ABSTRACT

The invention relates to a polishing and grinding system useful with a variety of substrates, including, without limitation, precious stones and jewelry and for the sharpening of tools such as drill bits, knives and chisels. The system may be configured for use in a variety of positions, including handheld operation. A series of optional elements are also described, including a tool rest and a shelf, each to facilitate different grinding and/or polishing operations.
Figure 1D
Figure 1E
Figure 4B
Figure 5B
Figure 6
Figure 8B
Figure 8C
Figure 9C
POLISHING AND GRINDING SYSTEM

FIELD OF THE INVENTION

[0001] This invention relates to the polishing and grinding art, and more particularly to a polishing and grinding system useful to polish, grind, sand, burnish and/or finish a number of different objects and materials.

BACKGROUND OF THE INVENTION

[0002] A variety of polishing and grinding systems have been made available in the past. Many incorporate a rotating element, such as a disc, against which various substrates can be positioned so they may be polished or ground when the disc rotates. These systems have a number of shortcomings. For instance, some of these systems are bulky or are designed to reside permanently in a single location, which limits their utility and/or portability. Some systems lack flexibility in the positioning of the rotating disc or element, making it inconvenient or even dangerous for a user to hold a substrate in the required position for system operation. Other systems may require extensive, burdensome or counterintuitive setup procedures before operation. Some systems restrict operation to certain types of substrate or workpiece materials. A variety of other shortcomings in these systems will be readily apparent to those of skill in the art.

[0003] The invention provides an improved polishing and grinding system that obviates many of the shortcomings of conventional systems. Other objects, advantages and features of this invention will become more apparent from the following description.

SUMMARY OF THE INVENTION

[0004] In an embodiment, the invention includes an apparatus for grinding and/or polishing, comprising a main body; a shaft in rotatable communication with the main body, wherein a portion of the shaft resides outside the main body, and wherein the portion of the shaft that resides outside the main body is configured for removable attachment to a disc for grinding and/or polishing a substrate; and a base, removably attached to the main body, wherein the base is configured for removable attachment to the main body in a first position, in which the shaft is orientated in a substantially upright position, and a second position, in which the shaft is orientated in a substantially horizontal position. The first position may comprise an ergonomic tilt, wherein the shaft is orientated in a substantially upright position and with a tilt in the general direction of a user of the apparatus during operation. The base may comprise at least one latch mechanism to removably attach the base to the main body. The apparatus may further comprise at least one electromechanical component housed within the main body and in mechanical communication with a portion of the shaft that resides within the main body, and being selected from the group consisting of a motor, a gear box, a power supply, and a control mechanism. The motor may be adapted for operation at a constant speed or at a variable speed, and for rotation in a single direction or in two directions. The apparatus may further comprise a switch configured on the main body and in communication with the at least one electromechanical component, wherein actuation of the switch causes the shaft to rotate. The apparatus may further comprise a hood to reduce dispersion of particulate matter and/or to improve safety during operation, wherein the hood is attached to the main body adjacent to the portion of the shaft that resides outside the main body. The hood may be removably attached to the main body. The hood may comprise an opening therethrough to facilitate exhaust of the particulate matter during operation. The main body may comprise a handle. The handle may be collapsible so as to be substantially flush with and/or possessing a reduced profile relative to the main body when in a collapsed configuration. The handle may be in a fixed position with respect to the main body. The base may comprise a drawer. The apparatus may further comprise a shelf for placing items to be polished and/or ground during operation of the apparatus or for containing a volume of liquid into which items may be placed for cooling, rinsing and/or lubricating. The shelf may be configured for removable placement within the base. The apparatus may further comprise a tool rest to impart stability and/or improve accuracy and/or improve safety during operation. The tool rest may be removably attached to the main body. The tool rest may comprise a central element comprising a side adapted for use with items that have at least one substantially flat element and/or a side adapted for use with drill bits, wherein the central element is rotatable around its axis and positionable at a multitude of angles with respect to the disc, and, optionally, wherein the central element is lockable at each of at least one angle with respect to the disc.

[0005] In another embodiment, the invention includes a system for grinding and/or polishing, comprising the aforesaid apparatus and a disc for grinding and/or polishing a substrate, removably attached to the shaft of the apparatus.

[0006] In yet another embodiment, the invention includes a method of polishing, grinding, sanding, burnishing and/or finishing a substrate, comprising providing the aforesaid system; causing the disc to rotate; and contacting the rotating disc with the substrate to polish, grind, sand, burnish and/or finish the substrate. The substrate may be a precious stone, a semi-precious stone, a non-precious stone, jewelry, a tool, a drill bit, a router bit, a CNC end-mill, a knife, a chisel, a wood turning tool or a carving tool. In yet another embodiment, the invention includes a method for adjusting the orientation of an apparatus for grinding and/or polishing, comprising providing the aforesaid apparatus, wherein the base is removably attached to the main body in the first position; removing the main body from the base; and removably attaching the base to the main body in the second position.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0007] Exemplary embodiments are illustrated in referenced figures, wherein like numerals refer to like elements. It is intended that the embodiments and figures disclosed herein are to be considered illustrative rather than restrictive.

[0008] FIG. 1A-1G depicts a polishing and grinding system in connection with an embodiment of the present invention, in which the main body is configured in an upright position with respect to the base. FIGS. 1A and 1B depict a first perspective view of the system, with and without a disc, respectively. FIGS. 1C and 1G depict a second perspective view of the system, with the handle in folded and unfolded positions, respectively. FIGS. 1D, 1E and 1F depict front, side and rear elevation views of the system, respectively.

[0009] FIG. 2 depicts a perspective view of a polishing and grinding system in connection with an embodiment of the present invention, in which the base is separated from the remainder of the system.
FIG. 3 depicts a perspective view of a polishing and grinding system in connection with an embodiment of the present invention, in which the hood is separated from the remainder of the system.

FIG. 4A-4D depicts a polishing and grinding system in connection with an embodiment of the present invention, in which the main body is configured in a horizontal position with respect to the base. FIG. 4A depicts a first perspective view of the system, without a disc.

FIG. 4B depicts a second perspective view of the system, without a disc. FIG. 4C depicts a third perspective view of the system. FIG. 4D depicts a rear elevation view of the system.

FIG. 5A-5B depicts a release mechanism configured on the base of a polishing and grinding system in connection with an embodiment of the present invention. FIG. 5A is a perspective view of the portion of the system that includes the release mechanism, and FIG. 5B is a side elevation view of the portion of the system that includes the release mechanism, accompanied by a larger view thereof.

FIG. 6 depicts a drawer (in an open position) configured in the base of a polishing and grinding system in connection with an embodiment of the present invention.

FIG. 7A-7B depicts a shelf configured on the top of the main body of a polishing and grinding system in connection with an embodiment of the present invention. FIG. 7A is a perspective view of the system with the shelf attached. FIG. 7B is a similar perspective view of the system with the shelf nearly attached, accompanied by a larger view thereof.

FIG. 8A-8D depicts a tool rest that can be used with a polishing and grinding system in connection with an embodiment of the present invention. FIG. 8A depicts a first side of the tool rest, adapted for use with tools that have at least one substantially flat element. FIG. 8B depicts a second side of the tool rest, adapted for use with drill bits. FIGS. 8C and 8D depict perspective views of the system with the tool rest attached thereto, with and without a disc, respectively.

FIG. 9A-9C depicts various discs in connection with embodiments of the present invention. FIGS. 9A and 9B depict two different discs. FIG. 9C depicts the disc of FIG. 9B, removably attached to an attachment mechanism.

DESCRIPTION OF THE INVENTION

All references cited herein are incorporated by reference in their entirety as though fully set forth, to the extent not inconsistent with the present description. Unless defined otherwise, technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. One skilled in the art will recognize many methods and materials similar or equivalent to those described herein, which could be used in the practice of the present invention. Indeed, the present invention is in no way limited to the methods and materials described.

The invention relates to a polishing and grinding system. The system may be configured in a variety of ways so as to be useful for polishing, grinding, sanding, burnishing and/or finishing (referred to collectively herein as “polishing and grinding”) a variety of objects and materials. Simply by way of non-limiting example, the system can be used to shape and/or polish precious, semi-precious and non-precious stones and jewelry; to sharpen tools such as drill bits, router bits, CNC end-mills, knives and chisels, wood turning tools, and carving tools; or to grind, sand and/or polish a variety of surfaces and materials. A variety of additional uses will be readily apparent to those of skill in the art and can be implemented by way of routine effort in connection with alternate embodiments of the present invention.

In an embodiment of the invention, as illustrated in FIG. 1, the polishing and grinding system (or simply, the “system”) 100 comprises or consists of a main body 101 and a base 300. As illustrated in FIG. 2, the main body 101 may be removable from the base 300. Alternatively, the main body 101 may be substantially affixed to or unitary with the base 300.

Turning back to FIG. 1, the system 100 may also comprise or consist of a hood 102. The hood 102 may be removable from the main body 101 (FIG. 3). Alternatively, the main body 101 may be substantially affixed to or unitary with the hood 102. The hood 102 may generally enclose the region atop the main body 101. As illustrated in FIG. 1, the hood 102 generally encloses the region atop the main body 101, by fully covering two sides and mostly covering a third side. A variety of alternative configurations for the hood 102 may be used. In various embodiments, the hood 102 may reduce and/or control the dispersion of dust, debris and other particulate matter during operation of the system 100. It may also provide a safety feature, by limiting the inadvertent interaction between a user’s fingers or other external items with the rotating shaft during system operation. The hood 102 may include an opening 106 to serve as an exhaust portal for dust, debris and other particulate matter during system operation. A hose (not shown) or other apparatus may be affixed to the opening 106 to collect dust, debris and other particulate matter during system operation.

A shaft 104 is in rotatable communication with the main body 101, such that a portion of the shaft 104 reaches the interior of the main body 101 and another portion of the shaft 104 resides outside of the main body 101. In FIG. 1, only the portion of the shaft 104 that resides outside of the main body 101 is depicted.

An attachment mechanism 105 is configured on the end of the portion of the shaft 104 that resides outside of the main body 101. The attachment mechanism 105 is configured for removable attachment to a disc 200. As will be readily appreciated by those of skill in the art, the attachment mechanism 105 can be configured in a variety of ways to enable removable mechanical communication with a variety of discs 200. By way of example, the attachment mechanism may comprise or consist of one or more of screw threading, magnets, pins, grooves or a variety of additional elements that in each case enable a disc 200 to be removably attached thereto and used in connection with a polishing and/or grinding operation. Examples of discs 200 that may be used in connection with the present invention are described, for instance, in FIG. 9 and in U.S. Pat. Nos. 7,377,837 and 8,562,396, the contents of each of which are incorporated by reference herein as though fully set forth.

Contained within the main body 101 are various electromechanical elements of the system (not shown), which may include, in various embodiments, a motor, a power supply, other components necessary to drive the rotation of the shaft (and thus, the rotation of the disc), and further elements that will be readily apparent to those of skill in the art and which can be implemented in connection with alternate embodiments of the invention. If desired, a gear box (not shown) may also be contained within the main body 101 to increase or decrease the rotational speed of the motor and,
consequently, the rotational speed of the shaft 104. The gear box may be of conventional design. The motor may be a constant speed or a variable speed motor as desired for particular applications. The motor is in mechanical communication with the portion of the shaft 104 reaches the interior of the main body 101. In an embodiment, the system 100 is configured such that the shaft 104 is rotatable by the motor in one direction (i.e., clockwise or counterclockwise). In an alternate embodiment of the invention, the system 100 is configured such that the shaft 104 is rotatable by the motor in two directions (i.e., clockwise and counterclockwise). The system 100 also includes at least one controller 107 that enables a user to turn the motor on and off and/or to cause the motor to rotate the shaft 104 in a clockwise or counterclockwise direction and/or to change the speed of the motor.

[0025] The main body 101 may comprise or consist of a handle 103 to facilitate transportation of the system 100. The handle 103 may optionally be configured to be collapsible into a “folded” position that renders it substantially flush with and/or lowers its profile relative to the side of the main body 101 when not in use. When in use, the handle 103 may be in its “unfolded” position.

[0026] As noted above, the main body 101 may be removable from the base 300. It may also be configured for removable interaction with the base 300 in multiple positions. In FIG. 1, the main body 101 is illustrated in an upright position with respect to the base 300. The upright position may, in various embodiments such as those depicted throughout the drawings, include an ergonomic tilt oriented towards the user, which may, among other things, improve visibility during operation. In FIG. 4, the main body 101 is illustrated in a horizontal position with respect to the base 300. The flexibility offered by this embodiment of the invention may be advantageous so that, for instance, users have the choice of working with substrates that are more convenient or safer to work with when the main body 101 is in one of these two positions, but not the other position. As will be readily appreciated by those of skill in the art, any number of mechanical, magnetic or other components may be used to secure the main body 101 to the base 300 in either of these alternate positions. Simply by way of example, as illustrated in FIG. 5, the base 300 may include one or more latch mechanisms 301, which can be actuated by a user. In yet another embodiment, the one or more latch mechanisms 301 may be in mechanical communication with one or more pins 302, such that, when the latch mechanism 301 is actuated, the one or more pins 302 press in an outward direction from the base 300 so as to facilitate the separation or ejection of the main body 101 from the base 300. The latch mechanisms 301, with or without accompanying pins 302, may be configured to function with the main body 101 in either or both of its upright or horizontal positions, relative to the base 300. In yet another embodiment of the invention, the system may be used without the base 300 as a handheld tool.

[0027] As illustrated in FIG. 6, a drawer 303 (shown in an open position) may be configured in the base 300. The drawer 303 may, for instance, provide a convenient location for the storage of items useful in various grinding and/or polishing operations. In certain embodiments, such as those illustratively depicted throughout the drawings, the drawer 303 and the shelf 108 may be one and the same.

[0028] As illustrated in FIG. 7, the system 100 may include a shelf 108 configured on the top of the main body 101. The shelf 108 may be removable from the main body 101; for instance, through the mechanical interaction of several pins on the shelf 108 with corresponding holes 116 on the main body 101, as illustrated in FIG. 7B. Alternatively, the shelf 108 may be substantially affixed to or unitary with the main body 101. The shelf 108 may, for instance, provide a convenient location for placing items to be polished and/or ground during operation of the system, or it may be filled with water or another liquid into which such items may be placed for cooling, rinsing and/or lubricating.

[0029] As illustrated in FIG. 8, the system 100 may include a tool rest 109. The tool rest 109 can be configured to aid sharpening and/or polishing of other tools and materials (such as, without limitation, wood turning tools, router bits, planer blades, lawn mower blades, faceted stones, cabochon stones, etc.). The tool rest 109 may be removable from the main body 101; for instance, through the mechanical interaction of several pins on the tool rest 109 with corresponding holes 116 on the main body 101. Alternatively, the tool rest 109 may be substantially affixed to or unitary with the main body 101. The tool rest 109 may have a central element 114. The central element 114 may have a side adapted for use with tools or other items that have at least one substantially flat element 110. The central element 114 may have a side adapted for use with drill bits or similar bits or objects with like characteristics 111. The central element 114 of the tool rest 109 may be rotatable around its axis, allowing the central element 114 and the sides thereof to be positioned at a multitude of angles with respect to the disc 200. This may be advantageous in polishing and/or grinding different substrates, where one portion of the substrate rests on a side of the central element 114, and the other portion of the substrate interacts with the disc 200 where it is ground or polished during system operation. The tool rest 109 may impart stability and/or improve accuracy and/or improve safety during a polishing and/or grinding operation. The position of the central element 114 may be set by one or more locking apparatus 112.

[0030] The side adapted for use with tools that have at least one substantially flat element 110 may include various indicia 113 that inform a user as to the angle of the side relative to the edge of a disc 200. Internal pins and grooves between the central element 114 and the upright elements of the tool rest 109 may facilitate accurate locking of the central element 114 at various angles (i.e., a pin on the central element 114 may interact with a groove on the upright element when the central element reaches a particular angle, consistent with the indicia 113). The side adapted for use with tools that have at least one substantially flat element 110 may include an alignment mechanism 117 that may be slidable along the side, and that may be used to maintain the position of a substrate to be polished and/or ground. For instance, when a chisel is to be ground, the flat side of the chisel may be held against the side adapted for use with tools that have at least one substantially flat element 110, and it may then be supported against the alignment mechanism 117.

[0031] The side adapted for use with drill bits 111 may include various indicia 113 that inform a user as to the angle of the side relative to the edge of a disc 200. Internal pins and grooves between the central element 114 and the upright elements of the tool rest 109 may facilitate accurate locking of the central element 114 at various angles (i.e., a pin on the central element 114 may interact with a groove on the upright element when the central element reaches a particular angle,
consistent with the indicia 113). The side may also include one or more grooves 115 configured to receive drill bits of particular sizes.

[0032] The various methods and techniques described above provide a number of ways to carry out the invention. Of course, it is to be understood that not necessarily all objectives or advantages described may be achieved in accordance with any particular embodiment described herein. Thus, for example, those skilled in the art will recognize that the methods can be performed in a manner that achieves or optimizes one advantage or group of advantages as taught herein without necessarily achieving other objectives or advantages as may be taught or suggested herein. A variety of advantageous and disadvantageous alternatives are mentioned herein. It is to be understood that some preferred embodiments specifically include one, another, or several advantageous features, while others specifically exclude one, another, or several disadvantageous features, while still others specifically mitigate a present disadvantageous feature by inclusion of one, another, or several advantageous features.

[0033] Furthermore, the skilled artisan will recognize the applicability of various features from different embodiments. Similarly, the various elements, features and steps discussed above, as well as other known equivalents for each such element, feature or step, can be mixed and matched by one of ordinary skill in the art to perform methods in accordance with principles described herein. Among the various elements, features, and steps some will be specifically included and others specifically excluded in diverse embodiments.

[0034] Although the invention has been disclosed in the context of certain embodiments and examples, it will be understood by those skilled in the art that the embodiments of the invention extend beyond the specifically disclosed embodiments to other alternative embodiments and/or uses and modifications and equivalents thereof.

[0035] Many variations and alternative elements have been disclosed in embodiments of the present invention. Still further variations and alternate elements will be apparent to one of skill in the art. Various embodiments of the invention can specifically include or exclude any of these variations or elements.

[0036] In some embodiments, the terms “a” and “an” and “the” and similar references used in the context of describing a particular embodiment of the invention (especially in the context of certain of the following claims) can be construed to cover both the singular and the plural. The recitation of ranges of values herein is merely intended to serve as a shorthand method of referring individually to each separate value falling within the range. Unless otherwise indicated herein, each individual value is incorporated into the specification as if it were individually recited herein. All methods described herein can be performed in any suitable order unless otherwise indicated herein or otherwise clearly contradicted by context. The use of any and all examples, or exemplary language (e.g., “such as”) provided with respect to certain embodiments herein is intended merely to better illuminate the invention and does not pose a limitation on the scope of the invention otherwise claimed.

[0037] Preferred embodiments of this invention are described herein, including the best mode known to the inventors for carrying out the invention. Variations on those preferred embodiments will become apparent to those of ordinary skill in the art upon reading the foregoing description. It is contemplated that skilled artisans can employ such variations as appropriate, and the invention can be practiced otherwise than specifically described herein.

[0038] Accordingly, many embodiments of this invention include all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the invention unless otherwise indicated herein or otherwise clearly contradicted by context.

[0039] In closing, it is to be understood that the embodiments of the invention disclosed herein are illustrative of the principles of the present invention. Other modifications that can be employed can be within the scope of the invention. Thus, by way of example, not of limitation, alternative configurations of the present invention can be utilized in accordance with the teachings herein. Accordingly, embodiments of the present invention are not limited to that precisely as shown and described.

What is claimed is:

1. An apparatus for grinding and/or polishing, comprising:

a shaft in rotatable communication with the main body,
wherein a portion of the shaft resides outside the main body,
and wherein the portion of the shaft that resides outside the main body is configured for removable attachment to a substrate; and

a base, removably attached to the main body,
wherein the base is configured for removable attachment to
the main body in a first position, in which the shaft is orientated in a substantially upright position, and a second position, in which the shaft is orientated in a substantially horizontal position.

2. The apparatus of claim 1, wherein the first position comprises an ergonomic tilt, wherein the shaft is orientated in a substantially upright position and with a tilt in the general direction of a user of the apparatus during operation.

3. The apparatus of claim 1, wherein the base further comprises at least one latch mechanism to removably attach the base to the main body.

4. The apparatus of claim 1, further comprising at least one electromechanical component housed within the main body and in mechanical communication with a portion of the shaft that resides within the main body, the at least one electromechanical component selected from the group consisting of a motor, a gear box, a power supply, and a control mechanism.

5. The apparatus of claim 4, wherein the motor is adapted for operation at a constant speed or at a variable speed, and wherein the motor is adapted for rotation in a single direction or in two directions.

6. The apparatus of claim 4, further comprising a switch configured on the main body and in communication with the at least one electromechanical component, wherein actuation of the switch causes the shaft to rotate.

7. The apparatus of claim 1, further comprising a hood to reduce dispersion of particulate matter and/or to improve safety during operation, wherein the hood is attached to the main body adjacent to the portion of the shaft that resides outside the main body.

8. The apparatus of claim 7, wherein the hood is removably attached to the main body.

9. The apparatus of claim 7, wherein the hood comprises an opening therethrough to facilitate exhaust of the particulate matter during operation.
10. The apparatus of claim 1, wherein the main body comprises a handle.

11. The apparatus of claim 10, wherein the handle is collapsible so as to be substantially flush with and/or possessing a reduced profile relative to the main body when in a collapsed configuration.

12. The apparatus of claim 10, wherein the handle is in a fixed position with respect to the main body.

13. The apparatus of claim 1, wherein the base comprises a drawer.

14. The apparatus of claim 1, further comprising a shelf for placing items to be polished and/or ground during operation of the apparatus or for containing a volume of liquid into which items may be placed for cooling, rinsing and/or lubricating.

15. The apparatus of claim 14, wherein the shelf is configured for removable placement within the base.

16. The apparatus of claim 1, further comprising a tool rest to impart stability and/or improve accuracy and/or improve safety during operation.

17. The apparatus of claim 16, wherein the tool rest is removably attached to the main body.

18. The apparatus of claim 16, wherein the tool rest comprises a central element comprising a side adapted for use with tools that have at least one substantially flat element and/or a side adapted for use with drill bits, wherein the central element is rotatable around its axis and positionable at a multitude of angles with respect to the disc, and, optionally, wherein the central element is lockable at each of at least one angle with respect to the disc.

19. A system for grinding and/or polishing, comprising:

   the apparatus of claim 1; and

   a disc for grinding and/or polishing a substrate, removably attached to the shaft of the apparatus.

20. A method of polishing, grinding, sanding, burnishing and/or finishing a substrate, comprising:

   providing the system of claim 19;

   causing the disc to rotate; and

   contacting the rotating disc with the substrate to polish, grind, sand, burnish and/or finish the substrate.

21. The method of claim 20, wherein the substrate is selected from the group consisting of precious stones, semi-precious stones, non-precious stones, jewelry, tools, drill bits, router bits, CNC end-mills, knives, chisels, wood turning tools, and carving tools.

22. A method for adjusting the orientation of an apparatus for grinding and/or polishing, comprising:

   providing the apparatus of claim 1, wherein the base is removably attached to the main body in the first position; removing the main body from the base; and removably attaching the base to the main body in the second position.

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