APPARATUS FOR CYLINDRICALLY GRINDING WORKPIECES

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ABSTRACT

An exemplary apparatus for cylindrically grinding workpieces (60) includes a first holding tool (20), a second holding tool (30), and a first grinding wheel (10). The first holding tool is configured for positioning pre-grinding workpieces, and the first holding tool defines a first groove (24) for containing the pre-grinding workpieces to be partially ground. The second holding tool is configured for positioning the partially ground workpieces, and the second holding tool defines a second groove (34) for containing the partially ground workpieces. The first grinding wheel is configured for grinding the pre-grinding workpieces in the first holding tool. The first grinding wheel defines a first grinding groove (104), and the first grinding groove is defined by a semicircular bottom wall (1042) and two slanted walls (1044) connected with the semicircular bottom wall.
FIG. 6 (RELATED ART)
FIG. 7 (RELATED ART)
APPARATUS FOR CYLINDRICALLY GRINDING WORKPIECES

FIELD OF THE INVENTION

[0001] The present invention generally relates to cylindrical grinding apparatuses and, more particularly, to a holder for holding workpieces during a cylindrical grinding process.

DESCRIPTION OF RELATED ART

[0002] Usually, optical elements such as camera lenses and spectacles are in used in cylindrical form. However, original optical workpieces (i.e., lens blanks) are most easily manufactured in the form of a square. Therefore, these original optical workpieces have to be cylindrically ground before use.

[0003] A typical example of a contemporary cylindrical grinding apparatus is a central apparatus. The central apparatus typically includes a pair of holders for holding the original workpiece, where each holder has a hollow chamber communicating with a surface of the holder. The holder can hold the workpiece on its surface by using an air pump pumping the hollow chamber, a grinding wheel is then used to cylindrically grind the workpiece. However, the central apparatus can only cylindrically grind one workpiece at a time.

[0004] FIGS. 6-7 show an apparatus for cylindrically grinding more than one workpiece at a time. The apparatus includes a grinding wheel 80. The grinding wheel has a semicircular grinding groove 81. In use, firstly, a plurality of workpieces 70 are bonded together using adhesive. Secondly, the grinding wheel 80 is used to grind a first portion 71 of the workpieces 70 into a semicircular shape. Thirdly, a second portion 72 of the workpieces 70 is also ground into a semicircular shape using the grinding wheel 80. The final result being that the workpieces 70 are ground to a cylindrical shape.

[0005] After the first portion 71 is ground to a semicircular shape, two sharp-angled portions 73 are formed between the first portion 71 and the second portion 72. When grinding the second portion 72, the sharp-angled portion 73 may easily split under a grinding pressure of the grinding wheel 80.

[0006] Therefore, a new apparatus for cylindrically grinding workpieces is desired in order to overcome the above-described shortcomings.

SUMMARY OF THE INVENTION

[0007] In one embodiment, an apparatus for cylindrically grinding workpieces includes a first holding tool, a second holding tool, and a first grinding wheel. The first holding tool is configured for positioning pre-grinding workpieces, and the first holding tool defines a first groove for containing the pre-grinding workpieces to be partially ground. The second holding tool is configured for positioning the partially ground workpieces, and the second holding tool defines a second groove for containing the partially ground workpieces. The first grinding wheel is configured for grinding the pre-grinding workpieces in the first holding tool. The first grinding wheel defines a first grinding groove, and the first grinding groove is defined by a semicircular bottom wall and two slanted walls connected with the semicircular bottom wall.

[0008] Other advantages and novel features will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Many aspects of the apparatus can be better understood with reference to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present apparatus. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0010] FIG. 1 is a schematic view of a first grinding wheel of an apparatus for cylindrically grinding workpieces in accordance with a preferred embodiment;

[0011] FIG. 2 is a cross-sectional view of the first grinding wheel in FIG. 1;

[0012] FIG. 3 is a schematic view of a step of a process for cylindrically grinding workpieces in accordance with a preferred embodiment;

[0013] FIG. 4 is a schematic view of another step subsequent to the step in FIG. 3;

[0014] FIG. 5 is a schematic view of a further step subsequent to the step in FIG. 4;

[0015] FIG. 6 is a schematic view of a grinding wheel for cylindrically grinding workpieces from the related art; and

[0016] FIG. 7 is a cross-sectional view of the grinding wheel in FIG. 6.

DETAILED DESCRIPTION OF THE INVENTION

[0017] Referring to FIGS. 1-5, in a preferred embodiment, an apparatus for cylindrically grinding workpieces, includes a first grinding wheel 10, a first holding tool 20, a second holding tool 30, and a second grinding wheel 40. The holding tools 20, 30 are configured for positioning workpieces 60. In this embodiment, the workpieces 60 are optical elements, such as infrared cut filters and ultraviolet cut filters.

[0018] Referring to FIG. 3, the first holding tool 20 defines a first groove 24 for containing pre-grinding workpieces 60. The pre-grinding workpieces 60 can be optical elements having a non-cylindrical shape. In this preferred embodiment, the workpieces 60 are in substantially square form. Therefore, the first groove 24 is configured to have a V-shaped cross section, for compliantly receiving the pre-grinding workpieces 60 therein. Understandably, the cross section of the first groove 24 can be of other shape depending on the form of the pre-grinding workpieces 60. The pre-grinding workpieces 60 are partially ground on the first groove 24 using the first grinding wheel 10.

[0019] Referring to FIGS. 1-3, the first grinding wheel 10 can be disposed above the first holding tool 20. The first grinding wheel 10 includes a main body 11 and a driving shaft 12. The main body 11 has a cylindrical shape. A first grinding groove 104 is defined on an outer surface 101 of the main body 11. The first grinding groove 104 is defined by a semicircular bottom wall 1042 and two slanted walls 1044 connected with the semicircular bottom wall 1042. A distance between the slanted walls 1044 is bigger than a diameter of the semicircular bottom wall 1042. The driving shaft 12 is connected to the main body 11 for rotating the first grinding wheel 10.
Referring to FIG. 5, the second holding tool 30 defines a second groove 34 for containing the partially ground workpieces 60. The second groove 34 is configured to have a semicircular cross section. The partially ground workpieces 60 are ground to be cylinder shape on the second groove 34. The second grinding wheel 40 can be disposed above the second holding tool 30. The second grinding wheel 40 has a semicircular groove 42 for grinding the partially ground workpieces 60. The semicircular groove 42 has a similar shape to the second groove 34 of the second holding tool 30. The second grinding wheel 40 is connected to a driving mechanism 43. In this embodiment, the driving mechanism 43 is a motor.

Referring to FIGS. 3-5, an exemplary process for cylindrically grinding workpieces 60 includes the steps of:

1. A stack of workpieces 60 (i.e. pre-grinding workpieces) are placed in the first groove 24 of the first holding tool 20. A first portion 61 of the pre-grinding workpieces 60 projects out of the first groove 24.
2. The pre-grinding workpieces 60 are bonded on the first groove 24.
3. The first portion 61 of the pre-grinding workpieces 60 is partially ground to a first shape.
4. The partially ground workpieces 60 are placed in the second holding tool 30 with the first portion 61 held in the second groove 34, a second portion 63 of the workpieces 60 projects out of the second grooves 34.
5. The second portion 63 of the workpieces 60 is ground to a semicircular shape. In this way a plurality of cylindrical workpieces 60 can be obtained.
6. After the first portion 61 is partially ground, two slanted portions 62 are formed between the first portion 61 and the second portion 63 of the workpieces 60 by the slanted wall 1044 of the first grinding wheel 10. Because the slanted portion 62 forms an obtuse angle with a vertical tangent of the first portion 61, the workpieces 60 will not be prone to splitting during grinding of the second portion 63.
7. It is believed that the present embodiments and their advantages will be understood from the foregoing description, and it will be apparent that various changes may be made thereto without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the examples here before described merely being preferred or exemplary embodiments of the invention.

What is claimed is:

1. An apparatus for cylindrically grinding workpieces, comprising:
a first holding tool configured for positioning pre-grinding workpieces, the first holding tool defining a first groove for containing the pre-grinding workpieces to be partially ground;
a second holding tool configured for positioning the partially ground workpieces, the second holding tool defining a second groove for containing the partially ground workpieces; and
a first grinding wheel configured for grinding the pre-grinding workpieces in the first holding tool, the first grinding wheel defining a first grinding groove, the first grinding groove being defined by a semicircular bottom wall and two slanted walls connected with the semicircular wall.

2. The apparatus as claimed in claim 1, wherein a distance between the slanted walls is bigger than a diameter of the semicircular bottom wall.

3. The apparatus as claimed in claim 1, wherein the first grinding wheel includes a main body and a driving shaft connected to the main body for rotating the first grinding wheel.

4. The apparatus as claimed in claim 3, wherein the first grinding groove is formed on an outer surface of the main body.

5. The apparatus as claimed in claim 1, wherein the first groove has a V-shaped cross section.

6. The apparatus as claimed in claim 1, further comprising a second grinding wheel.

7. The apparatus as claimed in claim 6, wherein the second grinding wheel has a second grinding groove, and the second grinding groove has a semicircular cross section.

8. The apparatus as claimed in claim 1, wherein the second holding groove has a semicircular cross section.

9. A grinding wheel for cylindrically grinding workpieces, the grinding wheel defining a first grinding groove, the first grinding groove being defined by a semicircular bottom wall and two slanted walls connected with the semicircular bottom wall.

10. The grinding wheel as claimed in claim 9, wherein a distance between the slanted walls is bigger than a diameter of the semicircular bottom wall.

11. The grinding wheel as claimed in claim 9, wherein the grinding wheel is connected to a driving shaft for rotating the first grinding wheel.