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2,748,540

MULTIPLE WHEEL GRINDING MACHINE

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Fig. 1

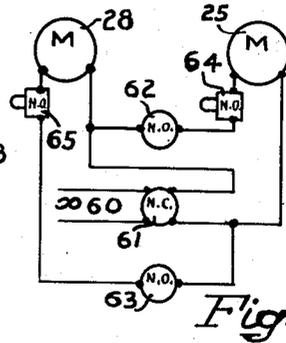
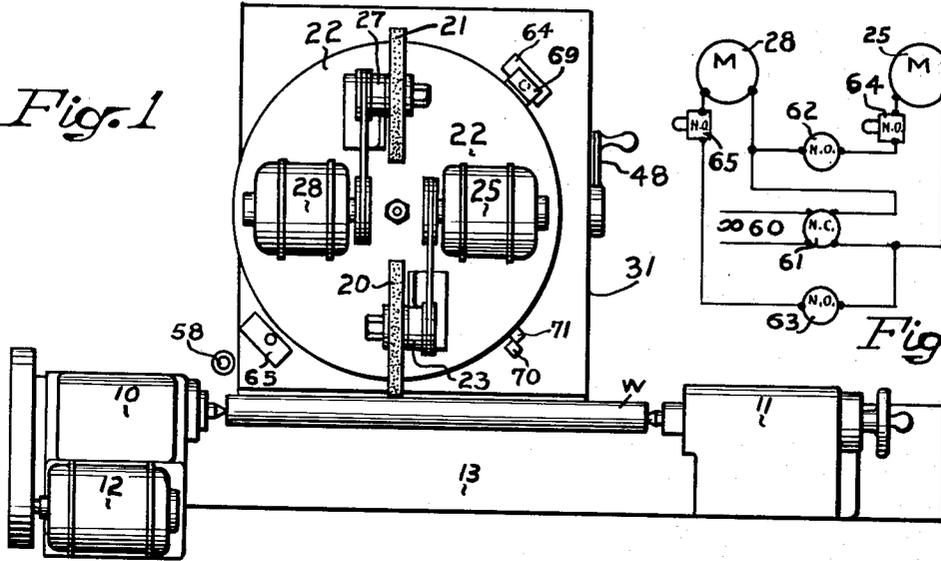


Fig. 4.

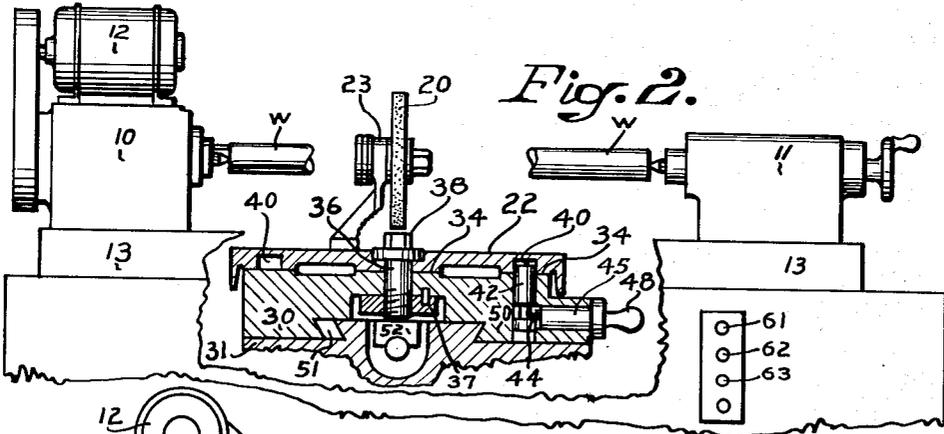


Fig. 2.

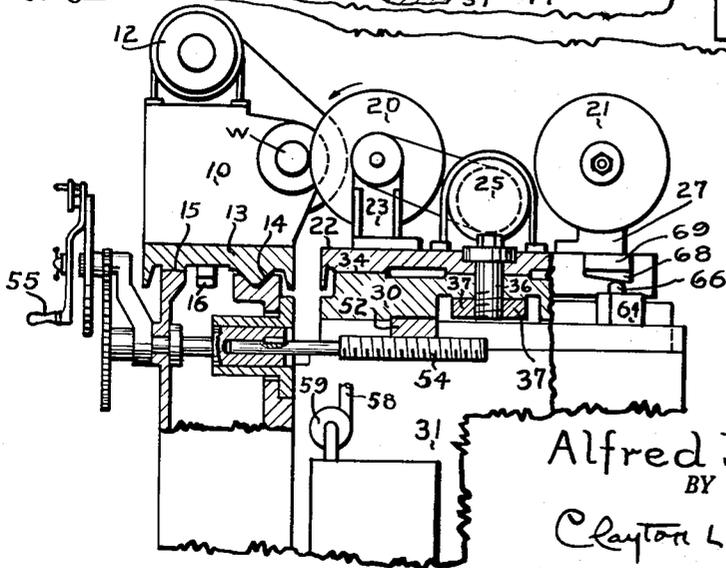


Fig. 3.

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MULTIPLE WHEEL GRINDING MACHINE

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1 Claim. (Cl. 51—95)

This invention relates to grinding machines, and more particularly to a machine in which different types of grinding wheel may be alternatively and selectively employed to grind a single work piece.

It is commonly desirable to rough grind a work piece by a coarse wheel and then to finish it in a subsequent operation by means of a wheel of finer abrasive grain or other different structure. The standard grinding machines are for grinding external or internal cylindrical surfaces or plane surfaces in which a given work piece and the abrasive wheel are moved relatively while the abrading action proceeds. When the work piece has been finished, such as in a rough grinding operation which brings the work to substantially the desired size, it must be removed from its supports and laid aside for a subsequent abrasive finishing step. That procedure may be satisfactory for grinding a large quantity of duplicate work pieces, but it is often desirable to rough grind and then finish a single work piece, without facing the problems inherent in changing the grinding wheel or remounting the work on another machine.

A primary object of my invention is to provide a grinding machine of this general class with a plurality of abrasive wheels so mounted that any wheel may be quickly brought into a duplicable operative relationship to the work piece without disturbing the setting of the work.

A further object is to provide a grinding machine in which separately driven grinding wheels are so mounted that any wheel may be quickly moved into a correct grinding relationship with a work piece, and wherein each wheel may be fed laterally toward the work with precision by the same wheel feed mechanism.

A further object is to provide a machine of this class wherein the wheels are mounted on a rotatable turret and the power drive is so coordinated with the turret and wheels that only the wheel to be used is automatically supplied with power, and wherein the turret may be operatively fixed only in a position which insures that the selected wheel is accurately located for its grinding operation. Further objects will be apparent in the following disclosure.

Referring to the drawings:

Fig. 1 is a top plan view of the machine, with parts omitted for clarity of illustration;

Fig. 2 is a fragmentary front vertical elevation, with parts in section;

Fig. 3 is a vertical transverse section, partly broken away; and

Fig. 4 is a simplified wiring diagram of the machine.

In the drawings, I have illustrated my multiple wheel turret in association with a cylindrical grinding machine, but this turret may also serve in other grinding machines, such as one employed for grinding internal cylinders or flat or other shaped surfaces. In the machine illustrated, a round work piece W is suitably mounted for positive rotation on work supports and table which may be of standard construction and operation, such as is shown in the U. S. patent to Norton No. 762,838 of

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June 14, 1904, or subsequent improvements thereof relating to cylindrical grinding machines. The cylindrical work piece may be supported on a centering pin carried by a suitable headstock 10 and a further pin carried by the tailstock 11. The work is suitably rotated, as by a dog on the headstock spindle driven by an electric motor 12, as is understood in the art. This work piece may be reciprocated relative to the abrasive wheel by suitable mechanism, such as a table 13 mounted on V and flat ways 14 and 15 and driven by reversing gear mechanism engaging the rack 16 fixed on the table, as is shown in the patent, so that a long piece may be properly presented to the grinding wheel. If the grinding operation is what is known as surface grinding and the work is a flat piece mounted on a reciprocating table, this construction may be of the general type shown in the U. S. patent to Norton #1,108,779 of August 25, 1914, and later modifications thereof, wherein a wheel is adjustably movable laterally over the work table. Similarly, an internal grinder may conform with the principles and construction disclosed in the U. S. patent to Taylor #1,805,056 of May 12, 1931, and related patents or later modifications thereof, such as a machine having the work mounted on a bridge over a reciprocating table carrying the grinding wheel.

The primary feature of this invention involves the use of a plurality of grinding wheels, such as a coarse abrasive wheel 20 and a fine abrasive or finishing wheel 21, which are rotatably mounted on horizontal spindles or axles in bearing supports of desired construction carried on a revoluble vertical axis turret 22. The wheel 20, which may be driven by an electric motor attached directly to its axle, is shown as mounted on a support 23 on the turret and power driven by a constant speed electric motor 25 of suitable characteristics mounted on the turret and having its pulley axially parallel with and belt connected to the grinding wheel axle. Similarly, the other wheel 21 carried by the mount 27 on the turret has its spindle driven by a belt from the motor 23 carried on the turret. In the form illustrated, each abrasive wheel is intended to be used in a position where the line of grinding contact with the work is axially parallel with the work axis. The grinding wheels are so mounted on the turret in a definite angular displacement that their operative faces or lines of contact with the work are equi-distant from the vertical axis about which the turret is revolved and each wheel may be positioned exactly relative to the work by rotation of the table and adjustment of the wheel feed mechanism. The turret is so constructed and the wheels are so located that the wheels may be brought readily into the same grinding position without interference with other parts of the machine. That is, the turret is mounted on bearings, ways or a centering device so arranged that the turret may be revolved in either direction for the selective orientation of a wheel.

In order that the grinding wheels may be moved precisely towards and from a work grinding position, the turret 22 is carried on a slide 30 which is slidably mounted on the base 31. The turret and the slide 30 are each preferably provided with an arcuate or a circular slideway 34 shaped as horizontal plane surfaces mounted in sliding contact so that the turret may slidably revolve about an axis perpendicular to and concentric with the slideways 34 so as to present the selected wheel in an operative grinding position. The turret may be axially located on the slide 30 by a vertical center pin 36 which has a large flat head fitting within a circular recess in the top of the turret.

The turret is releasably secured to the slide and may be held in a rigid position for a grinding operation by threads on the lower end of the center pin 36 for receiving a nut 37 which bears against a plane face on the under side

of the relatively stationary wheel slide 30. This nut is pinned to the slide or prevented from turning by shoulders of a recess 38 in the slide within which the nut is located. The center pin 36 may be turned relative to the nut 37 by means of a hex nut 38 secured to the top of the pin and turned suitably by a socket wrench removably or fixedly applied thereto, or by other suitable mechanism. Thus, to revolve the turret, the nut 37 is released from clamping engagement with the bottom of the slide, and when properly positioned the turret may be again clamped to the slide.

In order that the rotary turret 22 may be accurately positioned so that the line of contact of the grinding wheel with the work may be axially parallel with the work piece W, the under side of the turret is provided with accurately shaped vertical cylindrical or tapered holes 40 (Fig. 2) opening downwardly and preferably so located that they intersect the circular plane of the slide-way 34 where the turret 22 bears precisely on the slide. There is one hole 40 for each wheel on the turret. The turret support or slide 30 has one vertical cylindrical hole therein aligned with a hole 40 and arranged to carry a slidable cylindrical plug 42. The hole in the slide 30 is deep enough so that the plug 42 may ride downwardly and move entirely out of the hole 40 in the turret or may be thrust upwardly into that turret hole. The plug 42 and the walls of the holes in the turret and the slide are accurately shaped for interfitting slidably. The plug 42 may have its upper end tapered so as to aid its entry into the hole 40 for positioning the turret. This plug 42 may be moved vertically by means of a crank arm 44 which is shaped as a pin mounted eccentrically on a rotatable horizontal cylindrical body 45 mounted in a suitable horizontal bearing socket in the slide. The pin 44 rides in an elongated groove in the side of the vertical pin 42, and the parts are so shaped that this pin may contact with the lower face of the groove to draw the pin downwardly and when rotated to an upper position to force the pin upwardly. The rotatable body 45 may be rotated by means of a crank arm 48 suitably attached to the body 45 and projecting outwardly from the slide. If the wheels are mounted at 180° apart, as regards the centers of their grinding lines of contact with the work, the holes 40 are likewise 180° apart and so located that when the locking pin 42 fits in one turret socket 40, the associated wheel will be positioned exactly for the grinding operation, and each wheel will be thus locked in the same exact angular position as are the other wheels when engaging the work. This lock insures that the turret cannot be misplaced, and it must be locked only for grinding. If three wheels are mounted at angular displacements of 120°, then the holes 40 will likewise be 120° apart, so that the turret may be locked only in those positions which provide for one wheel grinding the work.

The turret assembly comprising the lower relatively stationary slide 30 is mounted for a sliding movement perpendicular to the work piece. The turret base 31, which may be integral with or separate from the work table supporting base, is provided with an upwardly projecting slideway, such as the dove-tailed slideway 50. The wheel slide 30 has a slideway which, with the aid of a standard adjustment gib 51, serves to interfit with the stationary slideway 50 of the base. This wheel slide may be precisely adjusted relative to the work by a standard wheel feed mechanism comprising a half nut 52 fixedly projecting downwardly from the bottom of the wheel slide and engaging the thread of the wheel feed screw 54 which is interconnected with a suitable manually operated wheel feed mechanism 55, such as is shown in the U. S. Patent to Norton #762,838 and later constructions of this type used in the industry. Hence the operating grinding wheel may be fed toward the work axis by proper manipulation of the hand wheel mechanism. The connections to the screw 54 pass through the work base to a position where the operator may watch

the grinding operation and suitably adjust the position of the grinding wheel. It will be observed that the wheels are so located on the turret that they may be revolved into a grinding position without interference with other parts of the machine, so that it is merely necessary to feed the wheel rearwardly only enough to clear the work when a second wheel is to be used. In a plane surface grinding machine, the wheel is raised for such clearance, and in a machine for grinding an internal cylindrical surface, the wheel may be fed laterally for the purpose.

It will be understood that the turret construction and mounting are necessarily coordinated with the other features of the selected type of machine, such as mounting the turret on the reciprocable table of an internal grinder in a position where each wheel may be brought accurately into a grinding position by revolving the turret. In that case, a secondary cross slide as above described may carry the turret and be mounted on the table for a transverse wheel feeding movement, or the turret base and slide as herein described may be employed with the work mounted on a reciprocable table. Also, I may employ various accessory devices, such as a suitable water circulating system indicated generally by the pipe 58 and pump 59 connecting a tank supply of fluid with the grinding zone. A wheel guard and other protective devices associated with the grinding wheel, as well as a wheel truing mechanism, may be employed and need not be illustrated.

The grinding wheels are so interconnected in an electrical power system that each wheel is rotated in the same angular direction when in contact with the work and only the wheel adjacent the work is rotated, while the other wheels remain inoperative and stationary. The power supply may be transmitted to the operative wheel through sliding contact members mounted respectively on the turret and base and preferably through spring pressed switches associated with the wheels and operated automatically in such a manner that only the front wheel may be rotated. A suitable power system for a two wheel machine, as shown in Fig. 4, comprises the main power line 60 connected through manually operated push button switches for starting and stopping the wheel, as well as the work movement. This may comprise a normally closed switch 61 which may be operated by a push button to serve as a stop switch. One line goes through a manually operated, normally open micro-switch 62 to the motor 25. The power line also connects to the other motor 28 through a normally open push button switch 63 and the normally closed stop switch 61, as illustrated. A normally open micro-switch 64 is interposed in the line to the motor 25 and another normally open micro-switch 65 is located in the line to the motor 28. These switches 64 and 65 of standard construction are so located on the wheel slide below the turret in a definite relation to the associated grinding wheel that when the turret has been moved around to an exact position for one of the wheels to contact with the work as is defined by the locking plunger 42, then the spring pressed contact 66 (Fig. 3) of the micro-switch 64, or switch 65, is struck and moved downwardly by a cam 68 to maintain the circuit closed. The cam has a beveled face and it is so mounted on a projecting angle plate 69 fixed on the turret that the cam will strike the switch contact member 66 and hold it down to close the normally open switch and thus insure that the current will feed to the wheel whose associated switch is under that cam 68. The other normally open micro-switch associated with the second wheel, such as switch 65 of wheel 28, will remain open because there is only one cam member 68 on the turret. The switch 65 is located and arranged relative to its wheel 28 as is switch 64 shown in Fig. 3. The two micro-switches 64 and 65 are mounted on the wheel slide at 180° apart relative to the turret rotation, so that when the turret is rotated from a first position of closing switch 64 to a second position 180° from the first and there locked in

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place by the sliding lock 42, then the cam 68 will close the other switch 65 and the associated wheel will be rotated accordingly. The main power line 60 may comprise cables that are fixed inside the base 31 and passed upwardly to connect with the switch members on the turret. To prevent the cable from being twisted seriously by rotation of the turret always in one direction and to avoid the use of sliding electrical contacts, I preferably provide a pair of associated stop members 70 and 71 (Fig. 1) mounted respectively on the wheel slide and the turret and so arranged that the turret may revolve in one direction only as far as is permitted by the contacting of the stop members, so that the turret must be rotated in the opposite direction to bring the other wheel into an operative position.

It will now be apparent that various types of grinding machines may be suitably modified to provide multiple wheel turrets and that equivalent constructions may be substituted for those herein described. Hence the above disclosure is to be interpreted as setting forth the principles of the invention and a preferred embodiment thereof and not as imposing limitations on the appended claim.

I claim:

A grinding machine comprising a base having longitudinal slideways, a work table slidably mounted thereon, said base having transverse slideways, a wheel slide mounted on the transverse ways for movement towards and from the work table, precision mechanism for moving the wheel slide on its ways, a revoluble turret on the slide, said turret and wheel slide having horizontal interfitting arcuate slideways for revolution of the turret about a vertical axis, means including a vertical center pin

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which locates the turret and releasably secures it rigidly on the slide, a plurality of rotatable grinding wheels, means including horizontal spindles for the wheels which locate the wheels in a definite radial angular displacement on the turret for alternatively grinding a work piece in the same position on the work table, locking means including a positioning member on the turret associated with each wheel and a single lock on the slide for locking the turret against revolution on the slide and positioning any selected wheel only in the same exact angular position relative to the work table, a separate electric motor connected to each axle for driving the associated wheel, a power circuit, and means including switches positioned on the slide in a definite relationship to the wheels and a single actuator therefor located on and moved by the turret for selectively interconnecting the power circuit only with the motor which is connected to rotate the wheel opposed to the work table.

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