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(54) **SUBSTRATE PREPARATION TOOL SYSTEM AND METHOD**

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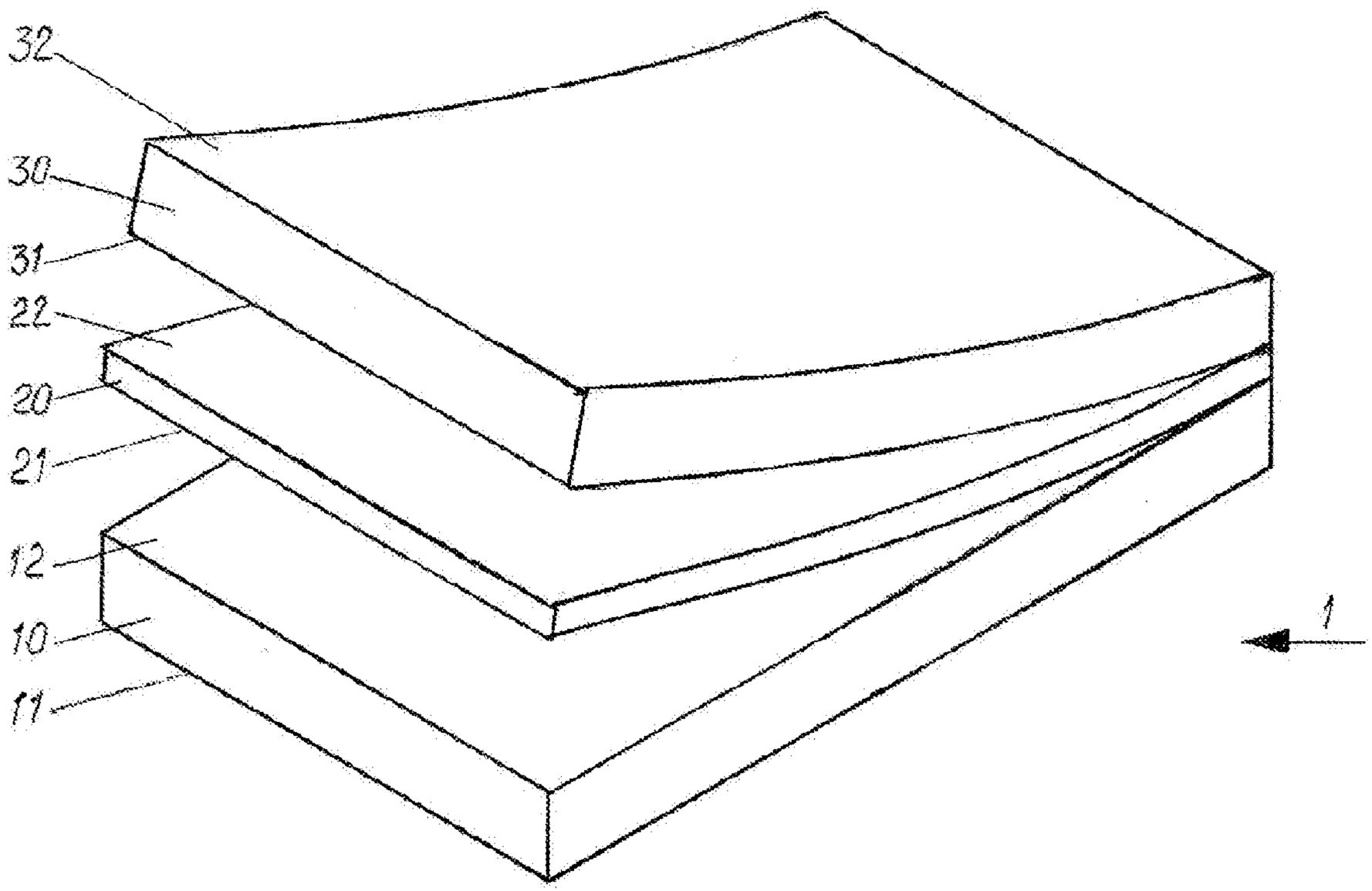
(57) **ABSTRACT**

A surface substrate preparation tool system comprised of a flexible foam member, a flexible abrasive member, and an adhesive member being affixed on one side to the foam member and on the other side to the abrasive member, wherein the foam member retains at least one liquid agent therein, and wherein a liquid agent can be delivered to the adhesive member or to the foam member during the surface preparation process.



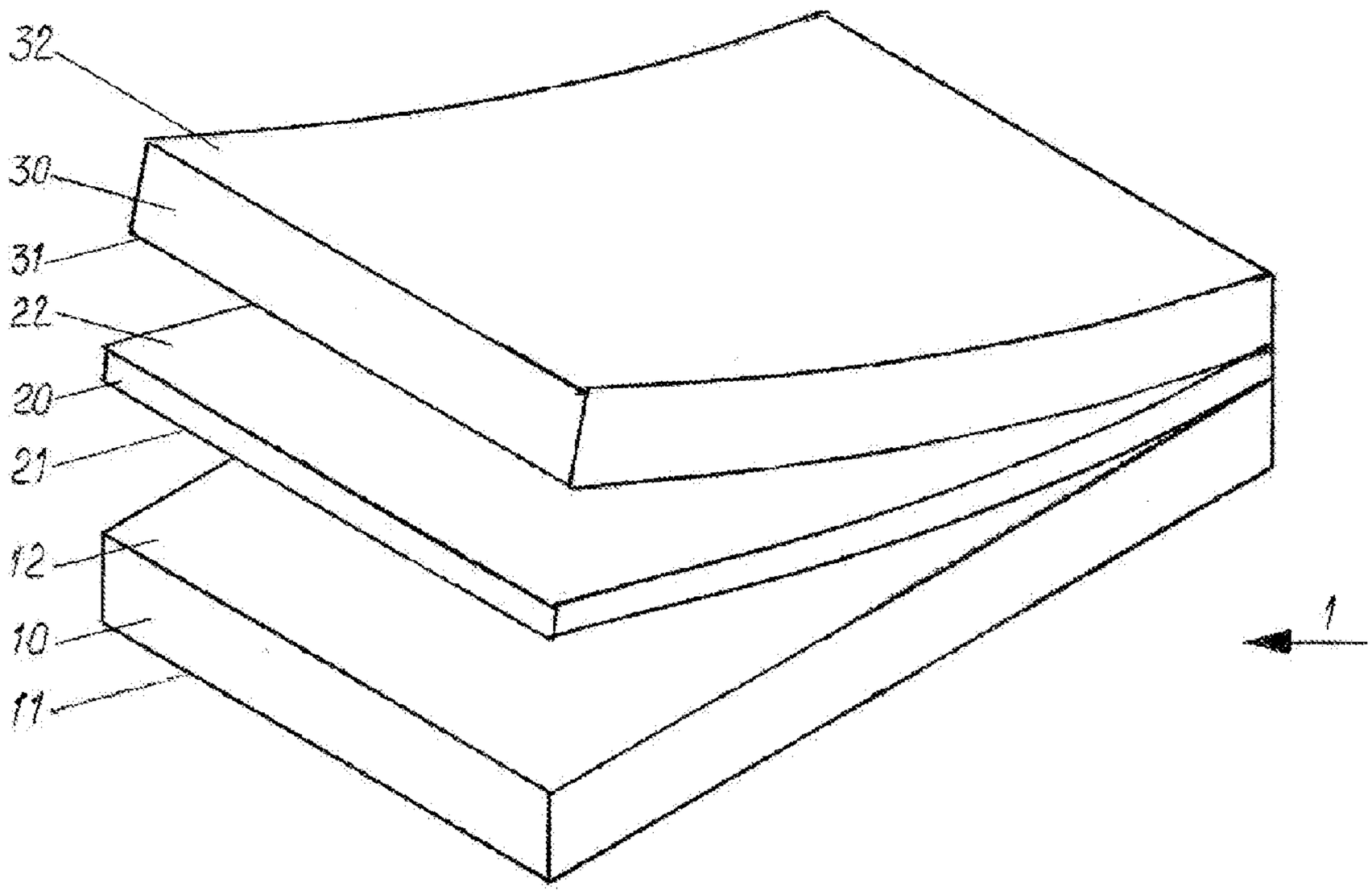


Fig. 1

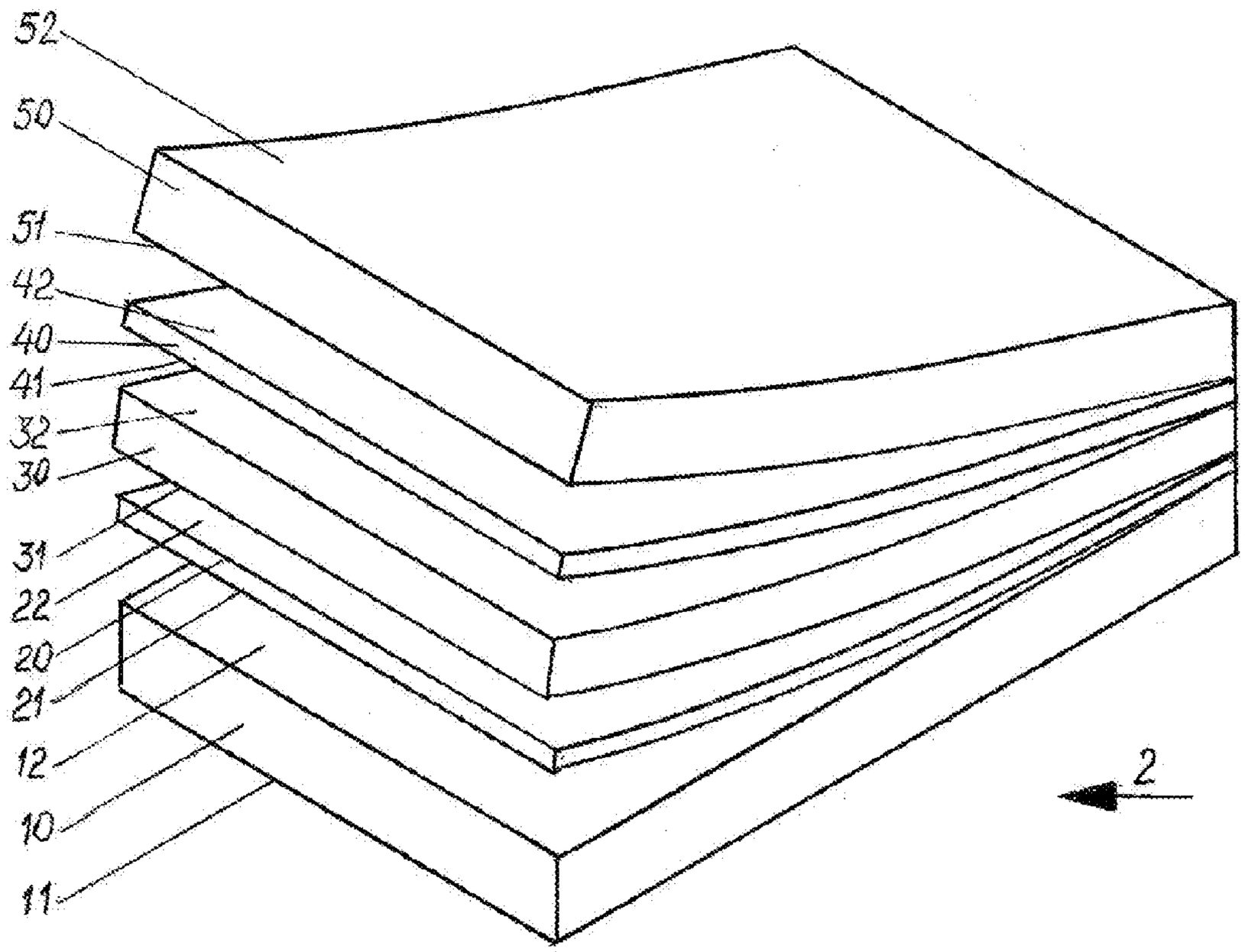


Fig. 2

SUBSTRATE PREPARATION TOOL SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the benefit under 35 U.S.C. §119(e) of the U.S. Provisional Patent Application Ser. No. 61/446,305, filed on Feb. 24, 2011, the content of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to the field of surface and substrate preparation tools, and in particular, surface and substrate preparation tools suitable for wet or dry cleaning, scrubbing, and abrading surfaces.

BACKGROUND OF THE INVENTION

[0003] Most substrates and surface areas require some form of preparation before the application of coatings materials. Traditionally, preparation includes first cleaning the surface of dirt and grease or other contaminants, and then deglossing the surface as needed by abrading the surfaces with sandpaper. Should the surface not be cleaned first of any grime the effectiveness of the sandpaper is compromised by clogging, a condition in which the open spaces of the sandpaper are filled, thus creating a smooth, non-abraded surface. Additionally, sandpaper in that condition will spread the contaminants to other parts of the surface, creating a bigger problem.

[0004] A multiplicity of tools has been created to simplify the preparation process from traditional sandpapers and steel wools, to sanding sponges, wire brushes, and scrapers. All of these tools are effective for their intended purposes. Still, even with the advent of numerous innovations, multiple steps are required to perform the preparation process. In effect, the preparation process has become more complicated, more costly, less efficient, and less environmentally friendly; and this problem is universal, crossing all trades. Hence, there is a need for a multi-purpose, multi-use tool that is effective in a variety of uses, efficient in simplifying the preparation process, and environmentally friendly. And, it is also desirable that the tool be suitable for use with a variety of solvents from water to organic thinners without degradation or the compromising of its effectiveness, and that the tool use the solvents in the most efficient and cost effective manner possible.

SUMMARY OF THE INVENTION

[0005] The present invention provides a surface and substrate preparation tool that is a multi-use system and method that is suitable for the preparation of a variety of substrates, such as wood, plastic, and metal prior to the application of residential, commercial, and industrial coatings like primers, finish paints, varnishes, lacquers, epoxies and other coatings or coverings.

[0006] In one aspect, the substrate preparation tool system comprises a flexible, absorbent foam member having first and second opposed major surfaces; a flexible abrasive member having an abrasive surface and a flexible backing surface, wherein the first major surface of the flexible foam member and the flexible backing surface of the abrasive member have substantively the same external dimensions other than thickness (e.g., substantially the same length and width dimensions); and an adhesive member joining the foam member to the abrasive member.

[0007] The foam member may be made of melamine foam, ceramic foam, polyvinyl alcohol foam, or the like. The foam member preferably has micro-abrasive properties so as to provide both cleaning and very fine polishing. It is also preferable that the foam member be sacrificial so as to provide a continuously clean abrasive surface. And, it is also preferable that the foam member be 200-300% denser than is commonly sold to homeowners, both for durability and to equal the wear time of the abrasive member. The abrasive member may be made of various abrasive sanding components, including but not limited to, abrasive woven or nonwoven materials, steel wool, and any other coated abrasive such as sandpaper. Preferably, the abrasive member is substantially more abrasive than the foam member.

[0008] In another aspect, the substrate preparation tool further comprises a microfiber finishing cloth that can be attached to the second major surface of the foam member, opposite the abrasive member, for finer polishing and cleaning.

[0009] In a further aspect, the substrate preparation tool may comprise one or more liquids retained in the foam member and transferred to the abrasive member during abrading, or to the second major surface of the foam member during cleaning or polishing. The foam member thus serves additional purpose as a reservoir for the liquids. The liquids include, but are not limited to, organic solvents such as paint thinners, lacquer thinner, acetone, methyl ethyl ketone ("MEK"), acetone, and cleaning fluids.

[0010] In preferred embodiments, the adhesive member allows for the flow of liquid from the foam member to the abrasive member. The adhesive member may be inherently porous, or if the adhesive member comprises an adhesive material which is impermeable to liquid, the adhesive material may be applied to the foam member and/or adhesive member in a pattern or amount which provides sufficient porosity to allow liquid to penetrate from the foam member through the adhesive member and subsequently to the abrasive member and then the substrate.

[0011] In yet another aspect, the substrate preparation tool may have another abrasive member adhesively affixed to the second major surface of the foam member. In this configuration, the foam member is in the middle like a sandwich, and can be used as a liquid reservoir for the two abrasive members on each side. The pad system can be configured so that each side may have the same or different liquid penetration rates and/or each side may have a different type of abrasive sanding component.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Accompanying this specification are drawings showing some embodiments of the invention wherein:

[0013] FIG. **1** is a perspective view of the various layers, in superimposed separated relation, not drawn to scale, illustrating one embodiment of the substrate preparation tool system in accordance with the present invention.

[0014] FIG. **2** is a perspective view of the various layers, in superimposed separated relation, not drawn to scale, illustrat-

ing another embodiment of the substrate preparation tool in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] The surface and substrate preparation and tool system in accordance with the present invention will now be discussed in detail. It should be noted that the invention in its broader aspects is not limited to the specific details, representative materials, sizes, integration, functions and shapes of parts, and illustrative examples described in connection with the preferred embodiments. Modifications and equivalents will be apparent to practitioners skilled in this art and are encompassed within the spirit and scope of the appended claims.

[0016] FIG. **1** is one exemplary embodiment of the substrate preparation tool. According to FIG. **1**, a surface preparation and finishing too system, **1**, has an abrasive member, **10**, an adhesive member, **20**, and a foam member, **30**. Optionally, it may have suitable liquids (not shown) retained in the foam member, **30**.

[0017] The abrasive member, **10**, has an abrasive surface, **11**, and a flexible backing surface, **12**. The foam member, **30**, has a first major surface **31** and a second opposed major surface **32**, wherein the first major surface of the foam member, **31**, and the flexible backing surface of the abrasive member, **12**, has substantively the same length and width. The adhesive member, **20**, is affixed on one side to the first major surface of the foam member, **31**, and on the other side to the flexible backing surface of the abrasive member, **12**.

[0018] Abrasive Member

[0019] The abrasive member, **10**, can comprise a flexible abrasive surface, **11**, containing abrasive sanding components, a flexible backing surface, **12**, upon which the abrasive sanding components are adhesively fixed, or can comprise a resinous material embedded with abrasive sanding components or particles, or can comprise another suitable construction having abrasive components. The abrasive member, **10**, is preferably sufficiently flexible for use on corners and contours. The abrasive member, **10**, is also preferably resistant to chemicals, organic solvents, and liquids that are commonly used in substrate and surface preparation, which include but are not limited to, paint thinners, lacquer thinners, acetones, denatured alcohol, MEK, Naphtha, chemical detergents and strippers/paint removers, and water. The abrasive sanding components or particles of the abrasive member, **10**, preferably have substantially uniform particle size and fall into standard categories (e.g., rated at 7 or above on Mohs scale of mineral hardness) so as to be easily recognizable by the general public as to their basic use and ability to abrade various substrates. In preferred embodiments, the abrasive sanding component can comprise or consist of steel wool, synthetic steel wool, garnet, emery, aluminum oxide, silicon carbide, alumina-zirconia, chromium oxide, calcium carbonate, diamond dust, pumice dust, novaculite, sand, silica, iron oxide, ceramic, borazon, or a combination thereof.

[0020] The flexible backing surface, **12**, can be made of woven or nonwoven materials, including but not limited to paper, cloth, rubber, resin, polyester, metal, and combinations thereof. When the abrasive member, **10**, is attached to the foam member, **30**, a durable abrasive side is created which allows the pad system to work on various substrates while preventing damage to the foam member, **30**.

[0021] The thickness of the abrasive member, **10**, may vary depending on need. However, in order to maintain resilient flexibility and sufficient abrading capability, the abrasive member is typically about 3⁄16 inch or 0.5 cm thick. The abrasive member, **10**, can be substantially rectangular, oval, circular, and even irregular. The overall shape and size of the abrasive member, **10**, is preferably adapted to that of the foam member, **30**, and both preferably have an ergonomic shaped body for hand holding.

[0022] The abrasive member, **10**, preferably has a relatively high level of porosity such that it tends to transfer liquid received from the foam member, **30**, to the abrasive surface, **11**, and to the substrate. The abrasive member, **10**, is also preferably substantially less absorbent than the foam member, **30**.

[0023] The abrasive member **10** can consist of or comprise a porous, synthetic (e.g., polyester) abrasive pad having an abrasive grain embedded throughout the pad, such as pads commonly called synthetic steel wool. Such materials are advantageous as an abrasive member in the substrate preparation tool because such materials won't rust, shred or splinter. Further, the abrasive grain is uniformly distributed throughout the material and is resin bonded to the non woven fibers which provides for consistent abrasion as well as durability and long life. Materials such as synthetic steel wool and non-woven abrasive pads can be cut or folded and can be used with or without chemicals.

[0024] Common uses for abrasives in accordance with the present invention include, but are not limited to, grinding, polishing, buffing, honing, cutting, drilling, sharpening, lapping, denubbing, and sanding.

[0025] Foam Member

[0026] In accordance with the present invention, the material for the foam member, **30**, preferably has an inherent hardness at the microscopic level while maintaining flexibility on a macro scale. The foam member, **30**, is preferably micro-abrasive and sacrificial in nature, and is substantially less abrasive than the abrasive member, **10**. The foam is also preferably resistant to the most common types of chemicals and organic solvents found in the construction trade, painting industry and home use, which include paint thinners, lacquer thinners, acetones, denatured alcohol, MEK, Naphtha, chemical detergents and strippers/paint removers. This feature is desirable because the foam member, **30**, is used for its intrinsic ability to retain those liquid agents without damage and without substantially degrading out or dissolving so that the surface preparation can be conducted using such liquids in an efficient, economical and environmentally friendly manner.

[0027] The foam member, **30**, preferably has a high absorbency so that it may hold copious amounts of liquid, as a reservoir. The amount of absorption is preferably up to about 90% of the volume of the foam member. Suitable liquids to be retained in the foam member include, but are not limited to paint thinners, lacquer thinners, acetones, denatured alcohol, MEK, Naphtha, chemical detergents, paint removers, and water. Methods used to impregnate the foam with the liquids can include direct pouring or by dipping.

[0028] The foam member, **30**, can be made of any material or any combinations of materials now known or later developed that are suitable for liquid absorption and retention. However, preferably, the foam member, **30**, is made of 100% or substantially absorbent, porous, low density open cell foam containing evenly distributed micro-porous hard polymeric substances, having a micro-abrasive property like extremely fine sandpaper. Melamine foam, which is a heat and chemical

resistant foam made of a formaldehyde-melamine-sodium bisulfite copolymer, is a suitable material or component for the foam member, **30**. Melamine foam is a low density open cell foam containing evenly distributed micro-porous hard polymeric substances. Therefore, it possesses micro-abrasive properties like extremely fine sandpaper. On a larger scale, however, melamine foam feels soft and is resiliently flexible. This makes it ideal for cleaning work on all types of surface substrates including flat and contoured substrates. It is discovered that melamine works effectively as micro-abrasive cleaner when it is a slightly moistened. The micro-porous structure of melamine foam advantageously allows it to be able to absorb copious amounts of liquid therein, and release the contained liquid as needed.

[0029] Other types of foam, such as polyvinyl alcohol foam and ceramic foam, or a combination thereof, may be used instead of melamine foam. It is discovered that ceramic foam appears to have characteristics that are similar to melamine foam, such as the inherent hardness at the microscopic level while maintaining flexibility on a macro scale. Ceramic foam sponges also, like melamine foam, hold copious amounts of liquid. Preferably, the foam member **30** has a density of about 200% greater than consumer-grade melamine pads, such as that sold by Procter & Gamble under the brand Magic Eraser. Such consumer-grade melamine pads typically have a density of about 7-8 kg/m^3, whereas the foam member **30** can have a density of about 15-17 kg/m^3.

[0030] The foam member, **30**, may have a cleaning component or cloth (not shown) attached to the foam opposite the abrasive member. The same type of adhesive layer used in between the abrasive member, **10**, and the foam member, **30**, can be used to adhesively affix the cleaning component to the foam member. With this configuration, the foam member, **30**, becomes a user friendly polishing tool that allows for intricate detail work. The foam member, **30**, can be utilized as a finer polishing tool, and further, with a quick rinse, the cleaning component will pick up all remaining residue. A cleaning component manufactured from microfiber material is eminently suitable for use in the surface preparation and finishing because microfiber cloth is known to have high water absorbency and have a particularly good cleaning effect during rotary movements of the cloth. The microfiber material used in this invention may be constructed of fibers having a 60%/40% blend by weight of polypropylene and polyester, or other blend of polymeric materials.

[0031] The foam member can have many shapes, such as substantially rectangular, rectilinear, oval, circular, and even irregular. The volume of the foam, which is determined by the surface size and the thickness, may vary depending on need but should be sized to provide the desired level of liquid absorption. Preferably, the abrasive member and the foam member have the same or substantially the same length and width, forming a rectilinear pad having six substantially planar sides, with the length and width of the members being the largest dimensions and the height/thickness being the smallest dimension.

[0032] In practice, the complimentary attributes of both the foam and abrasive members enhance the other's capabilities. This means that in most cases a surface substrate can be completely prepped by using a single substrate preparation tool and a bucket of clean water. For example, using the foam member and water, and occasionally rinsing in a bucket, a substrate can be cleaned of dirt, hand oils, grime, etc. Then, by switching to the abrasive member, the substrate can immediately be abraded using the abrasive side of the same tool. By alternating sides when using the preparation tool, an entire substrate, like a chair or table, or door and jamb, can be cleaned and de-glossed using a single tool. In this way, by combining their complimentary attributes, the inherent qualities of both abrasive and foam are enhanced, creating time, material, and labor savings. It is found that when micro-abrasive foam is combined with a steel wool replacement material, this tool system readily cleans and prepares most standard surfaces found in the residential, commercial, and industrial arenas. This combination of materials provides several other unexpected benefits that would not be possible if they were used separately.

[0033] First, it was found that melamine foam is not functional as a sponge. At the microscopic level it is as hard as glass. Therefore, though it will hold up to 90% of it volume in liquid, it does so through capillary action and not through material absorption as would a cotton rag. One benefit to this tool is that as the tool cleans and abrades a surface it also wicks the liquefied particulate matter into the foam member, which then rinses out easily into a bucket of water. That is, the particulate matter never becomes airborne, contaminants are not spread to other surface areas, and 99% of all residue ends up in a bucket of dirty water, leaving only a thin film of dewy moisture and melamine residue to be wiped away with a single clean rag. Therefore, this system eliminates the use of several rags in the cleaning abrading process, as well as saving time on clean up and dusting.

[0034] Second, because the melamine foam member is as hard as glass at the microscopic level, it is a sacrificial surface similar in some aspects to glass sanding blocks that have been used as a sand paper replacement. However, the problem with glass sanding blocks is a preponderance of glass and substrate residue. In contrast, the melamine/nonwoven tool system leaves behind only microscopic residue. And, because it is a sacrificial surface, the user is constantly utilizing a fresh unclogged surface. Further, because the nonwoven abrasive material is used in conjunction with the melamine, the surface is simultaneously or alternately cleaned of contaminants and deglossed by abrading. Then after the tool is rinsed and squeezed of its liquid content a quick swipe across the surface wicks up to 99% of the liquefied residue.

[0035] One benefit of bonding the nonwoven material to the melamine foam is that the nonwoven material actually prolongs the life of the foam member by protecting it from snags, sharp protrusions like splinters, nicks, hard nubs and sharp edges. Melamine foam, though hard as glass at the microscopic level is extremely fragile in the foam state. Therefore, in order for the foam member to be utilized at its maximum effectiveness, it must be bonded to the nonwoven material. Likewise, the nonwoven material's effectiveness is greatly enhanced by being bonded to the foam member because the liquid reservoir continuously rinses the nonwoven member while it is being used. Also, this combination eliminates the need for tack cloths because the dusty residue that would normally contaminate the surface has virtually been eliminated. The same can be said for the use of chemical cleaners and degreasers.

[0036] Oftentimes, the only way to begin preparation of a substrate surface is by the use of rags saturated with paint thinner or lacquer thinner. Or, waterborne chemical degreasers are applied and rinsed. This tool, and with its combination of components, and with the proper density of foam, those aspects of surface preparation are eliminated. is the combi-

nation results in an environmentally friendly tool whose effectiveness is maximized when its components are bonded together because nonwoven materials do not retain liquids and melamine foam is not strong enough by itself to withstand the rigors associated with commercial surface preparation.

[0037] This tool also functions as a finish applicator for touchup and faux finishing. For example, when lacquers are being sprayed on a surface drips, runs, and curtains sometime occur. Since the tool is impervious to organic solvents, the tool with a fine nonwoven material can be dampened with lacquer thinner and runs and drips on a surface are then easily smoothed out with the nonwoven material, and then finished with the foam member (unlike the standard foam brushes, this foam applicator will not immediately degrade when in contact with organic solvents). Furthermore, unlike a rag, the microscopic structure of the melamine inhibits evaporation so much less volatile organic compounds are released into the atmosphere. Again, the reservoir function of the melamine enhances the use of the nonwoven material and vice versa.

[0038] Another finish use of the tool comes into play with dealing with touchup problems cause by wear or slight impact damage resulting in unsightly nicks. After the preparation process has been completed, the foam member is dipped into the top coating and a simple swipe puts a fine finish where there was once an unsightly blemish. Again, the top coat can be water or solvent based, and the tool can easily be rinsed clean with the appropriate solvent. And, once the coating has been cleaned from the tool, any remaining solvent is easily rinsed in the bucket. The tool remains unharmed because the foam member, the nonwoven member, and the adhesive member are all impervious to organic solvents, including water.

[0039] Second, finally, a microfiber cleaning cloth may be utilized to pick up all remaining residue and provide a final touch-up of the finished preparation.

[0040] The combination of the foam and adhesive members, when bonded together as a single unit, not only enhance the inherent capabilities of both members, but also replace the need for several types of tools used on a single job. The nonwoven material bonded to the melamine foam is intended to abrade or degloss the surface in order to create mechanical adhesion for a top coating.

[0041] Adhesive Member

[0042] The adhesive member, **20**, comprises a layer of adhesive disposed between the foam member, **30**, and the abrasive member, **10**. One function of the adhesive member, **20**, is to fixedly couple the abrasive member, **10**, to the foam member, **30**; another function of the adhesive member is to control the rate that the liquid transfers from the foam member, **30**, to the abrasive member, **10**.

[0043] When the adhesive member, **20**, serves as a fastener to adhere the abrasive member, **10**, to the foam member, **30**, the adhesive member, **20**, should have sufficient integrity and adhesion to the abrasive material, **10**, to the flexible backing surface, **12**, of the abrasive member, and to the first major surface, **31**, of the foam member, **30**, so that the adhesive member, **20**, will not break, release the abrasive material, or release from the abrasive member or the foam member when the pad system is conformed and used to abrade a surface. Preferably, the adhesive member, **20**, consists or is comprised of a material with these characteristics: (a) high viscosity (for preventing total absorption by the foam member); (b) flexibility (for squeezing out excess materials and conforming to intricate detail work during use); (c) chemical resistance (for preventing deterioration when in contact with solvents like lacquer thinner, acetone, MEK, denatured alcohol, paint thinner and other liquid agents during use); and (d) quick cure time (for production purposes).

[0044] In one embodiment, the adhesive material is a two-component epoxy which has a short cure time (e.g., 5 minutes) and chemical resistance, for example resistance to the liquid agents recited herein. Other adhesive materials, such as non-rigid application adhesives used in protective clothing and multi-component adhesives, may also be employed.

[0045] The adhesive member, **20**, can also function as a partial barrier to limit or control liquid transfer between the foam member, **30**, and the abrasive member, **10**. It has been found that the coverage area, coverage pattern, and the thickness of the adhesive member, **20**, along with the level of liquid permeability of the adhesive material of the adhesive member contribute to the amount and rate of the liquid transferred from the foam member, **30**, to the abrasive member, **30**, (or to the cleaning component cloth, such as a microfiber cloth). Generally, if the foam and abrasive members are attached with a thin bead of adhesive around the perimeter of the members, the adhesive member provides minimal coverage between the members and it is possible for large amounts of liquid to pass from the foam member through to the abrasive member and onto the substrate without substantial resistance. The adhesive can be applied in a broad pattern, or applied in a thin line to obtain a desired flow-through ability of the preparation tool system. Where the adhesive member, **20**, is substantially impermeable to liquid, the adhesive material preferably covers no more than about 90% of the surface area between the abrasive member, **10**, and the foam member, **30**. Suitable coverage patterns for the adhesive material include a perimeter of adhesive with an X-pattern therein (e.g., corner-to-corner for rectilinear areas), or a cross-hatch or serpentine pattern within a perimeter of adhesive, or other suitable patterns.

[0046] When in use, liquid retained in the foam member, **30**, transfers naturally toward the abrasive surface, **11**, of the adhesive member, **10**, as the pad is pressed against the substrate surface. Preferably, the liquid penetration to the abrasive surface, **11**, should be controlled such that the abrasive side is kept damp but not saturated for best wet sanding result. More volume of the liquid may be released from the foam member, **30**, when the second major surface, **32**, of the foam member, **30**, is pressed against the substrate surface because the liquid need not pass the adhesive member, **20**. However, this would not cause problems because the efficacy of the preparation tool system is not adversely affected by either large or small amounts of liquid. In use, the liquid transferred to the abrasive member or the foam member surface not only replenishes the supply of the liquid for subsequent operations but also concurrently removes debris that has adhered to the surface or has become trapped in the pores of the members, thus, effectively rejuvenating the members to allow for extended and continued use.

[0047] FIG. **2** is another exemplary embodiment of the substrate preparation tool, which is substantially similar to the embodiment shown in FIG. **1**. However, in this embodiment, the foam member, **30**, is sandwiched between two opposed abrasive members, **10**, **50**.

[0048] In this embodiment, the abrasive members, **10**, **50**, the foam member, **30**, and each of the adhesive members, **10**, **40**, preferably have the same properties and construction as the corresponding structure described in the preparation tool

system having only one abrasive member (e.g. FIG. **1**). The suitable liquids to be retained in the foam member are the same as previously described.

[0049] In the substrate preparation tool, **2**, of FIG. **2**, the first abrasive member, **10**, can have an abrasive surface, **11**, and a flexible backing surface, **12**. The foam member, **30**, has a first major surface, **31**, and a second opposed major surface, **32**, wherein the first major surface of the foam member, **31**, and the flexible backing surface of the first abrasive member, **12**, have substantively the same length and width with similar or dissimilar height/thickness (the length and width being the largest dimensions and the height/thickness being the smallest dimension). The first adhesive member, **20**, is affixed on one side to the first major surface of the foam member, **31**, on the other side to the flexible backing surface of the first abrasive member, **12**. The second abrasive member, **50**, has a flexible backing surface, **51**, and an abrasive surface, **52**, wherein the second major surface of the foam member, **32**, and the flexible backing surface of the second abrasive member, **51**, have substantively the same length and width with similar or dissimilar height. The second adhesive member, **40**, is affixed on one side to the second major surface of the foam member, **32**, and on the other side to the flexible backing surface of the second abrasive member, **51**.

[0050] The foam member, **30**, in the substrate preparation tool of FIG. **2**, is used as a liquid reservoir for each abrasive member, **10**, **50**, on each side. However, the rates of penetration of liquid from the foam member, **30**, to the two abrasive members, **10**, **50**, can be different by using two different adhesive materials for the first and second adhesive members, where the different adhesive materials have different liquid permeability, and/or by applying the adhesive materials for the first and second adhesive members in different patterns or over different coverage areas. For example, the adhesive material for the first adhesive member, **10**, could cover about 90% of the surface area between the first abrasive member, **10**, and the foam member, **30**, while the adhesive material of the second adhesive member, **50**, could cover a about 5% (or another substantially lesser amount) of the corresponding surface area between the foam member, **30**, and the second abrasive member, **50**. Additionally, or alternatively, two different materials or constructions could be used for the first and second abrasive members to provide substantially different rates of liquid penetration.

[0051] Because the foam member, **30**, in the preparation tool system, **2**, of this embodiment is not used for finishing, the foam member can be made of any material or combination of materials now known or later developed suitable for absorption and retention of liquids, and preferably including the liquid agents listed herein.

[0052] Moreover, the two abrasive members can be advantageously made of two different abrasive materials with substantially different hardnesses that fall into standard categories (rated at 7 or above on Mohs scale of mineral hardness) so as to be easily recognizable by the general public as to their basic use and ability to abrade various substrates. Each abrasive member preferably has substantially uniform particle size. In practice, the abrasive member made of a harder abrasive material will be used first to abrade a surface, followed by using the other abrasive member made of a less hard abrasive material for further sanding and polishing.

[0053] As it is apparent from the above description, the present invention provides a surface preparation tool system which is unsurpassed in its efficiency for preparing, by cleaning and abrading, most surfaces by retaining within the pad system desired liquid as needed and delivering the liquid as needed during the process. The substrate preparation tool may be configured in an ergonomic shape for hand holding, or configured specifically for contoured moldings or ornate fixtures of wood metal or plastic; or affixed to a handle to help clean difficult-to-reach areas and make the user's work easier. The preparation tool system may also be manufactured at a sufficiently low cost to be disposable.

What is claimed is:

1. A substrate preparation tool system for working on a variety of substrates, said preparation tool system comprising:

an absorbent, micro-abrasive foam member comprising melamine foam;

a porous abrasive member having an abrasive surface, said abrasive surface being substantially more abrasive than said foam member, and said abrasive member comprising a synthetic, non-woven material embedded with abrasive grain;

an adhesive member joining said abrasive member to said foam member; and

said adhesive member being substantially porous to permit liquid to pass between said foam member to said abrasive member.

2. A substrate preparation tool system for working on a variety of substrates, said preparation tool system comprising:

an absorbent, micro-abrasive foam member;

a porous abrasive member having an abrasive surface; said abrasive surface being substantially more abrasive than said foam member;

an adhesive member joining said abrasive member to said foam member; and

said adhesive member being substantially porous to permit liquid to pass between said foam member to said abrasive member.

3. The substrate preparation tool system of claim **2**, wherein said abrasive surface comprises an abrasive sanding component rated no less than 7 on Mohs scale of mineral hardness.

4. The substrate preparation tool system of claim **3**, wherein said abrasive sanding component is a steel wool.

5. The substrate preparation tool system of claim **3**, wherein said abrasive sanding component is made of aluminum oxide.

6. The substrate preparation tool system of claim **2**, wherein said foam member comprises melamine, polyvinyl alcohol, or ceramic, or a combination thereof.

7. The substrate preparation tool system of claim **6**, wherein said foam member is made of melamine.

8. The substrate preparation tool system of claim **2**, wherein said foam member can absorb a liquid volume of at least 90% of a volume of said foam member.

9. The substrate preparation tool system of claim **2**, wherein said adhesive member covers no more than about 90% of a contact area between said foam member and said adhesive member.

10. The substrate preparation tool system of claim **9**, wherein said adhesive member is in the form of a bead of adhesive material around a perimeter of foam member.

11. The substrate preparation tool system of claim **2**, wherein said adhesive member is made of a two-component epoxy.

12. The substrate preparation tool system of claim **2**, wherein said foam member, said abrasive member and said adhesive member are substantially chemically resistant to organic solvents like paint thinners, lacquers, and cleaning fluids.

13. A surface preparation tool system for working on a variety of substrates, said preparation tool system comprising:

an absorbent foam member having first and second opposed major surfaces;

first and second porous abrasive members, each having an abrasive surface;

a first adhesive members joining said first abrasive member to said first major surface of said foam member, and a second adhesive members joining said second abrasive member to said second major surface of said foam member;

said first and second adhesive members being substantially porous to permit liquid to penetrate from said foam member to said first and second abrasive members;

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