F. E. BRIGHT.

GRINDING MACHINE.

APPLICATION FILED SEPT. 2, 1916.

1,289,375. Patented Dec. 31, 1918.

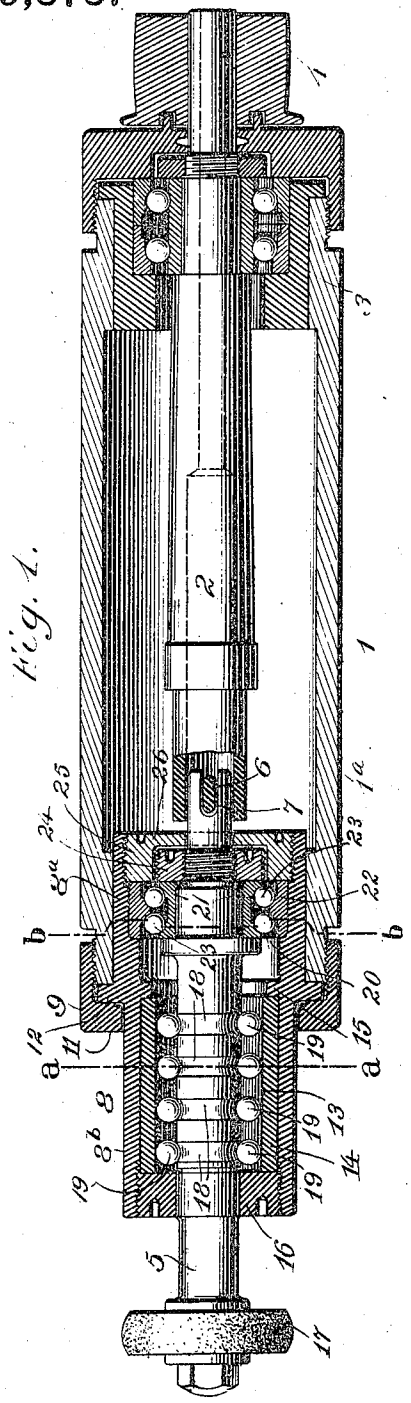

Fig. 1.

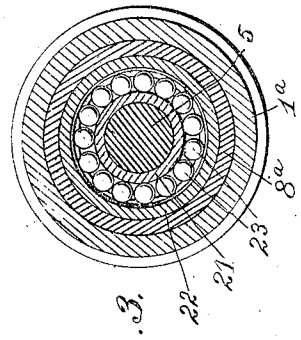

Fig. 3.

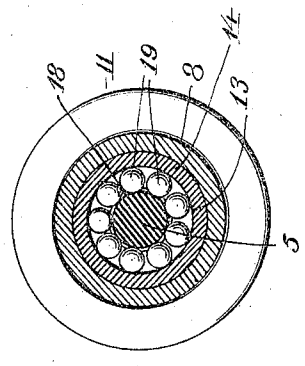

Fig. 2.

Inventor

F. E. Bright

By his Attorneys

Rogers, Kennedy & Campbell.

UNITED STATES PATENT OFFICE.

FRED E. BRIGHT, OF PHILADELPHIA, PENNSYLVANIA.

GRINDING-MACHINE.

1,289,375. Specification of Letters Patent. Patented Dec. 31, 1918.

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To all whom it may concern:

Be it known that I, FRED E. BRIGHT, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to machines for grinding or performing like operations such as finishing, polishing, etc., in which machines the operating tool or wheel is carried by a rotary spindle, my invention being directed to the means for mounting the spindle to cause it to run true without vibrations, particularly under high speeds.

In accordance with my invention the grinding spindle is flexibly connected with a rotary driving shaft in such manner as to avoid the transmission to the spindle of the vibrations of the shaft, and the spindle is given extended and accurate radial rotary support by means of antifriction rolling members surrounding the spindle and tracking on a surrounding relatively fixed bearing surface, the said parts being of such form and relative arrangement that the spindle will be supported to rotate freely and accurately about its longitudinal axis, and will be free from vibrations under the high speeds demanded in practice.

In the accompanying drawings:

Figure 1 is a longitudinal sectional elevation through the sustaining frame or sleeve of a grinding machine, showing the driving shaft mounted therein, and the cooperating grinding spindle mounted in said frame in accordance with my invention.

Fig. 2 is a transverse section on the line *a*—*a* of Fig. 1.

Fig. 3 is a similar view on the line *b*—*b* of Fig. 1.

Referring to the drawings:

1 indicates a sustaining frame for giving support to the rotary parts, which sustaining frame in the present instance is in the form of a sustaining sleeve 1^a which is adapted to be fixedly sustained in the main frame of the machine in the usual and customary manner. 2 indicates a driving shaft extending within the sustaining sleeve and mounted for rotation therein in the present instance by means of an antifriction bearing 3 surrounding the shaft between the same and the rear portion of the sleeve, a driving pulley 4 being applied to the shaft for rotating the same. 5 indicates a grinding spindle which extends in line with the driving shaft and the rear end of which is flexibly connected with the forward end of the shaft, in the present instance by means of a driving lug 6 on the shaft engaging in an open slot 7 in the end of the spindle, the arrangement being such that while the rotary motion of the shaft will be transmitted to the spindle, the latter will not be subject to the vibrations of the shaft.

The grinding spindle is rotatably mounted and sustained within an extension sleeve 8, comprising a rear portion 8^a extending within the forward end of the sustaining sleeve and a forward portion 8^b which projects forwardly from the end of the sleeve, the extension sleeve being detachably connected in fixed relation to the sustaining sleeve by means of a clamping nut 9 screwed on the outer end of the sustaining sleeve, and provided with an inwardly extending flange 11 engaging an annular outwardly projecting shoulder 12 on the extension sleeve which shoulder abuts against the outer end of the sustaining sleeve.

The extension sleeve is provided with an internal cylindrical bearing surface 13 formed on a hardened collar 14 which is seated within the forward portion of the extension sleeve and which abuts at its rear end against an inwardly extending annular shoulder 15 on said sleeve, the collar being fixedly held in place within the sleeve by means of a nut 16 screwed in the forward end of the extension sleeve and bearing against the forward end of the hardened collar. The grinding spindle extends loosely through a central opening in the nut 16 to the outside, where it is provided with a grinding tool 17; and within the bearing surface on the hardened collar, the grinding spindle is provided with a plurality of circumferential grooves 18, in the present instance four in number, in which grooves are disposed antifriction members in the form of spheres or balls 19. These balls traveling in the grooves in the rotation of the spindle, will track on the surrounding cylindrical bearing surface 13 and they will act to give extended and accurate radial rotary support

to the spindle while permitting the same to accommodate itself, without binding, to any unevenness or change in length due to expansion or contraction under the influence of heat or cold.

The position of the grinding spindle longitudinally of the extension sleeve, is controlled and determined by means of an antifriction thrust bearing 20 applied to the spindle in rear of the balls 19, and between the spindle and the rear portion 8^a of the sleeve. This bearing is in the form of an inner casing element 21 applied to the spindle, an outer casing element 22 seated in the extension sleeve, and two series of rolling members in the form of balls 23 located between the casing elements. The inner casing element is held fixedly in position on the spindle by means of a clamping nut 24 screwed on the spindle and bearing against the rear end of the casing element, while, the outer casing element is held fixedly in position in the extension sleeve by means of a clamping nut 25 screwed in the rear end of the sleeve and bearing against said casing element, the nut 25 loosely surrounding the nut 24 and being provided with an inwardly projecting annular flange 26 extending at the rear of the nut 24 and formed with a central opening which closely surrounds the rear projecting end of the grinding spindle. The bearing 20 will thus receive the end thrusts of the grinding spindle exerted in both directions and will effectively support the same in an axial direction.

The sole function of the antifriction rolling members 19 is to give radial support to the spindle, their capability of traveling longitudinally on the smooth cylindrical bearing surface 13 preventing them from giving any axial support to the spindle, such latter support being taken care of wholly by the bearing 20. By employing a plurality of series of these rolling members confined in circumferential grooves in the spindle, the latter is given wide and extended radial support which insures trueness and accuracy in centering and running, while at the same time there will be no possibility of the parts binding in the event of a slight endwise deflection of the spindle such as might occur from expansion or contraction or from other causes. In such abnormal actions of the spindle the rolling members will travel longitudinally along the smooth bearing surface and the parts will in this manner accommodate themselves without interference or binding.

It will be observed that the grinding spindle is sustained and mounted wholly within the extension sleeve, which latter is in turn detachably connected with the sustaining sleeve by the clamping nut 9 so that by the removal of this nut the extension sleeve and the contained bearings and grinding spindle may be removed as a whole endwise from the sustaining sleeve, thereby permitting ready access to the bearings and operative parts, the slotted end of the spindle in this action disengaging in an endwise direction from the driving lug on the shaft.

In the foregoing construction and accompanying drawings I have set forth my invention in the particular detailed form and construction which I prefer to adopt. It will be manifest, however, that various changes may be made in the details without departing from the limits of the invention; and further it will be understood that the invention is not limited to any particular form or construction of the parts except in so far as such limitations are specified in the claims.

Having thus described my invention, what I claim is:

1. The combination of a sustaining frame provided with an internal cylindrical bearing surface, a rotary drive shaft mounted in said frame, a grinding spindle extending within said bearing surface and flexibly connected with the shaft to be rotated thereby, and antifriction rolling members surrounding the spindle and tracking on the cylindrical bearing surface both circumferentially and axially to give radial support only to the spindle.

2. The combination of a sustaining frame provided with an internal bearing surface, a rotary drive shaft mounted in said frame, a grinding spindle extending within the bearing surface and flexibly connected with the drive shaft to be rotated thereby, and a plurality of antifriction rolling members between the spindle and bearing surface and giving radial support only to the spindle, said rolling members being confined to circumferential travel on one of said parts and being adapted to track both circumferentially and axially on the other part.

3. The combination of a sustaining frame provided with an internal bearing surface, a rotary shaft mounted in said frame, a grinding spindle extending within said bearing surface and flexibly connected with the shaft to be rotated thereby, one of said parts being provided with circumferential grooves and the other part having a plane surface, and a plurality of antifriction rolling members mounted in said grooves in one of the parts and tracking both circumferentially and axially on the plane surface of the other part and giving only radial support to the spindle.

4. The combination of a sustaining frame provided with an internal cylindrical bearing surface, a rotary drive shaft mounted in said frame, a grinding spindle extending within the bearing surface and flexibly connected with the driving shaft to be rotated

thereby, said spindle being provided with a plurality of circumferential grooves, and antifriction rolling members located in said grooves and tracking on said bearing surface both circumferentially and axially and giving only radial support to the spindle.

5. The combination of a sustaining frame provided with an internal smooth cylindrical bearing surface, a rotary drive shaft mounted therein, a grinding spindle extending within the bearing surface and flexibly connected with the shaft to be rotated thereby, antifriction rolling members between the spindle and bearing surface in position to track both circumferentially and axially on the bearing surface and giving the grinding spindle radial support only, and additional antifriction rolling members between the frame and spindle to give axial support to the spindle.

6. The combination of a sustaining sleeve, a rotary driving shaft mounted therein, an extension sleeve fixedly connected with the sustaining sleeve and provided with an internal smooth cylindrical bearing surface, a grinding spindle extending within the extension sleeve and flexibly connected with the driving shaft to be rotated thereby, antifriction rolling members between the spindle and bearing surface in position to track both circumferentially and axially on said bearing surface and giving radial support only to the spindle, and a thrust bearing between the spindle and extension sleeve to give axial support to the spindle.

7. The combination of a sustaining sleeve, a rotary drive shaft mounted therein, an extension sleeve having its inner end extending within the end of the sustaining sleeve and detachably connected therewith, the outer portion of the extension sleeve being provided with an internal smooth cylindrical bearing surface, a spindle extending within the extension sleeve, antifriction rolling members between the spindle and bearing surface to give radial rotary support only to the spindle, an antifriction bearing surrounding the spindle inward of said rolling members to give axial support to the spindle, said antifriction bearing comprising an inner casing element applied to the spindle, an outer casing element seated in the extension sleeve, and rolling members between said casing elements, a clamping nut screwed in the inner end of the extension sleeve and engaging the outer casing element to hold the same in position, and a clamping nut screwed on the spindle and engaging the inner casing element to hold the same on the spindle, the inner end of the spindle being extended beyond said clamping nuts and being flexibly connected with the said drive shaft to be rotated thereby.

In testimony whereof, I have affixed my signature hereto.

FRED E. BRIGHT.