

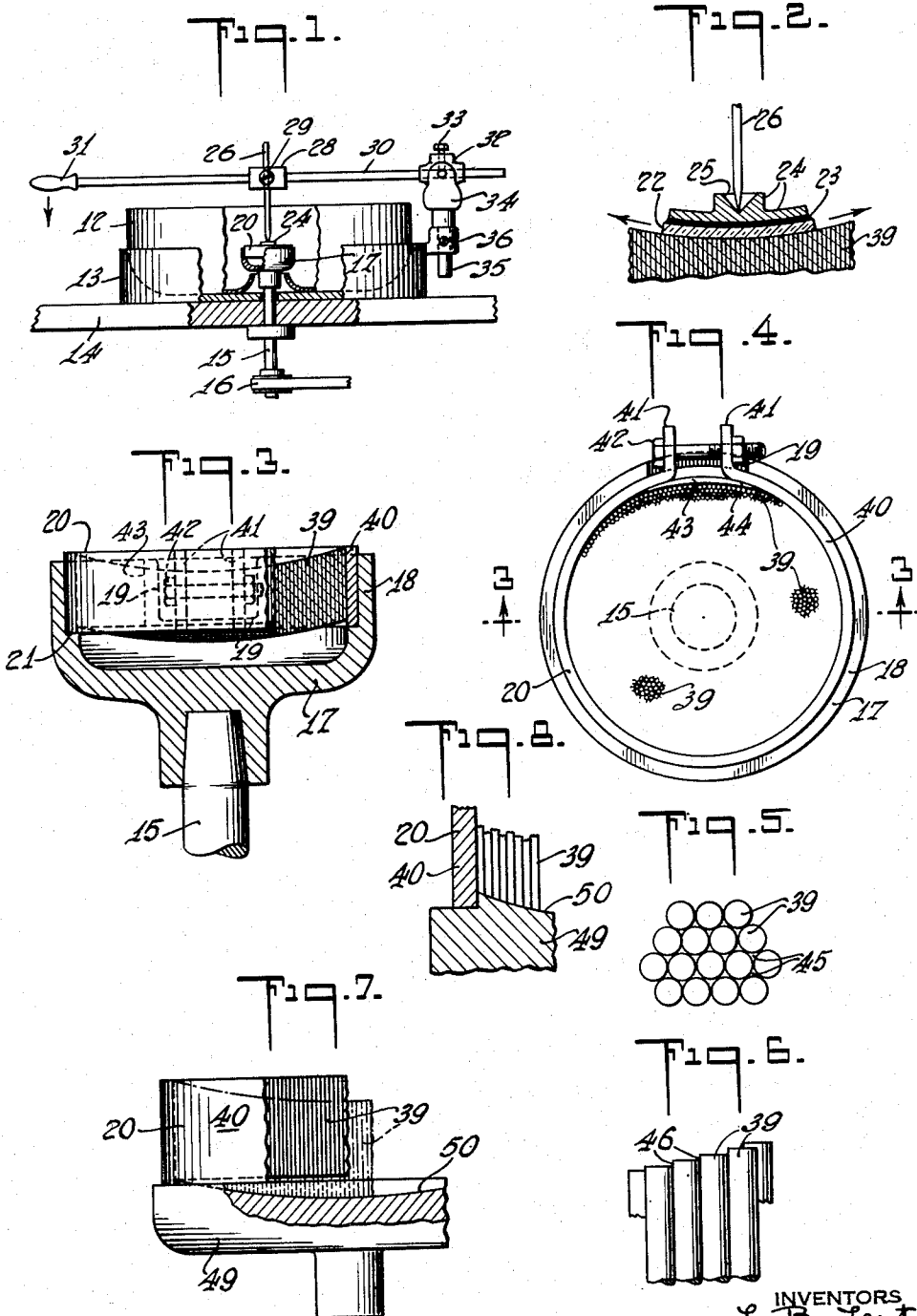
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L. B. LENT ET AL

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GRINDING TOOL

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INVENTORS
L. B. Lent &
J. D. Gamble
BY
Morrison, Kennedy & Campbell
ATTORNEYS.

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GRINDING TOOL

Leon B. Lent, White Plains, and John D. Gamble,
Forest Hills, N. Y.

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This invention is a novel grinding tool, and is shown embodied more particularly in a tool or lap of a class adapted for grinding to form the surfaces of lenses and like objects, but is adaptable to the grinding of various other objects and surfaces, whether of glass, metal or other material; and the invention includes certain methods, as further described.

A general object of the present invention is to afford a grinding tool or lap, adaptable either for manual or machine grinding, which will be efficient and accurate in operation and convenient in use. A further object is to afford a grinding tool which is adapted not only to the preliminary or rough grinding of the object to shape, with the use of powdered emery, silicon carbide or other abrasive, but also to the usual finer grinding which follows the rough grinding; so that the complete reduction or grinding can be performed by the same tool; and moreover by the applying of a conventional fabric or other pad the tool may be used for the finishing or polishing of the surface by the aid of applied rouge or other fine abrasive.

A particular object of the present invention is to afford a grinding tool which may readily be altered at will to adapt it to the grinding of different or varying contours, namely, by a predetermined setting or readjustment to shape, as will be described. According to this feature of the invention a single tool is adapted to do the grinding work of a large number of individual tools; the tool hereof, being substantially universal in its utility, obviates the necessity and inconvenience of keeping at hand a very great number of tools, as is now done in lens manufacture, saving also in investment and other costs, and materially facilitating the operation of a lens grinding shop.

Further objects are, to provide a grinding surface of such a character as to retain better the rough-grinding abrasive material upon its surface, thus expediting grinding action, and decreasing grinding time; to provide a grinding tool readily adjustable to a master surface or matrix; and to provide a tool which without readjustment may serve for both convex and corresponding concave grinding.

Further objects and advantages of the present invention will be made to appear in the herein-after following description of an illustrative embodiment thereof or will be understood by those conversant with the subject. To the attainment of such objects and advantages the present invention consists in the novel grinding tool or

lap, and the novel features of construction, combination and operation thereof, as well as the novel methods of constructing a grinding tool and of adjusting or readjusting it, herein illustrated or described.

In the accompanying drawing

Fig. 1 is what may be considered a front elevation, partly broken away and partly in section, of a conventional grinding apparatus employing the grinding tool of this invention, more particularly an illustrative apparatus such as is commonly used in the lens grinding art.

Fig. 2 on an enlarged scale, and looking from the right, is a central vertical section view showing the grinding tool, the work and the work holder in their operative relation.

Fig. 3 is a front elevation, partly in central section, of an illustrative grinding tool embodying the invention, and its mountings.

Fig. 4 is a top plan view of the parts shown in Fig. 3.

Fig. 5 on a further enlarged scale is an end or top view of a small number or group of the assembled elements or rods comprised in the make-up of the tool hereof.

Fig. 6 is a partial front elevation of the group or assemblage of rods of Fig. 5.

Fig. 7 is a front elevation partly in central section of the grinding tool hereof shown in adjusting relation to a suitable master surface or object to the contour of which the tool is to be adjusted.

Fig. 8 in central vertical section is an enlarged view of the lower left portion of Fig. 7.

While the grinding tool hereof may be used manually, or with various kinds or types of grinding machines or devices, it is herein shown in Fig. 1 in use in a simple grinding machine of the type, for example, adapted to grind spherical surfaces, as of lenses. A pan 12 is shown removably accommodated in a tray 13 attached on the top of a table 14. The pan is conventional, being adapted to catch and hold the grinding agent, abrasive or rouge, the grindings or glass particles, and the vehicle or water which may be used in the grinding operation.

Positioned centrally with respect to the tray is shown a spindle or driving shaft 15, having its bearings in or adjacent to the table and, below the table, carrying a pulley driven by a belt 16. The shaft may rotate either the tool or the work relatively to the other, but is herein shown as carrying and rotating the tool.

The top of the spindle is tapered to receive the tool or the means by which it is mounted remov-

ably thereon. For example, there is shown a chuck or tool support 17, its underneath boss being recessed for a taper fit upon the rotary spindle. The body of the chuck 17 is of cup shape, presenting a circumferential rim 18 with a notch or gap 19. In the chuck may be applied, positioned and secured the tool 20 of this invention, the structure of which will be further described. The tool may be removably fitted in the chuck, with part of it extending into the notch 19, preventing relative rotation.

The work or object to be operated on is shown as a glass lens 22, Fig. 2. This is required to be suitably mounted in opposition to the grinding tool so that, by relative movement, the tool may operate upon the convex, concave or other surface of the glass object. A conventional mounting for the lens is shown, with its convex surface to be ground exposed below. The work or lens is attached by a layer of pitch 23 to the curved surface of a block or work holder 24. A suitable connecting and operating means for the work holder may be as shown, it being formed with a conventional recess 25 of wide angle tapering to a fine point and adapted to be engaged by the sharp end or point of an operating shank or pin 26. This provides a loose or universal sort of connection, so that the center pin can shift the holder and work across the grinding tool, while allowing relative tilting between pin and holder, so that the lens adapts itself to the grinding surface of the tool during the grinding motions.

In Fig. 1 is shown a conventional or illustrative operating means for the described work holder or block. While the tool 19 is rotating beneath, and the work and holder are resting upon its top surface, of convex, concave or other contour, the center pin 26 is operable in a conventional way to keep the work in a suitable path of motion over the surface of the tool. The center pin 26 is shown mounted on a block or collar 28, from which it depends. By a set screw 29 in the block the center pin can be adjusted upwardly and downwardly. The block 28 may be fixed upon a lever or operating rod 30, having a handle 31 at its free end for conventional manipulation of the center pin. Other adjustments of the center pin are conventionally provided as follows. The rod 30 is mounted to slide adjustably through a block 32, thus determining the longitudinal position of the pin, and it may be turned in the block to determine the tilt of the pin; the block having a set screw 33 which therefore serves to secure the rod in position against both sliding and turning. This permits the center pin to be adjusted in relation to the axis of the tool, and to be inclined or tilted from the vertical to such angle as the workman may find desirable. The system of elements 26 to 33 is adapted to be bodily swung up and down, so that the workman can lift the handle when starting or after completing a grinding operation to insert and remove the work and holder; and during grinding he can bear down upon the rod to afford the necessary grinding pressure. For these purposes the block 32 is shown fulcrumed within a yoke 34 upon a horizontal axis. The workman must also be able to swing horizontally the handle during grinding, and for this purpose the shank 35 of the yoke 34 extends downwardly and turns within a stationary bearing or socket 36 constituting for example an extension of the tray 13. These various described mountings and connections afford

substantially universal adjustment and operation of the center pin and work holder.

The grinding apparatus 12 to 36 is merely illustrative, being adapted for spherical grinding and polishing. When a cylindrical component is involved the surfacing may be done by the present invention, by proper resetting of the tool elements. In that case, or for other non-spherical surfacing, the work and the tool may have various kinds of relative grinding movements, as is 10 conventional, without however any relative rotation.

Coming next to the tool or lap 20 of this invention, this may be described in one aspect as consisting of a multiplicity of thin upright elements 15 or rods 39 assembled or bundled snugly together in juxtaposition or mutual substantial contact, together with suitable means, as a surrounding confiner or strap 40, for confining or clamping the assemblage securely against displacement of rods during grinding operation. The drawing shows the component elements of the tool hereof as illustratively consisting of short lengths of rod, as metal wire, so arranged that the rod ends at one side of the grinding tool collectively define a 25 predetermined contour or desired curved grinding surface. For example, rods or wires 39 are shown as cylindrical, and they may be composed of steel or brass or other metal, tempered or otherwise treated or untreated, according to the particular 30 work to be done. Merely as an example, the rods may consist of metal wire of a diameter of $\frac{1}{32}$ inch or approximately .03 inch, but may vary in diameter, for example, between .01 inch and .10 inch. In any case the rods are quite stiff and 35 self supporting in use as contrasted with fine strips or strands that are flexible and bend over under grinding pressure.

The complete assemblage of the small elements, rods or wires 39 may contain such a large 40 number thereof as to occupy completely a circular space of diameter between, for example, two or three inches, although the size of the tool may be larger or smaller according to the needs. The clamping means or strap 40 surrounds the rod 45 assemblage and it may be arranged to be drawn tight thereon, for example, by wings or blocks 41, in the nature of outwardly extending flanges, spaced somewhat apart but adapted to be drawn forcibly together by a clamping device or bolt 42. 50 In order to close completely the circumference surrounding the rod assemblage, the clamp may contain a slidable piece or bridge 43 extending across the gap between the wings 41. The bridge 43 may be of thin metal, of the full depth of the 55 strap, and welded to one side, as at 44, while adapted to slide upon the other side of the strap. The strap may take different forms, e. g. may comprise a piece of clock spring overlapping itself and contracted circumferentially by any sort 60 of clamping means.

When the grinder rods 39 have been assembled in the strap 40 and there tightly clamped, thus constituting the tool of this invention, the tool may be set down within the rim of the chuck 17 65 and there secured in any suitable way, it being usually sufficient to position and seat the tool upon a ledge or shoulder or lugs 21 inside the chuck rim, with the tool wings 41 occupying the rim notch 19 to prevent turning.

The grinding tool thus described possesses substantial advantages in operation, in addition to its wide or universal adaptability. Thus looking 70 endwise or downwardly upon the tool, as in Fig. 5, it will be seen that there are small recesses or 75

interstices 45 between the round rods, these being adapted to receive and hold small portions of the grinding medium or abrasive. When the tool has been adjusted to a given curved contour, convex or concave, as in the side view Fig. 6, the extreme or grinding ends of adjacent rods will be in stepped arrangement or echelon, rather than in curvilinear alinement, and this results in the production of small end pockets 46 in the angles between each rod and the adjacent rod, and these pockets tend to hold the abrasive and improve the action.

The tool hereof is readily set or adjusted to any desired contour, for example, as follows. The clamping device 40 is adapted to be loosened at will, to relax the pressure and permit the resetting or longitudinal adjustment of the rods. Such adjustment may be determined by a master object or matrix 49 of any kind, shown to consist of a shaped metal form, such as another tool, and having at its outer or upper side the desired grinding contour or surface 50, Fig. 7. In this figure the tool 20 hereof is indicated as supported above such a master member 49. If the tool surface is initially plane, as there shown, there will be an initial gap between the lower ends of the rods 39 and the master surface 50 below. It is then only necessary to thrust downwardly the relaxed rods 39, until they are all in contact with the surface 50. For example, if the surface 50 is concave, as shown, the rods will be thrust down to the dotted position shown, thus affording a corresponding concave contour at the upper side of the tool. Fig. 8 shows this position on an enlarged scale. This resetting operation may be assisted by a tapping action, for example, by striking the upper ends of the rods by a small mallet of wood or soft metal. When so readjusted the clamping strap 40 is to be tightened, and the tool mounted in the chuck. When the grinding pressure is light the peripheral tool clamp 40 may be under reduced tension and the rods reset without relaxing the clamp, relying upon friction to hold the rods against slipping.

Several additional functions or advantages pertain to the described tool. The rods or wires 39 are preferably of uniform length, therefore, with any given setting, they will present a concave grinding contour at one side and the corresponding or complementary convex contour at the opposite side of the tool. As the tool may be inverted in the chuck this permits the same tool to grind the opposite sides of a given lens if so desired.

In constructing the tool hereof, the numerous thin elements, plates or rods may be first cut of slight overlength, and then assembled and clamped in flat contour, and then machined or ground collectively to a plane or flat condition at one side, and then reversed and reduced to parallel flat condition at the opposite side of the tool. By thus having all rods of the same length a setting at the lower side to a master contour is bound to duplicate at the upper surface of the tool the identical contour.

We claim:

1. A tool or lap for accurate grinding to predetermined form of the curved surfaces of glass lenses and like articles, said tool consisting of a collection of numerous stiff grinding rods of hard material the ends of which are adapted to contact with and reduce the surface of the article to be ground, such grinding rods being assembled and bundled snugly in mutual contact to stand

ing means holding the rod assemblage confined tightly and securely against relative longitudinal play or sliding during grinding, whereby is afforded a rigid entirety of unchangeable contour; such assembled rods being adapted to be pre-set into predetermined relative endwise positions, and there rigidly clamped, such as collectively to define an exposed grinding surface of definite curved contour which corresponds to the required contour of the article to be produced, for the continuous grinding and scientific reduction of such article to form during relative movement of the tool thereon.

2. A tool as in claim 1 and wherein the rods are cylindrical and have their ends bare for direct contact with the article to be reduced, and there are provided between the rods small recesses to receive and hold small portions of grinding medium.

3. A relatively movable tool or lap for accurate grinding to predetermined form of the curved surfaces of glass lenses and like articles, said tool consisting of a collection of numerous stiff grinding rods of hard material the ends of which are adapted to define the contour to be ground, such grinding rods being assembled and bundled snugly in mutual contact to stand stiffly in parallel relation, combined with clamping means holding the rod assemblage confined tightly and securely against relative longitudinal play or sliding during grinding, whereby is afforded a rigid entirety of unchangeable contour; such assembled rods being adapted to be pre-set into predetermined relative endwise positions, and there rigidly clamped, such as collectively to define an exposed grinding surface of definite curved contour which corresponds to the required contour of the article to be produced, and such clamping means comprising a peripheral confining strap having tightening means which may be relaxed at will to permit the rod assemblage readily to be reset to contour and thereupon reclamped to confine them thus.

4. A tool as in claim 3 and wherein the clamping means is a peripheral strap which leaves the rod ends operatively exposed at both sides of the tool, whereby, with each resetting of the tool two different grinding contours are afforded.

5. A rotatable grinding tool or lap for accurate reducing to predetermined spherical form of the curved surfaces of glass lenses and like articles, said tool consisting of a collection of numerous stiff grinding rods of hard material the ends of which are adapted to contact with and reduce the surface of the article to be ground, such grinding rods being assembled and bundled snugly in mutual contact to stand stiffly substantially parallel to the axis of tool rotation, combined with clamping means holding the rod assemblage confined tightly and securely against relative longitudinal play or sliding during grinding, whereby is afforded a rigid entirety of unchangeable contour; such assembled rods being adapted to be pre-set into predetermined relative endwise positions, and there rigidly clamped, such as collectively to define an exposed grinding surface of definite spherically curved contour symmetrical to the rotation axis and which corresponds to the required spherical contour of the article to be produced, for the continuous grinding and scientific reduction of such article to form during relative rotation of the tool.

LEON B. LENT.

JOHN D. GAMBLE.