

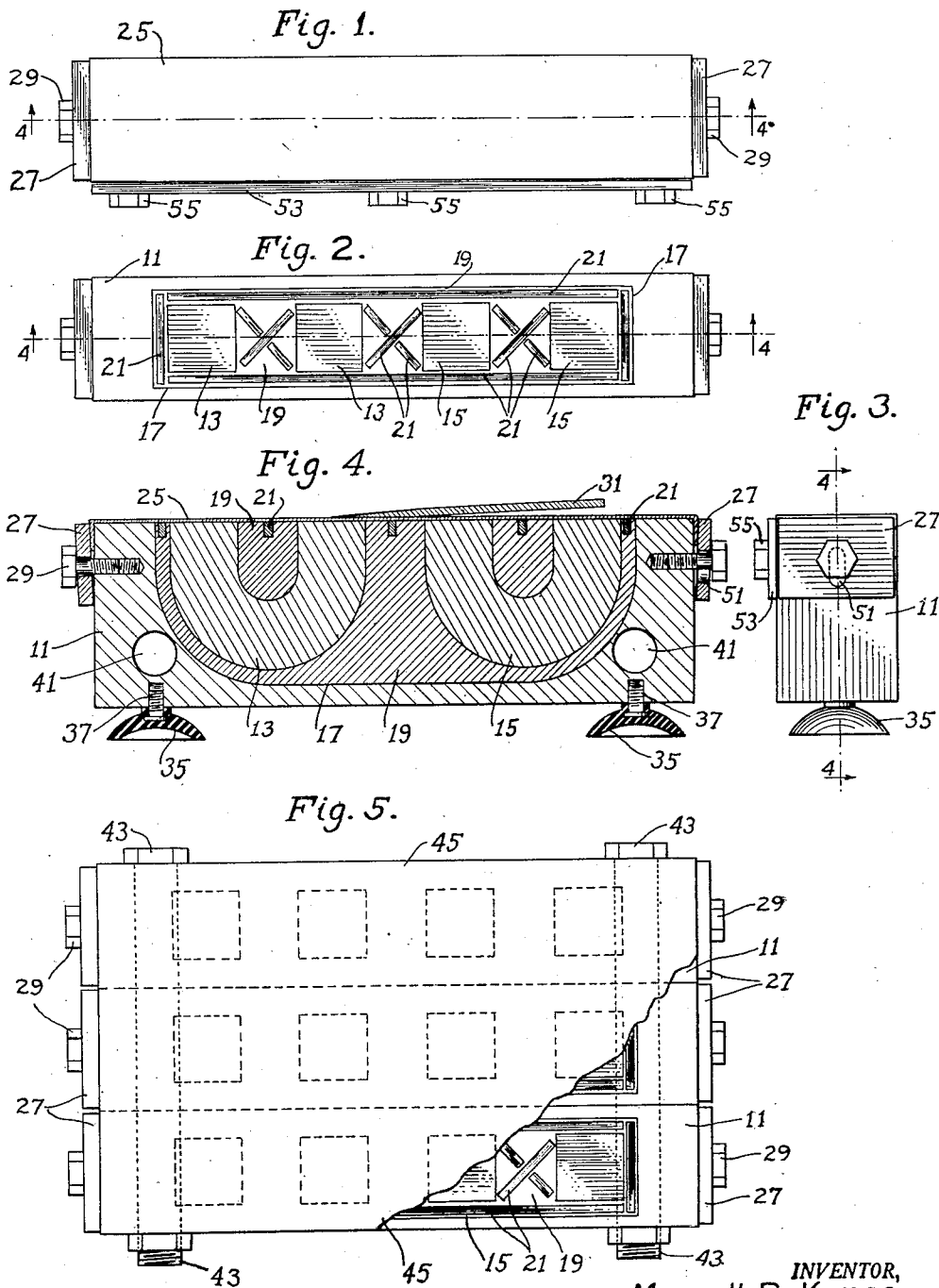
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MAGNETIC HONE AND LAP

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MAGNETIC HONE AND LAP

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This invention relates to a device for honing or lapping cutting tools, cutlery, small machine parts, and other surfaces.

An object of the invention is the provision of a generally improved and more satisfactory device useful as a hone and lap.

Another object is the provision of a device in which the article being honed or lapped is held against the working surface with an approximately uniform pressure and at a substantially constant angle, so that even an inexperienced person can produce excellent results in a honing or lapping operation.

Still another object is the provision of a honing and lapping device in which the wear is all taken by a thin, inexpensive, and easily renewable working surface, so that even hard and long continued use of the device does not cause wear or other damage to the permanent parts of the device.

A further object of the invention is the provision of a small, light, portable hone and lap having convenient means such as vacuum cups for holding the device, during use, in a stationary position on a table or other suitable supporting surface.

A still further object is the provision of a hone or lap in the form of a small unit which may be used by itself when honing or lapping small articles, and which may be easily and quickly attached to other similar units to form a larger honing surface for use in honing or lapping larger articles.

A still further object is the provision of a hone or lap in which magnetic force is employed for pressing the work against the working surface.

These and other desirable objects are accomplished by the construction disclosed as an illustrative embodiment of the invention in the following description and in the accompanying drawings forming a part hereof, in which:

Fig. 1 is a top plan view of a hone or lap unit in accordance with a preferred embodiment of the invention;

Fig. 2 is a view similar to Fig. 1 with the removable working surface removed to show the construction beneath;

Fig. 3 is an end elevation of the unit shown in Fig. 1;

Fig. 4 is a vertical section taken substantially on the lines 4—4 of Figs. 1, 2, and 3; and

Fig. 5 is a plan view showing a plurality of the individual units connected together to provide a larger honing surface, part of the working surface being broken away.

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The same reference numerals throughout the several views indicate the same parts.

Referring first to Figs. 1-4, the hone or lap unit in its preferred form comprises a main body 11, preferably of six-sided rectangular prismatic form, made preferably of metal which may be either magnetic or non-magnetic. Steel is a convenient material of which to make this body. Mounted within this body are one or more magnets, preferably of U-shaped form, having flat ends flush with the top surface of the body 11. As well understood in the art, such ends are sometimes referred to as the polar ends of the magnets. Two such magnets are shown in the drawings, at 13 and 15. They are conveniently mounted by providing in the body 11 a cavity 17 somewhat larger than the magnets, placing the magnets in proper position in the body, and then "casting" the magnets in the cavity by filling the cavity, around the magnets, with a filling 19 of molten or fluid material which will solidify after being placed in position. This filling 19 may be either metallic or non-metallic, but preferably is non-metallic. If metallic, the filling may conveniently be of Babbitt metal or lead. If non-metallic, it may conveniently be of any of the well-known plastic materials which will solidify or "set" after being poured or forced into the cavity. In either case (whether metallic or non-metallic) the top surface of the filling 19 may be strengthened and made more resistant to pressure by imbedding in the filling, flush with the top surface thereof, pieces or strips 21 of harder non-magnetic material, such as strips of copper. The top surfaces of the body 11, magnets 13 and 15, filling 19, and imbedded strips 21 are all carefully finished, by machining, grinding, or other suitable process, to a perfectly smooth flat continuous surface in a common plane.

The magnets employed are permanent magnets of relatively high strength and great permanence, such as the improved magnets of this nature which have been developed in recent years and are now available on the market; for example, sintered magnets, or "alnico" magnets.

The above-mentioned surface formed by the top faces of the magnets, the filling, and the body, constitutes what may be called the bed surface or master surface or true surface of the hone or lap, but does not constitute the actual working surface or wearing surface which comes in contact with the work to be honed or lapped. The working or wearing surface is formed by a thin, flexible sheet or strip of non-magnetic material 25 lying flat on and supported by and stretched

tightly over the bed surface, the ends of the strip 25 being turned down over the ends of body 11 and clamped tightly but releasably thereto by clamping bars 27 held by clamping screws 29.

For rough honing operations, the working surface 25 may be a sheet of any suitable known abrasive material; for example, sand paper, or preferably emery cloth, in the form of a strip of the same width as the body 11, and a little longer than the body so that the ends may be folded down and clamped by the bars 27. For fine honing and lapping operations, the working surface 25 is preferably a thin sheet of copper having a thickness in the neighborhood of 0.005 of an inch, which likewise is of the same width as the body 11 and a little longer than the body so that the ends may be clamped by the bars 27. This copper strip serves as an abrasive charging or holding medium. Jeweler's rouge or other suitable lapping compound of any known kind is applied to the top surface of the copper strip, and then the article to be honed or lapped is rubbed over this surface by hand.

Most articles to be honed or lapped are of ferrous material or other magnetic material. Examples are knives, scissors, chisels, the cutting bits of machine tools, milling cutters, etc. When such articles are rubbed over the working surface, the magnetic attraction of the unit holds the article against the working surface with approximately uniform pressure as the article is moved back and forth over the surface, and the magnetic force also tends to hold the article at a constant angularity to the working surface. For example, in the case of a chisel, the beveled edge of the chisel, when applied to the working surface, tends to remain flat on that surface. Hence even an unskilled person is able to do a remarkably fine job of sharpening, honing, or lapping, when using this device, for it is simply necessary to hold the work in approximately the correct position on the working surface and then draw it back and forth gently over the working surface. The magnetic attraction itself will tend to hold the work at the proper degree of angularity (assuming, of course, that the proper flat surface of the work has been placed against the working surface of the device) and will provide the necessary pressure between the work and the honing or lapping surface.

In Fig. 4 a fragment of a knife blade is diagrammatically indicated at 31, with one of the ground edges of the knife laid flat against the honing surface in the normal position in which the knife edge would be honed. It is seen that if the knife is gently drawn back and forth over the honing device, the edge will be honed and sharpened, without any danger of turning the edge as might easily happen in the hands of an unskilled person when using a conventional abrading stone.

The honing unit is relatively small and light, and if it is merely held by gravity on a flat supporting surface such as a table, it may have a tendency to shift on the supporting surface during a honing operation. To avoid such shifting while at the same time leaving both hands free to manipulate the work being honed, the honing device is preferably provided with a pair of rubber suction cups or vacuum cups as indicated at 35, each having molded integrally therein a screw threaded shank 37, the shanks being screwed snugly but removably into threaded openings in the bottom of the body 11 near the ends thereof. The vacuum cups may be unscrewed when not

needed, and when their shanks are screwed into the openings in the unit, the unit may be pressed firmly down on a flat surface such as a table, whereupon the vacuum cups will grip the surface and will hold the unit in substantially stationary position while a honing or lapping operation is being performed.

Sometimes it may be desired to have a larger honing surface than that provided by a single unit. To enable several units to be combined to provide a larger honing surface, each unit is provided with one or more openings 41 extending through the width of the unit near the bottom thereof as seen in Fig. 4. Several units may be lined up side by side with the holes 41 in alignment with each other, and bolts 43 may be placed through these holes to secure the units rigidly to each other as indicated in Fig. 5. In this case, the honing surface may be formed, as before, by individual strips 25 on each individual unit; but preferably is formed by a single large strip 45, of the same kind above mentioned, and of the proper dimensions to cover all of the connected units and to have its edges turned down to be clamped by the clamping bars 27 of all of the units. Great care is taken in manufacturing the units so that the side surfaces of the bodies 11 are exactly perpendicular to the top surface thereof, and so that the openings 41 in all the units are of the same size and in the same location. Hence when a series of units are assembled together as in Fig. 5, the top surfaces of all of the units will be accurately aligned in a common plane, thus providing, in effect, a single large honing or lapping surface which is perfectly smooth.

The top surface of the body, on which the strip 25 lies, has been described as being a plane surface. It is obvious, however, that for special purposes of honing or lapping special concave or convex work, the upper surface of the unit could, without departing from the invention, be made in the form of a portion of a cylinder, either convex or concave, on any required radius, so as to fit the curved surface of the special work for which the unit may be designed.

Copper has been mentioned above as the preferred material for forming the wearing surface for use in a fine honing or lapping operation. However, a very thin sheet of cast iron also makes an excellent lapping surface and may be used instead of copper. In this case, the iron being magnetic, there is some slight loss of magnetic attraction acting upon the work or article being lapped, compared with the attraction that would be present if a copper strip were used. But this loss is not serious and is more than counterbalanced by the advantage, under certain circumstances, of using cast iron rather than copper.

It is seen that even long continued use of the device in honing and lapping operations does not cause any appreciable wear on the bed surface at the top of the body 11, but wears only the working surface 25, which is in the form of an inexpensive strip easily removable and replaceable. Moreover, the strip 25 not only serves to take the wear, but also as a guard or protector, protecting the bed surface of the device from injury by accidental contact with other objects. If the bed surface does become injured or damaged, however, it may easily be refinished by grinding it down to a perfect plane, the thickness of the reinforcing strips 21 being such that they will remain firmly embedded in the filling 19 and will

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not be loosened by grinding and refinishing the top surface or bed surface of the hone.

The device of the present invention may be used not only as a magnetic hone or lap, but also as a small magnetic chuck for holding small work pieces while they are ground or otherwise operated upon in a suitable machine tool. This is especially the case in a home workshop or other small shop where the expense of a regular commercial magnetic chuck is ordinarily not justified. The magnetic hone may be clamped to the bed of the machine and the work may be placed on the hone and held by the magnetism thereof. To assist in holding the work against accidental slippage over the surface of the hone, one of the clamping strips 27 at the end of the hone may be provided with an elongated vertical slot rather than a round hole for the passage of the shank of the screw 29, as indicated at 51 in Figs. 3 and 4, so that when the screw 29 is loosened, the clamping bar 27 may be slightly raised to project a little above the top surface of the hone, and then may be clamped tightly in this position, thus furnishing a projection or ledge at one end of the hone to engage one end of the work placed thereon and prevent slipping. A similar ledge or projection may be furnished along one side of the hone, by means of a strip 53 having similar elongated slots through which the screws 55 pass. When using the device as a hone or lap, the strip 53 may be dropped down to be flush with or somewhat below the top surface of the hone, but when using it as a magnetic chuck, the strip may be raised up and then clamped in its raised position, to form a shoulder or projection along one side of the hone, to contact with the work and help to prevent the work from slipping over the surface of the hone when it is being used as a magnetic chuck.

It is seen from the foregoing disclosure that a construction is provided which admirably fulfills the above-mentioned objects of the invention. It is to be understood that the foregoing disclosure is given by way of illustrative example only, and that without departing from the invention, the construction may be varied within the scope of the appended claims.

What is claimed is:

1. A hone comprising a body having a true surface of predetermined shape, a magnet mounted in said body and having polar ends close to said surface, and a thin flexible layer of non-magnetic material overlying and protecting said surface and forming a working surface for contact with an article to be honed, said article being pressed against said working surface by the attraction of said magnet, said pressure of said article when attracted by said magnet serving to press said flexible layer into accurate conformity to the shape of said true surface.

2. A hone comprising a generally rectangular body, a U-shaped permanent magnet mounted in said body with its ends substantially flush with the top surface of said body, said top surface constituting a true surface of predetermined shape, a removable layer of non-magnetic material overlying and protecting said top surface of said body and forming a working surface for contact with an article to be honed, said non-magnetic material being flexible and being turned down over opposite ends of said body, and clamping members on opposite ends of said body for clamping said non-magnetic material in fixed position on said body, the magnetic attraction between said magnet and a magnetic article being honed

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serving to press such article against said flexible working surface and to press said flexible working surface against said true surface so that said flexible working surface has the correct shape of said true surface.

3. A hone including a plurality of connected units, each unit comprising a body of generally rectangular shape and a magnet mounted within said body with a polar end of the magnet substantially flush with the top surface of said body, said top surface constituting a master surface of predetermined shape, the body of each unit being detachably connected to the bodies of the other units with the top surface of each body forming a smooth continuation of the top surface of the body of an adjacent unit, and a thin layer of flexible material overlying and protecting said top surface of each body and forming a working surface for contact with an article to be honed, said article being pressed against said working surface by the attraction of said magnet, and serving to press said flexible material tightly against said master surface so that said flexible material accurately assumes the shape of said master surface.

4. A hone including a plurality of connected units, each unit comprising a body of generally rectangular shape and a magnet mounted within said body with a polar end of the magnet substantially flush with the top surface of said body, said top surface constituting a master surface of predetermined shape, the body of each unit being detachably connected to the bodies of the other units with the top surface of each body forming a smooth continuation of the top surface of the body of an adjacent unit, and a single continuous unitary sheet of flexible non-magnetic material overlying the top surfaces of all the connected units and forming a working surface for contact with an article to be honed, the attraction between the magnets and a magnetic article being honed on said flexible sheet serving to press said flexible sheet against the master surfaces of said unit bodies so that said flexible sheet constitutes a working surface having a shape accurately corresponding to the shape of said master surface.

5. A magnetic hone comprising a body having an upper surface, a magnet mounted in said body with one end of the magnet relatively close to said upper surface, a relatively thin sheet of material detachably mounted on said body in overlying relation to said upper surface and serving as a working surface for contact with an article to be honed while said article is pressed against said working surface by the attraction of said magnet, clamping means for clamping said thin sheet in fixed position on said upper surface, and holding means shiftable from a position flush with or below said upper surface, to a position projecting above said upper surface along an edge thereof, to assist in holding work against slipping on said upper surface when said hone is used as a magnetic chuck.

6. A construction as described in claim 5, in which said holding means is composed at least in part of said clamping means.

7. A magnetic hone comprising a body having an upper surface and a cavity of substantial size extending downwardly from said upper surface, a substantially U-shaped permanent magnet in said cavity with its base downwardly and with approximately parallel legs extending upwardly and terminating in ends substantially flush with said upper surface of said body, said magnet occu-

pying less than the entire volume of said cavity, a filling of cast material in said cavity around said magnet and between the legs thereof to anchor said magnet rigidly in said body, and strips of non-magnetic material harder than said filling sunk into the upper surface of said filling to strengthen the upper surface thereof.

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