

[54] TACKY FLOOR PAD

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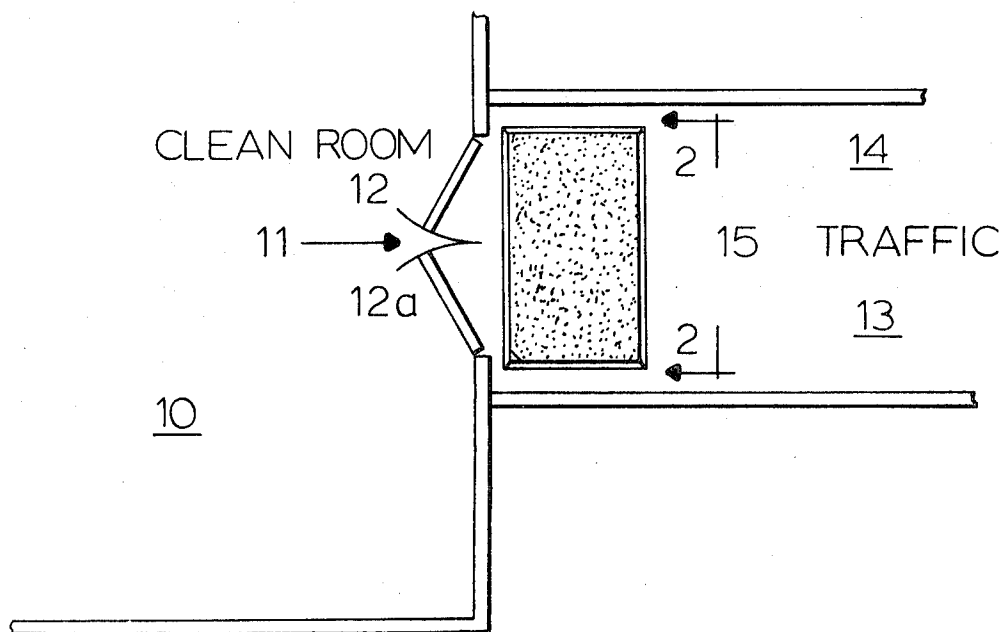
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[57]

ABSTRACT

A throw-away pad, especially for use at the entrance to a clean area but not exclusively for such use. Of multiple ply construction, it comprises a plurality of very thin poly-ethylene or polypropylene sheets, of suitable surface size and shape to receive at least a pair of shod feet. Each sheet bears a very thin coating of pressure-sensitive adhesive on its top surface. The bottom surface of the pad, that is, the bottom of the lowermost sheet thereof, also is coated with adhesive so that the pad, when in use, is removably adhered to the floor. The pressure-sensitive adhesive has a low modulus of elasticity, a high internal viscosity and high surface free energy, so that it firmly and aggressively grabs dirt from shoes of wheels passing over it, yet each sheet can be readily peeled off after use to expose a fresh adhesive surface to further traffic. The entire pad or stack is thin to present no hazard or obstacle to foot or to wheeled vehicles, e.g., to a gurney being wheeled into an operating room.

23 Claims, 5 Drawing Figures

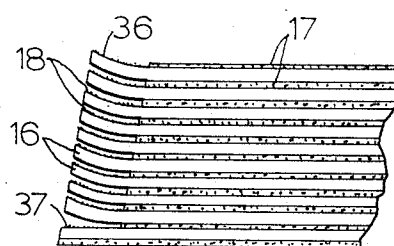
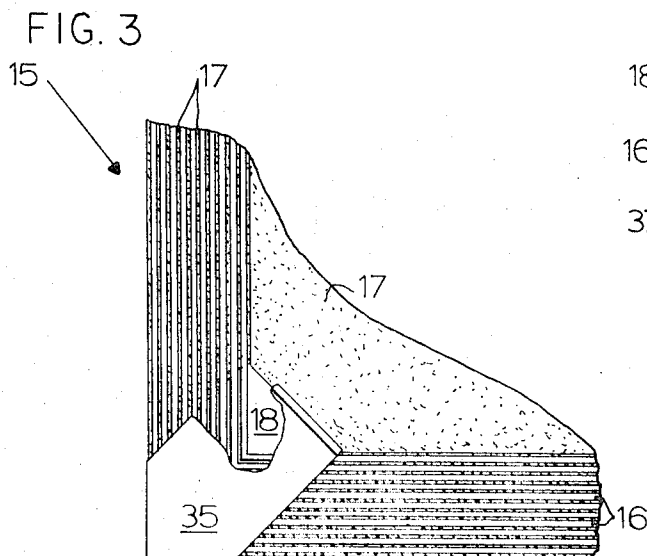
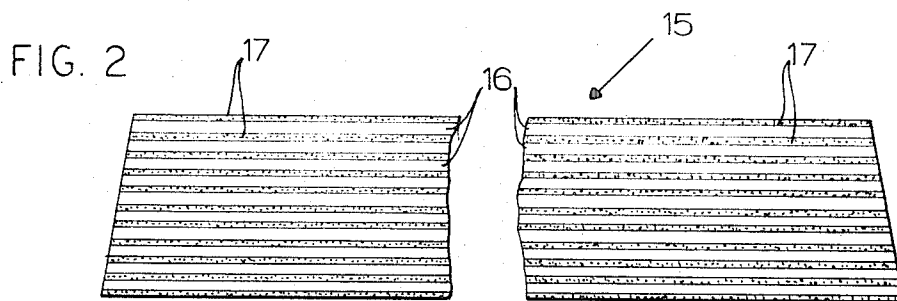
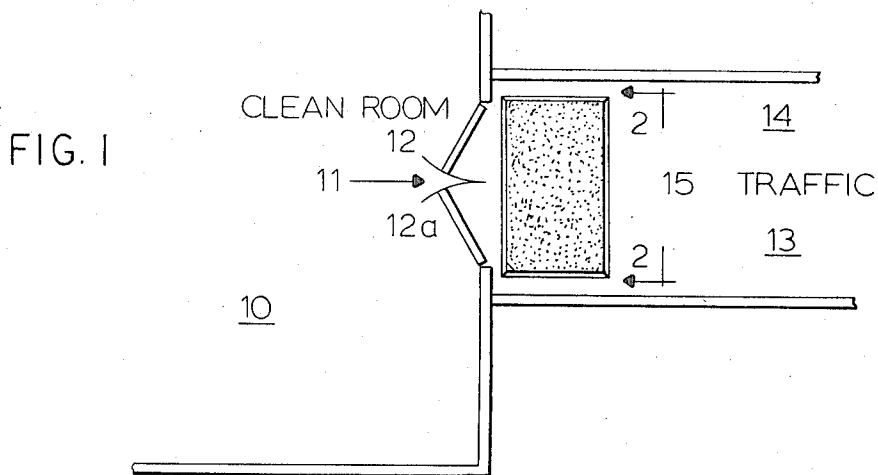


FIG. 4

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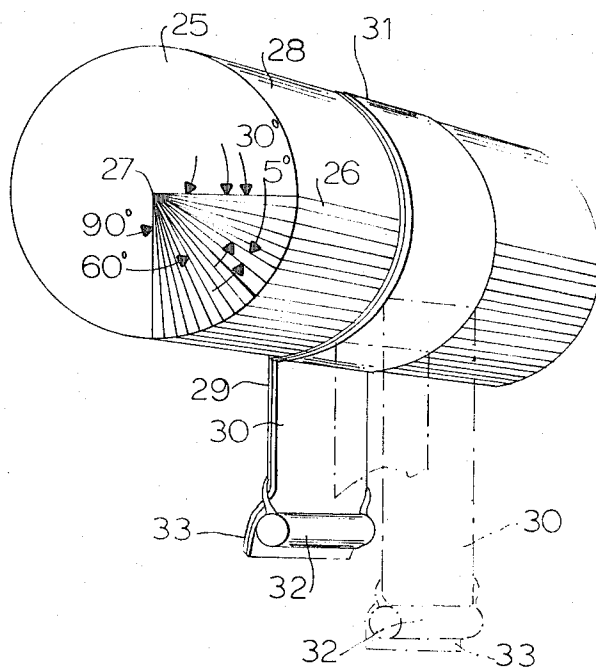


FIG. 5

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TACKY FLOOR PAD

BACKGROUND OF THE INVENTION

This invention relates to a throw-away pad of tacky- or sticky-surfaced sheets for removing dust and dirt from shoe soles, wheels and the like passing thereover, to assist in maintaining a clean area such as a hospital room or surgery in the desired clean condition. The pad or stack of sheets is adhered removably to a floor in suitable relationship to the room to be protected, and each sheet can be separately removed as used to present a fresh tacky surface for use.

With the rise of modern technology, "clean rooms" have become increasingly important. In the surgery, scrupulous cleanliness is vitally important to prevent infection. The indiscriminate use of antibiotics has caused the emergence of strains of resistant bacteria, and the unpleasant result has been that hospitals, instead of being sanctuaries of sterility, have become a source of new infections that are extremely difficult to combat. More scrupulous cleanliness is a better answer to the problem than is the continual indiscriminate use of antibiotics.

Similarly, in areas where microcircuitry and delicate space-age instruments are manufactured, one speck of dust can cause failure. Hence, techniques insuring the highest possible degree of cleanliness have received intensive study.

Two fruitful sources of dirt are shoe soles and cart wheels. Many efforts have been made to find an easy and convenient but yet effective method for removing dust and dirt from shoes, and in the case of surgeries, from the wheels of the cart on which the patient is moved about. Heretofore, such removal has been of varying degrees of efficacy — or lack of it — and of inconvenience. For example, air blast systems have not been very effective, and disinfectant wash troughs have been messy and have been impractical for cart wheels.

Various types of sticky pads have been tried heretofore, but have exhibited certain disadvantages. In our co-pending patent application, Ser. No. 47,453 filed June 18, 1970 now U.S. Pat. No. 3,717,897, there is described the construction of an inexpensive washable pad which can be made by anyone skilled in the art of coating adhesives. The cost of the pad originally is quite low, and it can be washed with water, or soapy water, to remove adhering dirt, so that its use is inexpensive. Furthermore, it can be washed repeatedly without substantially losing its effectiveness, so that the cost per fresh sticky surface is extremely low. However, as hourly wages climb ever higher and higher much effort is being expended to cut man-hours to an absolute minimum, resulting in a marked trend to one-use throw-aways, even in such items as hypodermic syringes. The pad of the present invention avoids the labor attendant upon renewing the fresh sticky surface by washing and provides such surface merely by peeling off the used sheet to expose such desired surface for contained use of the overall pad, and makes such a method economically feasible by reason of its extremely low-cost construction.

SUMMARY OF THE INVENTION

The pad of this invention employs a polyethylene or polypropylene sheet which can be walked on and wheeled over without tearing or destruction. A pressure-sensitive adhesive advantageously has been found

to remove dirt from shoes and wheels while at the same time it readily releases the polyethylene or polypropylene sheet which covers it to enable presentation of a fresh adhesive surface for use. The polyethylene or polypropylene is of such strength that very thin sheets can be used, and a very thin coating of the adhesive described can be employed, thus providing an overall pad which is sufficiently thin, even with a relatively large number of sheets, that there is substantially no obstruction to walking or to wheeling a cart over the surface of the starting pad, and, of course, even less as use and removal of sheets proceeds. The adhesive is not unpleasant to walk upon, and, on the other hand, the last sheet can be stripped from the floor without delamination or tearing when it is completely used or when the pad is to be removed for any reason.

The sheets are assembled with the intervening and exterior coatings of adhesive in a manner to provide a pad having the above advantages and other advantages that will become apparent from the description herein. When a dust-trap floor pad is designed to have a highly aggressive tack to catch and hold dirt well, and is also designed to have sufficiently low adhesion to the surface beneath in order to make it easy to remove when it has completed its service life, then a new problem arises. If a clean wheel or shoe is pressed upon it, then the possibility appears of pulling the whole sheet loose, the sheet possibly ending up wrapped around the shoe or wheel.

We have found that in the middle of the sheet the vacuum under the sheet prevents this catastrophic failure, and that such failures are initiated by a peel at the edges. Protection of the edge, therefore, prevents such failure, and we have found that if the adhesive on the under side of a sheet extends outwardly slightly further than the adhesive on the top side thereof, a peel will not be initiated. This differential can be as small as one-sixteenth inch and still be remarkably effective, and it can be as large as about one-fourth inch. One method of achieving this differential is the beveling of the completed pad, which serves to compress the pad to the floor, thereby preventing up-pull. A $\frac{5}{16}$ to $\frac{3}{8}$ inch bevel on a 10-level pad has been found to be an inexpensive but effective method of preventing lift-up or undesired removal of a sheet. The beveled edge may be dusted with a non-adhesive powder to prevent adhesion in this area. In a beveled stack-pad some provision is made to facilitate the removal of a layer when it has completed its useful life, for example, providing predetermined adhesive-free areas at an edge or corner portion of each sheet to enable grasping and pulling off of the sheet from the pad.

While any very aggressive pressure-sensitive adhesive mass based on natural or synthetic rubber may be used herein, the pressure-sensitive adhesive preferred for use herein is an acrylic latex, acrylic because of the very stable properties and long shelf life of acrylics, and latex because of the economy, safety, and convenience of latices as compared with solutions. Such latex of the proper physical properties has been found to adhere sufficiently firmly to the untreated surface of the polyethylene or polypropylene substrate so that the pad produced is stable in form for handling or shipping, but the latex releases the polyethylene or polypropylene readily when it is desired to tear away a used sheet. Acrylics, in sharp contrast to most adhesive masses, provide an almost indefinitely long shelf life to the

product with no deterioration or shift in properties, and the product exhibits relative insensitivity to heat and cold. No solvent is required to apply the latex, thus lowering the costs in manufacturing the pad, and the latex exhibits no flammability, while air pollution is avoided by its use without added solvent. Furthermore, this adhesive is effective in an extremely thin coating layer. The acrylic adhesive used herein is substantially non-reactive, i.e., of negligible further polymerization, and is of comparatively low molecular weight, for a latex, to obtain a very high surface free energy, i.e., soluble or nearly so in organic solvents such as tetrahydrofuran. A suitable acrylic latex, for example, is an emulsion polymer prepared from lower alkyl acrylates as the main monomers, having a pH of 6 to 6.5, viscosity of between 100 and 300 at a spindle/speed of 2/60, of 57 percent solids, and having a calculated glass transition temperature of -46°C . Production of such a polymer is described in Belgian Pat. No. 749,689.

In acrylics, the modulus of elasticity can be quite accurately defined in a roundabout way in terms of the "glass temperature," i.e., the temperature at which the torsional modulus is 300 kg/cm². The acrylic latex used herein should have a glass temperature of about -45°C ., or in the range of from about -30°C . to about -55°C ., so that it is very soft to enhance adhesion but is not too soft for durability. It has a high internal viscosity which is suitably measured by a method hereinafter described, to give for the present adhesive a tack angle of from 20° to 30° against a clean polyethylene surface, and an internal viscosity of several hours, advantageously from 5 to 24 hours.

Internal viscosity in a solid may be a new concept to some people, and an example may help: a vinyl garden hose has a high internal viscosity, while gum rubber has a low internal viscosity. Even though it may be "harder," a gum rubber tube suffers no harm from being run over by a car, while a vinyl garden hose (especially if old and cold) can be cracked to pieces by the same treatment, because it cannot deform quickly enough, due to its higher internal viscosity. If the rubber tube be heavy and firm, it may require more weight to flatten it than to flatten the vinyl hose; moreover, the rubber flattens partway immediately and stays there, while the vinyl slowly flattens out completely. Hence, the vinyl is considered "softer" because it flattens out further, but it is slow to do so, because it has a higher internal viscosity.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention and some modes of carrying it out will be illustrated by the following more specific description and by the annexed drawings, wherein:

FIG. 1 is a schematic view of the placement of a pad according to this invention in a corridor of a building and just outside the door or entrance to a clean room;

FIG. 2 is an enlarged view in side elevation of a pad according to this invention, showing beveled edges and adhesive-free corner surfaces at one end of the sheets to facilitate removal of a single sheet for renewal of surface; the view is broken in the middle in order to conserve space;

FIG. 3 is a partial top enlarged view of the stack or pad of FIG. 2, illustrating one means of forming the adhesive-free corner surfaces;

FIG. 4 is a partial side view of the article of FIG. 3 after corner treatment and showing a few sheets of the

pad or stack, placement of the adhesive thereon, and the freed corner edges; and

FIG. 5 is a view in perspective of a test-apparatus comprising a polished steel cylinder with scribed lines, with adhesive-coated strip on test and shown in alternative positions.

DETAILED DESCRIPTION OF THE INVENTION

As shown in FIGS. 2, 3 and 4, the pad 15 comprises a plurality of sheets 16, suitably five to fifty, of such sheets 16, each being coated with a layer 17 of acrylic latex adhesive as described herein. Each sheet 16 is very thin, being from 0.002 to 0.003 inch in thickness, and is of standard grade polyethylene or polypropylene, in either case with heavy corona discharge adhesion treatment on one surface which is readily available in commerce at no additional cost. When the treated surface is coated with the adhesive, good adhesion is obtained between the polyethylene or polypropylene and the coating. Further, by this means the required differential in adhesion between upper and lower surface is achieved, so that as a used sheet is stripped off, the adhesive mass always comes away clean from the lower surface of the used sheet, and never delaminates away from the upper surface of the new sheet beneath. The layer 17 of the pressure-sensitive adhesive is extremely thin, being from 0.00003 to 0.0003 inch, advantageously 0.0001 inch in thickness. Thus, the pad 15 containing ten such coated sheets is less than one thirty-second inch in thickness and does not present an obstacle to foot traffic or cause jarring or shock to a patient on a gurney when wheeled over such pad 15.

The bottom sheet, or all of them, may be of colored polyethylene or polypropylene, or the whole set may be transparent, or they or some of them may be imprinted with a decorative design, as desired.

Since the bottom sheet must be of sufficient strength to withstand removal without tearing from a floor whose adhesion may be greater than untreated polyethylene or polypropylene, a heavier film such as 0.004 inch is preferred.

Each sheet 16 is of polyethylene or polypropylene of the thickness described, and it is coated with a layer 17 of the acrylic adhesive over the entire upper surface of each sheet 16, except that a corner area or portion 18 is free of adhesive so that the sheet 16 can be easily grasped and stripped off after use. This is shown in exaggerated form in FIG. 4, and will be further described below. The lowermost sheet 16 has on its undersurface 22 a layer 23 of adhesive to removably affix the pad 15 to floor 14. The adhesive 23 may cover all of the underside of the lowest layer or a portion only, such as the edge portions. As shown in FIG. 1, the pad 15 or several such pads are arranged to be large enough to cover the floor area just outside of the entryway 11 so that all persons or the full perimeter of the wheels of vehicles entering the clean room 14 must pass thereover, and the adhesive layer 17 removes dust and dirt from wheels and shoes as they come into contact with such layer 17. After use, and as determined by the appearance of the top sheet, it is stripped off and a fresh surface exposed, down to the last sheet 16 of the stack 15.

We have found that the same coating may be used as the adhesive 23 which holds the pad 15 to the floor. However, since there is little control over the type of surface to which the pad 15 may be called upon to adhere, it has been found preferable to have this particu-

lar adhesive coating 23 thicker, such as a thickness of 0.0015 inch.

Internal viscosity is inconvenient to measure in terms of poises, and surface free energy is so difficult to measure in terms of ergs per square centimeter as to be impractical. Therefore, we have devised a simple empirical test to evaluate adhesives for possible use in the present invention.

FIG. 5 shows a polished steel cylinder 25, two inches in diameter, scribed with fine lines 26 parallel to the axis 27 and 5° apart over 90° of its surface 28. The cylinder 25 is mounted firmly in cantilever with the axis horizontal, in the position shown in FIG. 5. The cylinder 25 is covered with a cemented-on film of clear untreated polyethylene or polypropylene. A one mil film of the adhesive 29 under test is cast on a polyethylene terephthalate (Mylar) strip 30 of one mil thickness, which is then trimmed to a width of one inch. The polyethylene or polypropylene surface of the cylinder 25 is washed carefully with methyl ethyl ketone, and the strip 30 is placed over the scribed lines 26 and one end 31 draped over the top. The strip 30 is pressed firmly against the cylinder 25 to attain as near as possible 100 percent contact area. A 100-gram weight 32 is hung gently on the trailing end 33 and the time noted at the 90° position. The progress of the peel line is noted from time to time and it should come to a point within 5° of its final position in the times noted below. The total time allowed must be ample to ascertain that the peel line has in fact stopped moving, to insure that internal viscosity is not affecting the result. If the line is still moving after 30 hours, the formulation may be discarded as having too high an internal viscosity for a shoe-cleaning pad.

From this test, two things can be learned:

1. The stopping position of the peel line is a measure of the permanent tack of the adhesive in question against clean untreated polyethylene or polypropylene. Much experience has shown that the optimum for best all-around performance of the coatings 17 and 22 is given by an adhesive that stops at approximately 35°. Values in the range of about 15° to about 50° will give reasonable success, and very good results are obtained in a range of about 25° to about 40°.

2. The length of time from start to within 5° of finish (the finish is surprisingly definite though the high "cold flow" contributes a very slow movement of about 3° or 4° per day after the true peel motion has ceased) is a measure of the internal viscosity. The time should be in the range of 600 to 1,800 minutes, preferably from 900 to 1,500 minutes, and optimum results are generally obtained at about 1,200 minutes.

In a typical example according to this invention, a series of sheets of standard grade polyethylene having heavy corona discharge treatment on the upper surface thereon are cut to the desired size to make a pad suitable for placement before an entryway to a surgical operating room in a hospital. The polyethylene sheet material is from 0.002 to 0.003 inch in thickness. If thinner than 0.002 inch, the sheet may tear easily, and if it is thicker than 0.003 inch it is unnecessarily thick and expensive. The sheets 16 are of such size to be wide enough to span the entryway for which the pad 15 is intended and longer than a large step taken by a walking person, and will also receive the full perimeter of the wheel of such wheeled cart as may be encountered, for example, a hospital gurney. The size of the sheets may

be such that they may be used in modular fashion, and two or three or more may be placed side by side to cover wide areas. A mixture is prepared of an acrylic latex, or of latices, to arrive at the properties described above, and of a surfactant such as sodium salt of a sulfonated alkyl ester, available in commerce under the trademark Triton Gr-5, sufficient, suitably about 0.22 percent by weight of the total mixture, to effect good wetting when the mixture is coated onto the polyethylene. If desired, bacteriostats or anti-static components or both may be added. After these components are thoroughly admixed to form the desired adhesive, it is coated onto each sheet to cover the treated surface. The surface of each sheet as described is completely covered, and the sheets are stacked upon each other in the order of sheet of polyethylene - adhesive layer - sheet of polyethylene, etc. until from five to 50 of such sheets have been assembled into a stack. The bottom sheet is covered with the adhesive on its underside to cause it to adhere in place to the floor, and the assembled stack is beveled on all four sides, suitably about 1/8 to 1/4 inch for a 10-sheet stack. The procedure with polypropylene sheets is the same.

A pad of thick felt or polyurethane foam, or like absorbent material 35 is placed diagonally across a corner of pad 15. By any desired method, such as spraying, for example, the pad is wetted with a small amount of a suitable solvent for the adhesive, such as toluene, and the whole allowed to stand for several minutes, after which the pad is removed. It is then found that each sheet 16 up the stepped bevel has lifted along the corner portion 18 to a width of about one-fourth inch. Excess solvent is then blown off and talc or other suitable dry powdered, preferably mineral, solid is brushed under the lifted edges, the powder destroying the effectiveness of any adhesive which it covers.

When the pad is in place on a floor etc., as each sheet is exhausted of its dirt-grabbing property, it can be grasped by the hand or otherwise at the lifted corner to be pulled off to expose a fresh, clean adhesive surface.

The stack or pad is now ready for use and is placed before an entryway to a surgical operating room or industrial clean-room on the floor of the corridor leading thereto. After foot traffic and normal wheeled traffic have passed over the top sheet for from several hours to several days, depending on the traffic, and the adhesive has grabbed the pulled dirt and lint therefrom, the sheet is grasped by its adhesive-free edge and stripped from the stack, exposing the next adhesive surface for use.

The pad is also useful at the doors of clean rooms in hospitals or in homes or wherever dust control and cleanliness are desired.

It will be understood that the above specific description and the drawings have been given for purposes of illustration only and that variations and modifications can be made therein without departing from the spirit and scope of the appended claims.

Having now described the invention, what is claimed is:

1. A thin, throw-away cleansing pad adhesively and removably securable to a floor and adapted to form a substantially unobstructing portion of a pathway for foot or wheeled-cart traffic, comprising:

a. a plurality of sheets formed from a material selected from the group consisting of polyethylene

and polypropylene, in detachably stacked arrangement,

- b. each said sheet having an upper surface and a lower surface, the upper surface only having been corona-discharge-treated to improve adhesion thereto to an adhesive and rendering said upper surface preferentially adherent to said adhesive relative to said untreated lower surface, and
- c. a thin pressure-sensitive adhesive coating substantially covering and adhered to said upper surface of each said sheet and constituting the only material in between successive said sheets,
- d. said adhesive coating on said sheet extending further outwardly than such coating on the next higher sheet in said pad, to prevent peel and unwanted delamination from normal use.

2. The pad of claim 1 wherein said adhesive is an acrylic latex having a tack angle of from 20° to 30° and an internal viscosity of several hours, as determined by the tests described in this specification.

3. A pad as in claim 1 wherein each said sheet is from 0.002 to 0.004 inch in thickness and said adhesive coating is about 0.00003 to 0.0003 inch in thickness.

4. A pad as in claim 3 wherein said adhesive coating is about 0.0001 inch in thickness.

5. A pad as in claim 1 wherein said adhesive is an intimate admixture of an acrylic resin and a surfactant in amount sufficient to effect wetting when said admixture is coated onto a polyethylene substrate, exhibits a Young's modulus of -45° C. expressed as glass temperature; and has a tack angle of about 20° to 30° and an internal viscosity of from 5 to 24 hours as measured by the tests described herein by covering the steel cylinder described in said tests with a clean polyethylene surface, coating a polyethylene terephthalate strip with a layer of said adhesive mixture 0.001 inch thick, applying said coated strip over said polyethylene surface with 100 percent surface contact, hanging a 100 gram weight on a trailing edge of said strip to peel said strip from said surface to an equilibrium point, coming to a point within 5° of said equilibrium point within from 10 to 30 hours.

6. A pad as in claim 5 wherein said adhesive contains about 0.4 percent of said surfactant and about 99.60 percent of said acrylic resin.

7. A pad as in claim 1 wherein each said sheet has a corner area free of adhesive to enable grasping and removal of said sheet.

8. A pad as in claim 1 having beveled edges tapered inwardly by virtue of each sheet being larger in both lengthwise and widthwise dimensions than the sheet above it, the area of a lower sheet which projects beyond the sheet above being non-adhesive.

9. A pad as in claim 1 wherein each said adhesive coating extends outwardly at least one-sixteenth inch farther than the next higher coating.

10. A pad as in claim 1 wherein the lowermost sheet is coated with the same adhesive on its bottom surface in a thicker coating.

11. A clean room entryway including in combination:

- a. an entrance doorway leading into said clean room,
- b. a corridor leading to said doorway and having a floor, and
- c. an unframed pad assembly having beveled edges, for cleaning shoes and wheels disposed adhesively directly to said floor just outside said doorway and large enough to receive the full perimeter of such

wheel, and longer than a large step taken by a person walking, whereby to remove dust and dirt from wheels and shoes coming into contact therewith,

- d. said pad assembly comprising at least one stack of a plurality of sheets formed from a material selected from the group consisting of polyethylene and polypropylene, in detachably stacked arrangement, the upper surface only of each said sheet being corona-discharge treated to greatly improve adhesion, each said sheet having a thin layer of pressure-sensitive adhesive, substantially covering and adhered to said upper surface thereof and constituting the only material in between sheets, each downwardly succeeding layer of said adhesive extending outwardly farther than the next adjacent upper layer thereof to prevent peel and unwanted lamination being brought about by normal use.

12. A clean room entryway as in claim 11 wherein each said sheet is from 0.0002 to 0.004 inch in thickness and each said adhesive layer is about 0.0001 inch in thickness.

13. A clean room entryway as in claim 11 wherein said adhesive is an acrylic latex adhesive, has a Young's modulus of from about -30° C. to about -50° C. expressed as glass temperature, a tack angle of from 20° to 30° and an internal viscosity of from 10 to 30 hours when measured by tests described in this specification.

14. A clean room entryway as in claim 11 wherein said pad is adhered to said floor by the same adhesive material in a thicker layer.

15. A clean room entryway as in claim 11 wherein each said sheet has a corner portion freed of adhesive to enable grasping and lifting.

16. A clean room entryway as in claim 15 wherein each said succeeding layer of said adhesive extends at least 1/16 inch outwardly from said adjacent upper layer.

17. A clean room comprising walls, floor and ceiling defining a room, a doorway in one said wall, a hallway floor outside said doorway, and an unframed cleaning pad having beveled edges and adhesively and removably secured directly to said floor outside of said doorway and adapted to receive on its upper surface foot traffic and wheeled traffic, said pad being larger than a long step taken by a walking person and adapted to receive the full perimeter of the wheel of a wheeled cart, whereby to remove dust and dirt from wheels and shoes coming into contact therewith, said pad comprising a plurality of thin sheets formed from a material selected from the group consisting of polyethylene and polypropylene, in detachably stacked arrangement, each said sheet having a layer of pressure-sensitive adhesive substantially covering the upper face thereof, said upper face only having been corona-discharge pretreated to improve adhesion to an adhesive, each said sheet except the bottom being from 0.002 to 0.003 inch in thickness and said adhesive layer being from 0.00003 to 0.0003 inch in thickness, said pad having a thicker bottom sheet with a bottom surface and a thicker layer of adhesive disposed thereover to adhere said pad to said floor, each downwardly succeeding layer of said adhesive extending outwardly farther than the next adjacent upper layer of said adhesive in order to prevent undesired peeling upon normal use.

18. A clean room as in claim 17 wherein said first-mentioned adhesive layer is 0.001 inch in thickness.

19. A clean room as in claim 17 wherein said first mentioned adhesive has a Young's modulus of from -30°C. to -55°C. expressed as glass temperature, a tack angle of from 20° to 30° and an internal viscosity of from 10 to 30 hours when measured by tests described in this specification. 5

20. A clean room as in claim 19 wherein the second-mentioned adhesive is the same as the first-mentioned adhesive.

21. A clean room as in claim 17 wherein each sheet 10 has a corner portion freed of adhesive to enable grasping and lifting.

22. A clean room as in claim 17 wherein each said succeeding layer of said adhesive extends at least one-sixteenth inch outwardly from said adjacent upper 15 layer.

23. A thin, throw-away cleansing pad adhesively and

removably securable to a floor and adapted to form a substantially unobstructing portion of a pathway for foot or wheeled-cart traffic, comprising:

- a. a plurality of sheets formed from a material selected from the group consisting of polyethylene and polypropylene in detachably stacked arrangement, each said sheet having an upper surface and a lower surface, and
- b. a thin pressure-sensitive adhesive coating substantially covering and adhered to said upper surface of each said sheet and constituting the only material in between successive said sheets,
- c. said adhesive coating on each sheet extending further outwardly than such coating on the next higher sheet in said pad, to prevent peel and unwanted delamination from normal use.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,785,102 Dated January 15, 1974

Inventor(s) Homer C. Amos

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

Column 1, line 59, "contained" should read --continued--.

Column 1, line 60, "feasibly" should read --feasible--.

Column 2, line 11, "cours" should read --course--.

Column 6, line 57, "moficiations" should read --modifications--.

Column 7, line 13, "on said sheet" should read --on each sheet--.

Column 8, line 9, "grealy" should read --greatly--.

Signed and sealed this 6th day of August 1974.

(SEAL)

Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents