



US 20130324021A1

(19) **United States**(12) **Patent Application Publication****Ryan**(10) **Pub. No.: US 2013/0324021 A1**(43) **Pub. Date: Dec. 5, 2013**(54) **DIAMOND IMPREGNATED POLISHING PAD
WITH DIAMOND PUCKS**(71) Applicant: **Webster Ryan**, Shawnee, KS (US)(72) Inventor: **Webster Ryan**, Shawnee, KS (US)(21) Appl. No.: **13/907,125**(22) Filed: **May 31, 2013****Related U.S. Application Data**

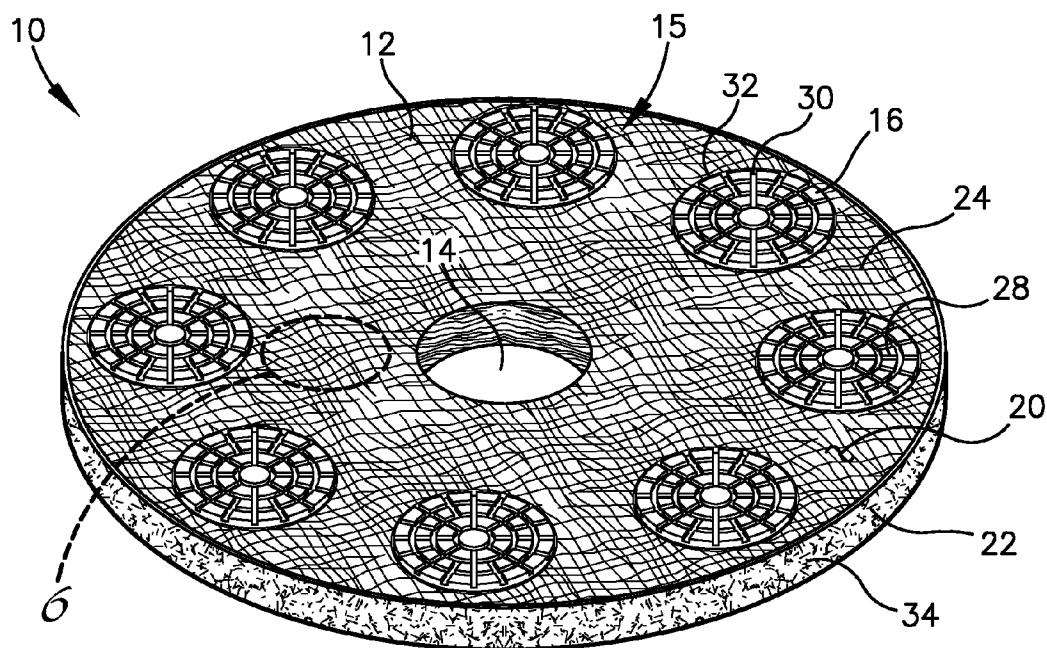
(60) Provisional application No. 61/789,682, filed on Mar. 15, 2013, provisional application No. 61/653,885, filed on May 31, 2012.

Publication Classification(51) **Int. Cl.**
B24D 11/00 (2006.01)(52) **U.S. Cl.**CPC **B24D 11/00** (2013.01)USPC **451/529**

(57)

ABSTRACT

An abrasive pad for use on hard surfaces is described. The pad includes a fibrous, non-woven body with an abrasive coating containing diamond particles applied to a first side thereof. A plurality of diamond-impregnated abrasive elements is affixed to the first side. One or more of the abrasive elements are located near an outer edge of the first side of the pad. A resilient reinforcing material is applied to the outer edge of the pad to resist compression of the pad and to maintain adjacent abrasive elements parallel to a surface being worked on. The abrasive elements at least partially recess into the pad body and enable simultaneous contact of the abrasive elements and the pad with the surface being worked on. Thereby, multiple surface-preparation steps, e.g. polishing and burnishing, are completed simultaneously reducing surface-preparation time and eliminating separate surface-preparation steps.



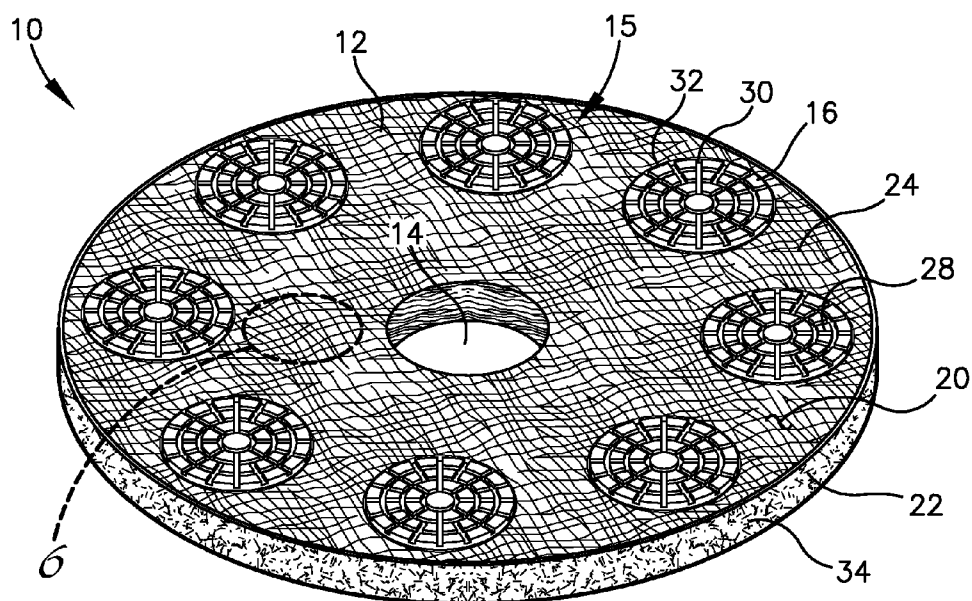


Fig. 1

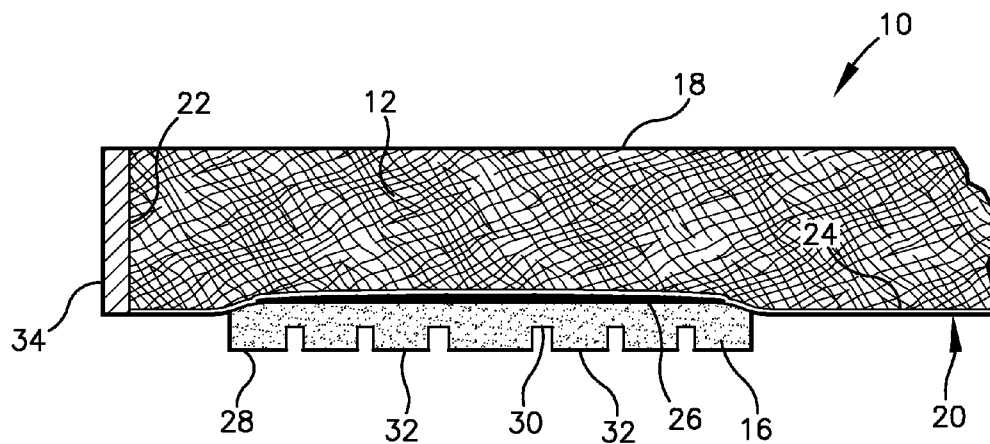
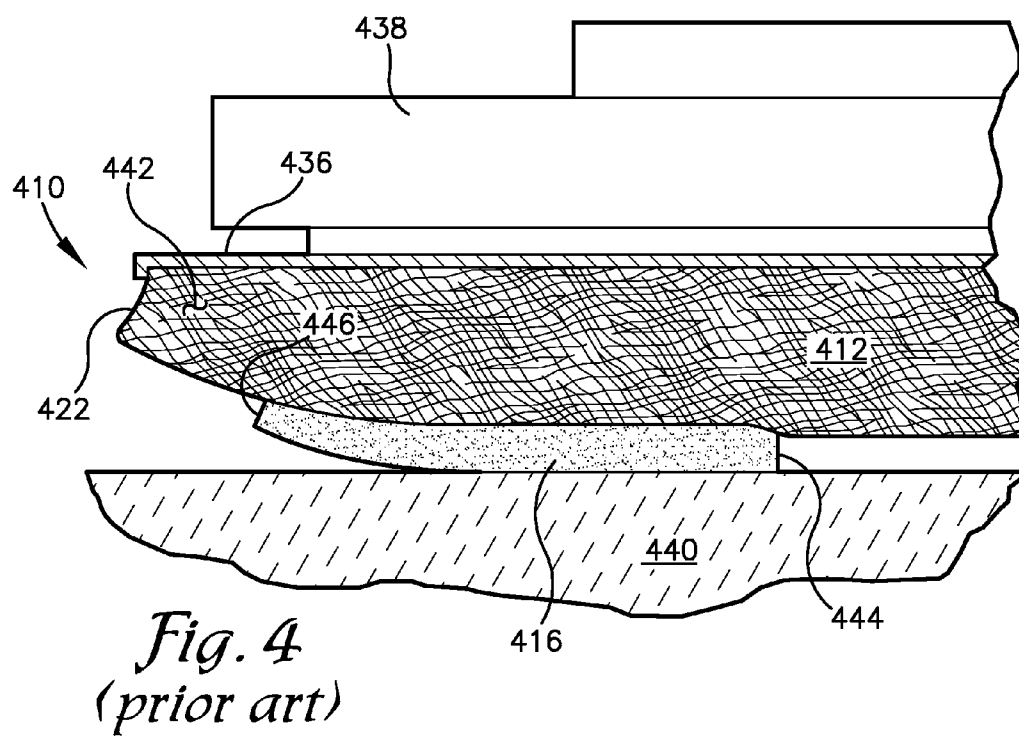
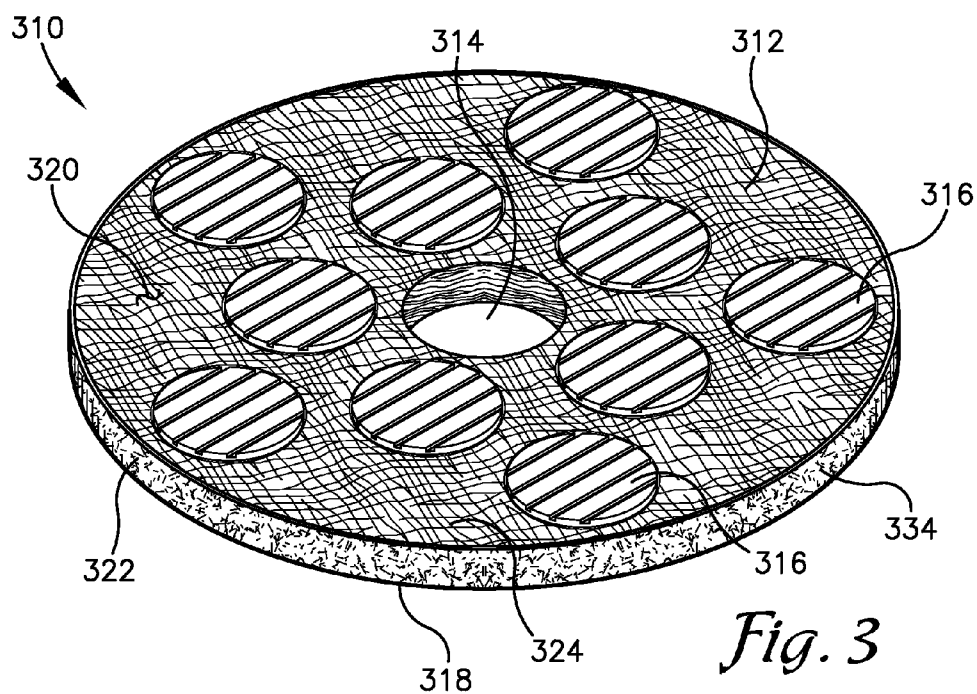


Fig. 2



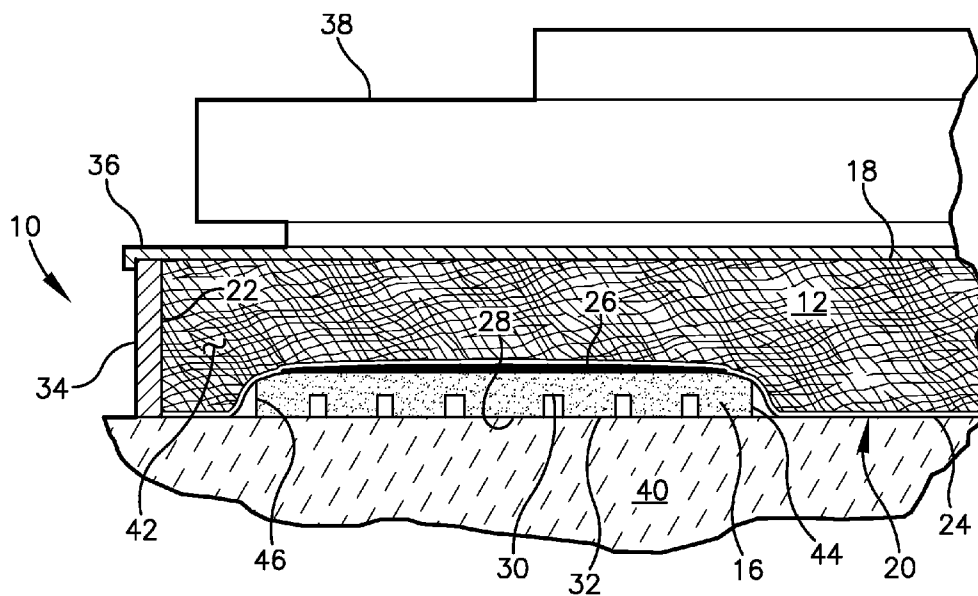


Fig. 5

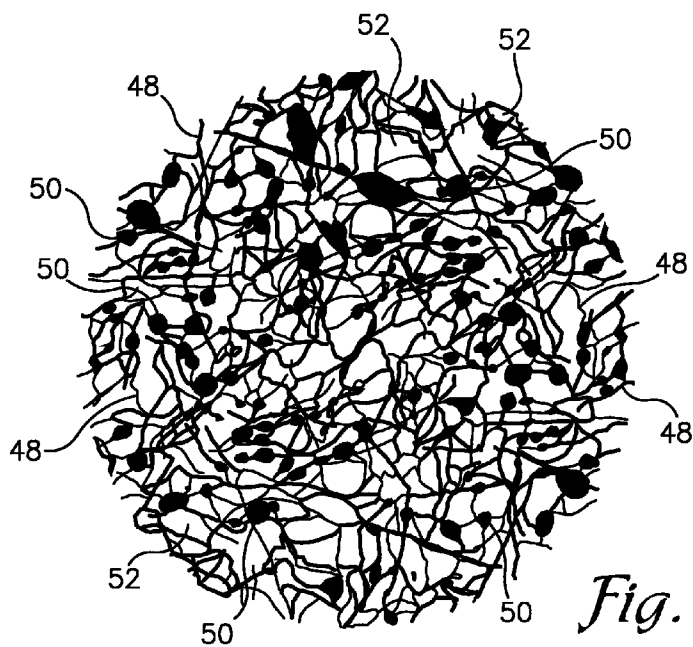


Fig. 6

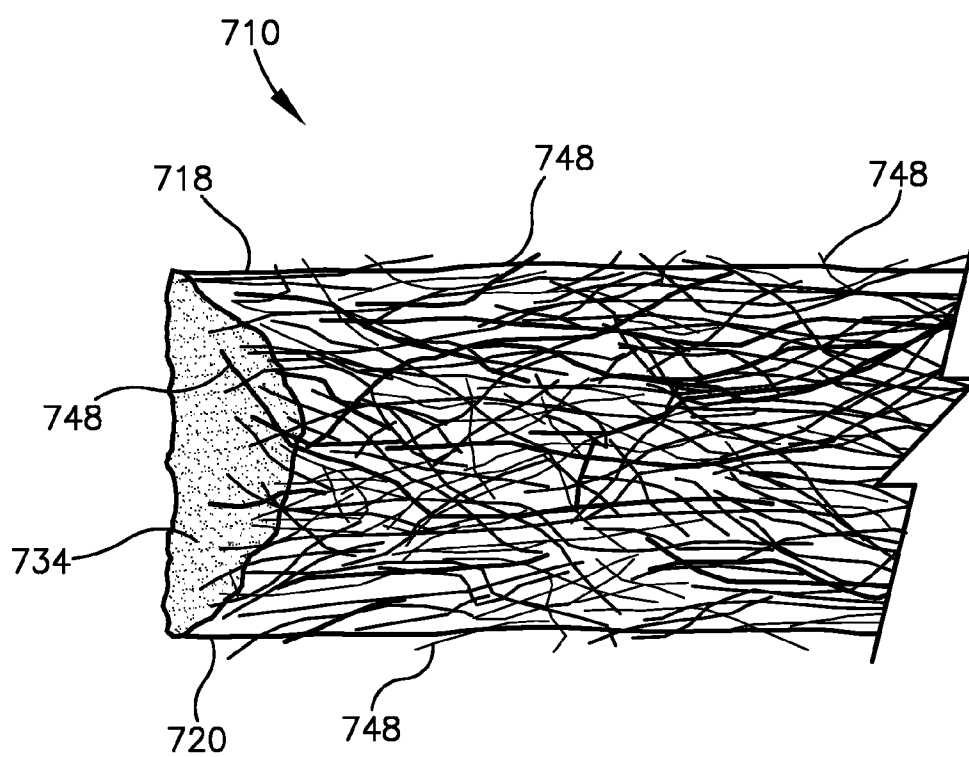
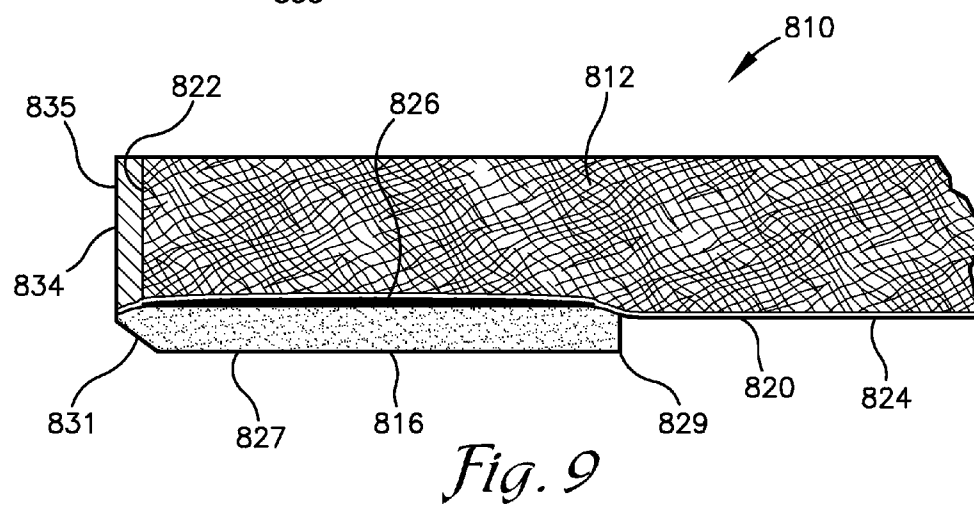
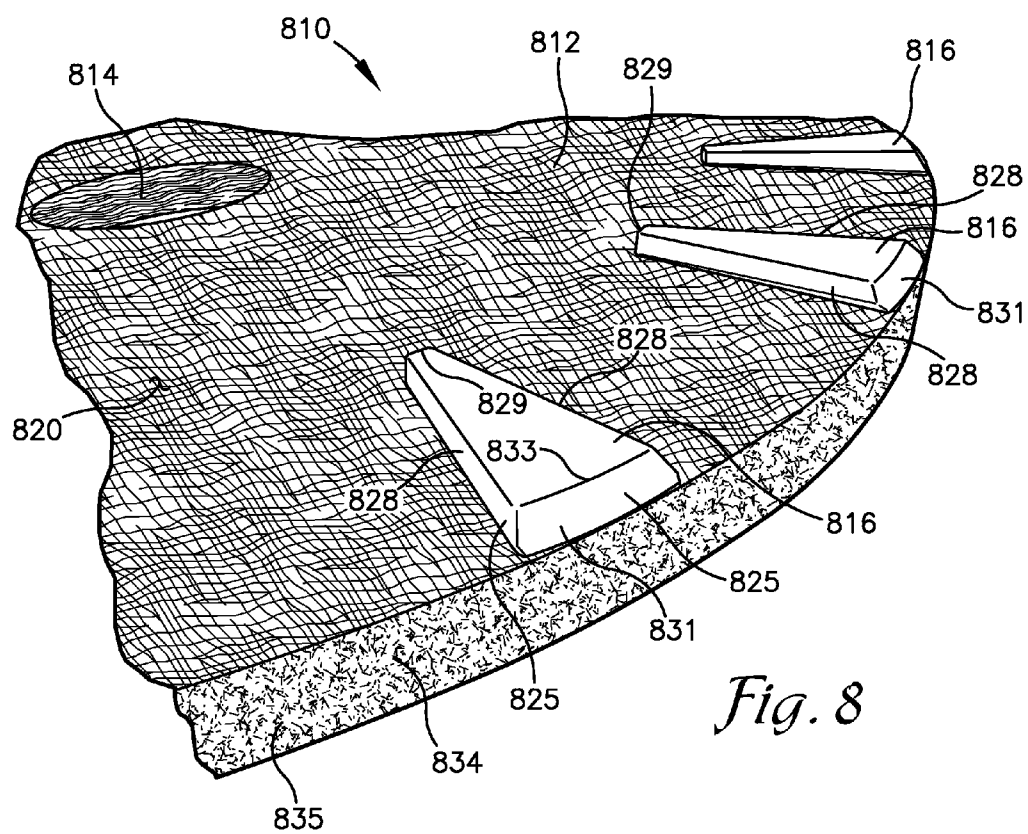


Fig. 7



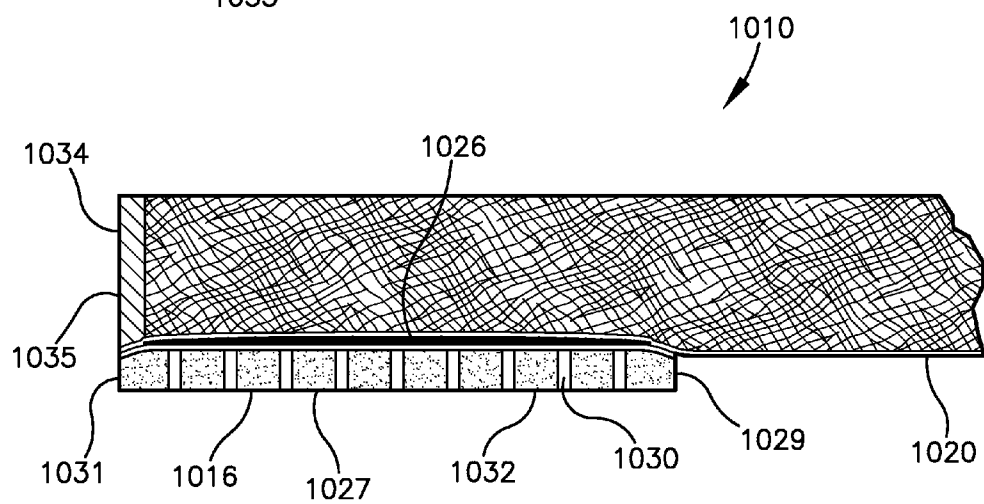
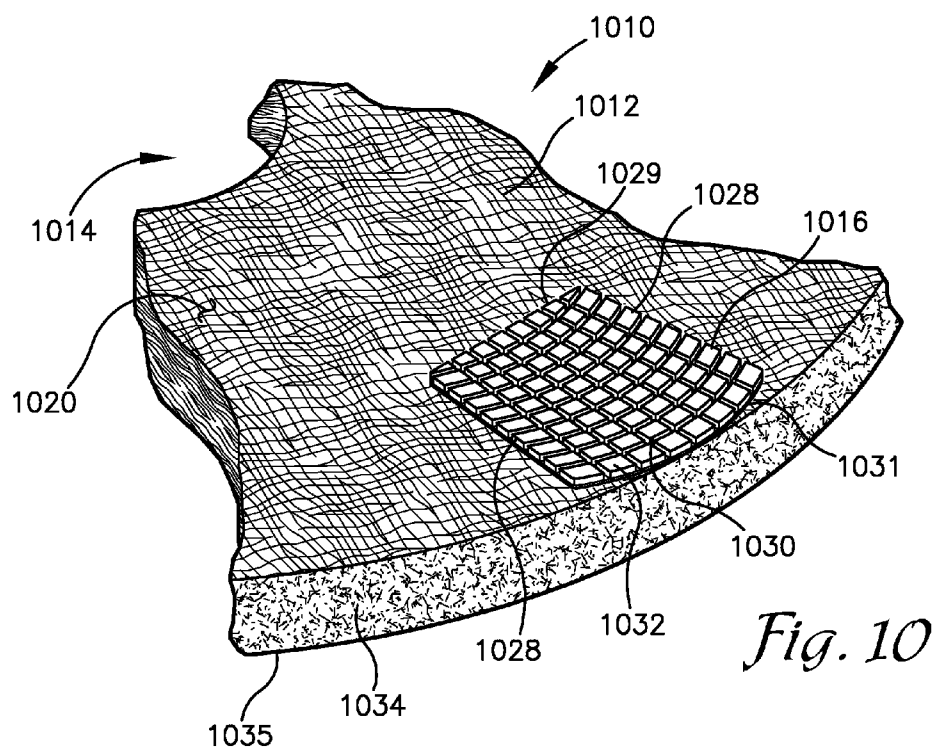


Fig. 11

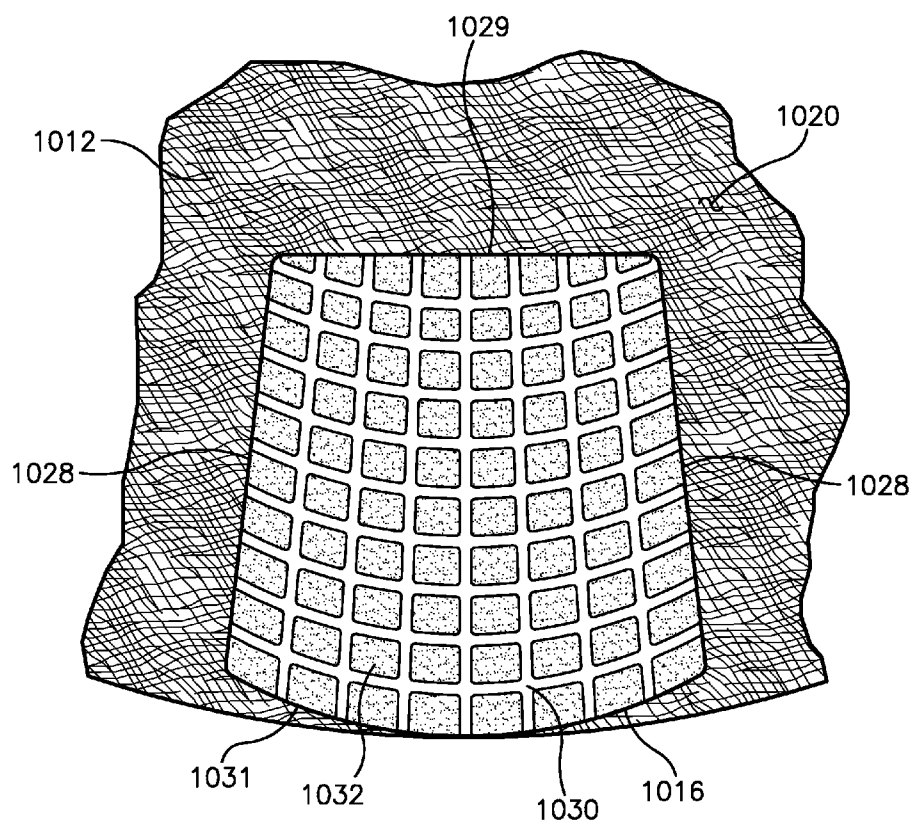


Fig. 12

DIAMOND IMPREGNATED POLISHING PAD WITH DIAMOND PUCKS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of provisional application Ser. No. 61/653,885 filed May 31, 2012, and provisional application Ser. No. 61/789,682 filed Mar. 15, 2013, the contents of which are incorporated herein by reference.

BACKGROUND

[0002] Numerous techniques are known for grinding, polishing, and finishing hard surfaces like concrete, terrazzo, and stone floors. These techniques employ various abrasive materials and chemicals that work on the surface to grind and polish the surface to a desired finish. For hard surfaces, like concrete flooring, the abrasive materials often employ diamonds or diamond particles that are embedded in a metallic, resinous, or similar binder. The diamond-impregnated abrasives can be coated on a variety of carrier pads or can be molded into abrasive components that are then attached to a carrier pad or carrier plate. For example, U.S. Pat. No. 794,495 to Gorton and U.S. Pat. No. 2,001,911 to Wooddell et al. describe cloth, fiber, thin sheet metal, or paper carrier disks with a plurality of abrading elements attached to the surfaces thereof. U.S. Pat. No. 6,234,886 to Rivard et al. describes a non-woven carrier pad with an abrasive coating applied to a working surface thereof and a plurality of abrasive sheets, e.g. sandpaper, coupled to the working surface. And U.S. Pat. No. 7,204,705 to Thysell describes a non-woven pad with recesses in which spring-biased, diamond-impregnated, resinous elements are disposed.

[0003] These carrier pads and/or molded abrasive components are coupled to a rotary grinding or polishing machine. Common grinding and polishing machines include an electric or propane motor rotatably coupled to a single platen or to a plurality of platens in a planetary arrangement. The carrier pad and/or the molded abrasive components are coupled to the platen and are rotated while in contact with a floor surface to abrade the surface.

[0004] Preparation of surfaces from a rough, coarse-cut material to a polished, high-shine, finished product employs a variety of steps, each of which employs a carrier pad and/or abrasive element having a different grit or coarseness. The preparation begins with more abrasive materials and progresses through a number of sequentially finer grit materials until a desired finish is achieved. For example, one common progression for preparing concrete begins with a 30-40 grit metal-bonded diamond particle abrasive elements and then proceeds through similar 80 and 150 grit abrasive elements. The concrete surface is then typically polished using 100 grit abrasive elements of resin-bonded diamond particles followed by similar abrasive elements of 200 grit and successively higher grits to a desired finish where each grit is typically double the previous grit.

SUMMARY

[0005] Embodiments of the invention are defined by the claims below, not this summary. A high-level overview of various aspects of the invention are provided here for that reason, to provide an overview of the disclosure, and to introduce a selection of concepts that are further described in the

Detailed-Description section below. This summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in isolation to determine the scope of the claimed subject matter.

[0006] In brief, this disclosure describes, among other things, an abrasive pad for use on hard surfaces, such as concrete, terrazzo, or stone floors. The abrasive pad includes a carrier pad and a plurality of abrasive elements affixed thereto. A reinforcing material may be disposed on an edge of the carrier pad. A working surface of the carrier pad is coated or impregnated with an abrasive, such as a diamond-impregnated resin having a grit suitable for grinding, polishing or burnishing the surface. The abrasive elements comprise low-profile, diamond-impregnated, resinous disks or resinous abrasive elements of a variety of shapes including circular, triangular, or quadrilateral, and certain shapes may have at least one side of the shape curved. The abrasive elements are affixed to the working surface of the carrier pad and have a grit suitable for grinding, polishing or burnishing the surface. The edge of the carrier pad is coated with the reinforcing material to resist compression of the carrier pad near the edge. As such, abrasive elements affixed near the edge are maintained substantially parallel to the working surface.

[0007] In operation, the abrasive pad is coupled to a grinding or polishing machine as known in the art and placed in contact with the surface to be worked on. The abrasive elements compress the overlying carrier pad and at least partially recess into the carrier pad. Thereby, both the abrasive elements and the abrasive coating on the carrier pad are simultaneously in contact with the surface and simultaneously grind, burnish and/or polish the surface. The combination of the abrasive elements and the carrier pad provide a cutting depth similar to that achieved with polishing but with a surface finish comparable to a burnished surface. And this surface finish is achieved in less time than separate polishing and burnishing steps using similar grit abrasive materials.

DESCRIPTION OF THE DRAWINGS

[0008] Illustrative embodiments of the invention are described in detail below with reference to the attached drawing figures, and wherein:

[0009] FIG. 1 is a perspective view of an abrasive pad depicted in accordance with an embodiment of the invention;

[0010] FIG. 2 is a partial cross-sectional view of the abrasive pad of FIG. 1 depicted in accordance with an embodiment of the invention;

[0011] FIG. 3 is a perspective view of an abrasive pad depicted in accordance with another embodiment of the invention;

[0012] FIG. 4 is an elevational, cross-sectional view of an abrasive pad in the prior art coupled to a floor-finishing machine depicting lifting of an abrasive disc away from a surface being worked on;

[0013] FIG. 5 is an elevational, cross-sectional view of the abrasive pad of FIG. 1 coupled to a floor-finishing machine in accordance with an embodiment of the invention;

[0014] FIG. 6 is an enlarged view of a working surface of the abrasive pad of FIG. 1 at the location 6 depicting fibers with abrasive resin thereon in accordance with an embodiment of the invention; and

[0015] FIG. 7 is an elevational cross-sectional view of an abrasive pad depicting a reinforcing material on a circumferential edge in accordance with an embodiment of the invention.

[0016] FIG. 8 is a perspective view of a triangular or wedge shaped abrasive pad depicted in accordance with an embodiment of the invention.

[0017] FIG. 9 is a partial cross-sectional view of the abrasive pad of FIG. 8 depicted in accordance with an embodiment of the invention.

[0018] FIG. 10 is a perspective view of a trapezoidal abrasive pad depicted in accordance with an embodiment of the invention.

[0019] FIG. 11 is a partial cross-sectional view of the abrasive pad of FIG. 10 depicted in accordance with an embodiment of the invention.

[0020] FIG. 12 is a plan view of the abrasive pad of FIG. 10 depicted in accordance with an embodiment of the invention.

DETAILED DESCRIPTION

[0021] The subject matter of select embodiments of the invention is described with specificity herein to meet statutory requirements. But the description itself is not intended to necessarily limit the scope of the claims. Rather, the claimed subject matter might be embodied in other ways to include different components, steps, or combinations thereof similar to the ones described in this document, in conjunction with other present or future technologies. Terms should not be interpreted as implying any particular order among or between various steps herein disclosed unless and except when the order of individual steps is explicitly described.

[0022] Embodiments of the invention are described herein with respect to finishing hard surfaces like concrete, terrazzo, and stone floor surfaces. However, embodiments of the invention are not so limited and might be configured for use on other hard or soft surfaces, such as glass, metals, wood, ceramics, or the like. Further, embodiments are described with respect to applications using a rotary grinding or polishing apparatus with a single platen as is known in the art. But, embodiments of the invention are configurable for use with other grinding/polishing apparatus including those with planetary platen configurations, as well as walk-behind, and ride-on models, among others. Exemplary apparatus include auto-scrubbers, swing-machines, and planetary grinders, among others known in the art.

[0023] With reference to FIGS. 1 and 2, an abrasive pad 10 is described in accordance with an embodiment of the invention. Embodiments of the invention are described herein with respect to the drawings in which reference numerals are employed to identify particular components or features. Similar elements in the various embodiments depicted are provided with reference numerals having matching second and third digits but with differing first digits, e.g. element 110 is similar to elements 210, 210, etc. Such is provided to avoid redundant description of similar features of the elements but is not intended to indicate in any way that the elements are identical.

[0024] The abrasive pad 10 comprises a body 12 and a plurality of abrasive elements 15 affixed thereto. The body 12 comprises a non-woven, lofty, fibrous pad having a non-working surface or side 18, a working surface 20 opposite the non-working side 18, and a circumferential edge 22. As best depicted by FIG. 6, the non-woven, lofty, fibrous material comprises polyester, nylon, or other fibers 48 that are adhered

together by one or more glues, adhesives, or the like, or by heating to cause partial melting and fusing of the fibers together as known in the art. In another embodiment, the body 12 is comprised of one or more woven materials like wool, nylon, or cotton, or non-woven materials like paper, rubber, metal, plastic, or similar materials.

[0025] The body 12 has a generally flat, cylindrical shape but can be configured as desired for a given application. As depicted in FIGS. 1-2, the body 12 has an industry standard twenty-seven inch diameter and an approximately 1 or 1/2 inch thickness but is not limited to any particular dimensions. The density and abrasiveness, among other inherent properties of the body 12 are also configurable to provide characteristics desired for a particular application. As depicted in FIG. 1, the body 12 includes a central aperture 14 that can be used for mounting on a rotary grinding, burnishing or polishing machine, such as a swing machine or autoscrubber as known in the art. But the aperture 14 can be sized or omitted based on requirements of a particular grinding or polishing machine with which the abrasive pad 10 is to be used.

[0026] A coating 24 of an abrasive material is applied to the working surface 20 of the body 12. The coating 24 is applied to the working surface 20 by spraying or can be applied by one or more of brushes, rollers, or submerging in the abrasive material in a liquid or flowable form, among other ways known in the art. The abrasive material is at least partially absorbed into the body 12 or can be superficial to the working surface. As depicted in FIG. 6, the abrasive material may at least partially coat the fibers 48 of the abrasive pad 10 and/or form globules 50 that adhere to one or more of the fibers 48. Open spaces 52 between the fibers 48 also allow for absorption and/or penetration of the abrasive material into the working surface 20.

[0027] The coating 24 comprises a resin with diamonds or diamond particles (which may be collectively referred to as diamonds) disposed therein but embodiments of the invention are not limited to a particular coating composition. The resin includes resins or binders available in the art, such as for example, phenolic, acrylic, melamine, and urea resins, or thermoplastics, and hybrid compositions that include one or more metals like copper mixed therein.

[0028] The diamonds are natural or industrial diamonds or particles thereof and might be coated with one or more materials, e.g. silver, titanium or other metals. In an embodiment, other abrasive materials, like garnet, corundum, silicates, metals, or the like, are used in addition to or instead of diamonds. The diamonds have an average diameter configured to provide a desired abrasive grit to the coating 24. In an embodiment, the diamonds have an average diameter of about 0.1 to about 30 μm (about 60,000 to about 350 grit) or between about 9 and about 15 μm (about 1000 and about 700 grit) or preferably about 12 μm (about 800 grit) suitable for grinding, polishing or burnishing a concrete, terrazzo, or stone floor. In embodiments the diamonds can be sized to provide any desired grit ranging, for example from about 50 grit to greater than 8500 grit.

[0029] In one embodiment, the abrasive elements 15 take the form of low-profile circular discs 16 that are attached to the working surface 20 of the body 12. The abrasive discs 16 are generally cylindrical with a diameter of about 1 to about 4 inches, or about 1.5 to about 3 inches, or more preferably about 2 to about 2.5 inches and with a height of about 0.2 to about 5 millimeters or more preferably about 0.25 to about 3

millimeters. It is to be understood that abrasive elements **15** having dimensions outside of the ranges specified may be utilized.

[0030] In another embodiment, as depicted in FIGS. **8** and **9**, the abrasive elements **15** take the form of low-profile similarly sized triangular or wedge shaped abrasive elements **816** attached to the working surface **820**. Each triangular element **816** has a height of about 1 to about 5 millimeters or more preferably about 1 to about 3 millimeters. The sides **825** of each triangular element **816** slope slightly inward from a base **826** attached to working surface **820** toward an outer surface **827** which is supported against a surface to be abraded thereby toward the middle of the element as the sides extend away from working surface **820**.

[0031] Each triangular element **816** is generally the shape of an isosceles triangle with two sides of equal length **828** converging on a point **829** remote from a third shorter side **831**. The point of convergence **829** and the midpoint **833** of the shorter side **831** align to form a centerline (not shown) of the triangular element **816**. The sides **828** are about 3 inches long and the short side or outer edge **831** is about 0.75 inches wide. Also, side **831** has an arcuate shape with a radius of curvature which preferably matches or closely approximates the radius of curvature of the circumferential edge **822** of the body **812**.

[0032] In another embodiment, as depicted in FIGS. **10**, **11** and **12**, the abrasive elements **15** take the form of low-profile generally trapezoid shaped abrasive elements **1016** attached to the working surface **1020**. Each trapezoidal abrasive element **1016** has a height of about 3 millimeters measured from a base **1026** attached to working surface **1020** to an outer surface **1027** which is supported against a surface to be abraded thereby. Each abrasive element **1016** is generally the shape of an isosceles trapezoid except one side of the abrasive element is curved. In one example, the curved side **1031** of abrasive element **1016** has an arcuate shape with a length of approximately 2.5 inches and an arc length of approximately 3.5 inches. The length of the abrasive elements **1016** may preferably range from about two to three inches. Abrasive element **1016** also has two convergent sides **1028** that are symmetrical about a centerline (not shown) extending through the midpoint of curved side **1031**. In the embodiment shown, the convergent sides **1028** create a taper that causes the abrasive element **1016** to narrow by about 0.5 inches to about two inches as the element extends from its curved side **1031** to its inner end **1029**. The convergent sides **1028** may also be described as tapering toward one another as they extend away from the curved side or outer end **1031** or as converging toward one another as they extend toward a center of the pad **1010**. The length of abrasive element **1016** in the embodiment shown is about 2.5 inches measured from the midpoint of the curved side **1031** to the inner end **1029**. The abrasive element **1016** in the embodiment shown is approximately 2.5 inches wide at its widest location near curved side **1031**.

[0033] The abrasive elements **1016** preferably are spaced over said working surface in generally equally spaced radial alignment. The tapered shape of the abrasive elements **1016** which narrow as they extend toward the center of the pad **1010** results in a generally uniform ratio of surface area of the pad **1010** covered by the abrasive elements **1016** in a radial direction over the portions of the pad **1010** covered by abrasive elements **1016**.

[0034] The radius of curvature of the curved side **1031** of abrasive element **1016** preferably matches the radius of curvature of the pad **1010** to which it is attached. However, it is foreseen that in order to reduce the number of molds necessary to produce the abrasive elements **1016**, the abrasive elements **1016** may be formed into a single standard size or fewer sizes than the sizes of the pads **1010** to which the abrasive elements **1016** are adapted to be attached. For example, conventional sizes for pads **1010** may range from seven inches up to twenty seven inches in diameter with standard sizes of sixteen, seventeen, twenty, twenty one and twenty seven inches in diameter. Standard diameters for floor pads range between twenty one and twenty seven inches. The abrasive element **1016** shown in FIGS. **10-12** is depicted as having a radius of curvature which matches the radius of curvature of a pad **10** that is smaller than the pad **1010** to which it is attached. For example, the pad **1010** shown could be representative of a pad having a diameter of twenty seven inches while the radius of curvature of the abrasive element **1016** matches the radius of curvature of a pad **10** having a diameter of twenty four inches. The abrasive element **1016** might then be used with any pads **10** having a diameter of between twenty one to twenty seven inches. A smaller sized abrasive element **1016** might then be used with pads **10** having diameters of between seven and twenty one inches and an even smaller sized abrasive element **1016** might be used with smaller pads **10**.

[0035] It is to be understood that some or all of the sides of the abrasive elements **15** could extend generally perpendicular to the working surface thereof such as working surface **20**. It is also understood that the sides could be radiused or a small radius or bevel could be formed between the side and the working surface. Also, shapes and dimensions of abrasive elements **15** other than those specifically identified herein are foreseen. It is also foreseen that abrasive elements of different sizes and shapes may be mounted together on a single working surface **20**.

[0036] The abrasive elements **15** are attached to the working surface **20** with one or more glues **26**, adhesives, or mechanical fasteners, such as hook-and-loop fasteners. Or the abrasive elements **15** might be integrally molded into the working surface **20**. The abrasive elements **15** are molded or constructed from a resin with diamonds or diamond particles (hereinafter collectively referred to as diamonds) disposed therein but, embodiments of the invention are not limited to a particular composition. For example, the abrasive elements **15** may comprise metal-bonded diamond particles or a base portion that is coated with a diamond-impregnated resin. The resin can be the same or different from that of the coating **24** and includes resins or binders available in the art, such as for example, phenolic, acrylic, melamine, and urea resins, or thermoplastics, and hybrid compositions that include one or more metals. In an embodiment, the abrasive elements **15** comprise FLEXDOTS from Superior Surface Solutions, Inc. of Kansas City, Mo.

[0037] The diamonds are natural or industrial diamonds or particles thereof and might be coated with one or more materials, e.g. silver. In an embodiment, other abrasive materials, like garnet, corundum, silicates, metals, or the like, are used in addition to or instead of diamonds. The diamonds/diamond particles have an average diameter configured to provide a desired abrasive grit to the abrasive elements **15**. In an embodiment, the diamonds/particles have an average diameter of about 15 to about 40 μm (about 1100 to about 325 grit)

or between about 20 and about 30 μm (about 900 to about 500 grit) or preferably about 23 to about 26 μm (about 400 grit) suitable for polishing a concrete, terrazzo, or stone floor. However, in embodiments the diamonds can be sized to provide any desired grit; typical sizes might range from about 50 to greater than 8500 grit.

[0038] It has also been determined that varying the grit of the diamonds in the coating 24 bonded to the pads 10 versus the grit of the diamonds incorporated into the abrasive elements 15 results in more efficient polishing. More specifically, the grit of the diamonds in the coating 24 on the pad 10 is preferably greater than the grit of the diamonds in the abrasive elements 15. Because a higher grit indicates a smaller size, the diamonds in the coating 24 on pads 10 are preferably smaller than the diamonds in the abrasive elements 15. In one embodiment the ratio of grits is 2 to 1 with the grit of the diamonds in the pad 10 at 800 and the grit of the diamonds in the abrasive element 15 at 400. Another embodiment might include a 400 grit pad 10 and a 200 grit abrasive element 15. It is to be understood that other variations in the ratio of grits may be used. For example, the ratio of the grit of the particles in the pad, a first grit, versus the ratio of the grit of the particles in the abrasive element, the second grit, will likely range from 1.5 to 1 to 2.5 to 1 although other ratios may also be utilized. In some applications, the grit of the diamond particles in the pad 10 may be less than the grit of the diamond particles in the abrasive elements 15. In such applications, the ratio of the second grit to the first grit will also likely be 1.5 to 1 to 2.5 to 1.

[0039] A contact surface 28 of the abrasive elements 15 is also configured with a plurality of recesses or channels 30 and plateaus 32. As depicted in FIG. 1, the channels 30 and plateaus 32 are configured in a radially extending grid pattern or, in another embodiment depicted in FIG. 3, channels and plateaus of abrasive discs 316 on an abrasive pad 310 are configured in a repeating linear pattern. In yet another embodiment, as depicted in FIG. 10, channels 1030 are arranged in a crossing arcuate grid pattern forming a plurality of quadrilateral plateaus 1032. It is understood that any pattern or configuration is useable in embodiments of the invention. It is also understood that the channels 30 may be any depth or of differing depths in the same abrasive element 15. The channels 30 may aid polishing by the plateaus 32 guiding materials produced by or used for polishing away from the plateaus 32. Such may decrease or eliminate scratching of the surface being worked on by those materials being trapped between the plateaus 32 and the surface and may reduce gumming of the abrasive elements 15. The materials include, for example, particles abraded from the surface being worked on, dirt or dust on the surface, particles from the abrasive elements 15, and fluids or polishing agents applied to the surface. In an embodiment, the channels 30 might also increase the flexibility of the abrasive elements 15 to enable better conformance of the abrasive elements 15 to uneven features of the surface being worked on.

[0040] As depicted in FIG. 1, the abrasive discs 16 are evenly spaced on the working surface 20 near the circumferential edge 22 of the body 12. In an embodiment, the abrasive discs 16 are all disposed within the outer third of the working surface 20. In another embodiment, depicted in FIG. 3, the abrasive discs 316 are disposed on a working surface 320 in a staggered arrangement across the entire working surface 320. It is to be understood that the arrangements of the abrasive discs 16 and 316 depicted in FIGS. 1 and 3 are exemplary and

not limiting. Other arrangements of the abrasive elements 15 can be used in embodiments of the invention without departing from the scope described herein.

[0041] As depicted in FIGS. 8, 9, 10, 11 and 12, if the abrasive elements 15 are in the form of wedges 816 or trapezoids 1016, the abrasive elements are preferably radially disposed about the center of central aperture 814 or 1014. Each abrasive element 816 or 1016 is oriented such that the center of central aperture 814 or 1014 aligns with the centerline of the abrasive element. Each abrasive element 816 or 1014 is located at the periphery of body 812 or 1012. Sides 831 or 1031 for each abrasive element align with the outermost circumferential surface 835 or 1035 of the body. A benefit of orienting the abrasive elements 816 and 1016 in this manner is that the widest portion, and consequently the greatest amount of surface area, of each abrasive element is at the periphery of the body. This ensures that a surface being treated by pad 810 or 1010 receives treatment from the abrasive elements even if the surface only contacts the periphery of the pad. Furthermore, when compared to disc shaped abrasive elements, using abrasive elements 816 and 1016 in the configurations disclosed herein results in treated surfaces receiving a more consistent ratio of pad working surface treatment to abrasive element treatment as the pad moves over the surface.

[0042] The abrasive pad 10 also includes a peripheral reinforcement 34 along at least a portion of the circumferential edge 22. The reinforcement 34 comprises one or more of a rubber, resin, latex, mastic, glue, adhesive, plastic, paper, wood, or metal that is applied or coupled to the circumferential edge 22. The reinforcement may comprise, for example, a polyvinyl acetate glue with a plasticizer added to result in a cured product that is more flexible and resilient. The reinforcement 34 at least partially reinforces the body 12 at the circumferential edge 22 against compression. The reinforcement 34 also allows at least partial flexibility of the abrasive pad 10 near the circumferential edge 22 to allow conformance to uneven features of the surface being worked on. The reinforcement 34 is applied to the entire circumferential edge 22 or can be applied only to sections of the circumferential edge 22 proximate to one or more of the abrasive elements 15.

[0043] It is foreseen that the abrasive elements 816 and 1016 may be used with or without a peripheral reinforcement 834 or 1034 (FIGS. 8, 9, 10, 11 and 12 show the elements being used with peripheral reinforcement). The peripheral placement of abrasive elements 816 and 1016 as described above allow the elements to make sufficient contact with the surface being treated without the need for peripheral reinforcement.

[0044] In another embodiment depicted in FIG. 7, the reinforcement 734 on an abrasive pad 710 can penetrate between the fibers 748 and at least partially into the abrasive pad 710. In an embodiment, the penetration of the reinforcement 734 into the abrasive pad 710 is not uniform. The reinforcement 734 penetrates a greater distance into the abrasive pad 710 near the middle of the thickness thereof than at the non-working side 718 and the working surface 720. However, the penetration of the reinforcement 734 can be configured in other ways including no penetration or uniform penetration, among others.

[0045] One or more layers of similar or dissimilar materials can be applied to the circumferential edge 22 to form the

reinforcement 34. In an embodiment, the reinforcement 34 is a rubber material such as PLIOBOND from Ashland, Inc. of Covington, Ky.

[0046] With reference now to FIG. 4, operation of an abrasive pad 410 of the prior art is described. As depicted in FIG. 4, the prior art abrasive pad 410 includes an abrasive element 416 affixed near a circumferential edge 422 of a working surface 420 thereof. The abrasive pad 410 is also coupled to a rigid or flexible driver 436 of a rotary grinding/polishing machine 438 as is known in the art. The abrasive pad 410 and abrasive element 416 may comprise similar materials and configurations as described above for the body 12 of the abrasive pad 10 and the abrasive elements 16. The abrasive pad 410 does not include the coating 24 or the reinforcement 34.

[0047] In use, the abrasive pad 410 is unable to maintain the abrasive elements 416 disposed adjacent to the circumferential edge 422 parallel to and in full contact with a surface 440 being worked on. The body 412 of the abrasive pad 410 in an area 442 that is near the circumferential edge 422 and between the abrasive element 416 and the circumferential edge 422 is compressed by forces applied during grinding/polishing. The forces include one or a combination of pressure applied by the grinding/polishing machine 438 toward the surface 440 and rotational forces resulting from rotating the abrasive pad 410 by the grinding/polishing machine 438. The body 412 in the area 442 is weaker than the remainder of the body 412 at least because of the free, unsupported circumferential edge 422; areas that are radially inward from the circumferential edge 422 are supported by the surrounding material of the body 412 and do not compress to the extent found in the area 442.

[0048] The abrasive element 416 is thus not equally supported across its width by the body 412, e.g. a greater force toward the surface 440 is applied near a radially inward edge 444 than is applied near a radially outward edge 446. As such, the radially outward edge 446 of the abrasive element 416 tends to lift away from the surface 440. This leads to uneven wear on the abrasive element 416, less grinding/polishing action being applied to the surface 440, and slower overall performance of the abrasive pad 410.

[0049] Turning now to FIG. 5, use of the abrasive pad 10 is described in accordance with an embodiment of the invention. The abrasive pad 10 is coupled to a rigid or flexible driver 36 of a rotary grinding/polishing machine 38 as is known in the art. Upon application of the working surface 20 of the abrasive pad 10 to a surface 40 to be ground/polished, the abrasive disc 16 at least partially compress overlying portions of the body 12 and at least partially recess into the body 12. In an embodiment, the abrasive elements 15 recess into the body 12 a sufficient distance to place both the contact surfaces 28 of the abrasive elements 15 and the working surface 20 of the abrasive pad 10 in contact with the surface 40 to be ground/polished.

[0050] The peripheral reinforcement 34 provides additional support for the area 42 between and/or proximate to the circumferential edge 22 and the abrasive elements 15. The contact surfaces 28 of the abrasive elements 15 are thus maintained parallel to and in contact with surface 40 during grinding/polishing. The reinforcement 34 has sufficient rigidity to substantially resist compression of the body 12 as described above and is sufficiently resilient to allow flexure of the body 12 when encountering obstructions or uneven features on the surface 40.

[0051] In operation, the simultaneous contact of the abrasive elements 15 and the coating 24 on the working surface 20 of the body 12 with the surface 40 provides synergistic benefits. For example, an abrasive element 15 with a lower grit can be paired with a coating 24 on the abrasive pad 10 that has a finer/higher grit to achieve a finish on the surface 40 comparable to that achievable through a number of separate steps using a plurality of pads, the finest of which having a grit similar to that of the coating 24.

[0052] And the abrasive elements 15 and coating 24 can be configured to simultaneously employ the benefits of each form of abrasive. For example, in concrete grinding/polishing, abrasive elements like the abrasive elements 15 do not substantially produce an effect known in the art as orange peel in the surface finish but, abrasive elements work relatively slowly. In contrast, pads with abrasive coatings like the abrasive pad 10 and coating 24, typically produce orange peel in the surface finish but work more quickly than abrasive elements. And larger, coarser grits tend to wear out more quickly when used as a coating on a pad than when applied via abrasive elements.

[0053] As such, continuing the above example, the lower grit abrasive element 15 provides slower but deeper cutting/polishing of the surface 40 while also substantially eliminating or reducing the appearance of orange peel from the surface 40. The higher grit coating 24 provides faster, shallower, and finer polishing of the surface 40. And the life of the coating 24 is extended because finer grit particles are used in the coating 24 and lower grit particles are placed in the longer lasting abrasive elements 15. In another embodiment, the abrasive element 15 has a higher grit while the coating 24 has a lower, coarser grit. In this case the finer grit particles in the abrasive element 15 refine orange peel created by the coarser grit particles in the coating 24. Such an arrangement may be beneficial for softer surfaces 40.

[0054] In one example, the abrasive pad 10 has an 800 grit coating 24 configured for burnishing a concrete surface 40 along with 400 grit abrasive elements 15 configured for polishing the surface 40. The abrasive elements 15 thus provide deeper cutting but slower polishing of the surface 40 while the coating 24 provides faster, shallower, finer burnishing of the surface 40. The resulting finish on the surface 40 is similar to a surface that is at least first polished with a 400 grit abrasive and then burnished with an 800 grit abrasive. But the resulting finish on the surface 40 is obtained in a single step rather than through two or more separate steps. And the time necessary for completing the single step is less than that required to complete the two or more separate steps. Further, by using the abrasive elements 15 and the coating 24 simultaneously, orange peel that might result from burnishing with the coating 24 is reduced or eliminated by the abrasive elements 15. As such, the resulting surface finish achieved by the abrasive pad 10 might exceed that achievable with separate polishing and burnishing pads without an additional step to remove the orange peel from the surface 40.

[0055] Many different arrangements of the various components depicted, as well as components not shown, are possible without departing from the scope of the claims below. Embodiments of the technology have been described with the intent to be illustrative rather than restrictive. Alternative embodiments will become apparent to readers of this disclosure after and because of reading it. Alternative means of implementing the aforementioned can be completed without departing from the scope of the claims below. Certain features

and subcombinations are of utility and may be employed without reference to other features and subcombinations and are contemplated within the scope of the claims.

What is claimed is:

1. An abrasive pad comprising:
 - a pad body having a first surface, a second surface opposite the first surface, and a circumferential face extending between the perimeters of the first and second surfaces;
 - a plurality of abrasive elements affixed to the second surface of the pad body, at least one of the abrasive elements being located proximate to the perimeter of the second surface; and
 - a reinforcing material applied to the circumferential face, the reinforcing material reinforcing the pad body against compression at the circumferential face and proximate to the at least one abrasive element, and the reinforcing material maintaining a working face of the at least one abrasive element substantially parallel to a surface being worked on.
2. The abrasive pad of claim 1, further comprising:
 - an abrasive coating applied to at least a portion of the second surface.
3. The abrasive pad of claim 2, wherein the abrasive coating includes one or more of diamonds and diamond particles.
4. The abrasive pad of claim 1, wherein the plurality of abrasive elements includes one or more of diamonds and diamond particles coated thereon or impregnated therein.
5. The abrasive pad of claim 1, wherein the plurality of abrasive elements have a low profile with a thickness of approximately 0.2 millimeters to about five millimeters.
6. The abrasive pad of claim 1, wherein the plurality of abrasive elements at least partially recess into the pad body and the plurality of abrasive elements and the second surface of the pad body simultaneously contact and abrade the surface being worked on.
7. The abrasive pad of claim 1, wherein the reinforcing material is resilient.
8. The abrasive pad of claim 8, wherein the reinforcing material comprises one or more layers of one or more of a resin, glue, rubber, or plastic.
9. The abrasive pad of claim 1, wherein the reinforcing material is applied to the entire circumferential face.
10. The abrasive pad of claim 1, wherein the reinforcing material is applied to the circumferential face at locations proximate to one or more of the plurality of abrasive elements.
11. A combination polishing and burnishing pad for use on hard surfaces, the pad comprising:
 - a pad body having a first surface, a second surface opposite the first surface, and a circumferential face extending between the perimeters of the first and second surfaces;
 - a diamond impregnated coating applied to at least a portion of the second surface and configured for burnishing a hard surface; and
 - a plurality of low-profile abrasive elements affixed to the second surface of the pad body and configured for polishing the hard surface, the abrasive elements at least partially recessing into the pad to provide simultaneous contact of the plurality of abrasive elements and the coating on the second surface with the hard surface to simultaneously polish and burnish the hard surface.
12. The combination polishing and burnishing pad of claim 11, further comprising:

a reinforcing material applied to the circumferential face, the reinforcing material reinforcing the pad body against compression at the circumferential face, and the reinforcing material maintaining a working face of the at least one abrasive element substantially parallel to a surface being worked on.

13. The combination polishing and burnishing pad of claim 12, wherein the reinforcing material is applied to the entire circumferential face.

14. The combination polishing and burnishing pad of claim 12, wherein the reinforcing material is applied to the circumferential face at locations proximate to one or more of the plurality of abrasive elements.

15. An abrasive pad for use on hard surfaces, the pad comprising:

a pad body of a fibrous, non-woven material having a first surface, a second surface opposite the first surface, and a circumferential surface extending between the perimeters of the first and second surfaces;

a diamond impregnated coating applied to the second surface, the coating having a first grit;

a plurality of abrasive elements coupled to the working surface, the abrasive elements having diamond particles impregnated therein and having a second grit that is more coarse than the first grit; and

a reinforcing material applied to at least a portion of the circumferential surface proximate to an abrasive element of the plurality of abrasive elements, the reinforcing material reinforcing the pad body against compression proximate to the edge face.

16. The abrasive pad of claim 15, wherein the reinforcing material maintains the at least one abrasive element substantially parallel to a surface being worked on.

17. The abrasive pad of claim 15, wherein the pad body is compressible to enable at least partial conformance to an uneven surface being worked on.

18. The abrasive pad of claim 17, wherein the reinforcing material is applied to the entire circumferential surface.

19. The abrasive pad of claim 15, wherein the coating on the second surface is configured for burnishing, the abrasive elements are configured for polishing, and the pad enables a burnished finish to be achieved without the use of separate polishing and burnishing pads.

20. An abrasive pad comprising:

a pad body having a working surface; and

a plurality of abrasive elements affixed to said working surface, each of said abrasive elements having at least three sides wherein at least two of said sides converge toward each other as they extend toward a center of said pad body.

21. The abrasive pad as in claim 20 wherein said abrasive element has a curved side positioned proximate an outer periphery of said abrasive pad and having a radius of curvature similar to a radius of curvature of said abrasive pad.

22. An abrasive pad comprising:

a fibrous pad body having a first surface and a second surface opposite the first surface with an abrasive coating applied to at least a portion of the second surface; said abrasive coating including a plurality of particles of an abrasive material having a first grit;

a plurality of abrasive elements affixed to the second surface of the pad body; said abrasive element including a

plurality of particles of the abrasive material having a second grit embedded therein; and

wherein the first grit is different than the second grit.

23. The abrasive pad as in claim **22** wherein the abrasive material comprises diamond particles.

24. The abrasive pad as in claim **22** wherein the first grit is greater than the second grit.

25. The abrasive pad as in claim **24** wherein the first grit is approximately 1.5 to 2.5 times greater than the second grit.

26. The abrasive pad as in claim **22** wherein the first grit is less than the second grit.

27. The abrasive pad as in claim **26** wherein the second grit is approximately 1.5 to 2.5 times greater than the first grit.

* * * * *