W. J. GUILD.

INTERNAL GRINDING MACHINE.

APPLICATION FILED JUNE 1, 1920.

1,361,850. **Patented Dec. 14, 1920.**

2 SHEETS—SHEET 1.

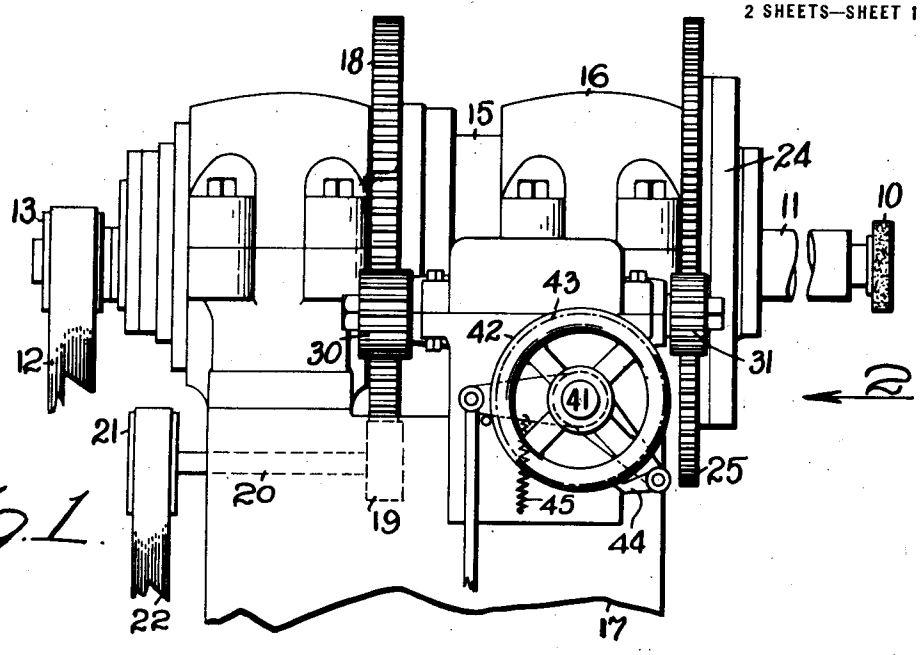

Fig. 1.

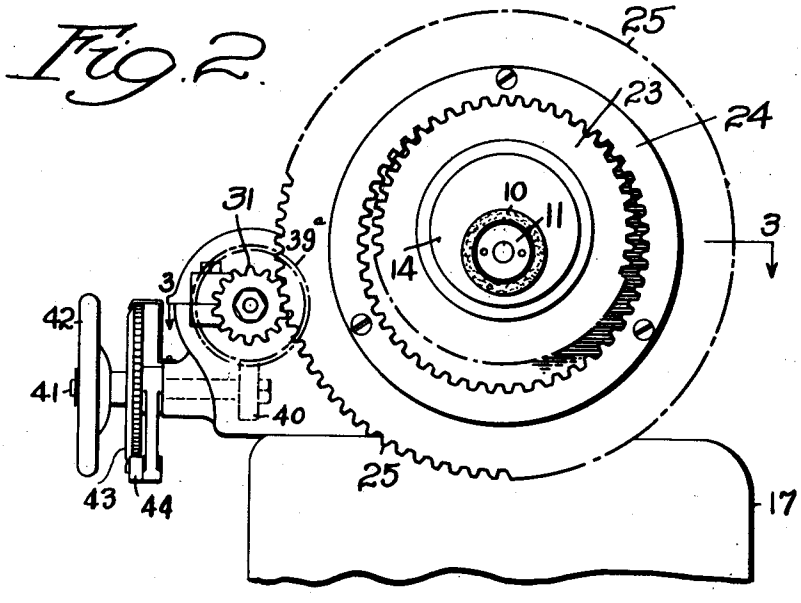

Fig. 2.

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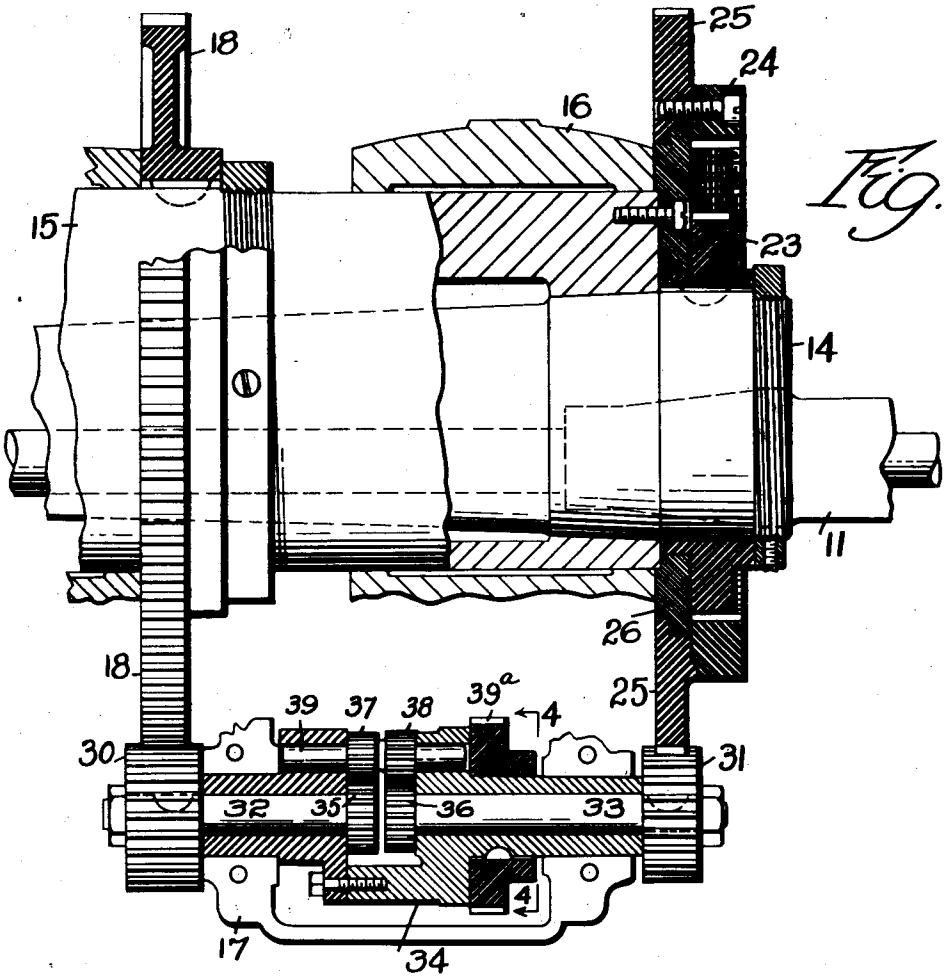

Fig. 3.

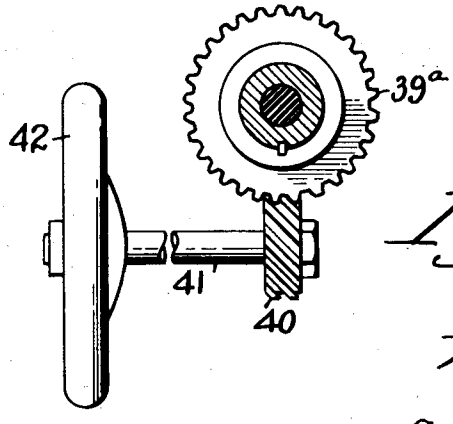

Fig. 4.

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UNITED STATES PATENT OFFICE.

WALDO J. GUILD, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO HEALD MACHINE COMPANY, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

INTERNAL GRINDING-MACHINE.

1,361,850. Specification of Letters Patent. Patented Dec. 14, 1920.

Application filed June 1, 1920. Serial No. 385,434.

To all whom it may concern:

Be it known that I, WALDO J. GUILD, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Internal Grinding-Machine, of which the following is a specification.

This invention relates to an internal grinding machine and particularly to an eccentric feed device therefor.

In a certain type of internal grinder, the grinding wheel spindle is mounted in a member which is independently rotatable about an axis eccentric to the axis of the spindle. It is necessary to adjust the eccentricity in suitable relation to the size of the hole to be ground and to the diameter of the grinding wheel.

It is the general object of my invention to provide improved mechanism for thus adjusting the eccentricity of the wheel spindle bearing while the machine is in operation, the adjustment being made at the convenience of the operator and to any desired amount.

A further feature of my invention relates to the provision of an improved automatic feed for an internal grinder of the type defined.

My invention further relates to arrangements and combinations of parts hereinafter described and more particularly pointed out in the appended claims.

A preferred form of my invention is shown in the drawings in which—

Figure 1 is a partial front elevation of a grinding machine embodying my improvements;

Fig. 2 is a right-hand side elevation thereof;

Fig. 3 is a horizontal sectional view taken along the line 3—3 in Fig. 2; and

Fig. 4 is a detail side elevation taken along the line 4—4 in Fig. 3.

Referring to the drawings, I have shown a grinding wheel 10, mounted on a spindle 11, which may be rotated in any convenient manner as by a belt 12 and pulley 13. The spindle 11 is provided with bearings eccentrically disposed in an inner member or sleeve 14 and the member 14 is also mounted for angular adjustment in an eccentric bearing in an outer member or sleeve 15 which, in turn, is rotatable in a fixed bearing 16 supported by the machine frame 17. A large spur gear 18 is keyed to the outer sleeve 15 and is continuously rotated by a pinion 19 mounted on a shaft 20 having a bearing in the machine frame 17 and provided with a pulley 21 driven by a suitable belt 22. The spindle 11 and the outer member or sleeve 15 are thus each continuously rotated during the operation of the machine but the spindle is of course driven at a very much greater speed.

A spur gear 23 is keyed to the inner sleeve 14 and meshes with an internal gear 24 fixed to the side of a large spur gear 25 which is freely rotatable upon a flanged plate 26 secured to one end of the outer sleeve 15 and concentric therewith.

Reference to Fig. 2 will clearly show the wheel spindle 11 eccentric in the inner sleeve 14, and the sleeve 14 eccentric with respect to the outer sleeve 15 and the internal gear 24 carried thereby. The eccentricity of the bearing for the inner sleeve 14 is constant, but the eccentricity of the spindle 11 may be varied by angularly adjusting the inner eccentric sleeve 14 in the outer eccentric sleeve 15, by which adjustment the eccentricity of the spindle 11 may be made equal to the sum of the eccentricities of the two sleeves, or to their difference, or to any intermediate combination thereof.

My invention as previously stated, relates particularly to improved means for thus angularly adjusting the inner sleeve 14 in the outer sleeve 15. For this purpose I have provided the mechanism most clearly shown in Fig. 3, in which a pinion 30 engages the first large gear 18 and a pinion 31 engages the second large gear 25. The pinions 30 and 31 are secured respectively to alined shafts 32 and 33, having bearings in a carrier 34 rotatably mounted in the frame 17.

The shafts 32 and 33 are provided with pinions 35 and 36 at their adjacent ends which pinions mesh with an additional pair of pinions 37 and 38 fixed to a third shaft 39, rotatably mounted in the carrier 34 and parallel to the shafts 32 and 33. A spiral gear 39^a is keyed to the carrier 34 and is engaged by a second spiral gear 40 (Fig. 4) mounted on a shaft 41 to which a hand wheel 42 is secured.

The gear sets 18—30—35—37 and 25—31—36—38 are so proportioned that the speed ratio between each of the large gears 18 and 25 and the third shaft 39 is the same, the ratio as shown in the drawings being eight to one. While the ratios are the same,

however, the ratios of the corresponding pairs of gears in each set are different, the gear 37 commonly having one more tooth than the gear 38 and the gear 35 having one more tooth than the gear 36. Similar differences occur in the other pairs of gears.

So long as the carrier 34 remains stationary, the gear 18 will rotate the shaft 39 eight times to each revolution of the outer eccentric sleeve 15 and the shaft 39 will, in turn, rotate the gear 25 once for each eight revolutions of the shaft 39. The gears 18 and 25 thus rotate at the same speed and there is no relative movement between the sleeve 15 and the gear 24. Consequently, there is no change in the angular adjustment of the gear 23 or the sleeve 14 upon which it is mounted.

If, however, the carrier 34 is itself given angular movement in either direction by the hand wheel 42, the different ratios of the gears 35—37 and 36—38 will result in angular movement of the gear 25 relative to the gear 18 and the outer sleeve 15, the movement of the gear 25 being greater or less according to the direction in which the carrier 34 is rotated. Such relative movement of the gear 25 acts through the gears 24 and 23 to change the angular position of the inner sleeve 14 in the outer sleeve 15.

It is thus possible to conveniently adjust the eccentricity of the wheel spindle at any time without using a hand operated device mounted on a rotating part, as has been frequently necessary heretofore. Such devices have been found dangerous and otherwise objectionable.

While the machine as thus described is designed for manual adjustment of the eccentricity, it will be obvious that any suitable power feed may be provided. One form of power feed mechanism is indicated in Figs. 1 and 2, comprising a ratchet wheel 43 fixed to the shaft 41, and a feed pawl 44 adapted to be actuated through connections (not shown) by the work-supporting slide or table. The wheel is commonly moved slightly outward at each end of the table travel. A spring 45 draws the feed pawl back after each feeding operation.

Having thus described my invention, it will be evident that changes and modifications can be made therein by those skilled in the art within the spirit and scope of my invention as set forth in the claims and I do not wish to be otherwise limited to the details herein disclosed, but what I claim is:—

1. An internal grinding machine having, in combination, a wheel spindle, an inner member in which said spindle is eccentrically and rotatably mounted, an outer member in which said inner member is eccentrically mounted, a supporting bearing for said outer member, means to independently rotate said outer member and said wheel spindle, and means to angularly adjust said inner member in said outer member, said means comprising a first gear rotating in fixed speed relation to said outer member, a second gear mounted to rotate freely about the axis of said outer member, a positive gear connection between said second gear and said inner eccentric member, alined shafts having pinions engaging said first and second gears respectively, each shaft having an additional pinion fixed thereon, a third shaft having pinions fixed thereto and engaging said additional pinions, a carrier for said third shaft angularly adjustable about the axis of said alined shafts and means to angularly adjust said carrier, whereby angular adjustment of said inner eccentric member relative to said outer eccentric member will result.

2. An internal grinding machine having, in combination, a wheel spindle, an inner member in which said spindle is eccentrically and rotatably mounted, an outer member in which said inner member is eccentrically mounted, a supporting bearing for said outer member, means to independently rotate said outer member and said wheel spindle, and means to angularly adjust said inner member in said outer member, said means comprising a first gear rotating in fixed speed relation to said outer member, a second gear mounted to rotate freely about the axis of said outer member, a positive gear connection between said second gear and said inner eccentric member, alined shafts having pinions engaging said first and second gears respectively, each shaft having an additional pinion fixed thereon, a third shaft having pinions fixed thereto and engaging said additional pinions, the speed ratio between said third shaft and one alined shaft being different from the speed ratio between said third shaft and the other alined shaft, a carrier for said third shaft angularly adjustable about the axis of said alined shafts and means to angularly adjust said carrier, whereby angular adjustment of said inner eccentric member relative to said outer eccentric member will result.

3. An internal grinding machine, having in combination, a wheel spindle, an inner member in which said spindle is eccentrically and rotatably mounted, an outer member in which said inner member is eccentrically mounted, a supporting bearing for said outer member, means to independently rotate said outer member and said wheel spindle, and means to angularly adjust said inner member in said outer member, said means comprising a first gear rotating in fixed speed relation to said outer member, a second gear mounted to rotate freely about the axis of said outer member, a positive gear connection between said second gear and said inner eccentric member, alined shafts having pinions engaging said first and second gears

respectively, each shaft having an additional pinion fixed thereon, a third shaft having pinions fixed thereto and engaging said additional pinions, a carrier for said third shaft angularly adjustable about the axis of said alined shafts, the speed ratio between said third shaft and said second gear being equal to the ratio between said third shaft and said outer member, said second gear and said outer eccentric member rotating in unison so long as said carrier remains stationary, and means to angularly adjust said carrier, whereby angular adjustment of said second gear and said inner eccentric member relative to said outer eccentric member will result.

4. An internal grinding machine having, in combination, a wheel spindle, an inner member in which said spindle is eccentrically and rotatably mounted, an outer member in which said inner member is eccentrically mounted, a supporting bearing for said outer member, means to independently rotate said outer member and said wheel spindle, and means to angularly adjust said inner member in said outer member, said means comprising a first gear rotating in fixed speed relation to said outer member, a second gear mounted to rotate freely about the axis of said outer member, a positive gear connection between said second gear and said inner eccentric member, a pair of unequal pinions, a carrier in which said pinions are mounted to rotate together, means to adjust said carrier angularly, additional pinions meshing with said unequal pinions and mounted for independent rotation about the axis of said carrier and positive gear connections from said additional pinions to said second gear and to said outer member respectively.

5. An internal grinding machine having, in combination, a wheel spindle, an inner member in which said spindle is eccentrically and rotatably mounted, an outer member in which said inner member is eccentrically mounted, a supporting bearing for said outer member, means to independently rotate said outer member and said wheel spindle, and means to angularly adjust said inner member in said outer member, said means comprising a first gear rotating in fixed speed relation to said outer member, a second gear mounted to rotate freely about the axis of said outer member, a positive gear connection between said second gear and said inner eccentric member, and driving connections between said first and second gears, said connections comprising a pair of alined shafts, a carrier angularly adjustable about the axis of said shafts, means to adjust said carrier, a geared member rotatably mounted in said carrier, said member having positive gear connection with each shaft but at different speed ratios and having positive gear connection at equal speed ratios through said alined shafts to said first gear and to said second gear respectively.

In testimony whereof I have hereunto affixed my signature.

WALDO J. GUILD.