Nov. 30, 1948. V. W. BUNKER 2,454,988

GRINDER SPEED CONTROL

Filed June 25, 1945 3 Sheets-Sheet 1

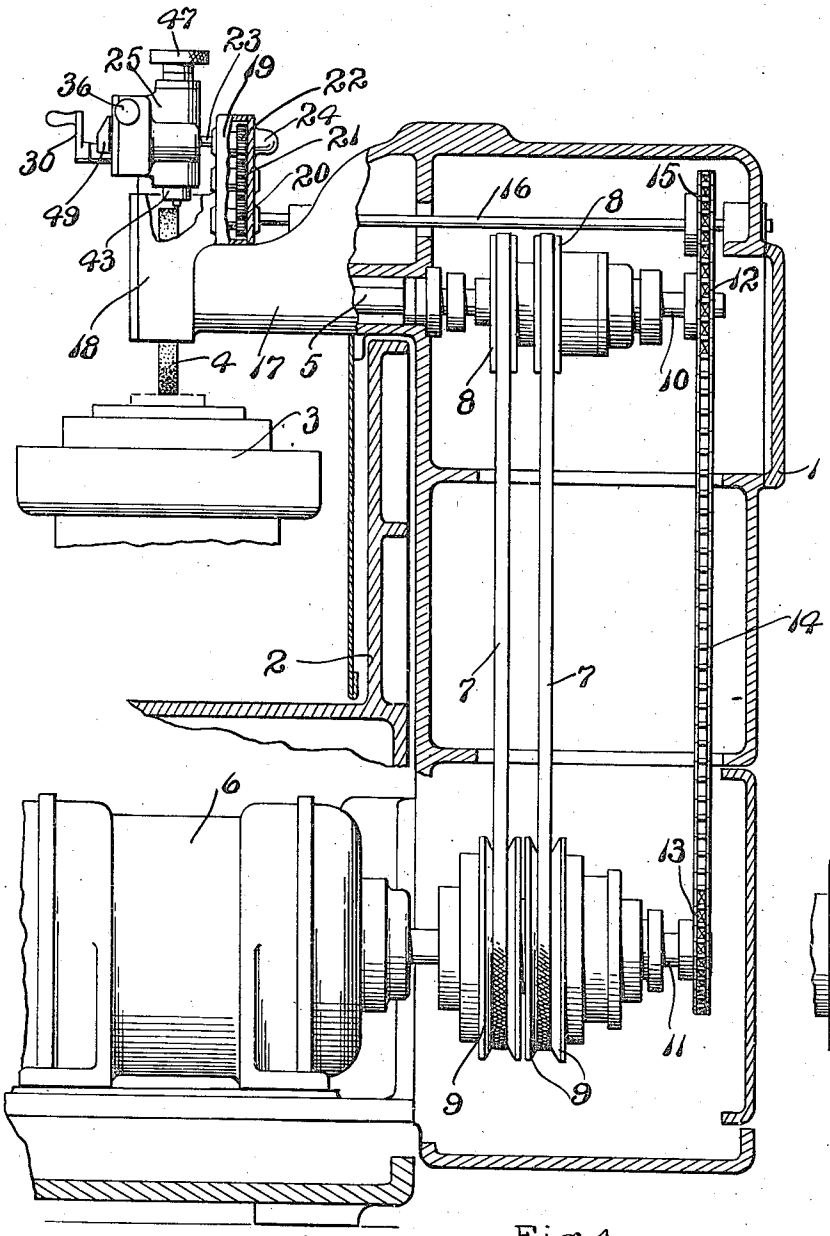


Fig. 1.

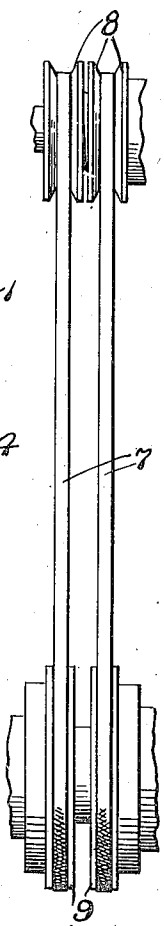


Fig. 2.

Inventor
Vincent W. Bunker
By Livernace and Van Antwerp
Attorneys

Nov. 30, 1948. V. W. BUNKER 2,454,988

GRINDER SPEED CONTROL

Filed June 25, 1945 3 Sheets-Sheet 2

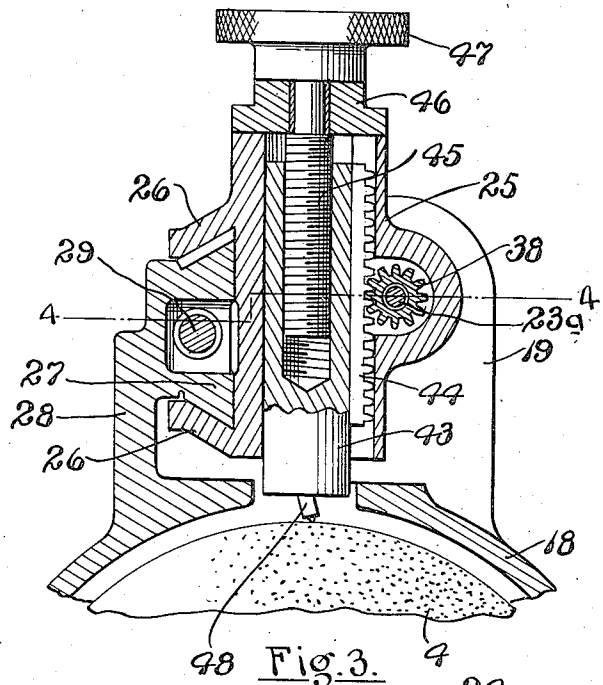


Fig. 3.

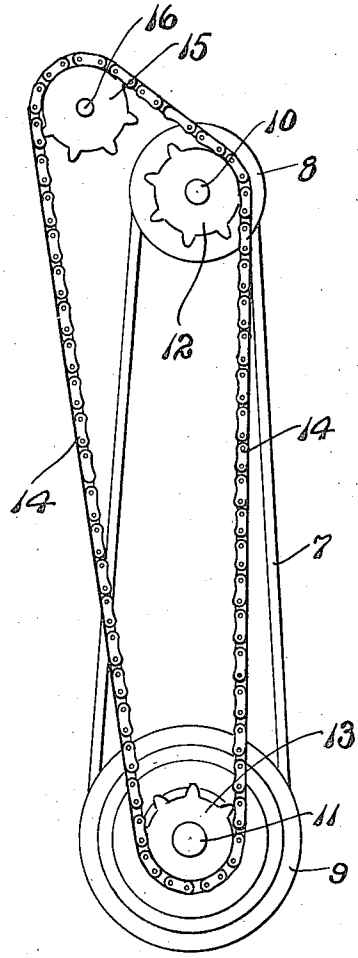


Fig. 5.

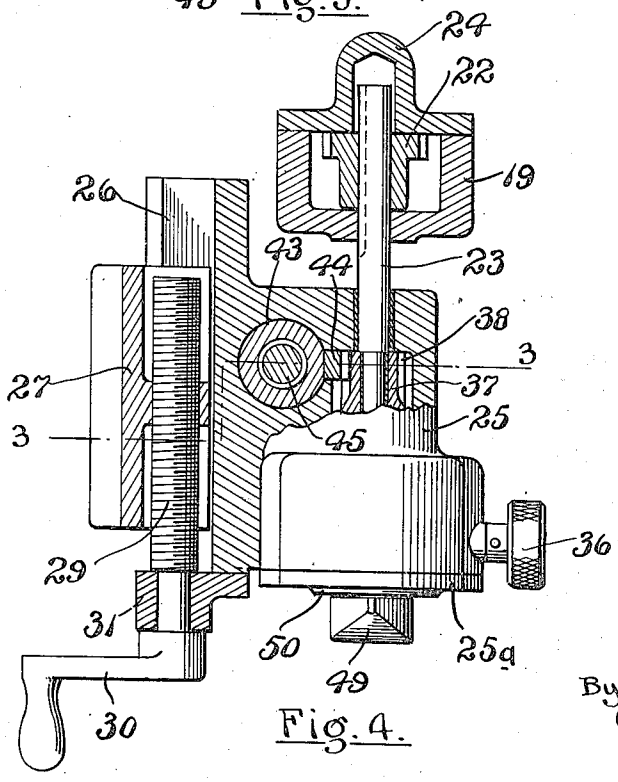


Fig. 4.

Inventor
Vincent W. Bunker
By Lawrence and Van Antwerp
Attorneys

Nov. 30, 1948. V. W. BUNKER 2,454,988

GRINDER SPEED CONTROL

Filed June 25, 1945 3 Sheets-Sheet 3

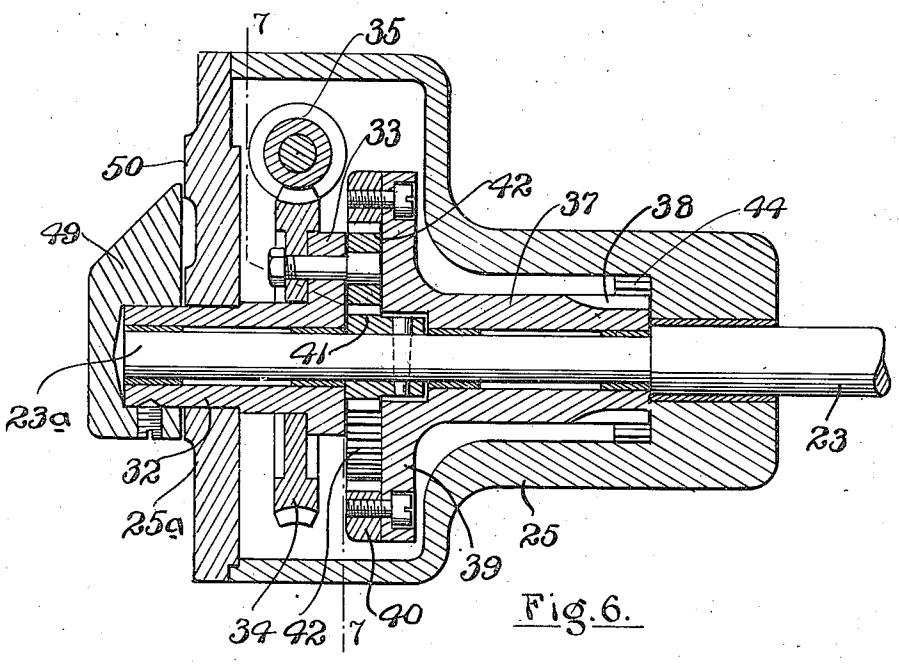


Fig.6.

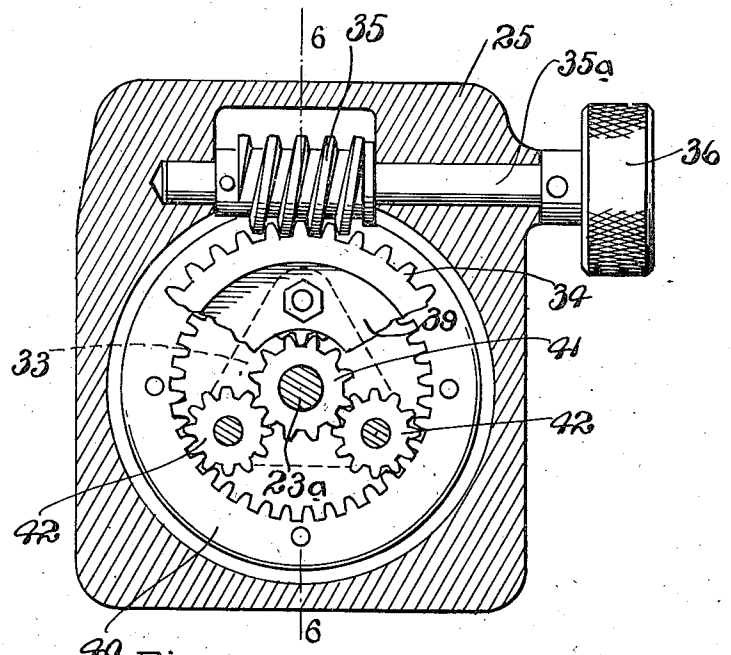


Fig.7.

Inventor
Vincent W. Bunker
By Livernance and
Van Antwerp
Attorneys

Patented Nov. 30, 1948

2,454,988

UNITED STATES PATENT OFFICE

2,454,988

GRINDER SPEED CONTROL

Vincent W. Bunker, Grand Rapids, Mich., assignor to Gallmeyer & Livingston Company, Grand Rapids, Mich., a corporation of Michigan

Application June 25, 1945, Serial No. 601,488

6 Claims. (Cl. 51—134.5)

1

This invention relates to grinding machines, particularly of the surface grinding type, in which a reciprocating work carrying table adjustable for different lengths of reciprocating movement, has associated therewith a grinding wheel above it, to be brought into operative grinding engagement with the work, which wheel normally is mounted for transverse movement or adjustment with respect to the length of the work holding table, and also may be moved vertically, or the table moved initially to adjust the work and wheel relative to each other.

In grinding machines of this or similar character the grinding wheels wear and are reduced in diameter. Such wheels require frequent dressing or turning at their peripheral surfaces, and this is done by moving a dressing tool across the surface of the grinding wheel while such wheel is rapidly rotating. With the change in diameter of the wheel the peripheral or lineal speed of the outer surface which grinds the work is changed, if the rotation of the wheel in revolutions per minute remains constant.

Grinding wheels which are used are not all of them of the same character. Because of the differences in the materials which make up various grinding wheels, the best lineal speeds at which the wheels operate upon their work varies, so that if two grinding wheels have the same diameter it does not follow that each should be driven at the same speed.

These two factors, the best operative or lineal peripheral speeds of grinding wheels, and the change in lineal speed as the diameter of a grinding wheel changes, require for best performance a provision of means whereby the peripheral or lineal speed of the grinding wheel may be initially determined and means provided to secure it, and that thereafter such speed be kept substantially constant throughout changes of diameter of the wheel, and also that in dressing the wheel and consequently reducing its diameter such substantial uniformity of lineal or peripheral speed of the grinding wheel shall be maintained and preferably automatically accomplished in connection with the dressing operation.

In the present invention, it is a primary object and purpose to accomplish both of these ends in a relatively simple and very practical manner. The grinding wheel is driven at an initial speed of revolutions per minute such that the lineal or peripheral speed of the wheel is the best for the work which it is to perform, and novel means are provided for such purpose. Associated with said means is a further novel means for accomplishing the dressing of the wheel, such dressing reducing the wheel diameter, and simultaneously changing the speed in revolutions per minute of the wheel so that its lineal or peripheral speed is maintained substantially constant and uniform throughout all of the varying changes in diameter of the wheel from the time it is first used until it has become so small that it must be discarded. Structural means embodying the invention for the attainment of the ends stated are described in the following description, taken in connection with the accompanying drawings, in which,

2

Fig. 1 is a fragmentary vertical section through a grinding machine equipped with my invention.

Fig. 2 is an elevation of speed change mechanism showing driving belts in grooves of their variable pitch sheaves, after the grinding wheel has become worn and reduced in diameter, the same view of said belts and sheaves in Fig. 1 showing them when the grinding wheel is substantially of larger diameter.

Fig. 3 is a vertical section substantially on the plane of line 3—3 of Fig. 4 of the mechanism for adjusting the speed change of the grinding machine.

Fig. 4 is a horizontal section substantially on the plane of line 4—4 of Fig. 3.

Fig. 5 is a fragmentary side elevation of the driving belts and their variable pitch sheaves, and the sprocket wheel and chain mechanism for adjusting them.

Fig. 6 is a longitudinal vertical section substantially on the plane of line 6—6 of Fig. 7, and

Fig. 7 is a transverse vertical section substantially on the plane of line 7—7 of Fig. 6.

Like reference characters refer to like parts in the different figures of the drawings.

All grinding machines of the surface grinding type include a vertical support indicated generally at 1, at the front side of which is a table carrying support 2, upon which the work holding table 3 is mounted for reciprocation in the direction of its length below a grinding wheel 4 mounted to turn about the horizontal axis of a shaft 5, to which the grinding wheel is secured at its outer end.

Means, well known in the art, are provided for the relative vertical adjustment of the grinding wheel and the work it is to grind with respect to each other to separate them or bring them into operative engagement. Such mechanism need not be shown and described, as such environment of the present invention has been long known.

The grinding wheel is driven by a motor 6 through intervening endless belts 7 which pass around upper variable pitch sheaves 8 mounted on the grinding wheel shaft 5, and lower variable pitch sheaves 9 on the shaft of the motor 6. The sheaves 8 and 9 are each in two halves adjustable toward and away from each other through the turning of shafts 10 and 11, respectively, which shafts are in axial alinement with the shaft 5 and the motor shaft. On said shafts

10 and 11 sprocket wheels 12 and 13, respectively, are secured around which an endless chain 14 passes, it also passing around a third sprocket wheel 15 mounted upon a shaft 16 located above and parallel to the shaft 5 as shown. Without going into detail of the mechanism which is actuated by turning the sprocket wheels 12 and 13, such detail of mechanism being old and well known, it is enough to say that the halves of the wheels 8 and 9 are simultaneously adjusted in opposite directions. For example, as shown in Fig. 1, the two parts of the upper wheels 8 are close together, so that the V-groove between them is of a narrower width and the effective pitch diameter of said pulleys is larger than when the parts of the pulleys are separated as shown in Fig. 2. Similarly the lower vari-pitch sheaves 9 have the two parts of each separated a greater distance than in Fig. 2, and the effective pitch diameter of the lower sheaves 9 is less when as in Fig. 1 than in Fig. 2. The two parts of the sheaves 8 are separated and simultaneously the two parts of the sheaves 9 are brought closer together on rotative movement in one direction of the sprocket wheels 12 and 13 imparted by the chain 14 through a rotation of the shaft 16, and such movements are reversed on rotation of shaft 16 in the opposite direction.

From this it will be understood that initially, as in Fig. 1, with the grinding wheel 4 at its maximum diameter, the revolutions per minute of the shaft 5 are less with the sheaves 8 and 9 as shown than it will be when the sheaves have been adjusted to their different positions as in Fig. 2, the rotation of the motor shaft 6 being constant. Therefore the lineal speed of the grinding wheel 4 may be held substantially constant by a proper operation of the shaft 16 to step up the speed of rotation of shaft 5 as the diameter of the grinding wheel decreases.

The shaft 5 extends through a forwardly extending journal housing 17 therefor, at the front end of which a hood 18 to cover the upper portion of the grinding wheel is located. Integral with the hood and the housing 17 is a vertical housing 19 in which three gears 20, 21 and 22 are mounted, the gear 20 being on the shaft 16, the gear 21 an idle gear, above it, and the gear 22 located at the rear end of a shaft 23 which extends through the front side of and away from the housing 19 (Fig. 1). The shaft 23 (Fig. 4) has a splined connection with its gear or pinion 22, and is lengthwise movable, and the rear side of the housing 19 is provided with a hollow projection 24 lengthwise of which the shaft 23 may be moved.

The shaft 23 extends into a housing 25 located above the hood 18 and in front of the housing 19 and mounted for movement on and suppported by the hood 18 (Fig. 3). Said housing is provided at its rear side with upper and lower outwardly extending guides 26, slidably mounted upon a horizontal way 27 which is connected with the hood 18 by an integral vertical supporting post 28. A screw threaded rod 29 threads through the way 27 (Fig. 4) and at its outer end is equipped with a handle 30. The outer end portion of the rod 29 is reduced in diameter and rotatably mounted in a bracket 31 permanently secured to the housing 25. By turning the handle 30 the housing may be moved on the guides 26 in a horizontal direction, and the shaft 23 will slide through the pinion 22.

Within the housing 25 (Fig. 6) a hollow shaft 32 is located which extends through and is mounted for rotation in the cover plate 25a of the housing. At its rear end it is formed with a triangular shaped head 33, the outline of which is shown in dotted lines in Fig. 7; and at the outer side of said head and surrounding the sleeve 32 a worm gear 34 is mounted and permanently secured. A worm 35 on a shaft 35a (Fig. 7) is in mesh with the gear 34 and the shaft at its outer end beyond the adjacent side of the housing, is equipped with a hand wheel 36 for manual turning.

Also within the housing, and in alinement with the sleeve shaft 32, is a second sleeve shaft 37 which at its inner end has a consecutive series of pinion teeth 38 cut around it. Adjacent to but spaced from the head 33, said sleeve has a circular disk-like head 39 at the outer face of which an annular ring gear 40 is permanently secured. A pinion 41 is pinned or otherwise fixedly secured to the reduced outer end portion 23a of shaft 23 (Fig. 6), and is in mesh with three spaced pinions 42 disposed around the pinion 41 mounted on and having their axes of rotation substantially at three corners of the triangular head 33. This provides a planetary transmission gearing as is evident.

Back of the housing portion which contains the planetary gearing described, the housing 25 is provided with a substantially vertical sleeve in which a cylindrical member 43 is vertically disposed, having at one side a rack 44 in mesh with the pinion 38. The rod 43 is interiorly bored and threaded. A screw threaded rod 45 is screwed into the cylindrical rod 43, is reduced in diameter at its upper end portion and passes through a cover 46 which is located over the sleeve portion of the housing described, and is equipped with a hand wheel 47 outside of the housing for manual operation. At the lower end of the cylindrical rod 43 the wheel dresser 48 of conventional type is carried, being raised and lowered by operation of the wheel.

At the front end of the reduced portion 23a of shaft 23, and outside of the cover plate 25a of the housing 25, an indicator finger 49 is secured to move over and in conjunction with an indicating scale located upon an outwardly embossed circular surface 50 on said plate 25a.

The shaft 16 is turned upon manual operation of either of the hand operated wheels or knobs 36 and 47. On turning the wheel 47 which raises or lowers the dresser, there is a direct connection of the rack 44 with the pinion 38 to thereby turn the sleeve 37 and its head 39, and through the planetary gearing transmission rotate the shaft 23 which has a direct gear connection with the shaft 16. On turning the head 36 the worm wheel 34 is rotated with a simultaneous rotation of the sleeve shaft 32 and its head 33, and thereupon a turning of the shaft 23 through the planetary transmission described. Such driving of the shaft 16 by the shaft 23 effects a change in adjustment of the vari-pitch V-belt pulleys 8 and 9 to vary the rotative speed of the shaft 5, on which the grinding wheel is secured, as it is driven by the constant speed motor 6.

It is accordingly evident that through operation of the hand wheel 36, the speed of rotation of the shaft 5 may be initially controlled and governed to obtain the best peripheral or lineal speed of the grinding wheel. Thereafter, in the frequent dressing of the wheel and the reduction, even though to a minor extent, of its diameter at each dressing, shaft 16 will be operated and the speed of rotation of the shaft 5 increased because of its having been turned through the engagement of the rack 44 with the pinion 38 as said rack

is moved downwardly more and more as the diameter of the grinding wheel decreases. Accordingly, there is provided mechanism for selectively securing the proper speed of the grinding wheel and which the wheel should have for its best work to be done, and a maintenance of such peripheral or lineal speed at which it is initially set, when subsequent dressings decrease the diameter of the wheel.

The bodily movement of the housing **25**, accomplished by turning the crank **30** (Fig. 4), is to move the dressing implement transversely of the wheel for the dressing operation.

The construction described is relatively simple, compact, readily manufactured and assembled and is true and accurate in its operations. One very desirable feature in connection with the present invention is that of insurance against excess or over speeding of the grinding wheel. With the construction described, in order for a new grinding wheel to be attached at the end of its shaft, it is necessary to return the dressing tool to outer position, thereby automatically reducing the speed of revolution of the driven shaft on which the grinding wheel is mounted, and correspondingly insuring that the peripheral speed of the new larger diameter grinding wheel shaft not be dangerously increased but remaining substantially constant with that of the smaller wheel which it replaces. With the dressing tool or implement moved inwardly toward the shaft on which the grinding wheel is secured and, thereupon, an increase of the speed revolution of said shaft, if a new wheel of larger diameter was connected to said shaft to replace an old wheel which had been decreased to its minimum size, and the speed or rotation of the shaft not reduced, danger of rupturing of the grinding wheel would be present. My invention safeguards against this without necessity of the operator of the machine doing anything more than moving the dressing implement outwardly to get it out of the way so that the new and larger diameter grinding wheel may be connected to the shaft.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. In a machine of the class described, a grinding wheel, a rotatable shaft on which the grinding wheel is carried, a power driving shaft, change speed driving means between said shafts for varying the speed of rotation of the first shaft with respect to a constant speed rotation of the power driving shaft, a third shaft mounted for rotation, means connecting said third shaft with said change speed mechanism for actuating said mechanism on rotation of the third shaft, a dressing implement for dressing the grinding surface of the wheel movable toward or away therefrom, means for simultaneously moving said dressing implement and turning the third shaft, and independent means for rotating said third shaft.

2. In a machine as described, a grinding wheel, a rotatable shaft on which the wheel is secured, a power driving shaft, change speed driving means between said shafts for driving the grinding wheel shaft at varying speeds of rotation with respect to a constant speed of rotation of the power driving shaft, a dressing implement mounted for movement radially inward toward or outward away from the grinding surface of the grinding wheel, manually operable means for moving said dressing implement, a shaft simultaneously rotated by operation of said manually operable means and said movement of the dressing implement, connections between said shaft and the speed changing mechanism for increasing the speed of rotation of the grinding wheel shaft upon movement of the dressing implement toward the grinding wheel and decreasing upon movement away therefrom, and manually operable means connected with said shaft for turning it independently of movement of said dressing implement.

3. In a grinding machine, a grinding wheel, a driven shaft on which the grinding wheel is secured, a power driving shaft, said shafts each having variable pitch sheaves thereon with power transmitting means between said sheaves to drive the driven from the driving shaft, a third shaft, a wheel on said third shaft, wheels connected one with each of the variable pitch sheaves on the driving and driven shafts, an endless belt around said wheels whereby rotation of the third shaft simultaneously actuates said sheaves to change the pitch thereof in inverse relation one to the other, a dressing implement mounted for movement toward and away from the grinding surface of the wheel, manually operable means for moving said implement in either of said directions, gearing connections between said implement and said third shaft whereby the third shaft is rotated by movement of said implement, a second manually operable means, and gearing connections therebetween and said third shaft for rotating said shaft independent of movement of the dressing implement.

4. A construction as defined in claim 3, wherein the driving means for said third shaft comprises a planetary transmission gearing connected to rotate the third shaft, means for driving said transmission gearing at one side thereof actuated by movement of the dressing implement, and means for independently driving said planetary transmission from the other side thereof by said manually operable means.

5. A grinding machine comprising a rotatably mounted grinding wheel, variable speed means for driving said grinding wheel, a dresser mounted for movement radially of said grinding wheel, a planetary gearing comprising a rotatable shaft acting to vary the speed of said driving means, a center gear fixed to said shaft, a ring gear surrounding said center gear and a planetary gear meshing with both said ring gear and said center gear, means actuated by movement of said dresser to rotate one of said ring or planetary gears and independent manual means to rotate the other of said ring or planetary gears.

6. The elements of claim 5 in which the means actuated by the dresser rotates said ring gear and the independent manual means rotates said planetary gear.

VINCENT W. BUNKER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
863,643	Ransom	Aug. 20, 1907
1,911,857	Stumpf	May 30, 1933
1,949,975	Reeves	Mar. 6, 1934
2,162,038	Trible	June 13, 1939

FOREIGN PATENTS

Number	Country	Date
325,155	Great Britain	Feb. 13, 1930