K. E. AHLBERG.

GRINDING DEVICE.

APPLICATION FILED MAR. 11, 1911.

1,010,565. **Patented Dec. 5, 1911.**

2 SHEETS—SHEET 1.

Fig. 1.

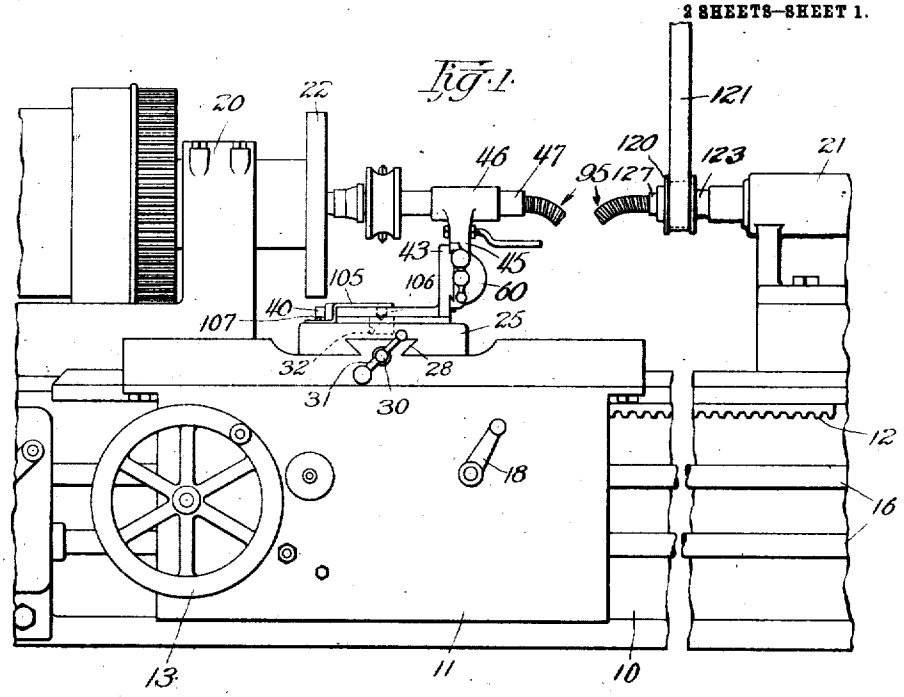
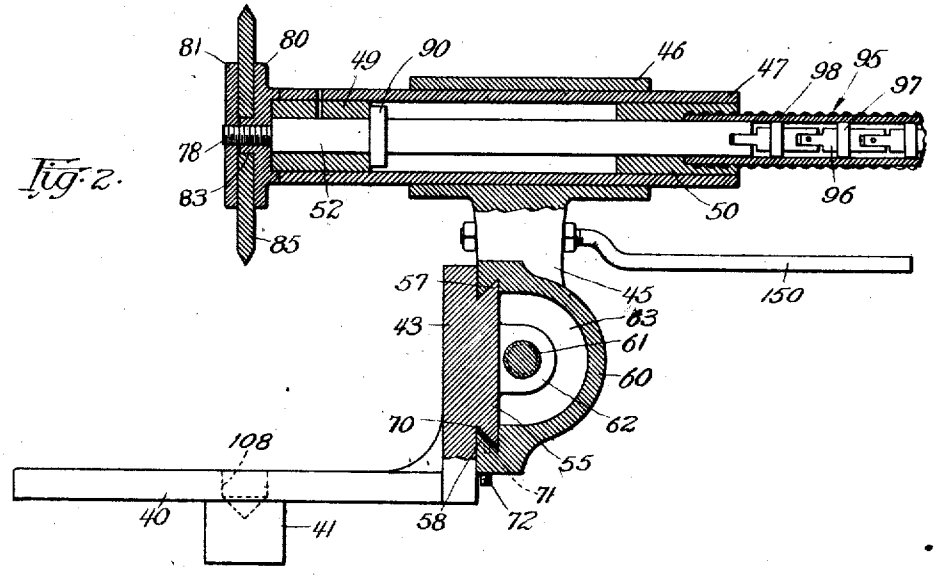


Fig. 2.



Witnesses:

F. Y. Bagg Jr.

Lillian E. Christensen

Inventor:

Karl E. Ahlberg.

by Hirschl & Hirschl

Attys.

K. E. AHLBERG.

GRINDING DEVICE.

APPLICATION FILED MAR. 11, 1911.

1,010,565.

Patented Dec. 5, 1911

2 SHEETS—SHEET 2.

Fig. 3.

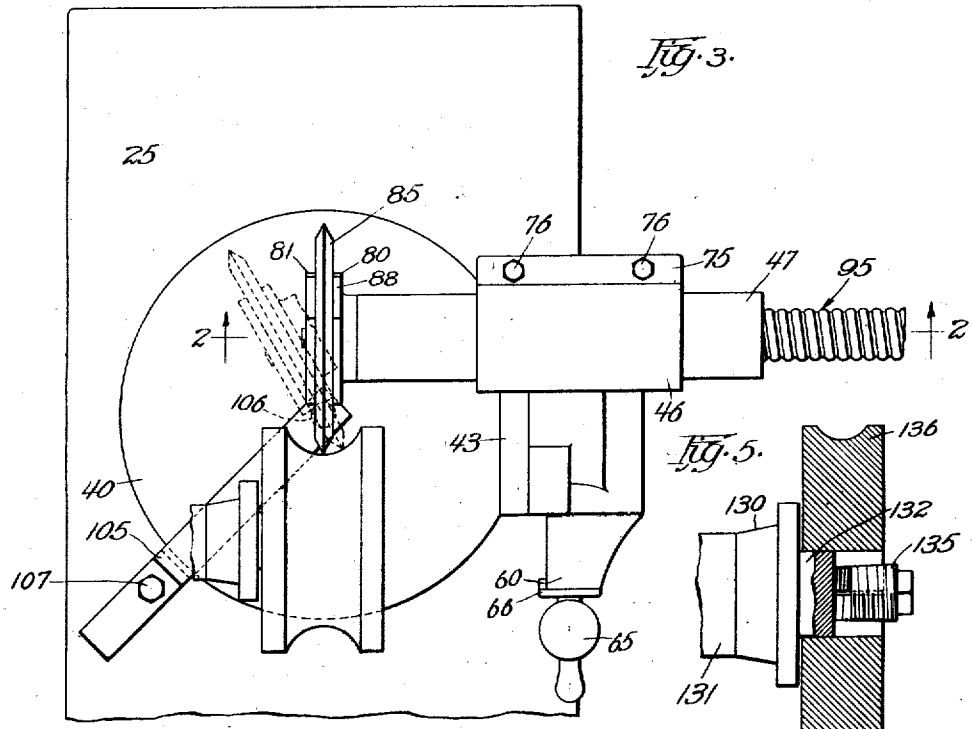


Fig. 5.

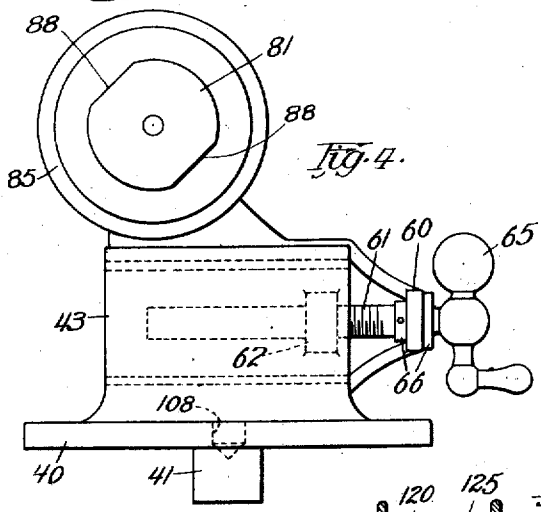


Fig. 4.

Fig. 6.

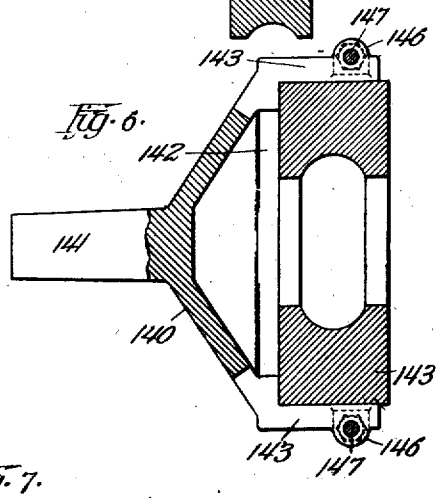
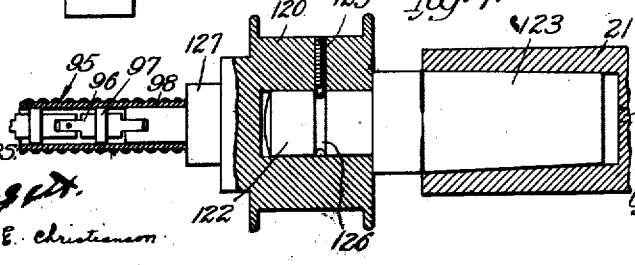


Fig. 7.



Witnesses
J. H. Daggett.
Lillian E. Christensen

Inventor:
Karl E. Ahlberg.
by Hirschl & Hirschl
Attys.

UNITED STATES PATENT OFFICE.

KARL E. AHLBERG, OF CHICAGO, ILLINOIS.

GRINDING DEVICE.

1,010,565. Specification of Letters Patent. Patented Dec. 5, 1911.

Application filed March 11, 1911. Serial No. 613,819.

To all whom it may concern:

Be it known that I, KARL E. AHLBERG, a citizen of the United States, residing at 316 East Thirty-ninth street, in the city of Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Grinding Devices, of which the following is a specification.

This invention relates to improvements in grinding devices and more especially to a rotating grinding disk or wheel adapted for operation upon a part which also rotates at a relatively different speed, the rotating parts being so arranged that the plane of rotation of one is movable relatively to the plane of rotation of the other. As here shown, it includes a rotating grinding disk or wheel so mounted and arranged as to adapt it for movement in a plane other than its plane of rotation, and is here illustrated in connection with its use for the purpose of grinding annular grooves in either the inner or outer cylindrical surfaces of parts which are at the same time rotating about their axes—such for example as the two ball-rings of the device known in the art as an "annular ball-bearing."

More particularly the device comprises means for supporting either one of such ball-rings and rotating it about its axis; and means for rotating the grinding disk at a relatively different speed with its grinding edge in contact with the portion of the ball ring which is to be ground; said grinding disk being mounted in a manner to permit of its movement about an axis or chord in the plane of the disk whereby a point on the periphery of said disk lying at the end of a radius which bisects such chord will describe the arc of a circle. The mounting of said grinding disk is adapted for horizontal movement relative to such last mentioned axis, whereby the latter is caused to approach or recede from the center of the disk; and the radius of an arc described by a point on the periphery of the disk moving about such axis as a center, is correspondingly increased or decreased in length.

The foregoing arrangement of parts is secured by providing a flat circular table adapted to rotate in a horizontal plane and mounting the grinding disk above it in such position that the vertical axis of rotation of said circular table passes through the plane of the disk; and providing means for shifting the position of the disk above the table inward and outward in the vertical plane of one of the radii of the circular table. By this means the two points on the periphery of the disk whose tangents are vertical lines may, by the rotation of the table, be caused to describe circular arcs in horizontal planes above and parallel to the plane of the table. One of these points is shown in Figs. 1 and 3 in engagement with an annular groove in the periphery of a ball-ring (the latter being the inner one of a complete bearing assembly); and the operation is the same when the device is used to grind an annular groove in the exterior member or ball-ring of such a bearing assembly, in such case the entire device being placed, relatively to the ball-ring, in such position that the disk may operate within the ring and its periphery may engage with the internal wall of the same.

As here illustrated, the ball-ring which is being operated upon is supported in the chuck of a lathe of well known form, and the grinding device, together with its mounting, is placed upon the bed of the lathe in a manner similar to the manner in which the lathe tools are commonly placed thereon, being rotated by means of a belt from a line-shaft overhead engaging with a pulley whose shaft is supported in the tail stock of the lathe, said pulley connecting with the spindle of the grinding disk by means of a flexible shaft in order to permit of the movement of the grinding disk about the vertical axis as above described. The device may however assume other forms without departing from the spirit of the present invention, as will appear from the further description thereof and as pointed out in the appended claims.

The device may be better understood by reference to the accompanying drawings, in which:

Figure 1 is a view in side elevation showing a portion of the bed of a lathe with the improved grinding device mounted thereon. Fig. 2 is an axial vertical section through the shaft or spindle of the grinding disk, being taken on the line 2—2 of Fig. 3. Fig. 3 is a top plan view of the grinding disk and its related parts. Fig. 4 is a view of the same parts in end elevation. Fig. 5 is a vertical axial section on a larger scale, taken through one of the clutch members used in connection with the device. Fig. 6 is a similar view, but on a smaller scale, showing a different form of clutch member.

Fig. 7 is a vertical axial section through the driving spindle of the grinding device.

As shown in said drawings 10 indicates the bed portion of a lathe upon which is mounted a sliding carriage 11, having concealed in its interior a spur pinion engaging with a horizontal rack 12 and actuated by a hand wheel 13, by means of which the carriage may be moved longitudinally along the bed. A frictional member, likewise concealed within said carriage, engages with a pair of horizontal rails 16 for the purpose of locking the carriage in its various positions upon the lathe bed, said member being actuated by a handle 18. Upon the upper part of the lathe bed is mounted a head-stock 20, and a tail-stock 21, the former supporting a rotating shaft to which is secured a chuck 22; upon the upper part of the carriage 11 is mounted a cross-sliding tool carrier 25, the same being formed with a transverse horizontal groove on its lower surface engaging with a correspondingly shaped tongue 28 upon said carriage, whereby said tool carrier is maintained in position upon the carriage but in a manner permitting of its relative crosswise motion. A screw 30 with a handle 31 engages with a nut upon said tool carrier for the purpose of effecting such crosswise motion. In the upper part of said tool carrier is formed a circular opening 32 in which is ordinarily placed a rotatable tool carrying member known as a turret.

All of the before mentioned parts constitute elements of a lathe of a general form commonly used for a variety of purposes; and the improved device which constitutes the subject of the present invention may be used in connection with such a lathe as well as in connection with lathes of many other well known forms, the particular construction of the before mentioned parts not constituting any part of the present invention.

40 indicates a flat horizontal circular table having at its center a depending cylindric hub 41 which is adapted to engage with the opening 32 in the tool carrier. At one part of the margin of said table is formed a vertical wall, 43 which carries the parts forming the bearing for the rotating grinding disk. These comprise a vertical standard 45 having its upper part formed as a horizontal journal box 46, supporting a tube 47 in which are fitted bushings 49 and 50. These bushings form bearings for a shaft or spindle 52. The said wall 43 is formed with an integral tongue or raised portion 55 upon its outer surface, said raised portion having its upper and lower faces diagonally undercut as indicated by the figures 57 and 58 to engage with correspondingly shaped portions of the member 45 whereby the latter and the wall member 43 are maintained in engagement with each other in a manner permitting of the relative horizontal sliding motion of the part 45. Upon one of the end faces of the standard 45 is formed a bracket member 60 forming a bearing for a rotating shaft 61, the greater portion of which is threaded to engage with a nut 62 rigidly secured to said supporting wall 43; the adjacent surface of the part 45 being semi-cylindrically curved outward in order to afford a space 63, (Fig. 4) for the accommodation of said screw and nut. Relative horizontal motion between the member 45 and the wall 43 may be effected by rotating said screw 61, a handle, 65 being provided upon its end for such purpose, and collars or flanges 66 securing it against endwise movement with respect to the bracket member 60. A thin strip of metal 70 is placed between the engaging faces 58 of the wall member 43 and the standard 45, being maintained therein by short vertical pins 71 as indicated. An adjusting screw 72 presses at its inner end against such strip for the purpose of springing the same upward and forcing it into frictional contact with the engaging face of the part 43 for the purpose of preventing such relative movement between the parts 45 and 43 as might otherwise be due to wear upon the engaging faces 57 and 58. The tube 47 passes through the journal box 46, the latter being longitudinally split at one side and formed with flanges 75 upon the adjacent margins of the split portions which flanges are engaged by bolts 76, by the tightening of which the tube 47 may be rigidly clamped within the journal box 46.

The bushings 49 and 50 are fitted into the ends of said tube and afford bearings for said shaft 52. One end of said shaft is reduced in diameter through a portion of its length 78, which reduced portion is threaded for engagement with an inner and outer flange or collar 80 and 81 respectively. The collar 80 is formed with a flat engaging face on one side for engaging with the end of the bushing 49 in order to prevent inward movement of the shaft 52 and upon its opposite side with a short cylindric boss or hub 83 upon which is placed a sharp-edged grinding disk 85. The outer collar 81 is then screwed upon the threaded portion 78 and forced tightly against the face of the grinding disk, whereby the disk is rigidly secured between the two collars. In order to afford means for engagement of a wrench with said collars 80 and 81 they are each flattened upon portions of their peripheries, as indicated by the portions 88 in Fig. 4. A flange or fixed collar 90 upon the shaft 52 engages with the inner face of the bushing 49 in order to prevent outward movement of said shaft. To the opposite end of said shaft 52 secured the flexible shaft 95 for the purpose of rotating the same; said shaft consisting of a number of short cylindric members 96, each universally jointed at each end to its adjacent

members and rotatably mounted in bearing members 97 secured in a flexible tube 98, which enters a short distance into the outer end of the bushing 50; said bushing having its interior diameter enlarged for a short distance for the purpose of accommodating the tube 98. The particular construction of said flexible shaft and its incasing tube form no part of the present invention, as other well known forms of these devices are adapted for use in connection with the other parts of the device here shown.

The table 40 rests upon the tool-carrier 25, being placed in position with its hub 41 engaging with the opening 32, and is secured against displacement by means of a flat spring 105, pinned at one end by means of a cap screw 107, to the said tool carrier 25 in a manner permitting it to extend over the upper surface of said table, and having at its other end a short stud or pin 106 which enters a small circular opening 108, in the center of the upper surface of said table.

Referring now to the means for rotating the flexible shaft 95 (Figs. 1 and 7), 120 indicates a belt pulley which is driven by a belt 121 from a line shaft over-head. Said pulley rotates upon a fixed shaft or spindle 122 supported in the tail-stock of the lathe, said spindle being tapered in diameter through a portion of its length 123 and being thrust into a correspondingly shaped opening in the tail-stock and remaining therein by its frictional engagement therewith. A screw 125 extends radially into the pulley and its inner end is rounded and engages with an annular groove in the spindle, whereby the pulley is prevented from slipping off its shaft. The outer face of the pulley is formed with a hub 127 to which is fixed an end of the said flexible shaft. An opening, 128, is provided through the rear portion of the tail-stock, through which may be thrust a rod for the purpose of removing the spindle 122. The means above described for supporting the pulley 120 adapt the device for use in connection with lathes of a well known form, the tail-stock being commonly formed as shown for the purpose of supporting other parts of the lathe therein, but the parts may be otherwise arranged; and the disk may be otherwise rotated than by means of a flexible shaft as here shown.

In Figs. 1, 3 and 5 is shown a clutching device 130, the same comprising a shank portion 131, only a part of the length of which is shown, and a short cylindrical portion of lesser diameter 132; the latter being made tubular, longitudinally slotted, and internally threaded, whereby it may be expanded by a short taper screw 135 which is forced into it. It is designed that one of the ball rings 136, (being the inner one of the two comprising an ordinary complete bearing assembly) shall be placed over the cylindrical part 132 as shown and such cylindrical part is then expanded by forcing the screw 135 into it; whereby the ring is frictionally retained in position. The shank 131 is then engaged by the chuck 22, in the same manner as would be any similarly shaped bar, for the purpose of rotating the ring.

In Fig. 6 is shown on a different scale a corresponding clutching device 140 which is used in connection with the grinding of the exterior ball-ring of a bearing assembly, said device comprising a shank portion 141, adapted to be engaged by the chuck as above described, and a ring-shaped portion or rim 142 within which the ball-ring 143 is placed. Said ring-shaped portion or rim is radially slotted at two diametrically opposite points 143, 143 in its circumference, its adjacent marginal portions being provided with lugs or projections 146, which are drawn together by means of bolts and nuts 147 whereby the rim may be contracted upon the ball-ring and both rotated together.

The operation of the device is as follows: The circular table with its attached parts is placed in position upon the lathe, and the part to be ground is secured to its corresponding clutching device, 130 or 140, and the latter engaged by the chuck. The position of the disk with respect to the axis of rotation of the table is then arranged by adjusting the screw 61, in order to secure the proper distance between such axis and one of the tangents to the disk which is parallel to it, this distance being the radius of the groove which will be ground (Fig. 3). The parts are then rotated, as above described, and brought into engagement by adjusting the tool carrier 25 through the screw 30; while the table is swung back and forth about its axis of rotation. This process is continued, the disk being kept in engagement with the ball-ring by adjusting the screw 30, to compensate for the material ground away, until the desired depth of groove has been cut. A handle 150, attached to the standard 45, provides a convenient means for swinging the table as above described.

While the improved grinding device has been described above as including a lathe among its elements, it is evident that other elements may be substituted without departing from the spirit of the present invention—as for example, the piece of work which is being ground may be otherwise supported and rotated than by means of a lathe; or, in other kinds of operations, it may not be rotated at all. Likewise, the parts particularly described above may be otherwise operated than as stated—as, for example, the grinding disk may be shifted above its table until the axis of the table falls outside the circumference of the disk (instead of intersecting it as a chord). In such case, swinging the table would cause the cutting edge

of the disk nearest to such axis to describe the arc of a circle lying entirely outside the circumference of the disk, whereby the surface of a cylinder could be ground away to leave a convex band. Or, by making the radius of such arc equal to the radius of the cylinder, the latter could be ground away to leave a sphere; and other shapes might be made, and the device otherwise varied and used.

I claim as my invention:

1. The combination with a lathe comprising a rotating chuck, a cross-sliding tool carrier, and a tail-stock, of a grinding device comprising a rotatable table detachably mounted upon said tool carrier, a grinding disk supported upon said table, a rotating member supported by said tail-stock, means for transmitting rotation from said member to said grinding disk, and means for varying the position of said grinding disk with respect to the axis of rotation of said table.

2. The combination with a lathe comprising a head stock and rotating chuck, a sliding carriage and a cross-sliding tool carrier having an opening in its top, of a detachable grinding device comprising a rotative table having a hub adapted to enter said opening, a grinding disk supported upon said table, means for sliding said grinding disk inward and outward with respect to the axis of rotation of said table, and means for rotating said table while said grinding disk is in rotation and operatively engaged with the work.

3. The combination with a lathe comprising a head stock and rotating chuck, a tail stock, a sliding carriage, and a cross-sliding tool carrier having an opening in its top, of a detachable grinding device comprising a rotative table having a hub adapted to enter said opening, a grinding disk supported upon said table, means for sliding said grinding disk inward and outward with respect to the axis of rotation of said table, a rotating member supported by said tail stock, means for transmitting rotation from said member to said grinding disk, and means for rotating said table while said grinding disk is in rotation and operatively engaged with the work.

4. The combination with a lathe comprising a head stock and rotative chuck, a sliding carriage and a cross-sliding tool carrier with an opening in its top, of a detachable grinding device comprising a rotative table having a cylindric hub adapted to engage with said opening, a grinding disk supported by said table, and means for varying the position of said disk along the direction of a radius of said table and also for rotating said table while the grinding disk is in rotation and operatively engaged with the work.

5. The combination with a lathe comprising a head stock and rotative chuck, a sliding carriage and a cross-sliding tool carrier with an opening in its top, of a detachable grinding device comprising a rotative table having a cylindric hub adapted to engage with said opening, and a grinding disk supported by said table and relatively movable in the direction of a radius thereof, said disk being designed for inward and outward movement with respect to the axis of rotation of said table, and said table being designed for rotation while the grinding disk is in rotation and operatively engaged with the work.

6. The combination with a lathe comprising a head stock and rotating chuck, a sliding carriage and a cross-sliding tool carrier, of a detachable grinding device comprising a rotative table adapted to engage with said cross-sliding tool carrier, and a grinding disk supported upon said table and movable relative thereto.

7. The combination with a lathe comprising a head stock and rotating chuck, a sliding carriage and a cross-sliding tool carrier, of a detachable grinding device comprising a rotative table adapted to engage with said cross-sliding tool carrier, a grinding disk supported upon said table, and means for sliding said grinding disk inward and outward with respect to the axis of rotation of said table.

8. The combination with a lathe comprising a head stock and rotating chuck, a sliding carriage and a cross-sliding tool carrier, of a detachable grinding device comprising a rotative table adapted to engage with said cross-sliding tool carrier, a grinding disk supported upon said table and movable relative thereto, and means for rotating said table while said grinding disk is in rotation and operatively engaged with the work.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses this 9th day of March 1911.

KARL E. AHLBERG.

Witnesses:
E. RAPHAEL NOURSE,
EMIL R. ROSENTHAL.