March 3, 1931. R. MERSHON 1,794,975

GRINDING MACHINE

Filed Dec. 21, 1927 2 Sheets-Sheet 1

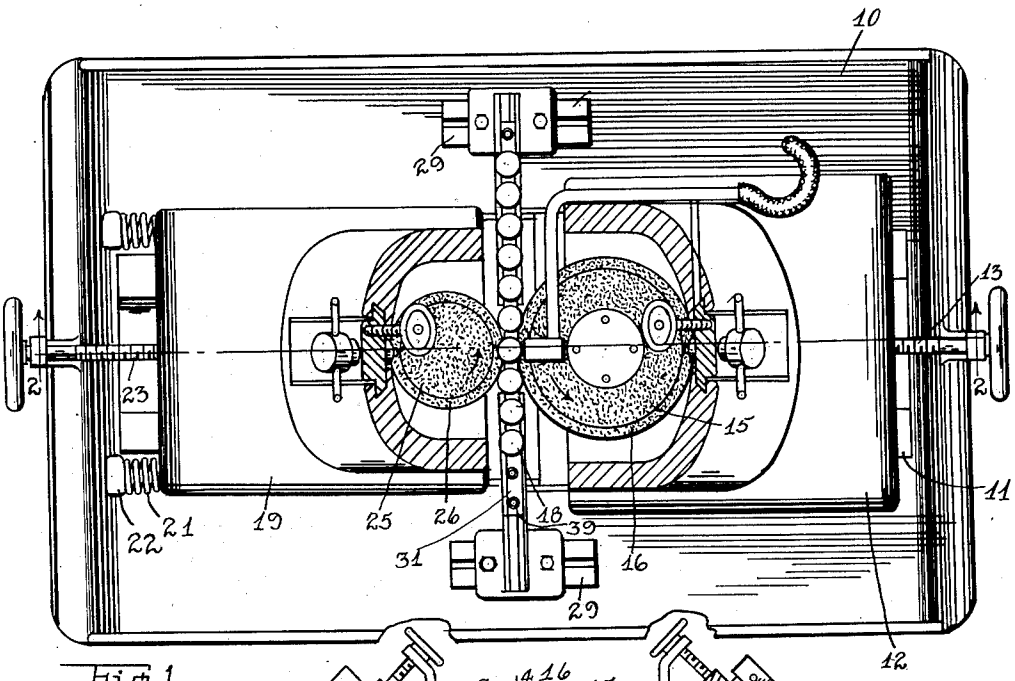


Fig. 1.

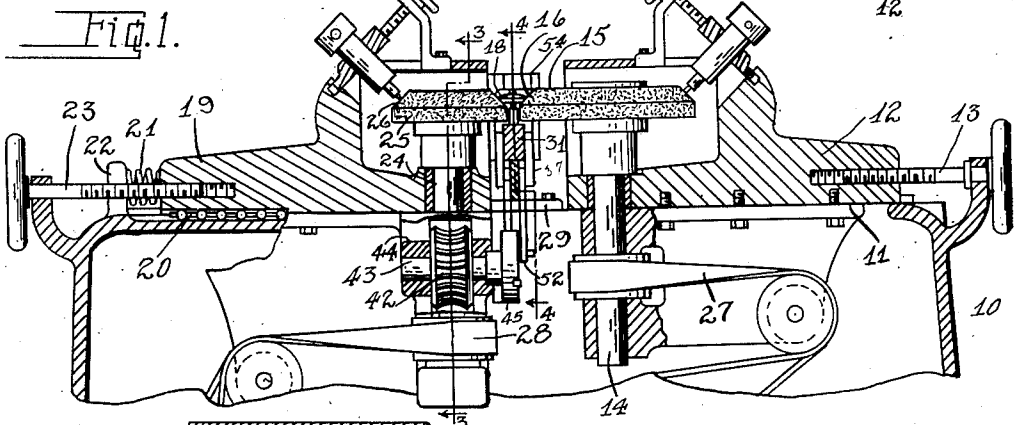


Fig. 2.

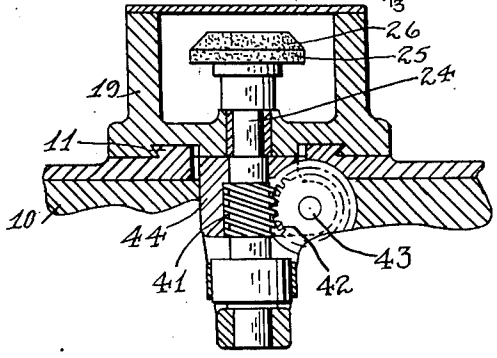


Fig. 3.

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GRINDING MACHINE

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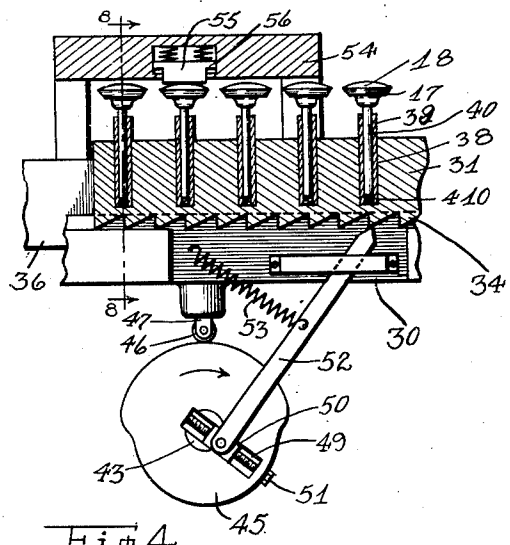


Fig. 4.

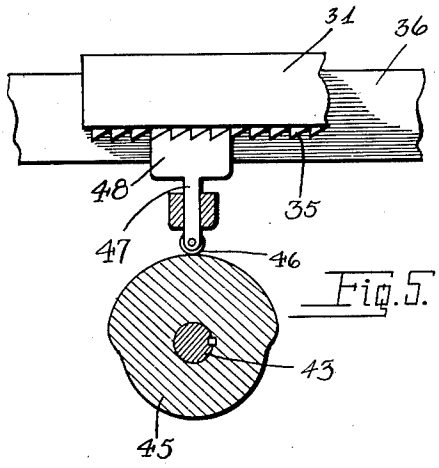


Fig. 5.

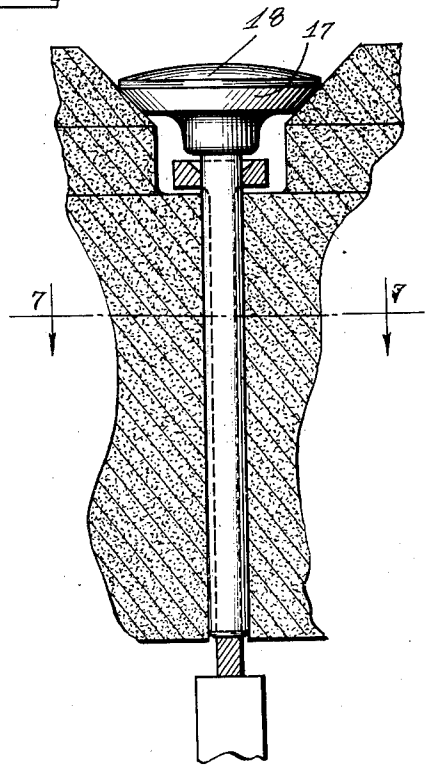


Fig. 6.

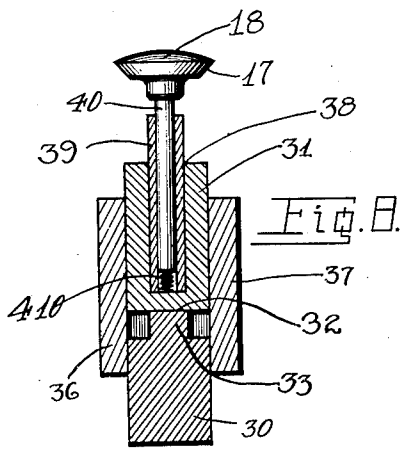


Fig. 8.

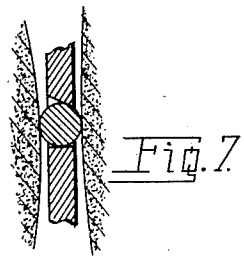


Fig. 7.

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Patented Mar. 3, 1931

1,794,975

UNITED STATES PATENT OFFICE

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GRINDING MACHINE

Application filed December 21, 1927. Serial No. 241,544.

This invention relates to improvements in grinding machinery and has particular reference to a novel and improved structure especially adapted for use in production of tapered work.

One of the principal objects of the present invention is the provision of a structure for the rapid successive production of a plurality of frusto-conical or tapered work pieces.

A further object of the invention is the provision of a machine which may be satisfactorily employed for the rapid and accurate formation of the seating face of an automobile valve or like article, in proper concentric release to the position determining stem thereof.

A further object of the present invention is the provision of a machine operating in accordance with centerless grinding principles which shall be capable of rapid formation of tapered or other non-cylindrical surfaces on headed work pieces or the like either separately or in conjuction with the formation of concentrically disposed cylindrical surfaces on other portions of the work piece.

Other objects and advantages of the present invention should be readily apparent by reference to the following specification taken in conjunction with the accompanying drawings, and it is to be understood that I may make any modifications or variations in the specific structural details hereinafter disclosed within the scope of the appended claims without departing from or exceeding the spirit of the invention.

Figure 1 is a plan view of a machine embodying the present improvements.

Figure 2 is a fragmentary vertical section as on line 2—2 of Figure 1.

Figure 3 is a section as on line 3—3 of Figure 2.

Figure 4 is a fragmentary section as on line 4—4 of Figure 2.

Figure 5 is a view of the work rest lock mechanism.

Figure 6 is a fragmentary view illustrating a slightly modified form of the invention in which a double grinding of the operation is performed.

Figure 7 is a transverse section on line 7—7 of Figure 6, and Figure 8 is a section on line 8—8 of Figure 4.

In the drawings in which similar characters of reference are employed to denote corresponding parts throughout the several views the numeral 10 designates the bed of the machine having ways 11 for the grinding wheel slide 12 whose position on the bed may be adjusted by screw 13. This slide has journaled therein the vertical shaft 14 bearing at its upper end the grinding wheel 15 formed with a beveled face 16 of proper angle to produce the seating face 17 on valve 18.

Disposed in opposition to slide 12 is a second slide 19 mounted on the anti-friction bearings 20 to facilitate free in and out movement thereon. This slide is inwardly actuated as by springs 21 interposed between the rear of the slide and the lugs 22 on the bed.

Its inward movement is limited and controlled by the adjusting screw 23. This slide has journaled therein the spindle 24 for the regulating wheel 25 which has a beveled face 26 corresponding in angle to the bevel 16 on the grinding wheel.

It will be understood that there is here provided a machine for operation in accordance with established centerless grinding principles to the extent that the grinding wheel is suitably driven as by belt 27 and other power connections at a high or grinding rate of speed, preferably a surface speed of between 5000 to 6000 feet per minute and in the direction indicated by the arrow thereon in Figure 1 of the drawings.

The regulating wheel is also operated as by belt 28 from suitable power drive and in the direction indicated by the arrow thereon in Figure 1. This wheel, however, is driven at a slow rate of speed to frictionally engage and control the rate of rotation of a work piece when within a grinding throat between the two wheels. On account of the resilient or yielding backing up of the regulating wheel this wheel has the capacity for slide in and out movement permitting of expansion of the normal adjustment of the grinding throat when a work piece is first forced into the throat while allowing the regulating wheel to follow up the work and insure proper fric-

tional engagement between the parts as stock is removed from the work piece. It will be evident that the spring yielding feature as respects the regulating wheel may be utilized or not and that if preferred the regulating wheel may be adjusted to its exact proper position through use of the screw 23 when no yielding will take place.

In conventional centerless grinding prior to the present invention it has been customary to place the work on a stationary work rest in the throat between the grinding and regulating wheels and to withdraw the work axially or parallel with the rest at the completion of grinding.

As distinguished from the previous practices, in the present invention the grinding and regulating wheels as shown occupy a horizontal position. Carried by the bed intermediate the two wheel spindles is a bracket 29 having a blade portion 30 adapted to slidably support a work carrier 31. The carrier 31 is preferably formed on its under side with the groove 32 to receive the guide rib 33 on the bracket and has the portions at the sides of the groove formed with the serration or teeth 34 and 35. Guide plates 36 and 37 carried by the portion 30 of the bracket serve to laterally engage and steady work carrier 31 in its operative position.

To support the work pieces during the grinding operation the carrier is formed with a plurality of sockets as at 38 in which are mounted the bushings 39 of size to rotatably receive the previous ground stems 40 of the valves or like work pieces. The valves may either have their lower ends extending to the bottom of the sockets 38 or they may be interposed the cushion springs 410 tending to hold them in raised position so that they may more readily enter the grinding throat.

In the operation of the present machine a series of work pieces are loaded into a fixture 31 which is then placed upon the bracket guide 30 and placed in the direction of the throat between grinding and regulating wheels. To retain the work pieces in position for grinding and to successively present same in operative position in the machine use may be made of a suitable feed mechanism.

One such mechanism is illustrated in the drawings and includes a worm 41 on the regulating wheel shaft meshing with worm gear 42 mounted on spindle 43 journaled in the bracket 44 depending from the regulating wheel slide 19. Spindle 43 has keyed thereon the control cam 45 having a peripheral cam surface engaging rolier 46 on lock plunger 47 which is provided with a tooth head 48 interlocking when in raised position with the teeth 35 of work carrier 31. This inter-locking engagement thus secures the carrier against longitudinal movement.

Cam 45 is further provided with a guide slot 49 for eccentric block 50 whose position in the slot may be adjusted through the use of screw 51. Pivoted to this block is the push pawl 52 shifted by spring 53 to engage the teeth 34 on the carrier. It will be understood that cam 45 is rotated continuously from the regulating wheel spindle and in the direction indicated by the arrow thereon in Figure 4. As the cam rotates a low point will come beneath roller 46 allowing the locking head 48 to move downward out of engagement with teeth 35. At the same time the rotary movement of block 50 will shift pawl 52 to the left as viewed in Figure 4 and as the head 48 is disengaged pawl 52 will be in interlocking engagement with one of the teeth 34 and as the cam continues to rotate the pawl will press against the carrier moving same transversely from front to rear of the machine carrying the work pieces therewith. At the completion of this pushing movement the locking head will be again raised causing a dwell of the work piece between the wheels for a completion of the grinding thereon, after which the particular work piece will be carried on through the grinding throat for discharge at a circumferentially advance point relative to the grinding wheel as distinguished from a discharge of the work piece axially as occurs in the conventional type of centerless grinders.

In ordinary centerless grinding the work piece is engaged in the throat between grinding and regulating wheels in such manner that either by its axial introduction or by a decreasing in the operative width of the throat a pressure is exerted by the grinding wheel against the work and the stock removal takes place.

In the production of taper work, however, a different condition arises due to the fact that any pressure against the tapered sides of a work piece would tend to squeeze out the work piece without grinding. In the present invention therefore, an over head member or bridge 54 is provided in opposition to the work carrier guide 30. This bridge bearing a resiliently actuated shoe 55 disposed in alinement with the narrow portion of the grinding throat between grinding and regulating wheels. As the work is progressed along its guide toward grinding position the upper face of the work will be engaged by this shoe and the work piece pressed downward toward the beveled faces 15 and 26 of the grinding and regulating wheels. It will be noted this is a resilient pressure action in which sufficient force will be exerted to properly hold the work against the grinding wheel for stock removal and the regulating wheel for frictional control of the work but at the same time there will be a sufficient yielding action to compensate for thickness variations of the valve heads. This is feasible since the prime

essential in grinding a valve face is that a proper smooth surface of prescribed angle be formed and the matter of exact amount of stock removed or all alternate length or thickness is of secondary importance and can be otherwise readily taken care of so long as a properly seating surface is produced.

It will be particularly noted that due to the cushion springs 410 the work pieces as they approach grinding position will be held with the surface 17 to be ground at a sufficient height to clear the outer edges of the wheels as the work pieces enter the throat. Subsequently and as the pieces are engaged by the shoe 55 they are moved downwardly as they shift inwardly and thus forced into proper grinding and controlling relation with the respective wheels. As mentioned this is a yielding action pressing the valves downward in their guide bushings as stock is removed from the valve face. This may be either an unlimited action or the shoe may be provided with a stop flange 56 for inter-engagement with the bridge 54 to limit the maximum downward movement that may be imparted to a work piece while in grinding position.

The machine of Figures 6 and 7 is in general the same as that previously described, the distinction is that the grinding and regulating wheels are of greater width providing the portions 15′ and 25′ respectively, so spaced that they will engage the stem portion of the valve, grinding the stem at the same time that the seat is being ground on the mushroom head. In this instance the upper carrier portion 31′ is utilized, combined with lateral stem guiding or positioning members 57 and 58, formed as part of and movable with the carrier. The work is then simultaneously ground as to stem and seat, insuring absolute concentricity in these parts.

It will thus be seen that in the present machine the work is yieldingly supported in suitable position for entrance into the grinding throat, that it is then progressively advanced into a portion of the throat of decreasing separation between the wheels and at the same time is resiliently axially shifted to press the work downward into the taper throat provided by the beveled surface of the wheels so that the two wheels will suitably engage the work to grind and rotate the same. It will further be noted that suitable means such as the guide bushing 39 are provided for steadying the work piece against tilting action during the grinding thereof and that the yielding mounting of the regulating wheel additionally provides for a resilient follow up engagement of the work by the regulating wheel to insure proper control of rotation of the work at all times during the grinding.

I claim:

1. A machine for the grinding of tapered articles comprising a pair of opposed wheels having surfaces forming an included angle corresponding to that to be produced on a work piece, means supporting a work piece for axial rotation, one of said wheels being rotatable at a relatively slow rate of speed to control the rate of rotation of a work piece engaged thereby, the other of said wheels being rotatable at a grinding rate of speed to generate the prescribed surface of revolution on the work piece as it is rotated about its axis by the slow moving wheel, and means for shifting a work piece transversely of said surface in a plane bisecting the angle between said surfaces.

2. A machine for the grinding of tapered articles comprising a pair of opposed wheels having surfaces forming an included angle corresponding to that to be produced on a work piece, means supporting a work piece for axial rotation, one of said wheels being rotatable at a relatively slow rate of speed to control the rate of rotation of a work piece engaged thereby, the other of said wheels being rotatable at a grinding rate of speed to generate the prescribed surface of revolution on the work piece as it is rotated about its axis by the slow moving wheel, means for shifting a work piece transversely of said surface in a plane bisecting the angle between said surfaces, and means for yieldingly urging the work into engagement with the wheel surfaces.

3. A machine for the production of tapered work pieces comprising a pair of frusto-conical wheels disposed adjacent each other to provide the prescribed included angle of taper therebetween, one of said wheels being rotatable at a high grinding rate of speed, and the other of said wheels at a slow regulating speed for controlling the rotation of work, means supporting the work for axial rotation as controlled by the slow moving wheel, means for advancing work and its supporting means transversely of said surfaces whereby the prescribed taper will be generated on the work by the grinding wheel while pressed into opposition thereto by the controlling wheel.

4. A grinding machine of the character described comprising a pair of wheels rotatable about parallel axes, one of said wheels being rotatable at a high grinding rate of speed and the other at a slow work controlling rate of speed, said wheels being disposed in peripheral opposition one to the other and having beveled portions at the side producing frustro-conical surfaces of prescribed included angle, means rotatably supporting a work piece with opposed portions of the surface to be operated upon by the grinding wheel respectively engaged by the grinding and control wheels for moving the work piece transversely of said conical surfaces in a

plane normal to the common axial plane thereof.

5. A machine of the character described including opposed grinding and regulating wheels having active faces disposed at an angle one to the other for simultaneous engagement with different portions of a given surface zone of the work piece whereby the grinding wheel will produce an included angle of prescribed taper while the regulating wheel controls the rotation of the work and holds same in opposition to the grinding wheel, and means for progressively advancing a work piece tangentially of said surfaces.

6. A machine for the production of conical work comprising opposed grinding and regulating wheels having their operative surfaces angularly related, means rotatably supporting a work piece intermediate said angularly related surfaces, means for resiliently urging a work piece axially into engagement with said surfaces and additional means for shifting the work across said surfaces in a direction at an angle to that of the resilient urge.

7. A machine for the production of tapered articles including a high speed grinding wheel and an opposed slow speed regulating wheel for joint engagement with a work piece, said wheels having angularly related operative faces, means for rotatably supporting a work piece with its axis of rotation bisecting the angle between said faces, and means for urging the work piece axially whereby the same is forced into engagement with the operative faces of the wheels.

8. A machine for the production of tapered articles including a high speed grinding wheel and an opposed slow speed regulating wheel for joint engagement with a work piece, said wheels having angularly related operative faces, means for rotatably supporting a work piece with its axis bisecting the angle between said faces, means for urging the work piece axially whereby the same is forced into engagement with the operative faces of the wheels, and additional means for shifting the axis of the work piece along the plane bisecting the included angle of the operative wheel faces.

9. A machine for the production of tapered articles such as valve seat faces including a grinding wheel rotatable at a high grinding rate of speed and an opposed regulating wheel rotatable at a slow work controlling rate of speed, said wheels having operative faces making equal angles with an intermediate bisecting plane, a work support disposed in said bisecting plane, and means for imparting an intermittent progressive movement to the work support whereby work pieces carried thereby are successively presented in operative relation to the wheel faces.

10. A machine for the production of tapered articles such as valve seat faces including a grinding wheel rotatable at a high grinding rate of speed and an opposed regulating wheel rotatable at a slow work controlling rate of speed, said wheels having operative faces making equal angles with an intermediate bisecting plane, a work support disposed in said bisecting plane, means for imparting an intermittent progressive movement to the work support whereby work pieces carried thereby are successively presented in operative relation to the wheel faces, and means operating in an angularly related direction as respects the direction of movement of the work support for holding an individual work piece in contact with the angularly related wheel surfaces at a given position during the movement of the work and its support.

11. A machine for simultaneous formation of cylindrical and tapered portions on a work piece such as mushroom valve comprising a grinding wheel operable at a high grinding rate of speed having a cylindrical periphery for engagement with the valve stem and a conically tapered portion for engagement with the valve head, an opposed regulating wheel operable at a slow rate of speed adapted to frictionally engage the work piece and control the rate of rotation thereof, the opposed wheels forming a successively narrowing and widening throat, means for steadying the work pieces against canting or displacement within the throat and means for progressing the work pieces laterally through the throat from entrance to discharge side thereof.

12. A machine for the production of tapered work pieces including a pair of vertically mounted spindles having parallel axes, a grinding wheel carried by one of said spindles rotatable in a horizontal plane at a high grinding rate of speed, a regulating wheel carried by the other of said spindles and disposed in opposition to the grinding wheel, said regulating wheel being operable at a slow rate of speed to control the rate of rotation of a work piece in engagement therewith, said wheels being disposed in peripheral opposition one to the other and being beveled at one edge to form frustro-conical operative faces, a work support carried by the machine subtending the space between the opposed peripheries of the wheels, and means engageable with the work support for axially steadying a work piece at a point remote from its engagement with the frustro-conical faces of the wheels.

13. A machine for the production of tapered work pieces including a pair of vertically mounted spindles having parallel axes, a grinding wheel carried by one of said spindles rotatable in a horizontal plane at a high grinding rate of speed, a regulating wheel carried by the other of said spindles and disposed in opposition to the grinding wheel,

said regulating wheel being operable at a slow rate of speed to control the rate of rotation of a work piece in engagement therewith, said wheels being disposed in peripheral opposition one to the other and being beveled at one edge to form frustro-conical operative faces, a work support carried by the machine subtending the space between the opposed peripheries of the wheels, means engageable with the work support for axially steadying a work piece at a point remote from its engagement with the frustro-conical faces of the wheels, and means for advancing the work and its steadying member along the support to successively shift the work into and out of engagement with said wheel faces.

14. A machine for the production of tapered work pieces including a pair of vertically mounted spindles having parallel axes, a grinding wheel carried by one of said spindles rotatable in a horizontal plane at a high grinding rate of speed, a regulating wheel carried by the other of said spindles and disposed in opposition to the grinding wheel, said regulating wheel being operable at a slow rate of speed to control the rate of rotation of a work piece in engagement therewith, said wheels being disposed in peripheral opposition one to the other and being beveled at one edge to form frustro-conical operative faces, a work support carried by the machine subtending the space between the opposed peripheries of the wheels, means engageable with the work support for axially steadying a work piece at a point remote from its engagement with the frustro-conical faces of the wheels, means for advancing the work and its steadying member along the support to successively shift the work into and out of engagement with said wheel faces, and means including a driven control member having alternately operating shifting and locating means whereby the work advance and dwell is imparted to the work.

15. A machine of the character described including opposed grinding and regulating wheels having active faces disposed at an angle one to the other of prescribed taper for simultaneous engagement with opposed portions of the work to be ground, means for rotatably supporting and advancing the work while in engagement with said means whereby the one wheel will shape the work to the prescribed form and the other wheel will control the rotation thereof during grinding, and means for resiliently urging the work into engagement with the wheel surfaces to maintain contact therebetween.

16. A machine of the character described including opposed grinding and regulating wheels having active faces disposed at an angle to one another simultaneously to engage a work piece surface with an included angle of prescribed taper, means for rotatably supporting a work piece tangentially of said surface in joint engagement therewith whereby the one wheel will shape the work to prescribed form and the other will frictionally engage and control rotation of the work during grinding, means for resiliently urging the work into engagement with the wheel surfaces to maintain contact therebetween, and means for progressively advancing the work along a path substantially bisecting the angle of the active faces of the wheel surfaces from one side to the other of the wheels substantially as and for the purpose described.

In testimony whereof I affix my signature.

RALPH MERSHON.