Aug. 1, 1939. V. W. GIDEON 2,167,647

GRINDING MACHINE

Filed April 29, 1938 4 Sheets-Sheet 1

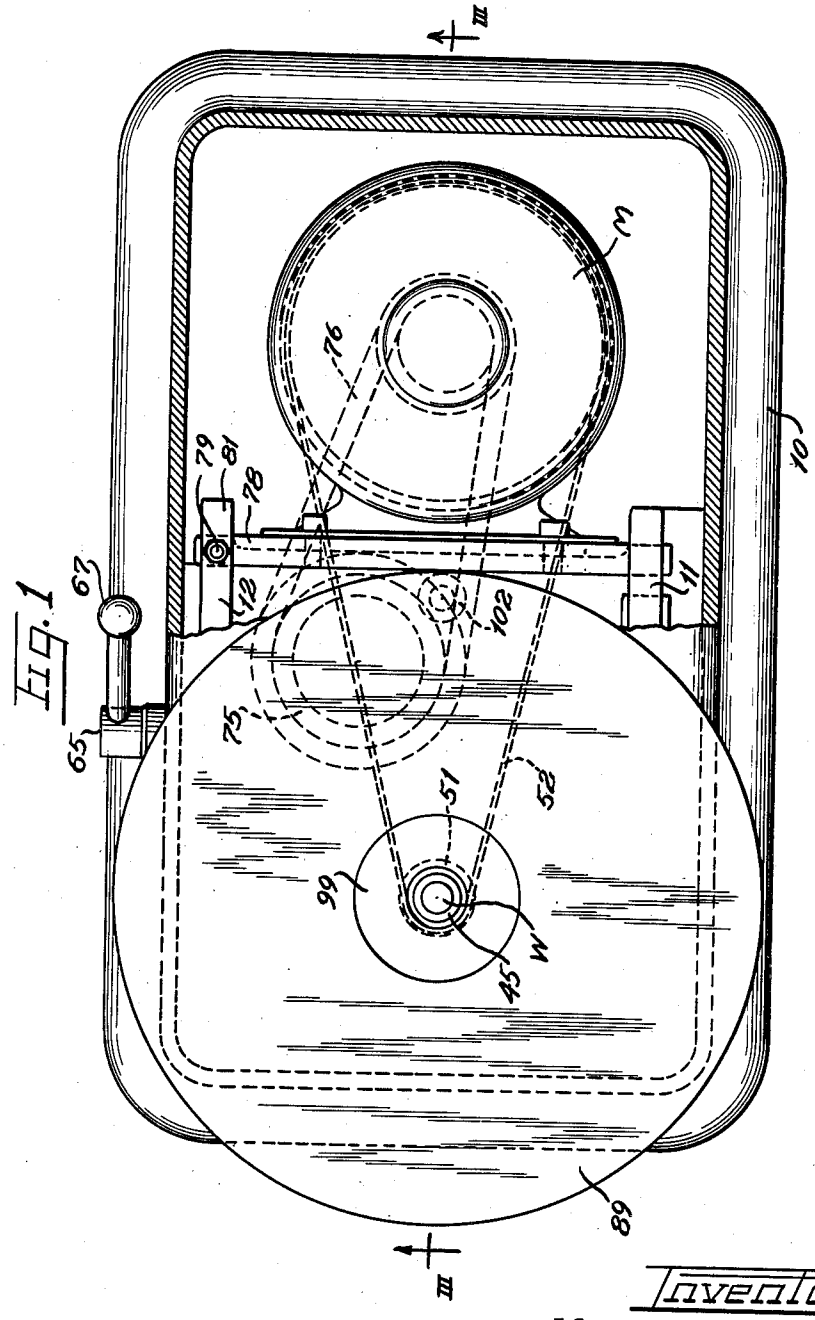

Fig. 1

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GRINDING MACHINE

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Fig. 4

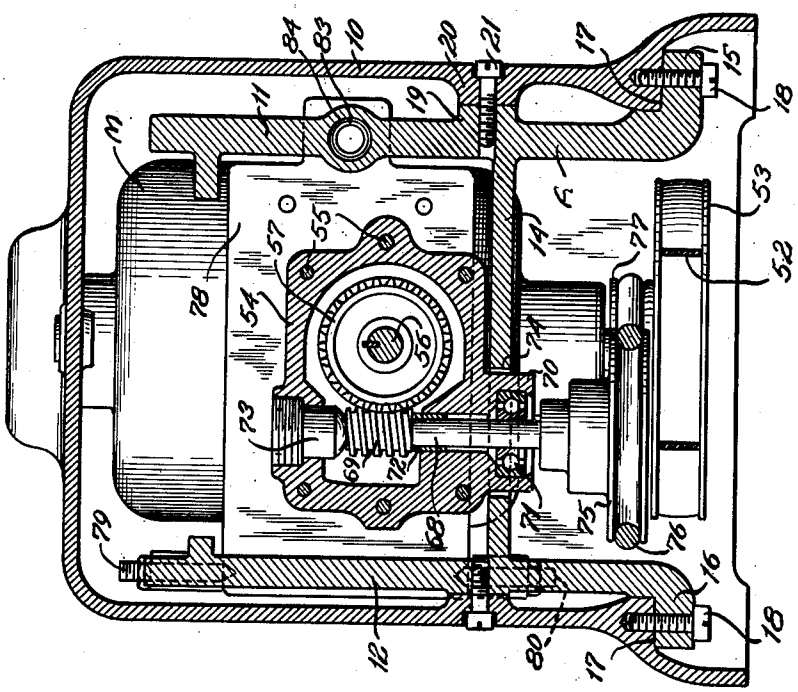
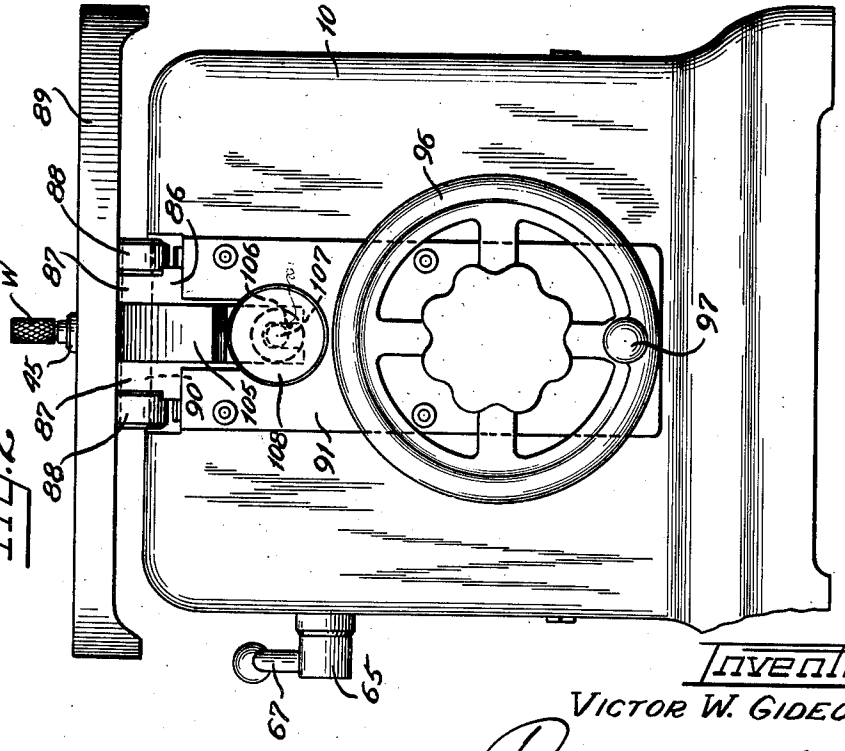


Fig. 2



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GRINDING MACHINE

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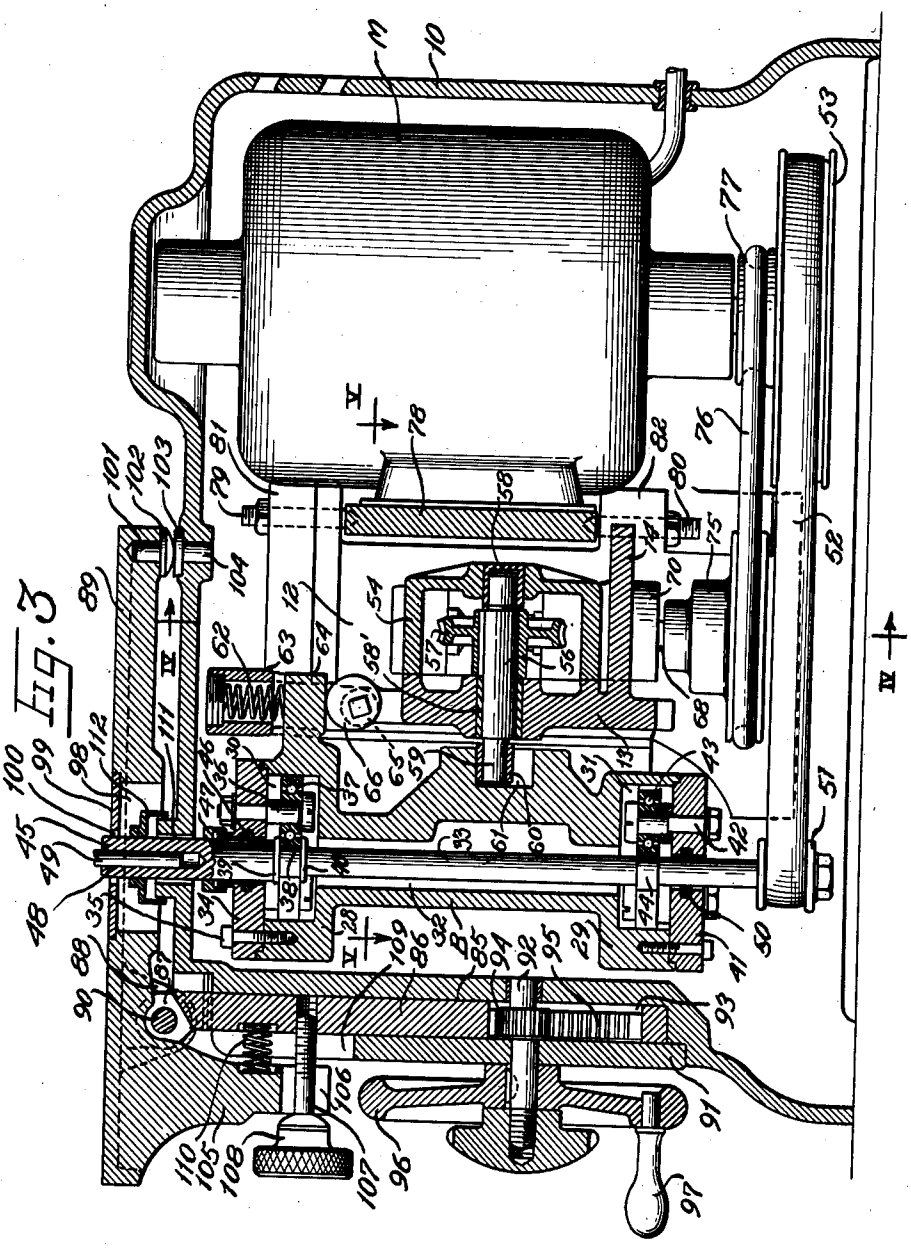

Fig. 3

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Fig. 5

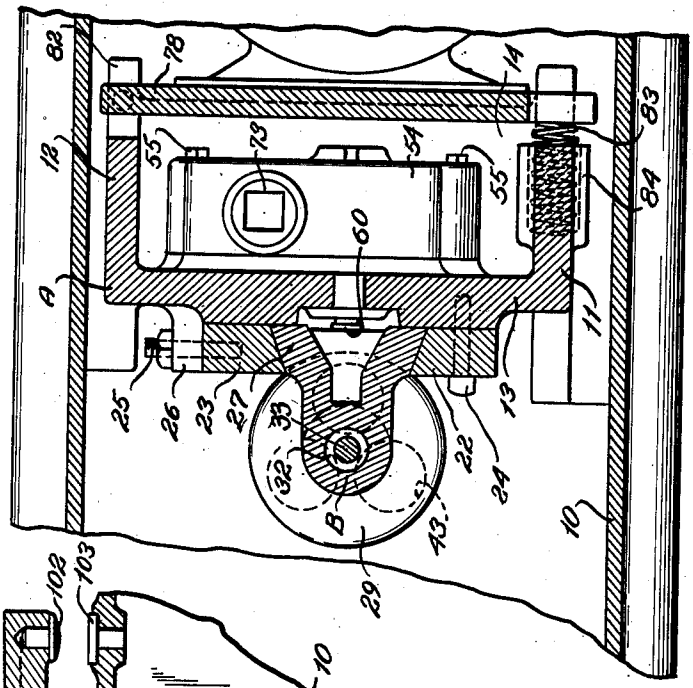
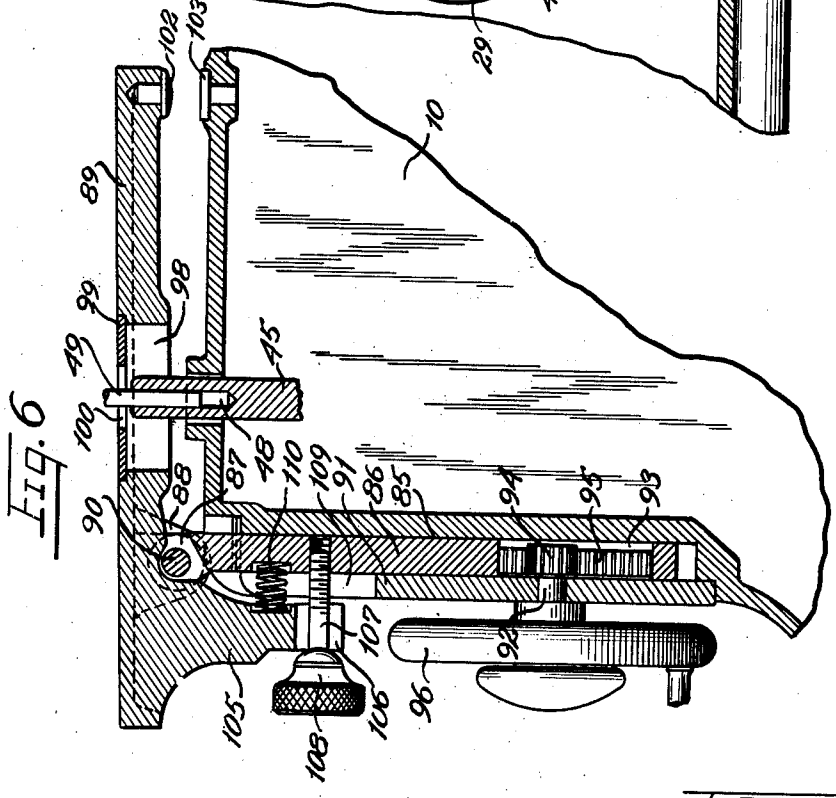


Fig. 6



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UNITED STATES PATENT OFFICE

2,167,647

GRINDING MACHINE

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Application April 29, 1938, Serial No. 204,929

6 Claims. (Cl. 51—34)

This invention relates to grinding machines, particularly to grinding machines of the vertical type for profile grinding of dies or structural parts where accuracy and precision are required, the general object of the invention being to produce a comparatively light and compact structure in which a grinding wheel supporting spindle may be rotated at high speed and axially oscillated at a lower speed.

More in detail, one important object is to provide a supporting frame on which various operating parts are all mounted and adjusted, the supporting frame being detachably inserted into a housing on which the work supporting table is mounted for application of work to the grinding wheel projecting from the housing.

A further important object is to provide a work supporting table with means for accurately adjusting the table into angular position relative to the grinding wheel axis and for maintaining the angularity of the table when the table is bodily adjusted vertically for proper application of the work to the grinding wheel.

Another important object is to provide a comparatively light mounting frame for the grinding wheel supporting spindle together with an electric motor for rotating the spindle at high velocity, and speed reduction means driven by the same motor and connected with the spindle mounting frame for vertically oscillating the frame and the spindle therewith.

The invention also embodies other features of construction arrangement and operation, and a machine embodying the various features of the invention is disclosed on the drawings, in which drawings:

Figure 1 is a plan view of the machine with part of the housing in section;

Figure 2 is an end elevation;

Figure 3 is a section on plane III—III of Figure 1;

Figure 4 is a section on plane IV—IV of Figure 3;

Figure 5 is a section on plane V—V of Figure 3; and

Figure 6 is a fragmentary view similar to Figure 3 showing the work supporting table in angular adjusted position.

The housing 10 for the machine is of generally rectangular shape and has an open bottom. The supporting frame A for the various operating elements comprises side walls 11 and 12, a back wall 13 extending between the upper portion of the side walls and a bottom wall 14 extending horizontally and forwardly from the lower end of the back wall. At their lower ends the side walls 11 and 12 have outwardly directed longitudinally extending flanges 15 and 16 for seating against shoulders 17 provided on the longitudinal side of the housing 10, screws 18 extending through the flanges assisting in holding the frame A within the housing. The side walls 11 and 12 may also have bosses 19 engaging bosses 20 of the housing, with screws 21 extending through the housing and into the side walls to further secure the frame A within the housing.

Against the outer side of the back wall 13 of the frame A vertically extending guide rails 22 and 23 are mounted, the rail 22 being secured as by means of screws 24 threading into the back wall 13, and the rail 23 being shown secured by screws or pins 25 extending through lugs 26 on the back wall 13. The inner sides of the guide rails are inclined to receive between them the dovetail wall 27 on the mounting frame B for the grinding wheel spindle structure for vertical oscillation of the frame B. The frame B has enlargements 28 and 29 in its upper and lower ends providing cylindrical chambers 30 and 31 with which the bore 32 through the frame B communicates. Extending through the bore and the chambers is the grinder wheel supporting spindle 33.

A cover 34 is provided for the upper chamber 30 and detachably secured as by screws 35, and depending from the cover into the chamber 30 are bearing pins 36 for anti-friction bearing structures 37 comprising outer and inner race members with bearing balls therebetween, the outer race member 38 engaging the cylindrical wall of the chamber 30 and engaging the spindle shaft between collars 39 and 40 on the spindle, the spindle being thus vertically supported by the anti-friction bearings and being centered by the bearings in the chamber 30. I have shown three bearing structures spaced 120° apart.

For the lower chamber 31 a cover 41 is provided from which pins or shafts 42 extend into the chamber for journalling the anti-friction bearing structures 43 whose outer races engage with the cylindrical wall of the chamber and with the cylindrical collar or flange 44 on the spindle, three bearing structures being shown which accurately center the spindle in the chamber.

The spindle is axially supported and suspended in the frame B by the engagement of the upper bearing structure 37 with the spindle between the collars 39 and 40, the lower collar 44 or rail being engaged by the bearing structure 43 to maintain the axial alignment of the spindle. At its upper end the spindle has the head 45 extending

through an opening in the cover 34 with a sealing gasket 46 extending into the opening to surround the spindle head to prevent escape of lubricant from the chamber 30. The cover 34 may have a flange extended upwardly therefrom to surround the head 45 and to receive a cap 47 surrounding the head and serving to prevent dust or foreign matter from entering the bearing chamber. The head 45 is provided with a bore 48 for receiving the stem 49 of the support for the grinding wheel W.

At its lower end the spindle 33 extends through an opening in the cover 41 into which a washer or gasket 50 extends to surround the spindle and to prevent leakage of lubricant from the chamber 31. At its lower end the spindle terminates in a pulley 51 for receiving the driving belt 52 extending from the large drive pulley 53 mounted on the shaft of the electric motor M.

The reduction gearing for controlling the vertical oscillation of the spindle mounting frame B is within a housing 54 detachably secured against the inner side of the back wall 13 of the frame A, as by screws 55. Extending longitudinally through the housing is a shaft 56 on which is keyed the worm wheel 57, the shaft at its outer end being journalled in a bushing cup 58 seated in the outer wall of the housing 54. At its inner end the shaft extends through a bearing bushing 58′ in the rear wall 13 of the frame A, and the shaft has the eccentric extension 59 provided with a roller 60 for engagement with the upper side of the opening 61 in the spindle mounting frame B, so that as the shaft 56 is rotated the frame B will be vertically oscillated. After raising of the frame by the eccentric or cam extension 59, it may be returned by gravity, or a spring 62 may be provided for returning the frame. The spring may be mounted within a housing 63 on the frame A to bear against the extension 64 from the upper part of the spindle mounting frame B, as clearly shown by Figure 3.

Extending inwardly from the side wall of the housing 10 is a shaft 65 which has secured on its inner end a cam disk 66 for engaging against the underside of the extension 64 on the frame B to raise this frame out of the path of the cam roller 60 if vertical reciprocation of the frame B is not desired, a lever 67 being provided on the outer end of the shaft for operation thereof and the cam 66.

Extending vertically through the gear housing 54, Figure 4, is the shaft 68 for the worm pinion 69 with meshes with the worm gear 57. The shaft extends downwardly through the bottom wall of the housing 54 which is provided with an enlargement 70 forming a recess for an anti-friction bearing 71, the inner end of the shaft being journalled by a bushing 72. The axial thrust of the shaft 68 is taken up by a plug 73 threaded into the upper wall of the housing 54.

The enlargement 70 for the bearing 71 extends downwardly through the opening 74 in the cross wall 14 of the frame A, and secured to the lower end of the shaft 69 is a pulley 75 connected by belt 76 with the pulley 77 on the shaft of the motor M. The size of the pulleys 75 and 77 is such that the worm wheel 57 will be driven by the worm at a comparatively low speed so that the rate of vertical oscillation of the spindle mounting frame B is comparatively small. The drive of the small spindle pulley 51 by the large motor pulley 53 is such that the spindle will be rotated at a comparatively very high speed.

The motor M is secured to a plate 78 extending across the inner end of the frame A between the side walls thereof, the end of the plate away from the belt being pivoted by upper and lower pins 79 and 80 extending through extensions 81 and 82 on the side wall 12 of the frame A, so that the motor structure is hinged for swing of its pulley end, a spring 83 (Figure 5) abutting the free end of the plate and tending to swing it and the motor structure so that the belts will be set yieldably taut for efficient driving of the pulleys 51 and 75. As shown, the spring 83 is seated in a pocket 84 provided in the side wall 11 of the frame A, Figure 4.

The front end of the housing 10 has a vertically extending guideway 85 for a plate 86 which at its upper end has ears 87 aligning with lugs 88 extending downwardly from the work supporting table 89, a pin 90 extending through the ears and lugs so that the table is hinged to the plate. A cover plate 91 is secured to the housing across the guide channel 85 for holding the plate 86 therein. Journalled in the housing end wall and in the cover 91 is a shaft 92, and the plate 86 has the longitudinally extending opening 93 for the gear pinion 94 on the shaft 92, which meshes with teeth 95 provided on the plate 86 so that upon turning of the shaft the plate may be raised and lowered for raising and lowering of the work supporting table. At its outer end the shaft 92 has a hand wheel 96 secured thereto and provided with a handle 97.

The work supporting table 89 is shown as of circular shape and has a comparatively large passageway 98 therethrough for the spindle head 45, a cover plate 99 for the passageway having a smaller opening 100. At its inner side and in the bottom thereof, the table receives a pin 101 terminating in a rounded contact head 102, and below this contact head a contact plate 103 is mounted on the top of the housing 10, as by means of a pin 104 extending from the head through a suitable opening in the housing top. When the table supporting plate 86 is in its lower position, and the contact head 102 engages with the plate 103, as shown in Figure 3, the upper surface of the table will be in a plane at right angles with the axis of the spindle and the grinding wheel. It may be desirable to set the table with its top surface at an angle with the spindle axis, and for this purpose the table is hinged to the plate 86 as has been described. Depending from the outer end of the table is an arm 105 having a slot 106 in its lower end for passage of a set screw 107 which threads into the plate 86, the screw having a head 108 for abutting the arm 105 adjacent to the slot 106. The cover plate 91 has a clearance slot 109 for the screw, and a spring 110 between the arm and the plate 86 tends to swing the arm outwardly to hold it against the screw head, or if the screw head is withdrawn from the arm, the spring will hold the table with its contact 102 in engagement with the contact plate 103. If a certain angularity of the table relative to the spindle axis is desired, this angle may be readily obtained by inserting a shim or metal strip of known gauge between the contact head 102 and the plate 103, and as the distance of the contact engagement from the pivot axis of the table is known, the desired angularity will be obtained by the proper gauge shim. Before the shim is withdrawn, the screw 107 is turned back for engagement of its head with the arm 105, and the screw will then hold the table in its set angular position against the force of the spring 110, and then the adjusted table may be bodily

raised by turning of the handwheel 96. Thus vertical adjustment or angular adjustment of the table may readily and accurately be made for bringing the work on the table into proper association with the grinding wheel.

All the grinder operating parts are mounted on the frame A and are properly adjusted before this frame is inserted into the housing 10, the parts being thus readily accessible so that adjustment or repair may readily be made. When the frame A is inserted, the head of the grinder spindle will be extended through the passageway 111 in the top of the housing 10, and this opening may be closed by a dust cap 112 surrounding the head as clearly shown in Figure 3. If it is desired to have the supporting frame and the spindle oscillate vertically, the cam 66 is turned down so that the spindle housing B will be supported by the cam roller 60 for oscillation. If vertical reciprocation is not desired, the cam 66 is swung up to raise the housing B above the range of the cam roller 66. All the grinder operation parts are protected by the housing against access of dust or dirt.

The spindle is directly driven by the belt from the large motor pulley, and the spindle is held against vertical displacement relative to the housing B and in accurate vertical alignment by the anti-friction bearings, the upper bearing, by engagement with the collars on the spindle, supporting the spindle vertically. With the simple arrangement shown, a compact, comparatively light, but highly efficient grinder structure is produced.

I have shown a practical and efficient embodiment of my invention but I do not desire to be limited to the exact construction, arrangement, and operation shown and described as changes and modifications may be made without departing from the scope of the invention.

I claim as follows:

1. A grinding machine of the class described comprising a housing, a vertical supporting frame within said housing, a spindle extending through said supporting frame and journalled therein for rotation, a driving motor within said housing having driving connection with said spindle for rotation thereof, the top of said housing having an opening through which said spindle projects, the upper end of said spindle being adapted to mount a grinding wheel, a work supporting table having an opening through which the spindle projects, a supporting plate for said table vertically adjustable on said housing for vertical bodily adjustment of said table, a hinge connection between said table and said supporting plate for adapting said table for angular adjustment relative to said spindle, a spring tending to hold said table horizontal, and an abutment screw for swinging said table to angular position.

2. A grinding machine of the class described comprising a housing, a vertical spindle journalled within said housing with its upper end projecting therefrom for supporting a grinding wheel, a driving motor for said spindle within said housing, a work supporting table having an opening through which the upper end of the spindle projects, a support for said table mounted on said housing for vertical adjustment whereby said table may be vertically adjusted relative to the grinding wheel, said table having hinge connection with said support whereby said table may be adjusted to an angle with the spindle axis, and a spring and an abutment screw cooperating to maintain the angular adjustment while said support is vertically adjusted.

3. A grinding machine of the class described comprising an enclosing housing, a spindle supporting frame mounted within said housing, a vertical spindle extending through and journalled in said frame and projecting through the top of said housing for supporting a grinding wheel, a motor mounted within said housing having driving connection with said spindle for high speed rotation thereof, a work supporting table having a passageway for receiving the grinding wheel end of the spindle, a plate vertically adjustable on the outside of said housing, said table having hinge connection at its outer end with said supporting plate whereby said table may be adjusted to an angle with the axis of the spindle, cooperating contacts between the inner end of said table and said housing between which gauge elements may be inserted for determining the angle of said table, locking means for locking said table to the supporting plate after adjustment of the table to angular position whereby said table may then be bodily adjusted vertically while retaining the angular adjustment of the table.

4. A grinding machine of the class described comprising a housing, a spindle supporting frame within said housing, a spindle extending vertically through said frame and journalled therein and projecting at its upper end through the housing top for mounting a grinding wheel, a circular work supporting table having an axial passageway through which the spindle projects, a supporting plate for the table having hinge connection with the outer end thereof, means for vertically adjusting said plate for vertical adjustment of the table, cooperating contacts at the opposite end of said table and on said housing respectively, the arrangement being such that when said supporting plate is in its lowermost position and said contacts are in engagement the supporting surface of said table will be in a plane at right angles with the spindle axis, said table by its hinge connection being adjustable to an angle with the spindle axis, the angle of adjustment being determined by the insertion of gauge means between said contacts, and locking means for holding said table in its angular adjusted position independently of the gauge means while said table is bodily adjusted vertically with its supporting plate.

5. A grinding machine of the class described comprising a housing, a spindle within said housing and driving means for rotating the spindle, said spindle extending vertically with its upper end projecting through the top of the housing for reception of a grinding wheel, a work supporting table having a passageway through which the spindle projects, a support for the table having hinge connection with the outer end thereof, means for vertically adjusting said support for vertical adjustment of the table, contacts at the opposite end of said table and on said housing respectively, the arrangement being such that when said supporting table is in normal position and said contacts are in engagement the supporting surface of said table will be in a plane at right angles with the spindle axis, spring means tending to hold said table with said contacts in engagement, said table by its hinge connection being adjustable to an angle with the spindle axis, the angle of adjustment being determined by the insertion of gauge means between said contacts, and adjustment means on said support for engagement with said table to counteract said spring means whereby said table will be held in its angu-

lar adjusted position independently of the gauge means while said table is bodily adjusted vertically with its support.

6. A grinding machine of the class described comprising a housing open at its bottom, a grinding wheel spindle and a supporting structure therefor, a driving motor and driving connection means operated thereby for effecting rotation of and axial movement of the spindle, and a supporting frame on which said spindle structure, said driving motor and driving connection are mounted to form a unitary assembly therewith adapted for insertion into said housing through the bottom thereof, said housing having supporting means to which said supporting frame may be detachably secured, the top of said housing having an opening for receiving the upper end of the spindle, and a work supporting table mounted on said housing, said housing completely enclosing said unitary assembly.

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