Oct. 23, 1951 R. E. McCOY 2,572,364

AUTOMATIC GRINDING MACHINE

Filed March 31, 1948 6 Sheets-Sheet 1

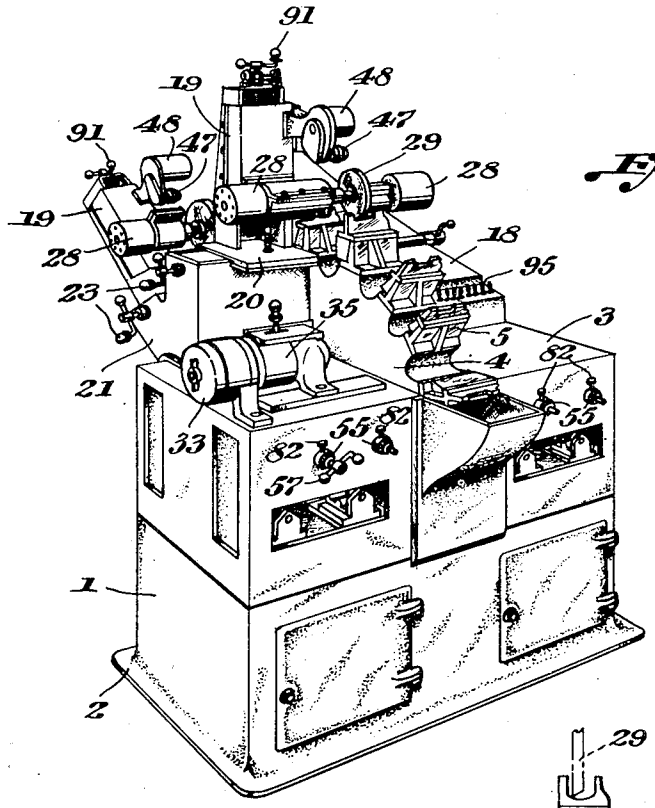


Fig. 1.

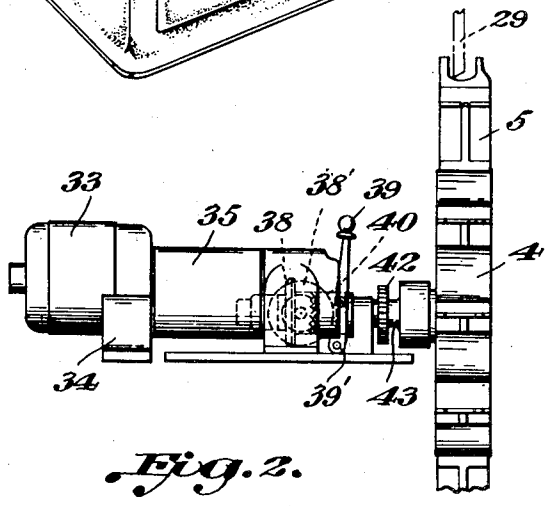


Fig. 2.

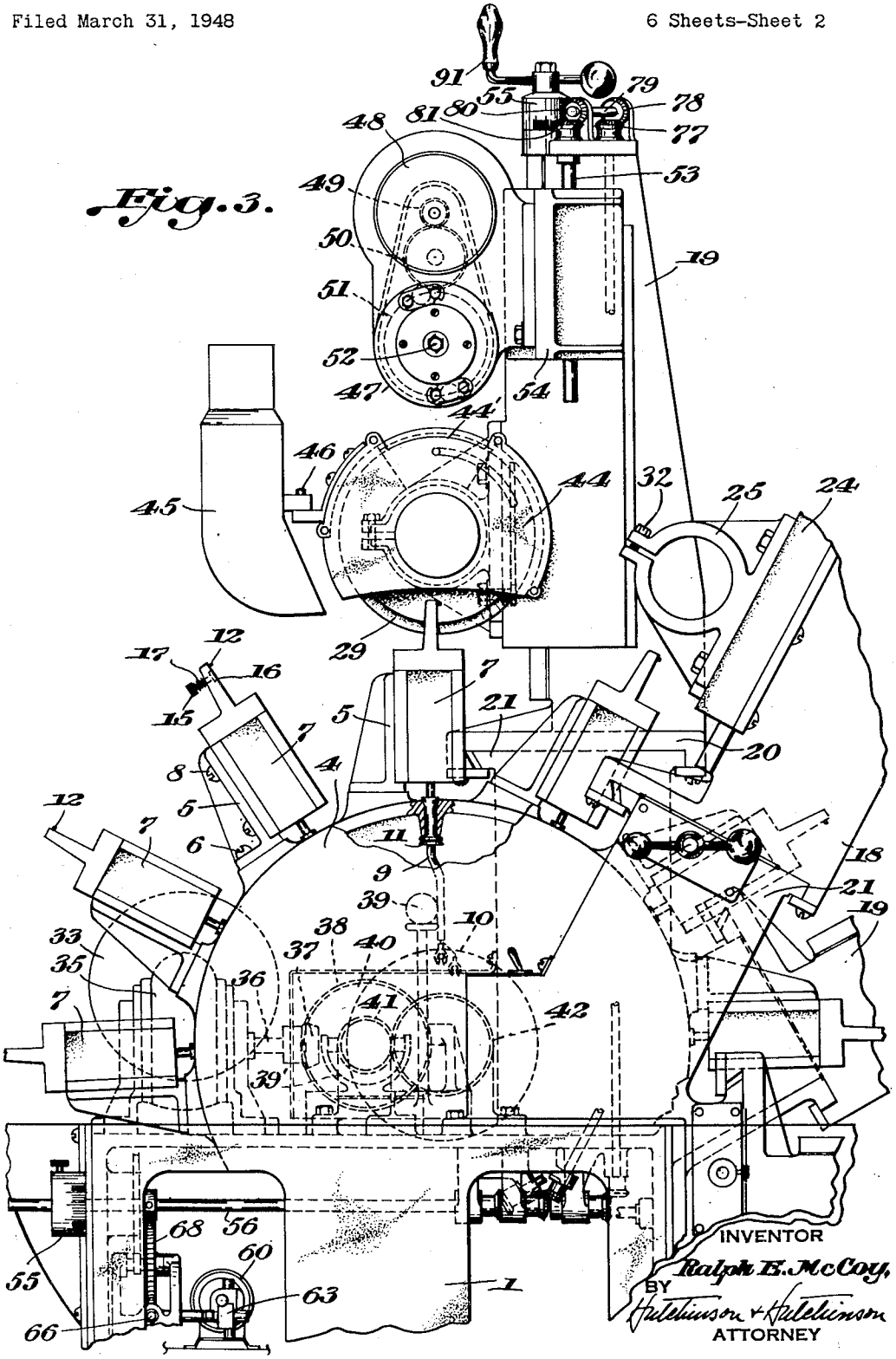
INVENTOR
Ralph E. McCoy,
BY
Hutchinson & Hutchinson
ATTORNEY

Oct. 23, 1951 R. E. McCOY 2,572,364

AUTOMATIC GRINDING MACHINE

Filed March 31, 1948 6 Sheets-Sheet 2

Fig. 3.



Oct. 23, 1951 R. E. McCOY 2,572,364

AUTOMATIC GRINDING MACHINE

Filed March 31, 1948 6 Sheets-Sheet 3

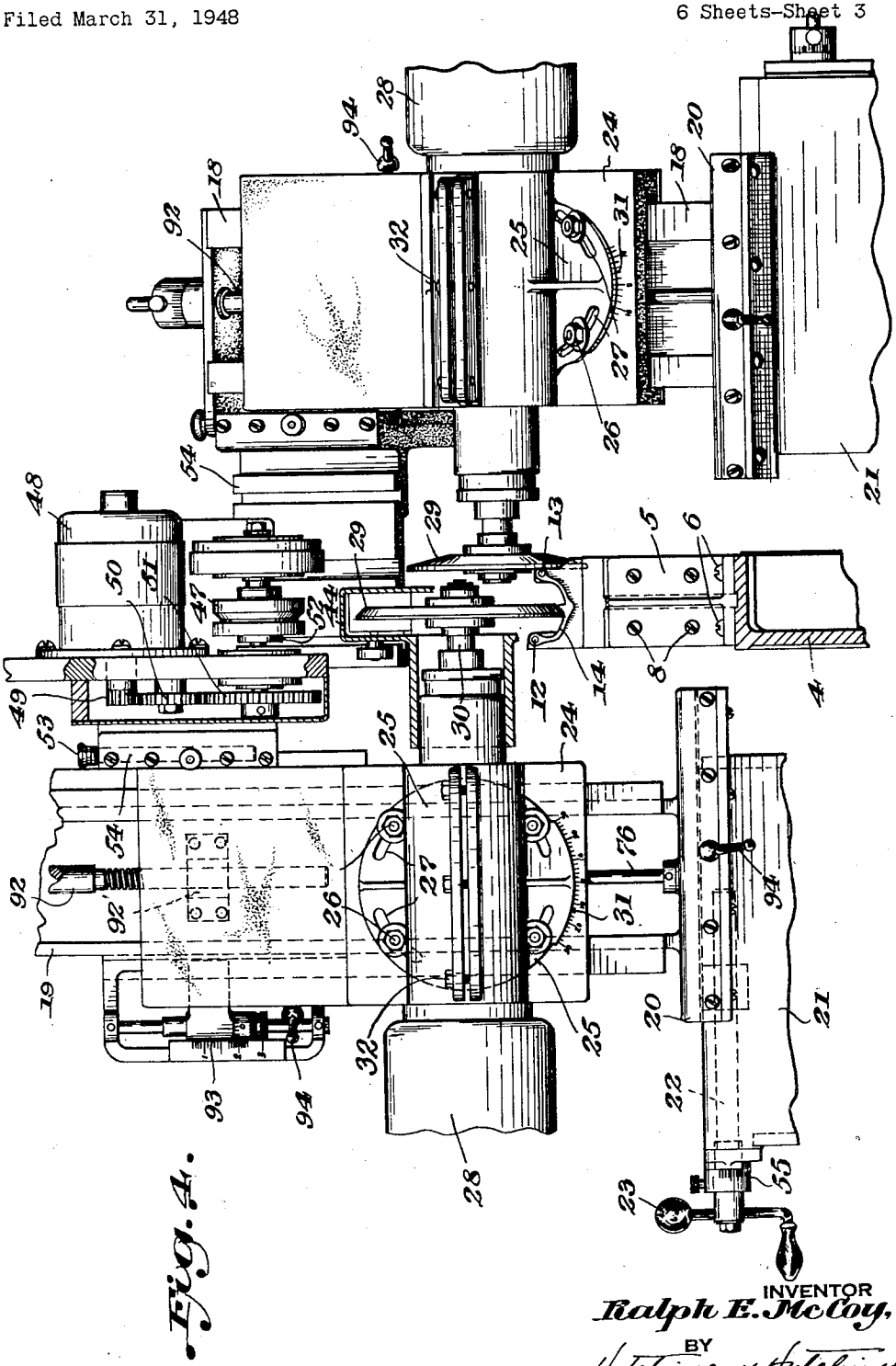


Fig. 4.

INVENTOR
Ralph E. McCoy,
BY
Hutchinson & Hutchinson
ATTORNEYS

Oct. 23, 1951 R. E. McCOY 2,572,364

AUTOMATIC GRINDING MACHINE

Filed March 31, 1948 6 Sheets-Sheet 4

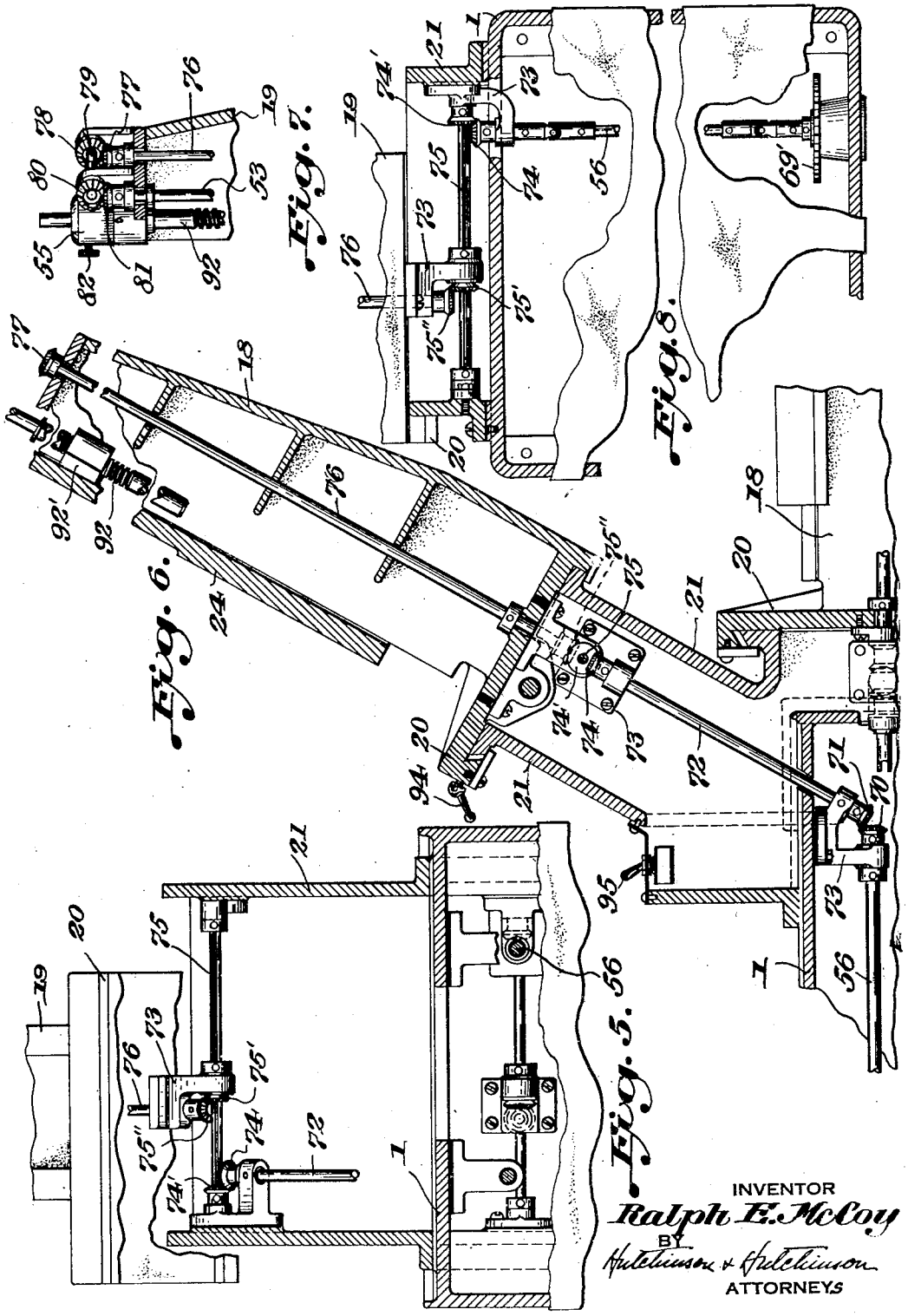


Fig. 7.

Fig. 8.

Fig. 6.

Fig. 5.

INVENTOR
Ralph E. McCoy
BY
Hutchinson & Hutchinson
ATTORNEYS

Oct. 23, 1951 R. E. McCOY 2,572,364

AUTOMATIC GRINDING MACHINE

Filed March 31, 1948 6 Sheets-Sheet 5

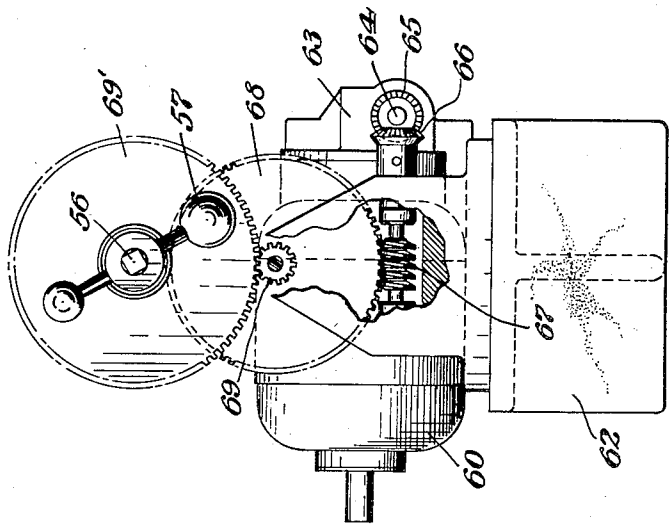


Fig. 10.

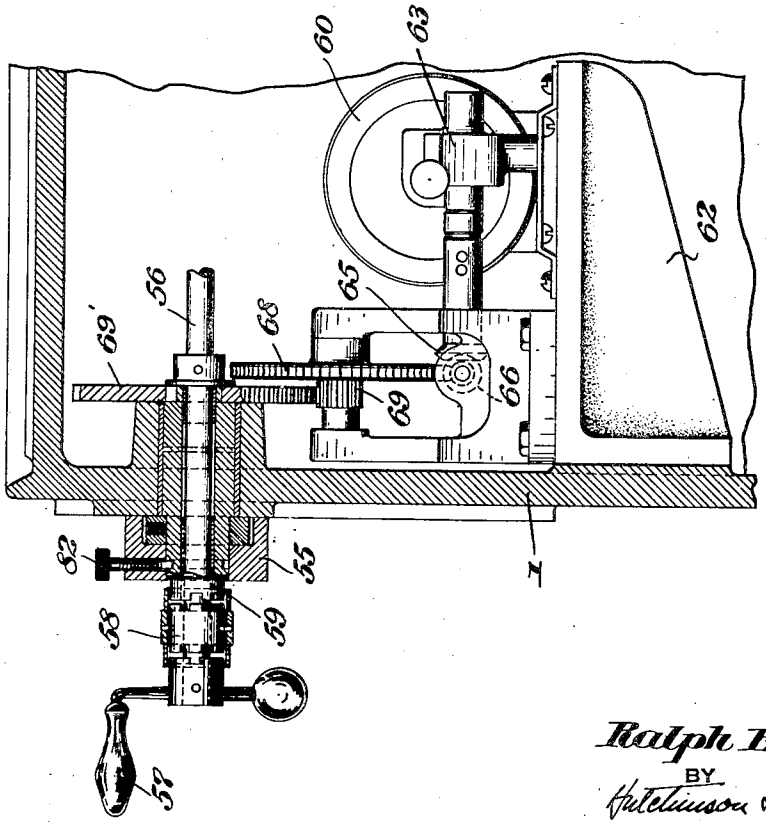


Fig. 9.

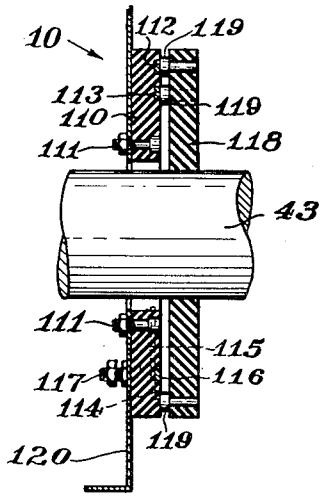
INVENTOR
Ralph E. McCoy,
BY
Hutchinson & Hutchinson
ATTORNEYS

Oct. 23, 1951 R. E. McCOY 2,572,364

AUTOMATIC GRINDING MACHINE

Filed March 31, 1948 6 Sheets-Sheet 6

Fig. 11.



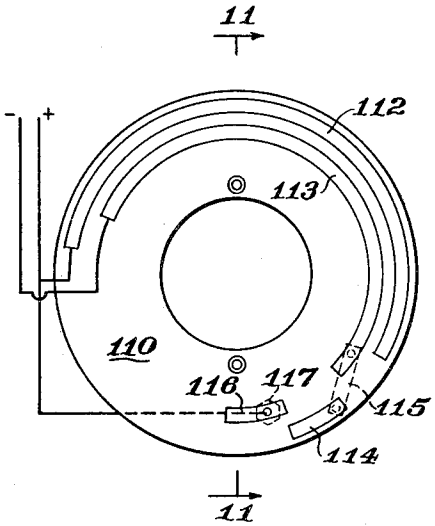


Fig. 12.

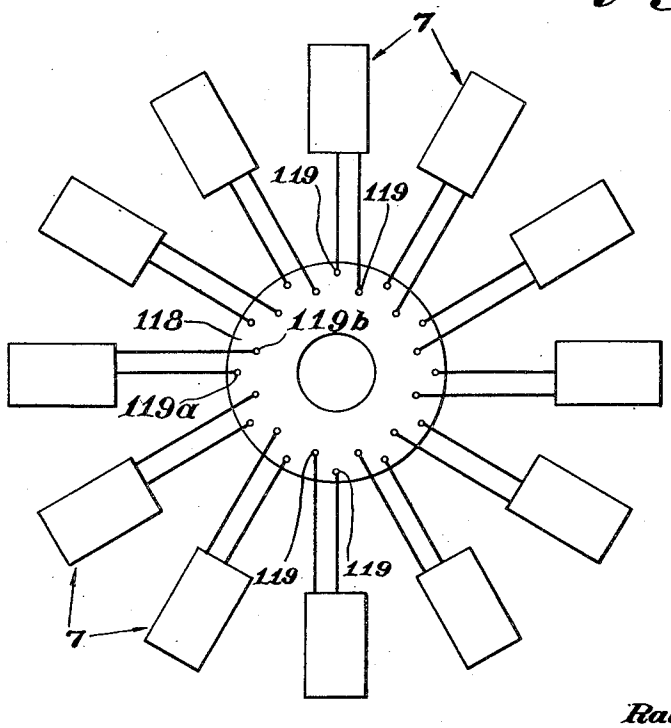


Fig. 13.

INVENTOR

Ralph E. McCoy.

BY Hutchinson & Hutchinson

ATTORNEY

Patented Oct. 23, 1951

2,572,364

UNITED STATES PATENT OFFICE

2,572,364

AUTOMATIC GRINDING MACHINE

Ralph E. McCoy, New Smyrna Beach, Fla., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application March 31, 1948, Serial No. 18,106

12 Claims. (Cl. 51—3)

1

This invention relates to improvements in automatic grinding machines, and in particular, to automatic grinding machines capable of performing a plurality of grinding operations on a part for a single mounting of the part in a chuck.

An object of the invention is to provide an improved grinding machine for automatically and consecutively grinding a plurality of parts to simultaneously produce high finishes on several surfaces of each part.

Another object of the invention is to provide an improved automatic grinding machine having a rotatable chuck wheel formed with a plurality of magnetic chucks for supporting a plurality of parts which will be engaged by a plurality of power operated rotatable grinding wheels whereby a plurality of surfaces on each part may be ground to a high finish while supported in one position or mounting in the chucks.

A further object of the invention is to provide an automatic grinding machine including a rotatable chuck wheel having a plurality of radially extending magnetic chucks supported thereon for holding parts to be ground, with means for grinding a plurality of surfaces on each of said parts while being supported in one position or mounting, and means for dressing the grinding wheels when necessary.

A still further object of the invention is to provide an improved power driven automatic grinding machine for grinding multiple surfaces on a plurality of parts supported by the machine, said grinding machine being highly efficient in operation and capable of mass production of many small parts which require a high finish on several surfaces.

Other objects will appear as the description proceeds.

In the accompanying drawings which form a part of this application,

Figure 1 is a perspective view of the improved automatic grinding machine;

Figure 2 is a side elevation of the improved chuck wheel driving mechanism showing the chuck wheel in end elevation;

Figure 3 is an enlarged side elevation of the automatic grinding machine with the protecting covers removed;

Figure 4 is a fragmentary enlarged front elevation of the upper portion of the automatic grinding machine, with portions thereof being broken away and in section;

Figure 5 is a partial sectional view of one arrangement of a dressing wheel adjustment drive;

Figure 6 is a partial sectional view of another

2

arrangement of a dressing wheel adjustment drive;

Figure 7 is a partial sectional view showing the gearing arrangement at the upper end of one of the grinding wheel supporting columns each of which is similarly constructed;

Figure 8 is a sectional view of another arrangement of a dressing wheel adjustment drive;

Figure 9 is an enlarged detail sectional view showing the manual and power drive for the dressing wheel;

Figure 10 is a front elevation of the manual and power drive for the dressing wheel with parts thereof being broken away and shown in section;

Figure 11 is a fragmentary enlarged sectional view of the commutator ring assembly for controlling the energization of the magnetic chucks;

Figure 12 is an enlarged diagrammatic view in front elevation of the commutator disc and the current distributing rings, and

Figure 13 is a diagrammatic view in front elevation of the disc associated with the commutator disc which carries the contact elements that cooperate with the current distributing rings of the commutator disc in the controlling of the energization of the magnetic chucks and showing the manner in which the chucks are electrically connected to the contact elements.

Like characters of reference are used throughout the following specification and the accompanying drawings to designate corresponding parts.

In carrying out the invention, there is provided a substantially rectangular shaped combined casing and frame 1 having a laterally extending supporting base flange 2 formed about its lower end. Mounted upon the upper portion 3 of the combined casing and frame 1 are the grinding and dressing units to be hereinafter described.

The chuck wheel

A chuck wheel 4 is rotatably mounted upon a horizontal axis suitably journaled in said frame 1 and extends partly above and partly below the top 3 of the frame 1, the top 3 being suitably divided for this purpose.

As best seen in Fig. 3, twelve bracket plates 5 are secured radially to the periphery of the chuck wheel 4 by means of the bolts 6, and each bracket plate 5 supports a magnetic chuck 7 diagrammatically shown and secured thereto by means of the bolts 8. The chucks 7 are electrically connected by means of the conductor cables 9 with an electric current distributing ring or commutator ring assembly generally indicated by the

reference character 10 disposed centrally within the chuck wheel 4. Oil retainer washers or gaskets 11 are disposed over the cables 9 adjacent the chuck wheel 4 to prevent oil from seeping down onto the ring 10.

Each of the twelve magnetic chucks 7 is provided with work positioning and supporting pins 12 and 13, which cooperate with the magnetic property of the chuck for supporting a work piece 14 in position during the subsequent grinding operation. The chuck wheel 4 is slowly rotated by means of an electric motor 33 and interconnected gearing hereinafter more fully described. As the chuck wheel 4 rotates, the magnetic chucks 7 are adapted to be individually energized and deenergized by means of the commutator ring assembly 10, which may be any conventional type of device for accomplishing the desired result. Such a commutator assembly should provide for energizing each chuck throughout a major portion of the rotation of said chuck wheel and for deenergizing the chuck throughout a minor portion of the rotation of the wheel. While the precise degrees of rotation of the periods of energization and deenergization are not critical, they will of course depend upon the design of the machine and may be varied to accomplish the desired result. In any event, the chucks should be deenergized as they move through the work loading and work removing station and be energized as they carry the work through the various grinding stations and throughout substantially the remaining portion of the chuck wheels' revolution, or until the chucks are again about to enter the work discharging station. Thus, for example, chucks 7 may be deenergized for 60 degrees of rotation and energized for the remaining 300 degrees of rotation, the deenergization affecting the three chucks 7 which are exposed for loading by the operator, being shown in Figs. 1 and 3 of the drawings and following the fourth chuck shown in a grinding position. Although the three chucks exposed for loading purposes are deenergized, the parts or work pieces 14 may continue to adhere to the chucks due to friction, and consequently a knock-off arrangement is preferably provided consisting of a push plunger 15 mounted in a countersunk hole 16 in each chuck and tensioned therein by a spring 17. As the chucks 7 rotate past the operator, the work pieces 14 may be released by pushing the plunger 15 inwardly, thereby knocking the work piece off of the chuck. Immediately thereafter, the operator may insert another work piece 14 to be ground.

While it has been indicated above that any suitable commutator ring assembly may be employed for the purpose of providing a means for energizing and deenergizing the magnetic chucks during rotation of the chuck wheel, there is illustrated in Figs. 11, 12 and 13 one form of commutator ring assembly that may be used for this purpose. The commutator ring assembly generally indicated by the reference character 10 in the illustrated form comprises two disc like members 110 and 118 formed of insulating material and suitably apertured for reception on the shaft 43 which carries the chuck wheel. Commutator disc 110 is adapted to be loosely mounted on the shaft 43 and preferably out of contact therewith said disc being fixed by means of the bolts 111 to a suitable bracket 120 carried by a fixed part of the machine frame so that the disc 110 will remain stationary while the shaft 43 and the chuck wheel carried thereby rotates. While the disc 110 is thus held stationary, the disc 118 is fastened or fixed to the shaft 43 in any suitable manner for rotation therewith in juxtaposition with respect to the stationary disc 110.

Disposed around one face of the disc 110 in concentric fashion are two metallic inserts 112 and 113 forming partial rings as will be clear from Fig. 12. The disc 118 is provided with a series of metallic spring contact plungers 119 arranged alternately in two concentric paths corresponding to and for cooperation with the commutator ring inserts 112 and 113, so that the ends of the spring urged metallic plungers will sweep over the ring inserts on the face of disc 110, when the disc 118 is rotated with reference to disc 110. If twelve magnetic chucks 7 are carried by the chuck wheel, then the disc 118 should carry twenty-four plungers 119—twelve pairs of plungers, one in each of the two concentric paths, one pair for each chuck, such as 119*a* and 119*b*.

The outer commutator ring 112 of the disc 110 is connected to the positive side of a suitable power source and extends through an arc of suitable length to accomplish the desired period of energization of the chucks during the rotation of the chuck wheel. The inner ring 113 is connected to the negative side of the power source and extends through an arc of similar length which leads the positive ring 112 by a suitable degree, such as 15° in a clockwise direction when viewing Fig. 12. It should be noted that the lead between each pair of contact plungers 119 is the same as the lead between the insert rings 112 and 113.

With the ring 112 connected to the positive side of the line and ring 113 connected to the negative side of the line, one spring contact plunger, such as plunger 119*a*, is connected to one side of a chuck magnet 7 and the next offset plunger, such as 119*b*, is connected to the other side of the same chuck magnet so that the rings 112 and 113 form a bridge which must be connected through the contact plungers in order to energize the chuck magnet.

Viewing Figs. 12 and 13, the two discs 110 and 118 are shown in a position corresponding to the position of the chuck wheel shown in Fig. 3. In this position spring contact plungers 119*a* and 119*b* would be electrically connected to the first chuck magnet 7 shown at the left of said Fig. 3. In this position the plungers 119*a* and 119*b* are out of contact with the rings 112 and 113 and consequently said chuck magnet is in a deenergized state. The magnet being in a loading position makes it necessary that it be deenergized. Assuming that the machine is running and a part has been positioned on this particular chuck, the disc 118 will be rotating with the chuck wheel in a clockwise direction and after approximately 30° of rotation after loading the plungers 119*a* and 119*b* will come into contact with the rings 112 and 113, respectively, to close the circuit and energize said chuck magnet by a circuit from the line, through ring 112, plunger 119*a*, chuck magnet 7, plunger 119*b* ring 113 to the other side of the line. The chuck magnet will remain energized during rotation of the chuck wheel through the grinding positions and into the unloading area until such time as the plungers 119*a* and 119*b* ride off of the ends of rings 112 and 113 and onto the insulating material of the disc 118 consequently breaking the circuit and deenergizing the chuck magnet.

Due to the residual magnetism left in the chuck magnet, it may be desirable, although not necessary, to provide means as shown in Fig. 12 for

aiding in the deenergization of the chuck magnets, such as a polarity reversing arrangement at the bottom of the disc 110. This comprises a separate metal insert 114 disposed in the path of the positive ring 112 but electrically connected to the negative ring 113 by means of a connecting insert 115. A further separate metallic insert 116 disposed in the path of the negative ring 113 is connected as at 117 to the positive side of the line. By virtue of such a construction when the plungers 119a and 119b ride over the inserts 114 and 116 the polarity of the magnet will be reversed and the magnet will be positively deenergized. After riding over the inserts 114 and 116, the deenergized chuck magnet continues in its movement with the wheel and again enters the loading zone where the work piece is removed and a new piece is inserted in the chuck and the cycle is repeated.

The chuck wheel drive

The means for rotating the chuck wheel 4 comprises an electric motor 33 secured to the top of the casing and frame 1 by means of the bracket 34. A gear reduction mechanism 35 is associated with the driving motor 33, which in turn rotates the shaft 36 disposed at right angles to the motor 33, and upon which a bevel gear 37 is secured. The bevel gear 37 drives a suitably supported spiral bevel gear 38 and cooperating clutch disk 38'. A clutch lever 39 is associated with a yoke lever 39', and when pushed forward actuates the yoke lever 39' to advance a clutch disk 40 to engage the clutch disk 38' thereby transmitting rotation to a gear 41, which in turn meshes with and drives a gear 42 secured to the shaft 43 and the chuck wheel 4 mounted thereon.

The grinding wheel supporting columns

The grinding machine is provided with a plurality of grinding wheel supporting columns, four of such columns being specifically embodied in this disclosure, two of which are disposed on the right-hand side of the chuck wheel 4 and bear the reference numeral 18, and the other two columns which are disposed on the left-hand side of the chuck wheel and being designated by the reference numeral 19, said columns being preferably positioned in staggered relationship with reference to the chuck wheel.

Each of the columns 18 and 19 is similarly constructed and carries a complete grinding unit comprising an electric motor and grinding wheel and additionally means for dressing the grinding wheel. Further there is associated with each of the columns means for adjusting the position of the grinding wheel, vertically, horizontally and angularly with reference to the presentment of the work by the slowly rotating chuck wheel 4, as will hereinafter be described.

Horizontal adjustment of grinding wheels

Each of the columns 18 and 19 is formed with a grooved base portion 20 which is slidably mounted upon and interlocks with a suitably flanged top portion of a guide column 21 which is supported by the combined casing and frame 1. Horizontal adjustment between said parts is effected by means of a micrometer adjusting screw 22 rotatably carried by the guide column 21 and driven by a crank 23 which cooperates with a threaded nut carried by the base 20 in a conventional manner. It will therefore be appreciated that on manual rotation of the screw 22 by means of crank 23 the base portion 20 of the columns 18 and 19 will be horizontally adjustable with reference to the fixed flanged guide columns 21 so as to move said columns 18 and 19, and consequently the grinding wheels carried thereby, to the desired operative position with reference to the work supported in the chucks of the rotatable chuck wheel 4.

Angular adjustment of grinding wheels

A plate 24, as best shown in Fig. 4 of the drawings, is slidably attached to each of the flanged columns 18 and 19 and has adjustably secured thereto a bracket 25 by means of bolts 26 which extend through elongated arcuate slots 27 in said bracket. Each bracket 25 in turn supports a complete motor driven grinding wheel unit, comprising a motor 28, grinding wheel 29 secured to the motor shaft 30 and suitable housing for the parts. By virtue of the manner of mounting the bracket 25 upon the plate 24 a tilting or angular adjustment of the grinding wheel with reference to the work is possible. A calibrated scale 31 in the form of an arc is provided upon the plate 24, whereby the angular inclination or tilt of the bracket 25 may be measured and set at the desired setting, after which the bracket is made fast to the plate 24 as will be fully understood.

A preliminary and rough longitudinal adjustment of the motor 28 and the grinding wheel 29 supported thereby may be made by loosening the bolts 32 on the bracket 25 to permit shifting of the grinding unit to bring the grinding wheel to the proper relative position with respect to the work pieces 14, after which the bolts 32 are tightened to maintain that position.

Vertical adjustment of grinding wheel

The several grinding machine units, as heretofore mentioned, are each carried by means of a bracket 25 on the plate 24, said plate being slidably mounted on the column 18 or 19 as the case may be. Vertical, or rather longitudinal movement of the plate 24 along said column is effected by manual rotation of crank 91, mounted at the outer end of the column, said crank being secured to a micrometer screw 92 journaled in the column and which is threaded through a threaded nut 92' secured to the plate 24. Consequently, on rotation of crank 91 grinding wheel 29 may be vertically adjusted with reference to the work 14 carried in the chuck 7. The adjustment is governed by micrometer dials generally indicated by the reference numeral 93 for gauging the height and depth of the cut to be made in the work pieces 14, and when the desired adjustment is secured, the parts may be securely fixed by means of suitable locking means manually operable by the handles 94.

A metal covering or guard 44 is preferably provided for each of the grinding wheels 29 to protect the operator of the grinding machine, the same being supported in any desired manner so as to be movable with the grinding wheel during adjustment of the latter. A preferred manner of mounting the guards 44 is shown in Fig. 4 and involves a laterally extending tubular supporting element on the guard snugly fitted over the housing for the shaft 30 of the grinding wheel assembly. The covering or guard 44 is additionally broken away at 44' to permit dressing of the grinding wheel 29 from above as will hereinafter be explained. Provision is also made for the removal of the dust and grindings by means of suction nozzles 45 secured by the bolts 46, or otherwise, to the coverings or guards 44,

the outlets from said nozzles or pipes 45 being connected to any conventional vacuum system (not shown).

It will be understood that the cross sectional shape of the grinding surface as well as the positioning of each of the grinding wheels 29 will be dependent upon the shape of the work pieces and the desired areas to be ground. After the work has been inserted in the chuck and the desired grinding wheels 29 mounted, said wheels may be easily adjusted to the desired position by the structure which has heretofore been described. On rotation of crank 23 the wheel 29 may be adjusted transversely or horizontally of the work 14. By adjustment of the bracket 25 with reference to plate 24 the wheel 29 may be angularly positioned with reference to the work 14. Vertical adjustment is affected by rotation of crank 91. Additionally a preliminary rough adjustment may be made by sliding the grinding wheel assembly transversely of the bracket 25. After the precise position for each grinding wheel has been determined the bolts 32 and 26 on the bracket 25 will be made secure, the sliding base 20 of the columns 18 and 19 will be locked to the guide column 21 and the sliding plate 24 will be locked to the columns 18 and 19, both locking means under the control of suitable crank elements 94. The machine is then ready for operation. The motors 28 of the four grinding wheels are started, the magnetic chucks 7 are energized, and the drive to the chuck wheel is engaged. The work pieces 14 to be ground are placed in the chucks 7 by the operator as the chuck wheel 4 slowly rotates. It will be understood that the chuck wheel will carry each work piece consecutively to each of the grinding wheels 29 where each wheel will grind a different surface on said piece. In the embodiment shown in the drawings four different surfaces on a single work piece will be ground on one setting of the piece during a complete revolution of the chuck wheel.

Dressing of grinding wheels

Periodically the surfaces of the grinding wheels 29 will become impaired by clogging and it is necessary to dress said surfaces by crushing a few thousandths of an inch of said surface and thus restore its peripheral face, the wheel dressers employed being shaped, of course, to the correct grinding wheel contour. In this connection, each of the columns 18 and 19 additionally support a vertically adjustable wheel dresser 47 which is driven by an electric motor 48, through the intermeshing train of gears 49, 50 and 51, the gear 51 being secured to the axle 52 upon which the wheel dresser 47 is mounted. In dressing a grinding wheel 29, the dressing wheel 47 is positioned with its supporting shaft 52 at right angles to a vertically disposed micrometer adjusting or feed screw 53 and with said shaft 52 parallel to the shaft 30 of the grinding wheel so that the dressing wheel when fed will move toward the grinding wheel with the respective peripheries of the two wheels in proper dressing relationship, as will be apparent from Fig. 4 of the drawings. The dressing wheel is moved by suitable means, hereinafter described, at a uniform slow rate radially into engagement with the grinding wheel 29 while the grinding wheel motor 28 is inoperative.

Feed of dressing units

The wheel dresser unit will be slidably mounted upon a dovetailed bed 54 carried by the columns 18 and 19 for feeding the dresser wheel 47 into and out of contact with the grinding wheel 29. The inward movement of the wheel dresser can be controlled, either by hand or by power, the latter being preferred as it enables the rate of feed into the grinding wheel to be determined exactly, the preferred rate of feed being .0002 inch per revolution of the grinding wheel 29.

Extending forwardly from the upper front face of the grinding machine casing and frame 1 are four micrometer dial feed devices 55. By referring to Fig. 9 of the drawings, it will be seen that each feed device 55 is supported upon a shaft 56 and may be coupled to a hand crank 57 by means of a clutch 58 which is engageable with the end of the shaft 56 at 59, thus enabling the operator of the grinding machine to adjust or rather feed the dresser wheel 47 by hand through connections hereinafter described on depression of the crank, engagement of the clutch and rotation of said crank. While the feed of the wheels 47 in the dressing operation may be completely made by this hand control as mentioned above, it is preferred to use the hand control for rapid initial adjustment of the dresser wheel into dressing position and to thereafter utilize the power feed mechanism, to be hereinafter described, for the actual dressing operation since said mechanism will control the feed at a much slower rate of movement and quite accurately.

Referring now to Figures 9 and 10 of the drawings, it will be seen that an electric motor 60 will be suitably mounted upon a bracket 62 supported by the casing or frame 1, and operates through a gear reduction mechanism 63 to drive or rotate the shaft 64 which is disposed at right angles to the electric motor 60. A bevel gear 65 secured to the shaft 64 meshes with and drives another bevel gear 66, which in turn drives a worm 67 and worm gear 68. A small spur gear 69 is attached to the worm gear 68 and drives an intermeshing spur gear 69' secured to the shaft 56.

The rotatable shaft 56 supports a bevel gear 70 on its other end which meshes with and drives a bevel gear 71 attached to a shaft 72. The adjacent ends of the shafts 56 and 72 are supported in the bearing bracket 73 secured to the casing or frame 1. Shaft 72 supports a bevel gear 74 on its upper end which meshes with and drives a bevel gear 74' mounted upon the rotatable shaft 75. Shaft 75 supports a bevel gear 75' which meshes with and drives the bevel gear 75'' on the lower end of the shaft 76 whose upper end extends through the supporting columns 18 or 19 upon which the wheel dresser unit is mounted, and supports the bevel gear 77 on the upper end. As seen in Fig. 7, the bevel gear 77 meshes with and drives another bevel gear 78 mounted on the shaft 79 which also supports a bevel gear 80 which meshes with and drives the bevel gear 81 mounted on the micrometer screw 53, the said screw 53 having cooperative engagement with a threaded nut carried by the bed upon which the dresser unit is mounted. Consequently as shaft 56 is rotated by either the motor 60 or by crank 57 a drive is effected through the recited gearing and connecting shafts to rotate the micrometer screw 53 which in cooperation with the fixed nut carried by the dresser unit will feed the said dresser unit toward or away from the grinding wheels 29 depending on the direction of rotation of shaft 56.

The various interconnected shafts 56, 72, 75, 76 and 79 through which the drive to the dressing wheel feed screw 53 is effected are each suitably journaled in their respective housings by any suitable means such as bracket members gener-

ally designated by the reference numeral 73, as will be apparent from an inspection of Figs. 5 to 8.

To permit the horizontal adjustment of the columns 18 and 19 with reference to their supporting columns 21 while still maintaining the drive for radially feeding the dressing wheels 47 to the grinding wheels 29 through said columns as recited above, it will be understood that some form of sliding arrangement must be provided in said drive between columns 18 or 19 and 21. A preferred arrangement to accomplish this result is best illustrated in Figs. 5 and 8 of the drawing where it will be observed that shaft 75 suitably journaled in the supporting column 21 is provided with a key slot extending its entire length. Bevel gear 75' is keyed to shaft 75 so that said gear is driven thereby, but at the same time is capable of being longitudinally slidable along shaft 75 as column 19 and the attached bracket 73 is adjusted with respect to supporting column 21 in the horizontal positioning of the grinding wheel 29.

It will be understood that due to the different angular relationship of the four columns 18 and 19, and their supporting columns 21 with respect to the combined casing and frame 1 of the machine (the columns being staggered with respect to the chuck wheel 4), the gearing and connecting shafts from the motors 60 through the frame 1 and supporting columns 21 to the shafts 76 in columns 18 or 19, will be suitably modified and arranged to suit the requirements. This is quite clearly indicated in Figs. 5, 6 and 8 where the drive from shafts 56 through the casing 1 and supporting columns 21 to the keyed shafts 75 involve slight angular modifications to accommodate the particular configuration of parts and the angles involved, all of which will be understood by one skilled in the art.

In dressing each grinding wheel 29, the dressing unit is fed into immediate dressing position with the wheel 29, preferably by hand, as mentioned above. The drive motor for the dressing wheel is turned on and the micrometer dial feed device 55 is set away from an index mark by the number of graduations indicating the amount of radius to be removed from the wheel. The feed motor 60 is then energized and the dresser wheel is fed at a uniformly slow rate into the surface of the grinding wheel 29. The operator will observe the micrometer dial device 55, which has been set by means of set screws 82 to turn with shaft 56, and when said device 55 reaches the zero indication, the operator will stop the feed by cutting off the motor 60. The grinding wheel 29 will then have been dressed down the predetermined amount. Thereafter the grinding wheel 29 will be adjusted by its own micrometer adjusting screw 92 to compensate for its reduced radius. On retraction of the dressing wheels by hand, the machine will be ready for further grinding.

The several motors employed in the machine and involving grinding wheel motors 28, dresser wheel drive motors 48, dresser wheel feed motors 60 and chuck wheel drive motor 33, will be individually controlled by a plurality of localized switches 95 suitably mounted upon the top of the casing or frame 1 and conventional associated circuits.

While the preferred embodiment of the instant invention has been illustrated and described, it will be understood that it is not intended to limit the scope of the invention thereto, as many minor changes in detail of construction may be resorted to without departure from the spirit of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. An automatic grinding machine including a supporting casing and frame, a rotatable magnetic chuck supporting wheel mounted thereon, a plurality of individual magnetic work holding chucks mounted on the periphery of said wheel, grinding wheel supporting columns on said casing and frame at the opposite sides of said chuck supporting wheel, means for continuously energizing said magnetic chucks throughout a major portion of each complete revolution of said chuck supporting wheel, said means including means for deenergizing said chucks during the remaining portion of each revolution of said wheel, means for rotating said chuck supporting wheel, and motor driven grinding wheels adjustably supported on said columns.

2. The subject matter as claimed in claim 1 and work knockoff means carried by said magnetic chucks whereby the work may be conveniently removed from said chucks during the period of their deenergization.

3. An automatic grinding machine including a supporting casing and frame, a rotatable magnetic chuck supporting wheel mounted thereon, a plurality of individual magnetic work holding chucks mounted on the periphery of said wheel, grinding wheel supporting columns on said casing and frame at the opposite sides of said chuck supporting wheel, means for energizing said magnetic chucks through a part of each complete rotation of said chuck supporting wheel, means for rotating said chuck supporting wheel, motor driven grinding wheels supported on said columns and means for adjusting said grinding wheels vertically and horizontally with reference to said magnetic chucks.

4. An automatic grinding machine including a supporting casing and frame, a rotatable magnetic chuck supporting wheel mounted thereon, a plurality of individual magnetic work holding chucks mounted on the periphery of said wheel, grinding wheel supporting columns on said casing and frame at the opposite sides of said chuck supporting wheel, means for energizing said magnetic chucks through a part of each complete rotation of said chuck supporting wheel, means for rotating said chuck supporting wheel, motor driven grinding wheels supported on said columns and means for adjusting said grinding wheels vertically, horizontally and angularly with reference to said magnetic chucks.

5. An automatic grinding machine including a supporting casing and frame, a rotatable chuck supporting wheel mounted thereon, grinding wheel supporting columns on said casing and frame at the opposite sides of said chuck supporting wheel, means for rotating said chuck supporting wheel, motor driven grinding wheels supported on said columns, means for adjusting said grinding wheels with respect to the work carried in said chucks, means for horizontally adjusting the position of said columns with respect to the frame, motor driven dressing wheels adjustably carried by said columns for dressing said grinding wheels, a power source carried by said frame, a feed screw carried by each of said columns for moving said dressing wheels toward and away from the grinding wheels and means including a slidable connection for transmitting

the drive from said power source through said frame and columns to said feed screws.

6. An automatic grinding machine including a supporting casing and frame, a rotatable magnetic chuck supporting wheel mounted thereon, a plurality of individual magnetic work holding chucks mounted on the periphery of said wheel, grinding wheel supporting columns on said casing and frame at the opposite sides of said chuck supporting wheel, means for energizing said magnetic chucks through a part of each complete rotation of said chuck supporting wheel, means for rotating said chuck supporting wheel, motor driven grinding wheels supported on said columns, means for adjusting said grinding wheels with respect to the work carried in said magnetic chucks, means for horizontallly adjusting the position of said columns with respect to the frame, motor driven dressing wheels adjustably carried by said columns for dressing said grinding wheels, a power source carried by said frame, a feed screw carried by each of said columns for moving said dressing wheels toward and away from the grinding wheels and means including a slidable connection for transmitting the drive from said power source through said frame and columns to said feed screws.

7. An automatic grinding machine including a supporting casing and frame, a rotatable magnetic chuck supporting wheel mounted thereon, a plurality of individual magnetic work holding chucks mounted on the periphery of said wheel, grinding wheel supporting columns on said casing and frame at the opposite sides of said chuck supporting wheel, means for energizing said magnetic chucks through a part of each complete rotation of said chuck supporting wheel, means for rotating said chuck supporting wheel, motor driven grinding wheels supported on said columns, means for adjusting said grinding wheels with respect to the work carried in said magnetic chucks, motor driven dressing wheels carried by said columns for dressing said grinding wheels, means for feeding said dressing wheels into operative engagement with said grinding wheels to dress the same, said last mentioned means including hand operated means for initially moving the dressing wheels rapidly into dressing position and motor operated means for thereafter slowly feeding the dressing wheels into engagement with the surfaces of the grinding wheels to crush the surface thereof a predetermined amount.

8. An automatic grinding machine including a supporting casing and frame, a rotatable magnetic chuck supporting wheel journaled therein, a plurality of magnetic work holding chucks mounted on the periphery of said wheel, means for rotating said chuck wheel, means for energizing said magnetic chucks through a major part of each complete revolution of said chuck wheel and for deenergizing said chucks during the remainder of said revolution, a plurality of supporting columns carried by said frame on opposite sides of said chuck wheel, motor driven grinding wheels carried by said columns for engagement with the work carried in the chucks of said wheel, means for adjusting the vertical and angular position of said motor driven grinding wheels with reference to said columns, and means for horizontally adjusting said columns with respect to said frame.

9. An automatic grinding machine including a supporting casing and frame, a rotatable magnetic chuck supporting wheel journaled therein,

a plurality of magnetic work holding chucks mounted on the periphery of said wheel, means for rotating said chuck wheel, means for energizing said magnetic chucks through a major part of each complete revolution of said chuck wheel and for deenergizing said chucks during the remainder of said revolution, a plurality of supporting columns carried by said frame on opposite sides of said chuck wheel, motor driven grinding wheels carried by said columns for engagement with the work carried in the chucks of said wheel, means for adjusting the vertical and angular position of said motor driven grinding wheels with reference to said columns, means for horizontally adjusting said columns with respect to said frame, motor driven dressing wheels carried by said columns, and selective manual and motor driven means for feeding said dressing wheels into operative engagement with said grinding wheels to dress the same irrespective of the horizontal adjustment of said columns.

10. The subject matter as claimed in claim 9 wherein said means permitting operation of said dressing wheel feeding means irrespective of the horizontal adjustment of said columns with respect to the frame includes a slidable keyed connection.

11. The subject matter as claimed in claim 9 wherein said motor driven means for feeding the dressing wheels includes a source of power carried by said frame, a feed screw carried by each of said columns and means including a slidable connection for transmitting the drive from said power source through said frame and columns to said feed screws.

12. An automatic grinding machine including a rotatable wheel, a plurality of radially disposed individual magnetic work supporting chucks mounted on the periphery of said wheel, means for rotating said wheel, and a plurality of grinding means carried by said machine and positioned with reference to the periphery of said wheel for consecutive grinding operation upon each piece of work as the wheel is rotated whereby a plurality of surfaces on each piece of work may be ground on a single revolution of said wheel, means for successively energizing each magnetic work supporting chuck as it leaves a work loading and discharging station and maintaining each chuck continuously energized throughout the major portion of each revolution of the wheel, and means for successively deenergizing each chuck upon its return to said station.

RALPH E. McCOY.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
773,612	Wallace et al.	Nov. 1, 1904
1,026,350	Greene	May 14, 1912
1,043,973	Schesch	Nov. 12, 1912
1,548,562	Spencer	Aug. 4, 1925
1,753,448	Smith	Apr. 8, 1930
1,886,699	Larson	Nov. 9, 1932
2,076,808	Bryant	Apr. 13, 1937
2,222,580	Bergfeldt	Nov. 19, 1940
2,385,644	Polk	Sept. 25, 1945

FOREIGN PATENTS

Number	Country	Date
117,606	Australia	Oct. 21, 1943