

F. L. BARR.
GRINDING MACHINE.
APPLICATION FILED AUG. 20, 1918.

1,306,400.

Patented June 10, 1919.
4 SHEETS—SHEET 1.

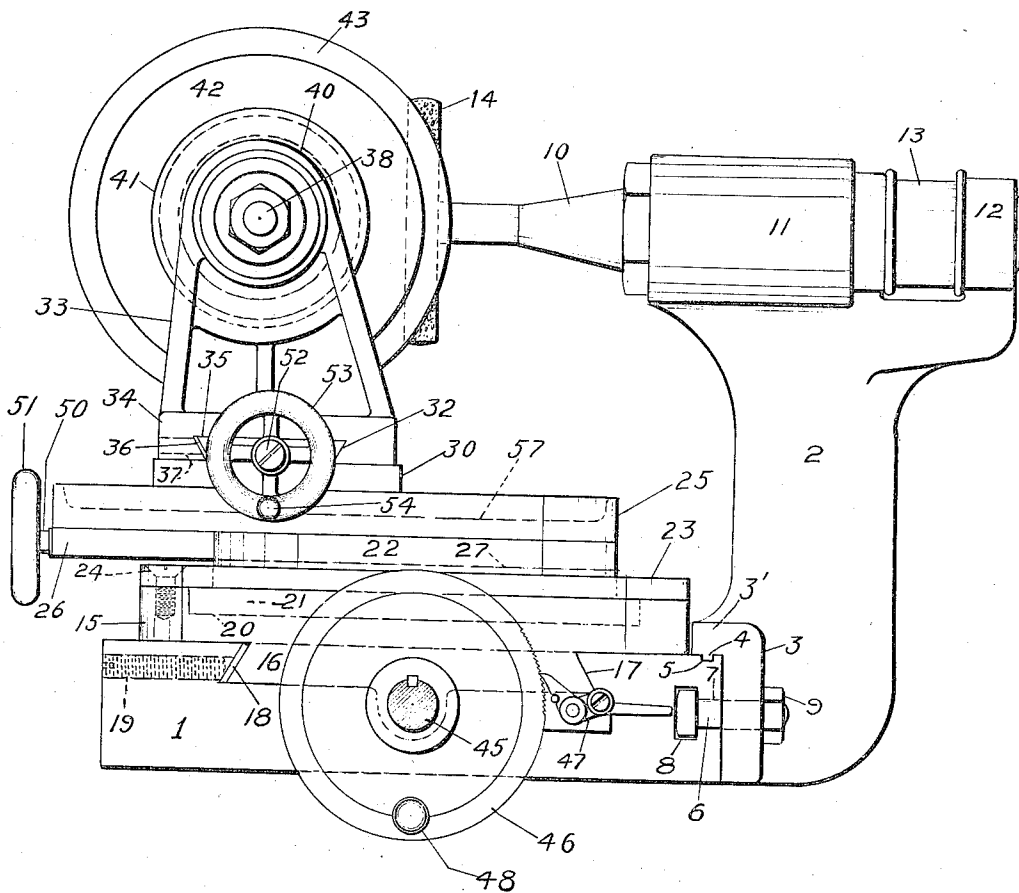


FIG. 1

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his ATTORNEY

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4 SHEETS—SHEET 2.

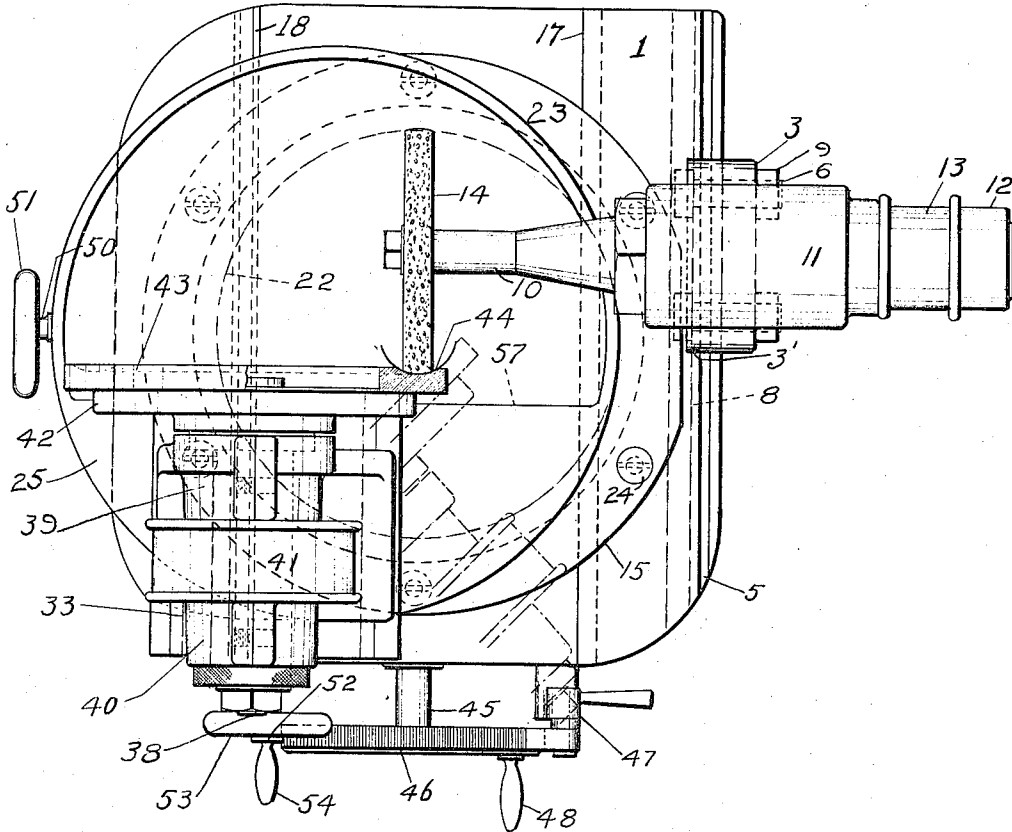


FIG. 2

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4 SHEETS—SHEET 3.

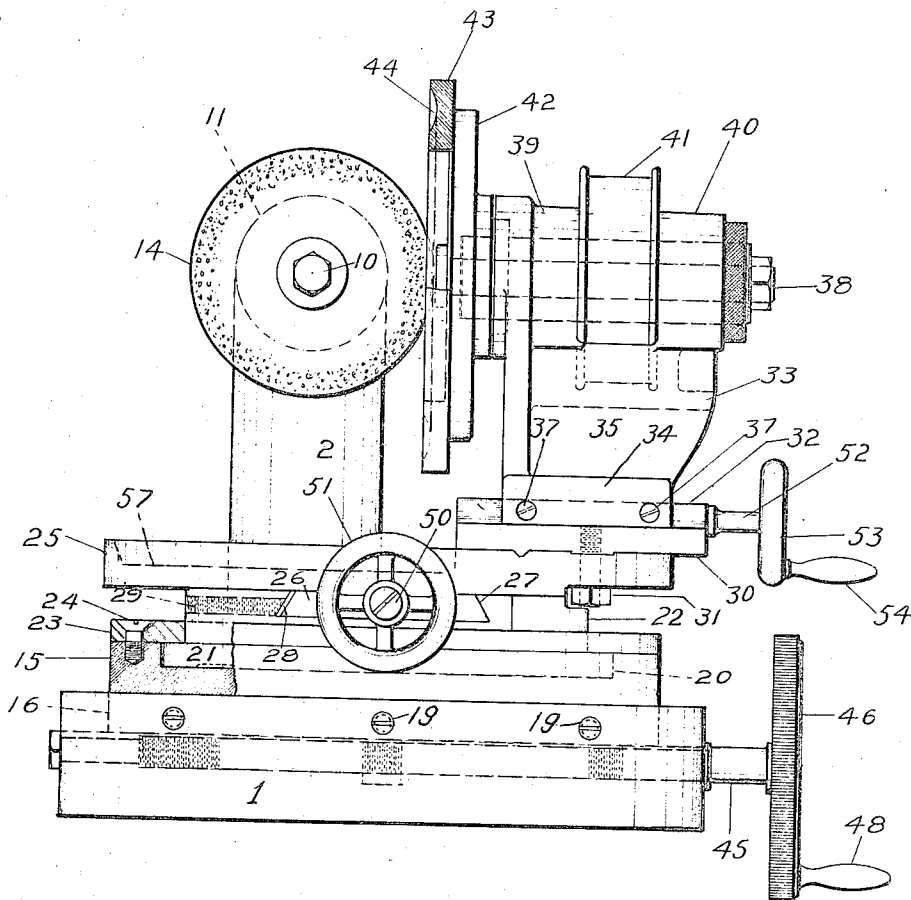


FIG. 3

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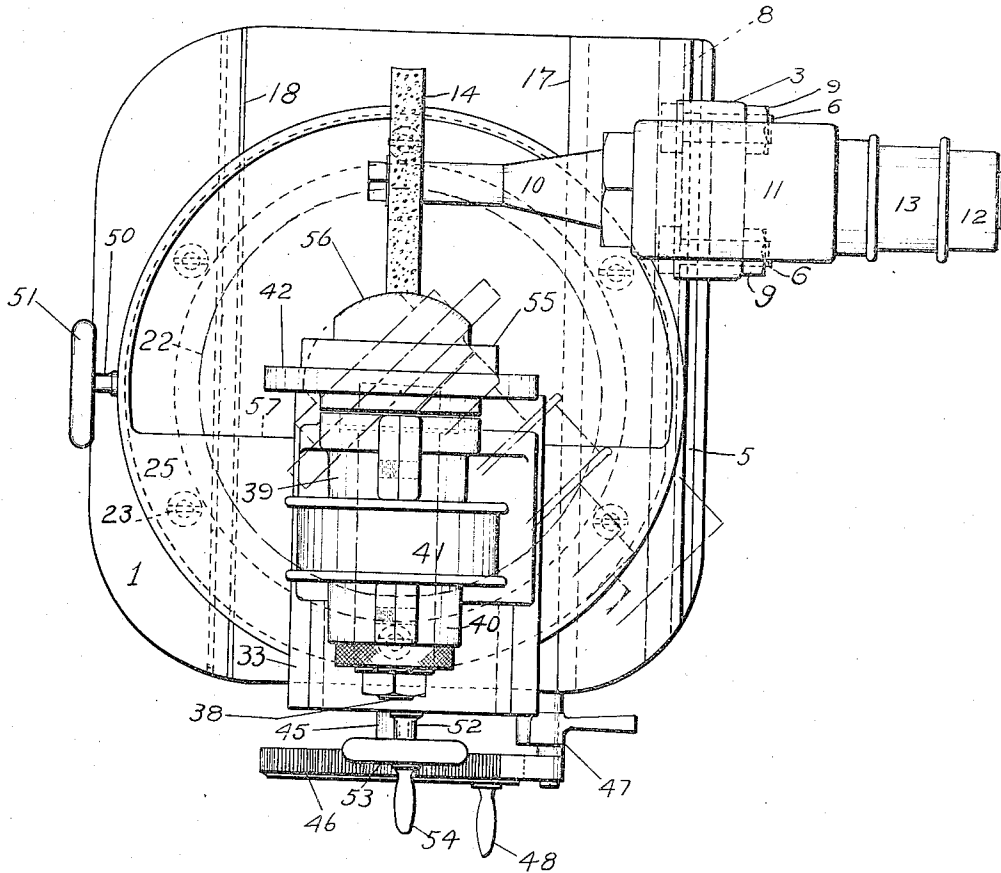


FIG. 4

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UNITED STATES PATENT OFFICE.

FLETCHER L. BARR, OF SOUTH ORANGE, NEW JERSEY, ASSIGNOR TO THE HART ROLLER BEARING COMPANY, OF EAST ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

GRINDING-MACHINE.

1,306,400.

Specification of Letters Patent.

Patented June 10, 1919.

Application filed August 20, 1918. Serial No. 250,686.

To all whom it may concern:

Be it known that I, FLETCHER L. BARR, a citizen of the United States, and a resident of South Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a description.

My invention relates to grinding machines, and more especially to an improved universal radial grinding machine adapted to grind surfaces curved either convexly or concavely.

One of the objects of my invention is to provide a grinding machine of this character which is easily and readily adjustable to grind either concave or convex surfaces on any desired radius, and which is especially designed to grind annular curved surfaces such, for example, as those of raceways for ball bearings.

Another object of my invention is to provide such a machine with an adjustment to enable the same to grind annular surfaces of any desired diameter.

A further, and one of the principal objects of my invention is to provide a machine with which the above results may be obtained without shaping the face of the grinding wheel in accordance with the curvature of the surface to be ground.

My invention also comprises a grinding machine for attaining the foregoing objects, which is simple in construction, extremely effective in action, and easy to manipulate.

Other objects and features of my invention reside in the construction of parts and combinations of elements hereinafter more particularly described and claimed.

In order that my invention may be more clearly understood, attention is directed to the drawings accompanying and forming a part of this specification, in the several views of which like parts are designated by the same reference characters, and in which:

Figure 1 is a view in front elevation of a grinding machine in accordance with my invention, shown set in position to grind a concave annular surface on the work carried thereby;

Fig. 2 is a plan view of the machine as

shown in Fig. 1, the work being shown partly in section;

Fig. 3 is a view in side elevation of the machine as shown in Fig. 1, parts being in section; and

Fig. 4 is a view similar to Fig. 2 showing the machine set in position to grind a spherical convex surface on the work carried thereby.

Referring now to the drawings, reference character 1 represents the base of my improved grinding machine, which is preferably substantially rectangular, and 2 represents a standard or bracket which is mounted at its lower end on the base 1 for adjustment along one side thereof. The bracket 2 is provided at its lower end with a flange 3 bearing against the right hand side edge of the base 1, referring to Figs. 1 and 2, and this flange is provided with a portion 3' extending at right angles thereto which bears on the top of the base 1. The portion 3' is provided on its lower surface with a projection or key 4 which fits a key-way or guide groove 5 on the top of the base 1. The bracket 2 is adapted to be clamped or locked in any position to which it is adjusted on the base 1 by means of bolts 6 which extend through holes in the flange 3 and into a slot 7 in the base, the heads of the bolts being disposed in an enlargement 8 of the slot 7, and by lock-nuts 9 threaded on the ends of the bolts which extend beyond the outer surface of flange 3.

A horizontal grinding-wheel shaft or spindle 10 is rotatably mounted in spaced fixed bearings 11 and 12 formed on the upper end of the bracket or standard 2, and has secured thereto between said bearings a pulley 13 whereby the same is adapted to be operated by a belt (not shown), driven from any suitable source of power. The shaft 10 extends inwardly over the base 1 and has secured to its inner end in any suitable manner the grinding wheel 14.

A carriage 15 is slidably mounted for horizontal movement on the base 1, as by means of a guide or way 16 provided on the bottom thereof which projects into and has a dovetail connection with a guideway 17 in the top of the base. The guideway 17 is

preferably formed midway between the sides of the base and preferably extends at right angles to the shaft 10. One side of the guideway 17 is provided with a wear plate 18 which is adapted to be adjusted to take up wear and lost motion by screws 19. By tightening the screws 19 sufficiently, the carriage 15 may, of course, be locked in any adjusted position on the base 1.

The carriage 15, which is preferably circular, is provided in its upper side with a circular recess 20 in which an annular flange 21 formed on a circular support or plate 22 closely fits whereby the latter is mounted for oscillatory movement. A ring 23 detachably secured to the top of carriage 15, as by screws 24, overlies the flange 21 and thereby retains the support or plate 22 in proper operative position on the carriage. A table 25 preferably in the form of a large circular plate is mounted for sliding movement on the support 22, as by means of a guide or way 26 provided on the bottom thereof which has a dovetail connection with a guideway 27 formed in the top of the support and extending diametrically across the same. One side of the guideway 27 is provided with a wear plate 28 which is adapted to be adjusted to take up wear and lost motion as by screws 29. By tightening the screws 29 sufficiently, it will be apparent that the table 25 may be locked in any position to which it may be adjusted on the support 22.

A plate 30 is detachably secured, as by means of a screw 31, to the top of table 25 at one side thereof, and is provided with a guide or way 32 projecting upwardly therefrom. Reference character 33 represents the work head, the base 34 of which is provided with a guideway 35 having a dovetailed connection with the guide or way 32, whereby the work head is slidably mounted on the plate 30 and table 25. One side of the guideway 35 is provided with a wear plate 36 which is adjustable by means of screws 37 to take up wear and lost motion. By tightening screws 37 sufficiently, the work head 33 may be locked in adjusted position on the table 25.

A horizontal work shaft or spindle 38 is rotatably mounted in fixed position on the upper end of the work head 33 in spaced bearings 39 and 40. Secured to the shaft 38 between the bearings 39 and 40 is a pulley 41 whereby the shaft is adapted to be driven from a suitable source of power by means of a belt (not shown). The shaft 38 is parallel to the guide 32 and guideway 35 whereby movement of the work head 33 on the plate 30 and table 25 effects adjustment of the shaft and the work carried thereby in the direction of the length of such shaft. The inner end of the shaft or spindle 38 has a

circular chuck 42 mounted thereon for carrying the work to be ground. In Figs. 1 to 3, the work shown consists of a flat ring or annulus 43 provided on one face with a concave annular groove 44 comprising a ball-bearing raceway. The ring 43 is suitably secured to the chuck 42 concentrically with the axis of shaft 38 and with the grooved face thereof facing the edge of the grinding wheel 14.

Adjustment of the carriage 15 and the parts carried thereby on the base 1 is effected by turning the screw 45, which is rotatably mounted on the base 1 but immovable longitudinally with respect thereto and which has a threaded connection with the carriage. The movement of the carriage 15 rearwardly on the base 1 is utilized to feed the work 43 in the grinding operation, and is effected, when the machine is in operation, by means of a ratchet wheel 46 secured to the outer end of the screw 45 and a pawl mechanism 47, which is operated automatically in the usual manner by means (not shown), and which coacts with the ratchet wheel to rotate the latter and thereby by the screw 45, step by step. The pawl mechanism 47 may be thrown out of operative position with respect to the ratchet wheel 46 and the latter turned by the handle 48 to effect either a quick return movement of the carriage 15 or a rapid feeding movement of the work.

Adjustment of the table 25 on the carriage 15 is effected by turning a screw 50 rotatably mounted on the table and having a threaded connection (not shown) with the carriage. The end of this screw 50 has a hand wheel 51 secured thereto to facilitate turning of the screw.

The adjustment of the work head 33 relative to the table 25 is effected in a like manner by means of a screw 52 rotatably mounted on the plate 30 secured to the table, and having a threaded connection (not shown) with the work head, the outer end of this screw having secured thereto a wheel 53 provided with a handle 54 to facilitate turning of the screw.

When the carriage 15, table 25, and work head 33 have been so adjusted as to bring the portion of the work which it is desired to grind into proper position relative to the periphery of the grinding wheel 14, the work head 33 is preferably locked to the plate 30 and table 25 by tightening screws 37 and the wheel 53 and handle 54 are then utilized in the grinding operation to oscillate the work while in engagement with the periphery of the grinding wheel, about the axis of the swiveled support 22, as indicated in dotted lines in Figs. 2 and 4, so as to grind a surface of the desired radius on the work. It will be seen that in such oscillatory move-

ment the support 22, table 25, and the work head 33 are all moved as a unit about the axis of the support. This axis is preferably located in a plane normal to the axis of the grinding wheel spindle 10 at the center of the grinding wheel, or, in other words, in the plane of the central circular section of the grinding wheel, and is adjustable only in such plane. Consequently, it will be apparent that the curvature of the surface ground on the work will have a point in the axis of the support 22 as a center. Movement of the table 25 on the swiveled support 22 effects the lateral adjustment of the work shaft 38 and the center of the work relative to the periphery of the grinding wheel 14 and thereby variation in the diameter of the surface of the annular groove or other surface of the work which will be ground; and movement of the work head 33 on the table 25, which is preferably at right angles to the movement of the table on the support 22, will effect the adjustment of the radius of curvature of the surface ground, or, in other words, in the radius of the arc of oscillation of the work. Referring to Figs. 1 to 3, for example, if the screw 50 is turned so as to move the table 25 on the support 22, the distance between the center of the work 43 and the periphery of grinding wheel 14 will be changed, and the diameter of the annular groove 44 which will be ground will therefore be either increased or decreased, according to the direction in which the table is moved. And if the work head 33 is moved on the table 25 by turning screw 52, the distance of the groove 44 from the axis of oscillation of the work, *i. e.*, the axis of support 22, will be changed, and the radius of the arc of oscillation or the curvature of the surface ground will therefore be varied. It will be apparent that with the construction described, it will be unnecessary to shape the periphery of the grinding wheel to the curvature of the surface which it is desired to grind, as it will be impossible to grind such surface on any curvature other than one having a center in the axis of the support 22 and having a radius equal to the shortest distance between said axis and said surface. Consequently, the periphery of the grinding wheel will quickly wear to a curvature of the same radius, as illustrated. The adjustment of the carriage 15 on base 1 to effect the feeding of the work against the periphery of the grinding wheel will in no way effect the curvature of the surface ground, as the axis of the support 22 will be moved the same distance as the work in such adjustment, and consequently the radius of the arc of oscillation of the portion of the work ground will remain unchanged.

When the work head 33 is adjusted to such a position on the table 25 that that part of

the work in contact with the periphery of the grinding wheel is at one side of the axis of support 22, or forwardly thereof with reference to the front of the machine, as shown in the drawings, a concave surface will be ground on the work, as shown in Figs. 1 to 3. But when the head 33 is adjusted so that the work where it contacts the grinding wheel is on the other side of the axis of oscillation, or rearwardly thereof with reference to the front of the machine, the portion of the work engaged by the grinding wheel will be ground convexly, as shown in Fig. 4, in which 55 represents the work and 56 the surface ground thereon. In Fig. 4 the table 25 is also shown adjusted to such a position on the support 22, that the center of the work on the head 33 will be in the plane in which the central circular section of the grinding wheel 14 and the axis of the swiveled support 22 are both located. Accordingly, the surface 56 ground on the work 55 will be spherical as well as convex. It will also be evident that if the table 25 be adjusted on the support 22 so that the center of the work on the head 33 is in the plane of the central section of the grinding wheel and the other parts of the machine are in the positions shown in Figs. 1 to 3, a circular depression having a spherical concave surface will be ground at the central portion of the work.

The top of the table 25 is provided with a substantially semi-circular depression or recess 57 for receiving the oil and other material which falls from the work and grinding wheel during the grinding operation.

If desired, suitable indicating means may be associated with each of the devices for effecting the adjustments of carriage 15, table 25 and work head 33 respectively. It is also to be understood that the grinding machine specifically described herein is subject to numerous modifications in the size, shape and arrangement of its parts without departing from the spirit of the invention and the scope of the appended claims.

Having now described my invention, what I claim as new and desire to protect by Letters Patent is as follows:—

1. In a grinding machine, the combination of a rotatable grinding wheel, a rotatable work support mounted for oscillation with the work carried thereby in engagement with the periphery of said wheel, means for adjusting the work support in a direction to effect adjustment of the radius of the arc of the oscillatory movement thereof, and means for adjusting the work support relatively to the grinding wheel without effecting any change in the radius of such oscillatory movement.

2. In a grinding machine, a rotatable grinding wheel, an oscillatory support, a

work-carrying shaft or spindle rotatably mounted on said support to oscillate therewith, the axis of oscillation of said support and the center of the grinding wheel being
5 located in a plane normal to the axis of said wheel, a base with which said support has a slidable connection; and means for adjusting said support on said base to effect the feeding of the work carried by the work-
10 carrying shaft or spindle relative to the grinding wheel.

3. In a grinding machine, a rotatable grinding wheel, an oscillatory support, a work-carrying shaft or spindle rotatably
15 mounted on said support to oscillate therewith, the axis of oscillation of said support and the center of the grinding wheel being located in a plane normal to the axis of said wheel, a base with which said support has a
20 slidable connection, and automatically op-

erated means for adjusting said support on said base to effect the feeding of the work carried by the work-carrying shaft or spindle relative to the grinding wheel during the grinding operation. 25

4. In a grinding machine, a rotatable grinding wheel, an oscillatory support, and a work-carrying member rotatably mounted on said support to oscillate therewith, the axis of oscillation of said support being
30 located in the plane of the central circular section of the grinding wheel, said support being adjustable relatively to the grinding wheel without effecting any change in the radius of the arch of oscillation of the work
35 carried by said member.

This specification signed and witnessed this 19th day of August, 1918.

FLETCHER L. BARR.