July 21, 1953 D. R. PETERSON 2,645,886

SURFACE GRINDER

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Fig. 1

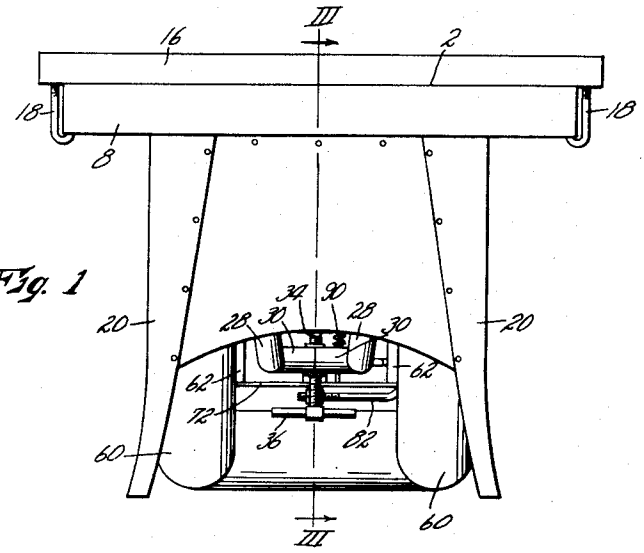


Fig. 2

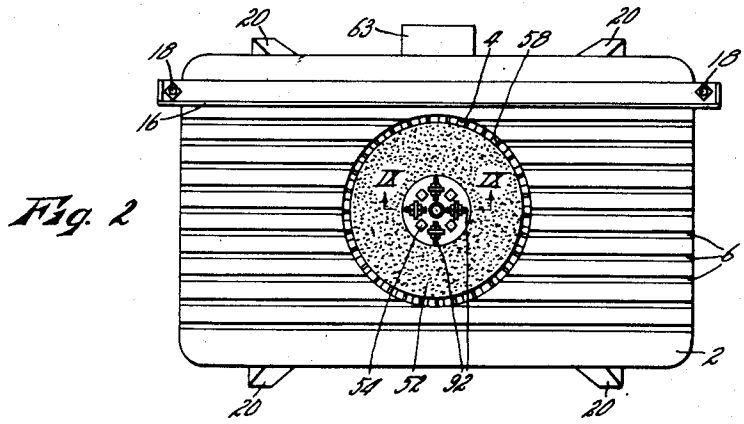
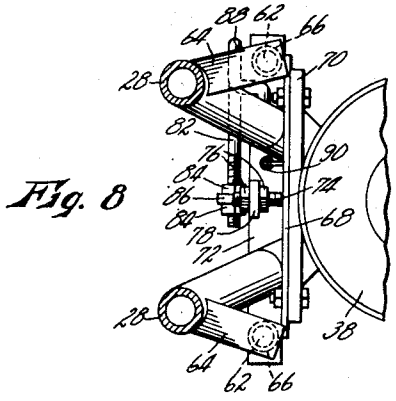


Fig. 8



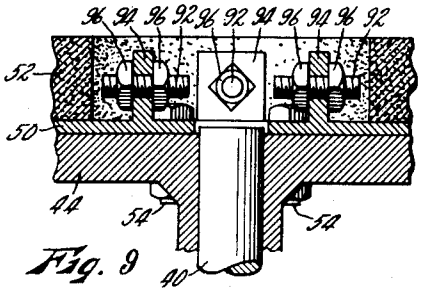


Fig. 9

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Fig. 3

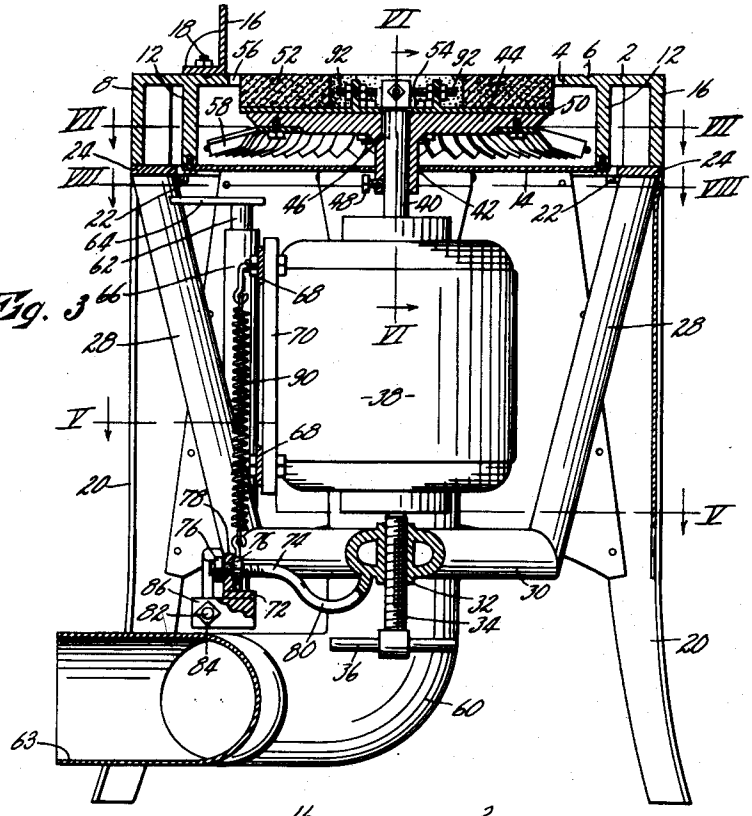
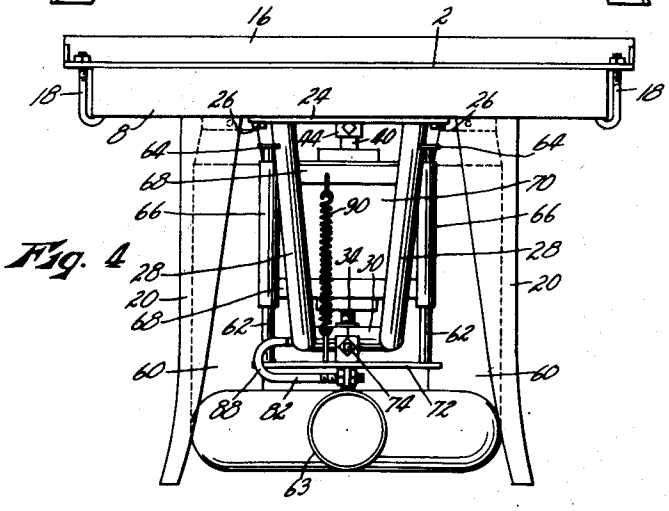


Fig. 4



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SURFACE GRINDER

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Fig. 5

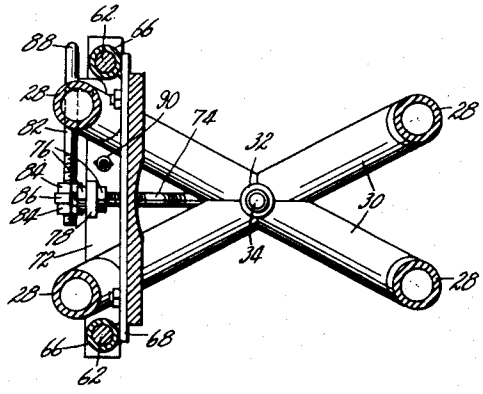


Fig. 6

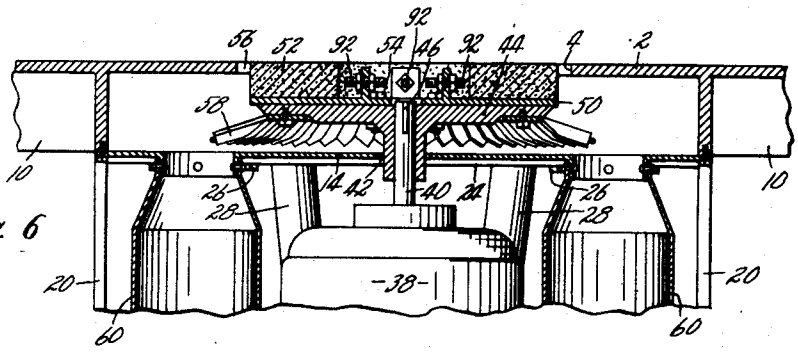
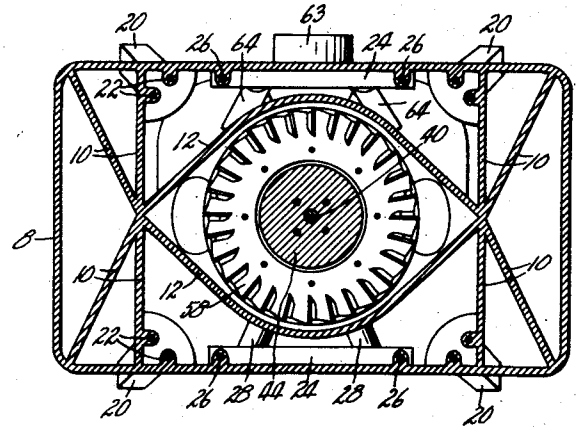


Fig. 7



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UNITED STATES PATENT OFFICE

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SURFACE GRINDER

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Application May 9, 1949, Serial No. 92,117

7 Claims. (Cl. 51—54)

1

This invention relates to new and useful improvements in grinders, and has particular reference to horizontal surface grinders.

The principal object of the present invention is the provision, in a grinder having a grinding wheel with its planar upper surface substantially flush with the upper surface of a grinding table, of means for causing the upper end of the axis of said wheel to gyrate rapidly as said grinding wheel rotates. This causes a vibratory tilting of the grinding wheel in all directions, with the result that each point of the periphery vibrates substantially vertically, or to and from any object which is passed over the grinding table. This provides a much more rapid cut than has heretofore been obtainable with grinding wheels which rotate about a fixed axis. Also, when the wheel contacts the work at any given point to cut chips therefrom and then vibrates downwardly away from the work, there will be provided between the wheel and the work sufficient clearance to permit said chips to be thrown outwardly to the periphery of the wheel for disposal. This tends to prevent clogging or glazing of the grinding surface.

Another object is the provision, in a surface grinder of the character described, of a grinding wheel mounted directly on the upper end of the drive shaft of a vertically disposed motor, said motor being supported against vertical movement and being resiliently supported laterally in such manner that the upper end of said shaft may gyrate about the vertical, thus producing a vibratory tilting of the grinding wheel. By supporting the motor resiliently, the stresses induced by said vibration in the motor bearings are greatly reduced. The normal eccentricity of the grinding wheel, or the uneven weight of the work against the wheel, are usually sufficient to initiate and maintain the vibration.

A further object is the provision, in a surface grinder of the character described, of adjustable means for eccentrically loading the grinding wheel, whereby the amplitude of the vibration of said wheel may be controlled.

Other objects are simplicity and economy of construction, efficiency of operation, durability, and adjustability to perform various types of work.

With these objects in view, as well as other objects which will become apparent in the course of the specification, reference will be had to the drawing, wherein:

Figure 1 is a front elevation of a horizontal surface grinder embodying the present invention.

Fig. 2 is a plan view of the grinder.

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Fig. 3 is an enlarged section taken on line III—III of Fig. 1, with parts left in elevation.

Fig. 4 is a rear elevation of the grinder.

Fig. 5 is a fragmentary section taken on line V—V of Fig. 3.

Fig. 6 is a fragmentary vertical section taken on line VI—VI of Fig. 3.

Fig. 7 is a reduced horizontal section taken on line VII—VII of Fig. 3.

Fig. 8 is a fragmentary horizontal section taken on line VIII—VIII of Fig. 3.

Fig. 9 is an enlarged fragmentary section taken on line IX—IX of Fig. 2.

Like reference numerals apply to similar parts, and the numeral 2 applies to a rectangular grinding table having a circular hole 4 formed centrally therein, and having a plurality of parallel grooves 6 formed longitudinally in the upper surface thereof. A downwardly extending flange 8 is disposed about the edge of said table. Also extending downwardly from said table are a plurality of reinforcing ribs 10, as shown in Fig. 7, and a pair of ribs 12 which form a chamber therebetween for containing the grinding wheel and exhaust fan. A plate 14, rigidly attached to the lower edges of ribs 12, serves to close the lower side of said chamber. A guide rail 16 for guiding the objects being ground across table 2, is adjustably fixed to the upper surface of said table by means of J-bolts 18, which engage said guide rail at their upper ends and flange 8 at their lower ends. Said grinding table is supported by a plurality of floor-engaging legs 20 rigidly attached at their upper ends to flange 8 and ribs 10 by means of screws 22.

To plates 24, respectively fixed to flange 8 at centrally disposed points along the front and rear edges of table 2 by means of screws 26, is welded a motor support frame comprising two tubular members 28 welded to each of plates 24, said tubular members being downwardly and inwardly convergent, and two horizontal crossed tubular members 30 joining the lower ends of tubular members 28, as shown in Fig. 5.

Welded in the juncture of tubular members 30 is a vertical, internally threaded bushing 32, which carries a vertical support screw 34, which may be turned by means of a handle 36 fixed to its lower end. A motor 38 is supported on the upper end of said screw. The drive shaft 40 of said motor extends substantially vertically upwardly through a hole 42 formed in plate 14. A hub 44 is rigidly attached to the upper end of said motor shaft within the chamber formed by table 2, ribs 12, and plate 14, by means of key 46 and set screw 48. A plate 50, to the upper surface

of which is bonded a grinding wheel 52, is rigidly attached to said hub by means of bolts 54. Said grinding wheel extends upwardly through hole 4 of table 2, and its planar upper surface is normally substantially coplanar with the upper surface of said table. Said wheel is of somewhat smaller diameter than hole 4, leaving an annular space 56 between said grinding wheel and the edge of said hole, through which grindings may be exhausted by fan 58. Said fan, which may be of any suitable type, is fixed to the lower surface of hub 44 and rotates therewith. Grindings drawn through annular space 56 by said fan into the chamber formed by table 2, ribs 12, and plate 14, are exhausted from said chamber through a pair of downwardly extending exhaust tubes 60 disposed on opposite sides of motor 38, said tubes communicating at their upper ends with said chamber through plate 14, and converging at their lower ends through a rearwardly projecting horizontal exhaust tube 62. Said exhaust tube is adapted to be connected with any suitable means for conducting the grindings away from the grinder.

Motor 38 is positioned and guided for lateral vibratory movement by two substantially vertical guide rods 62, each rigidly attached at its upper end to the free end portion of a cantilever support member 64. Said support members are welded respectively at their fixed ends to the upper end portions of tubular member 28 at the rearward side of table 2. Said support members are sufficiently thin to permit limited resilient bending and torsional strains to be set up therein. Thus guide rods 62 have a limited universal movement about their upper ends. A sleeve 66 is carried for sliding movement along each of guide rods 62, and said sleeves are connected by cross-bars 68. Base plate 70 of motor 38 is rigidly attached to said cross-bars.

The lower ends of guide rods 62 are connected by means of a relatively thin bar 72 rigidly attached thereto. A bolt stud 74 extending parallel to the transverse axis of table 2, is welded or otherwise rigidly fixed at its forward end to the juncture point of horizontal tubular frame members 30, as best shown in Fig. 3, and at its rearward end is adjustably fixed by lock nuts 76 to lug 78 which is rigidly attached to bar 72 at the midpoint thereof. Intermediate its ends bolt stud 74 is formed to present a goose-neck 80, which permits a limited resilient longitudinal extension of said bolt stud. A second bolt stud 82, extending parallel to the longitudinal axis of table 2, is rigidly attached at one end to one of tubular members 28 and at its opposite end is adjustably fixed by means of lock nuts 84 to a lug 86 rigidly attached to bar 72 at the midpoint thereof. Bolt stud 82 is also provided with a goose-neck 88 intermediate its ends.

Lock nuts 76 and 84 may be selectively loosened and tightened to level the planar upper surface of grinding wheel 52 with the upper surface of table 2 while the machine is at rest. Adjusting these lock nuts pivots guide rods 62 about their upper ends, and these rods in turn tilt motor 38 and the grinding wheel. Turning screw 34 by means of handle 36 adjusts grinding wheel 52 vertically relative to the grinding table, according to the depth of the cut desired. Since grinding wheels are very rarely, if ever, completely homogenous, grinding wheel 52 will always have a certain degree of eccentricity, so that when motor 38 is set in operation to turn

the wheel, said eccentricity will cause the upper end of drive shaft 40 to gyrate slightly. Since the motor is carried on guide rods 62 which are free to pivot universally at their upper ends, both the grinding wheel and the motor will gyrate tiltingly about their vertical axes. In this manner a large amount of stress is removed from the motor bearings which would occur if the motor were rigidly mounted. Transverse movement of the lower ends of guide rods 62 in any direction is permitted by the goose-necks in bolt studs 74 and 82. There will be a slight slippage between support screw 34 and motor 38. Any possibility of chattering or vibration between said motor and said support screw is prevented by a tension spring 90, which is secured at its upper end to one of cross-bars 68 and at its lower end to bar 72, thus holding the motor firmly against screw 34.

Due to the above described oscillatory tilting motion of the grinding wheel, any point about the periphery of said wheel vibrates vertically and thus contacts the object to be ground during only a small portion of each revolution. This produces a sort of slapping action between the wheel and the work which has been found to produce a much more rapid, efficient grinding with no sacrifice in accuracy. Moreover, the wheel contacts the work at only one portion of its periphery at any given instant, and the remainder of the wheel will be spaced apart from the work sufficiently to provide adequate clearance for the disposal of grindings and chips of metal. Thus glazing and clogging of the grinding surface is greatly reduced.

Another means for initiating and maintaining the vibratory tilting of the grinding wheel is the object being ground. The grinding wheel is in effect resiliently mounted, and when the object to be ground contacts the wheel it has the effect of loading the wheel unevenly, or eccentrically. This will of course cause the wheel to vibrate as described.

While in most cases the parts may be so proportioned that the natural eccentricity of the wheel, and the contacting of the wheel by the object being ground, will produce a vibration of the wheel of suitable amplitude, in some cases it may be desirable to control the amplitude of the vibration adjustably. For example, the normal tendency of a very heavy piece of work to dampen the vibrations of the wheel may be counteracted by increasing the normal amplitude of the vibration. This adjustment is best accomplished by varying the eccentricity of the grinding wheel, and as shown in the drawings is obtained by means of four counterweights having the form of threaded bolts 92. As best shown in Figs. 2 and 9, said bolts are disposed horizontally within the inner diameter of grinding wheel 52. They are disposed radially relative to said wheel, being equally spaced therearound, and extend through lugs 94 rigidly attached to grinding wheel mounting plate 50. Each bolt is adjustably secured in its lug by means of lock nuts 96 which engage opposite sides of said lug. By tightening and loosening said lock nuts selectively, bolts 92 may be moved radially to adjust the eccentric loading of the grinding wheel at will.

While I have shown a specific embodiment of my invention, it is apparent that many minor variations of construction and operation could be made without departing from the spirit of the invention.

What I claim is:

1. A surface grinder comprising a horizontal grinding table, a rigid motor support frame fixed beneath said table, a substantially vertical motor supported slidably at its lower end on said frame, a grinding wheel fixed to the upwardly extended drive shaft of said motor and having its upper surface substantially coplanar with the upper surface of said table, a plurality of vertical guide members supporting said motor horizontally, said guide members being connected at one end to said frame for limited universal movement, and resilient means urging said guide members toward the vertical.

2. A surface grinder comprising a horizontal grinding table, a rigid motor support frame fixed beneath said table, a substantially vertical motor supported slidably at its lower end on said frame, a grinding wheel fixed to the upwardly extended drive shaft of said motor and having its upper surface substantially coplanar with the upper surface of said table, a plurality of vertical guide members arranged at one side of said motor and connected to said motor to support it horizontally, and a plurality of resilient cantilever members each fixed at one end to said frame, and to the free ends of which said guide members are respectively connected.

3. A surface grinder comprising a horizontal grinding table, a rigid motor support frame fixed beneath said table, a substantially vertical motor supported slidably at its lower end on said frame, means carried by said frame for adjusting said motor vertically, a grinding wheel fixed to the upwardly extended drive shaft of said motor and having its upper surface substantially coplanar with the surface of said table, a plurality of vertical guide rods arranged along one side of said motor and having their upper ends carried by said frame for limited universal movement, said motor being carried on said vertical guide rods for sliding movement, and resilient means urging said guide rods toward the vertical.

4. A surface grinder comprising a horizontal grinding table, a rigid motor support frame fixed beneath said table, a substantially vertical motor supported slidably at its lower end on said frame, a grinding wheel fixed to the upwardly extended drive shaft of said motor and having its upper surface substantially coplanar with the upper surface of said table, a plurality of vertical guide members supporting said motor horizontally, said guide members being connected at one end to said frame for limited universal movement, and resilient members connecting the opposite ends of said guide members to said frame to permit horizontal movement of said guide members in any direction.

5. A surface grinder comprising a horizontal grinding table, a rigid motor support frame fixed beneath said table, a substantially vertical motor supported slidably at its lower end on said frame, a grinding wheel fixed to the upwardly extended drive shaft of said motor and having its upper surface substantially coplanar with the upper surface of said table, a plurality of vertical guide members supporting said motor horizontally, said guide members being connected at one end to said frame for limited universal movement, and a pair of relatively right-angled members connecting the opposite ends of said guide members with said frame, said members being resiliently extendable whereby to permit limited horizontal movement of said guide members in any direction.

6. A surface grinder comprising a horizontal grinding table, a rigid motor support frame fixed beneath said table, a substantially vertical motor supported slidably at its lower end on said frame, a grinding wheel fixed to the upwardly extended drive shaft of said motor and having its upper surface substantially coplanar with the upper surface of said table, a plurality of vertical guide members supporting said motor horizontally, said guide members being connected at one end to said frame for limited universal movement, a pair of relatively right-angled members connecting the opposite ends of said guide members with said frame, said members being resiliently extendable whereby to permit limited horizontal movement of said guide members in any direction.

7. A surface grinder comprising a horizontal grinding table, a rigid motor support frame fixed to said table therebeneath, a motor having its drive shaft extending substantially vertically upwardly supported solidly at its lower end by said frame for horizontal sliding movement, means carried by said frame for adjusting said motor vertically, a grinding wheel fixed to said drive shaft and having its planar upper surface substantially coplanar with the surface of said table, a pair of resilient cantilever members fixed to said support frame adjacent the upper end of said motor, a substantially vertical guide rod having its upper end fixed to the free end of each of said cantilever supports, sleeves secured to said motor and carried for sliding movement on said guide rods, whereby said motor is supported horizontally, resilient means urging said motor downwardly against said frame, a transversely resilient connecting member joining the lower ends of said guide rods, and a pair of relatively right angled horizontal members each fixed at one end to said frame and adjustably fixed at its opposite end to said connecting member, said right angled members being resiliently extendable.

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