge means being means through which liquid in each of said compartments can pass through said driving plate;

means on the lower surface of said driving plate for securing a surface working pad thereto;

means for channeling said liquid passing through said openings into said surface working pad at a release zone;

a surface working pad formed of an open non-woven three-dimensional web material and secured with respect to said driving plate;

a pressure plate including a thin stiff body portion having an exposed smooth abrasion-free face and having means for releasably connecting said pressure plate to a portion of the face of the surface working pad, wherein the dimensions of the surface working pad and the pressure plate provide a peripheral surface working margin of said pad around the plate;

said release zone being entirely in a region directly above said pressure plate whereby liquid released into said zone cannot pass directly downwardly onto said surface.

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