

[72] Inventor **James W. Fogle**
Walkerton, Ind.
 [21] Appl. No. **815,069**
 [22] Filed **Apr. 10, 1969**
 [45] Patented **Sept. 14, 1971**
 [73] Assignee **The Wheelabrator Corporation**
Mishawaka, Ind.

2,240,246 4/1941 Hammell 51/9
 2,263,321 11/1941 Unger 51/9
 2,953,876 9/1960 Zieber et al. 51/8
 3,138,900 6/1964 Greenberg et al. 51/9

Primary Examiner—Lester M. Swingle
Attorney—McDougall, Hersh & Scott

[54] **BLAST MACHINE WITH AUTOMATIC BLAST
 WHEEL POSITIONER**
 12 Claims, 11 Drawing Figs.

[52] U.S. Cl. 51/9, 51/14
 [51] Int. Cl. B24c 3/14
 [50] Field of Search 51/9, 8, 14,
 15

[56] **References Cited**
UNITED STATES PATENTS
 1,974,470 9/1934 Ruemelin 51/8
 2,224,647 12/1940 Grocholl 51/9
 2,231,951 2/1941 Rosenberger 51/9

ABSTRACT: This application discloses a blast machine which includes a turret movable in a vertical plane and rotatable in a horizontal plane. Mounted inside the turret are throwing wheels which are supplied from a source of surface-treating material. The turret is mounted in a wall of a blast chamber so that when a workpiece to be treated is inside the chamber the turret may be moved vertically and rotated horizontally to insure treatment of the entire surface of the workpiece. The workpiece may be mounted on a carriage and moved to different positions within the chamber. The application also discloses an automatic control system so that the motions of the turret and the carriage may be controlled by a program stored on a data storage medium.

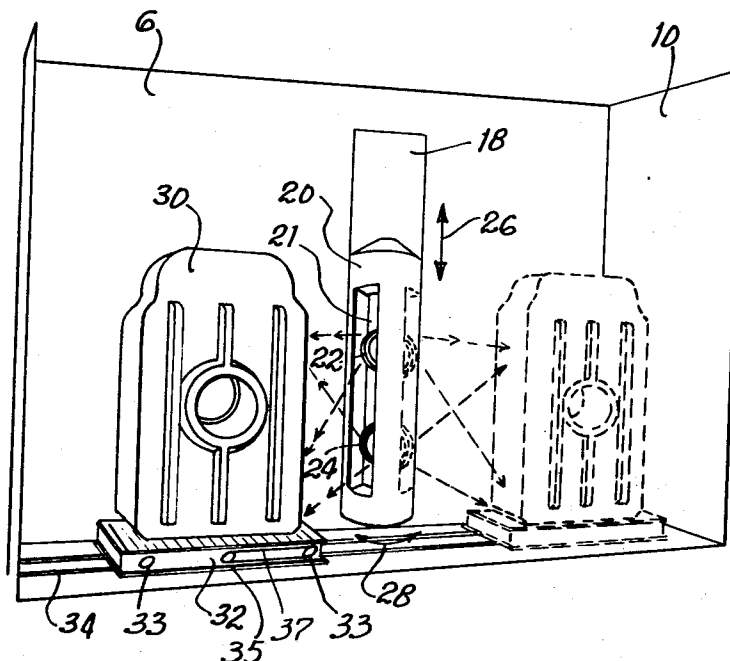


FIG. 1

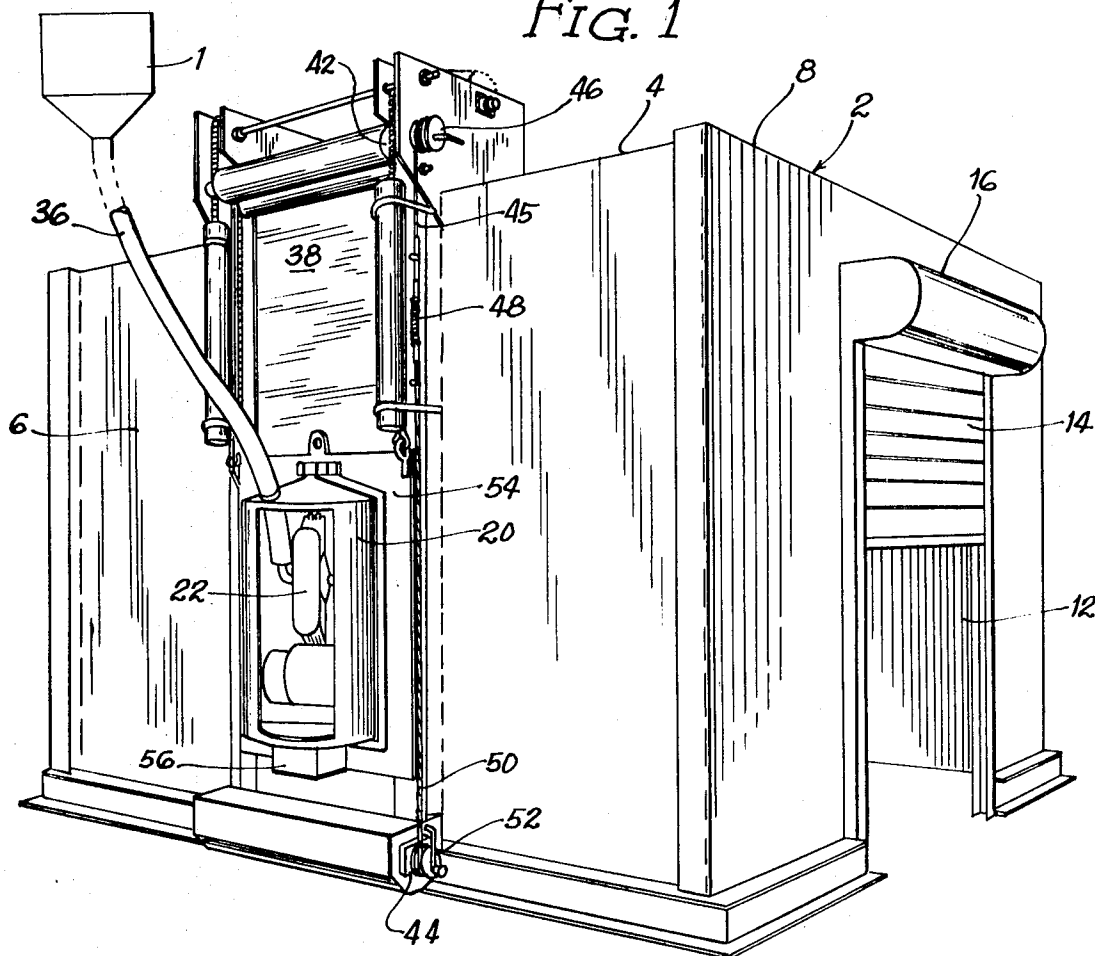
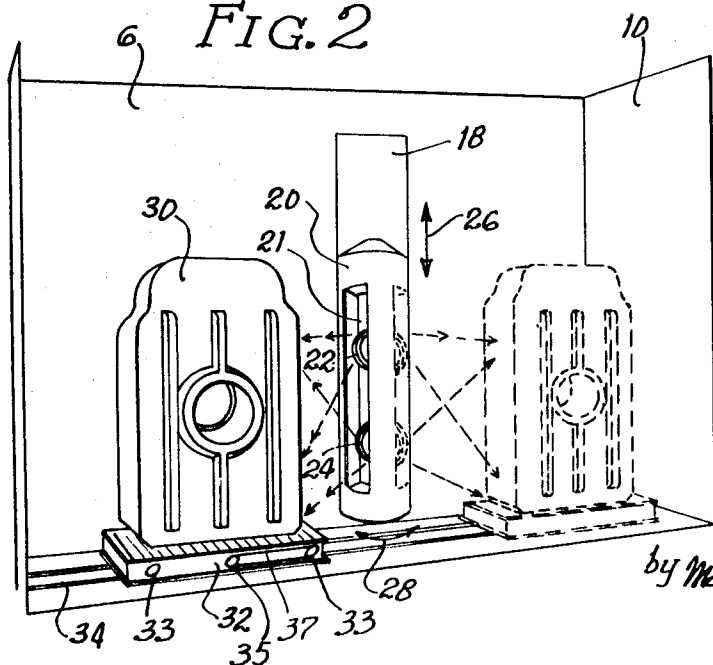
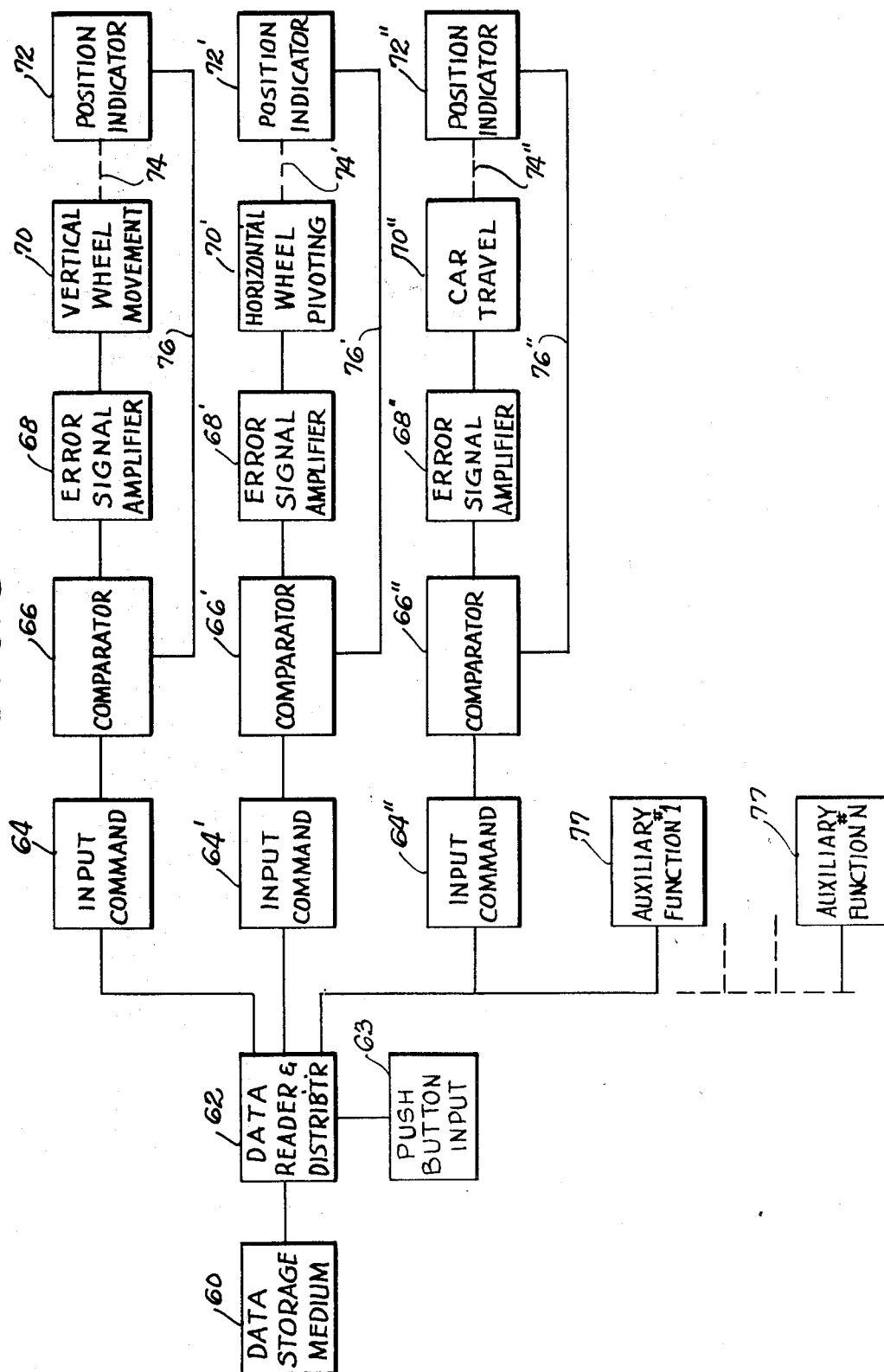


FIG. 2



INVENTOR
James W. Fogle
by McDougall, Hersh, Scott
and Ladd Attys

FIG. 3



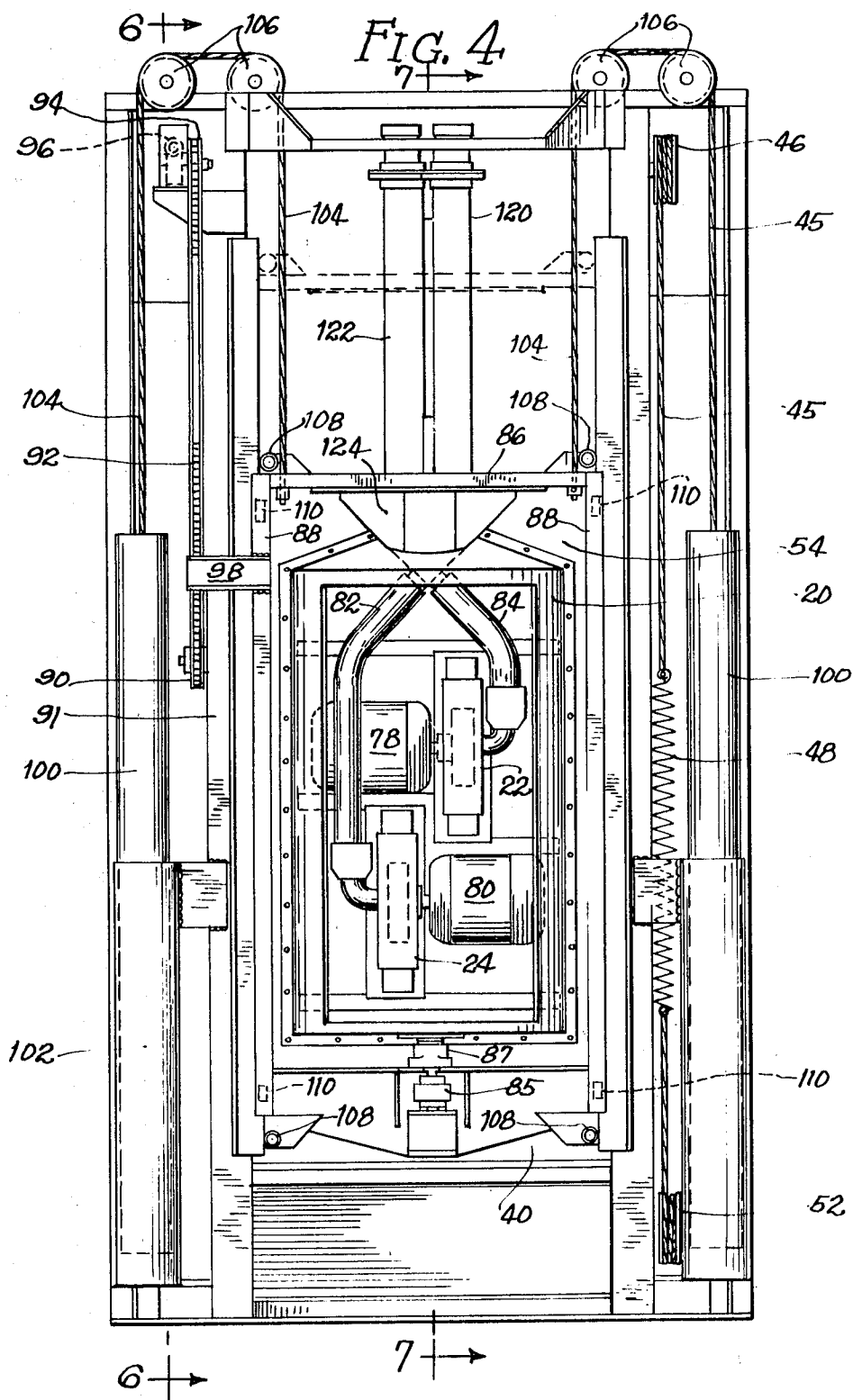


FIG. 5

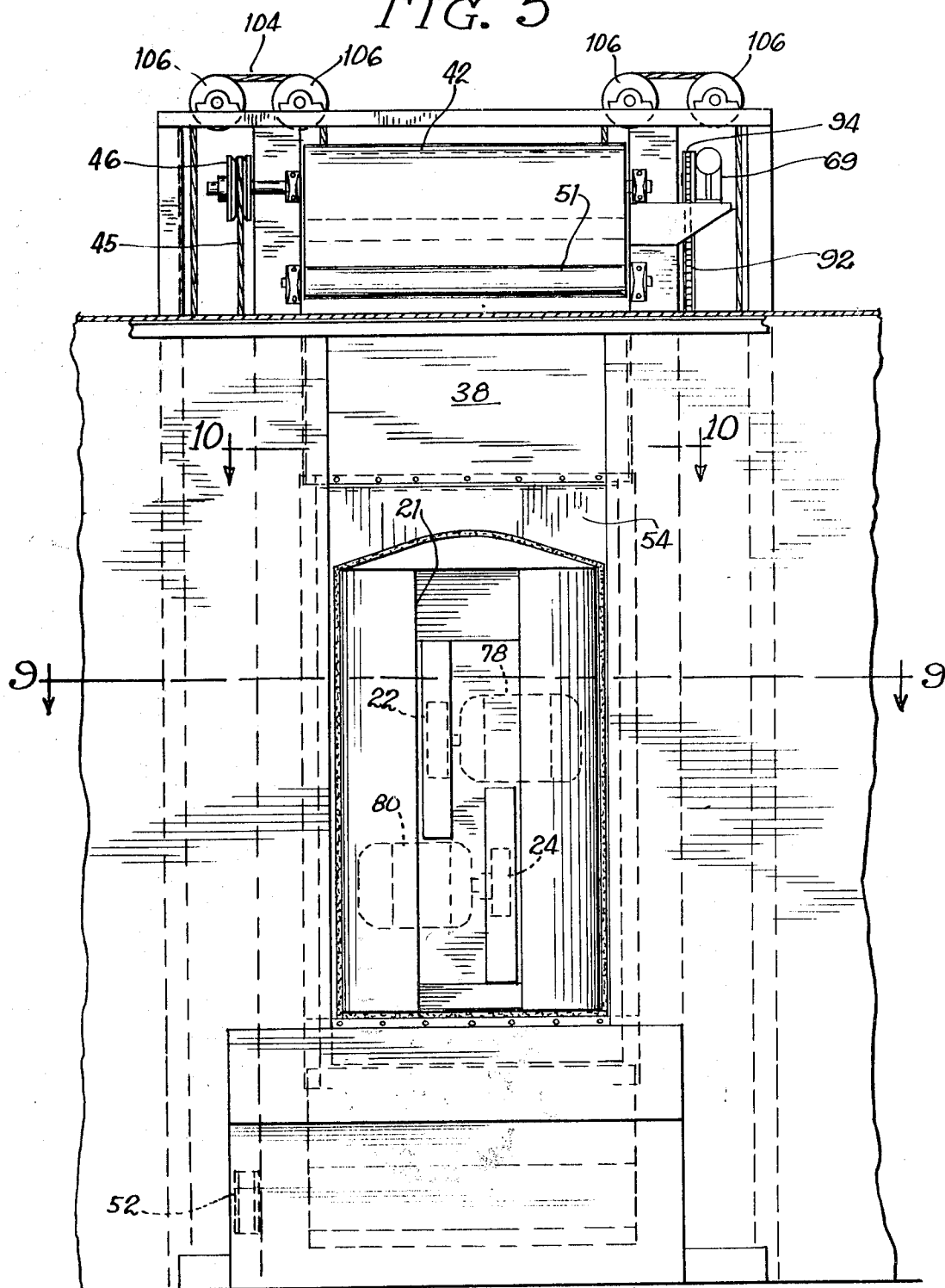


FIG. 6

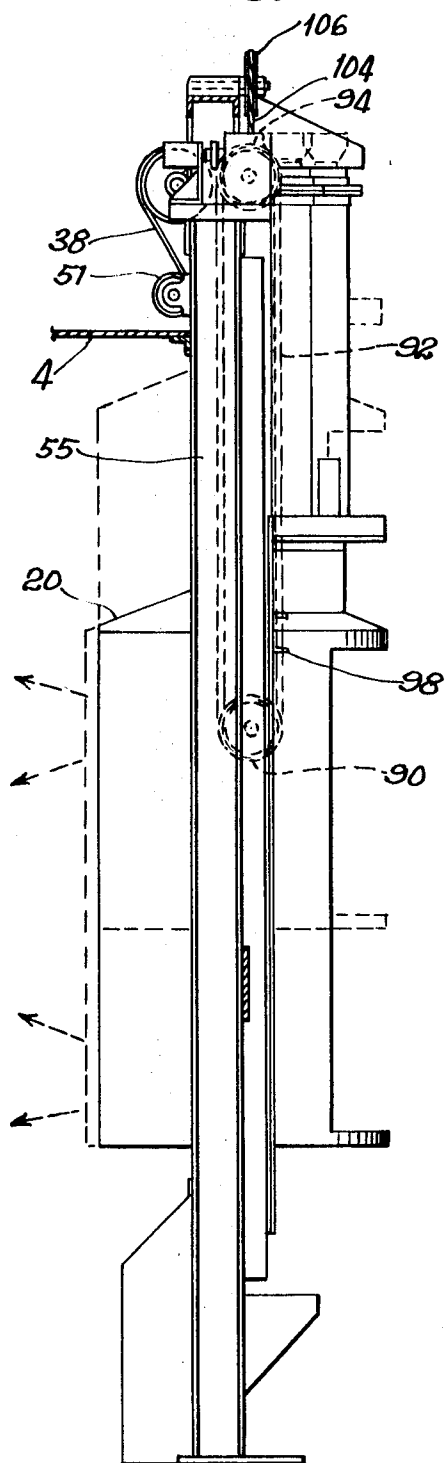


FIG. 7

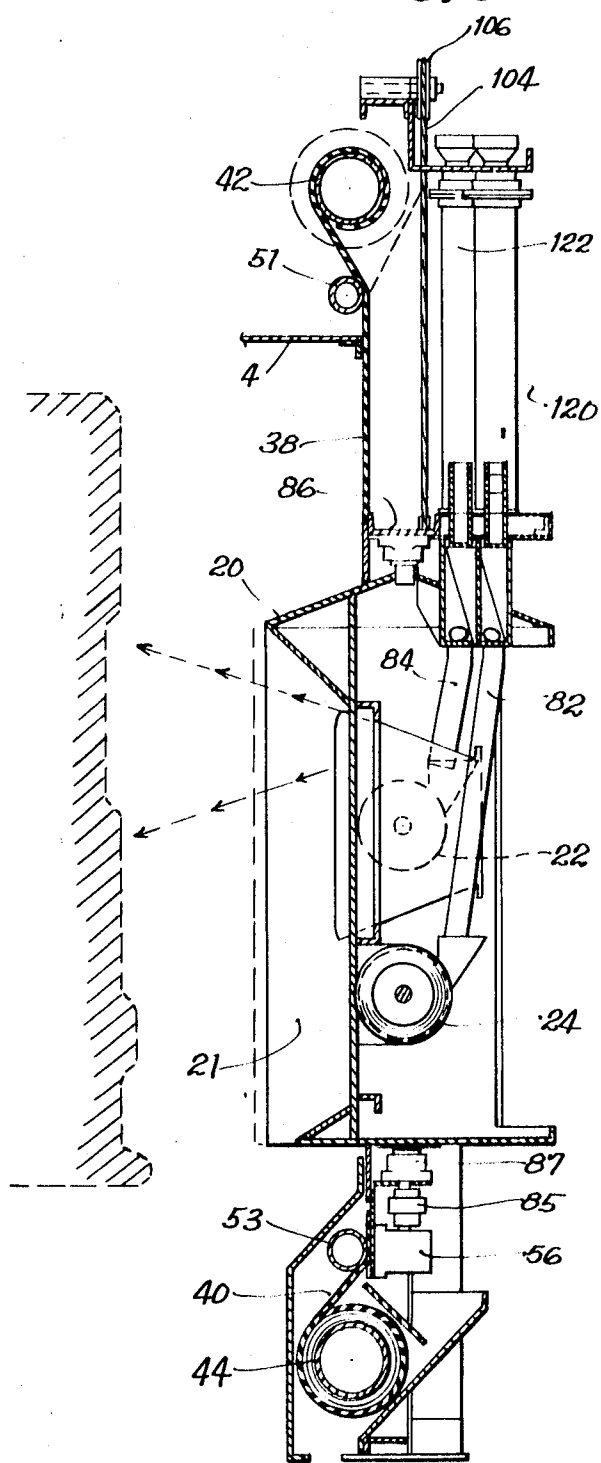


FIG. 8

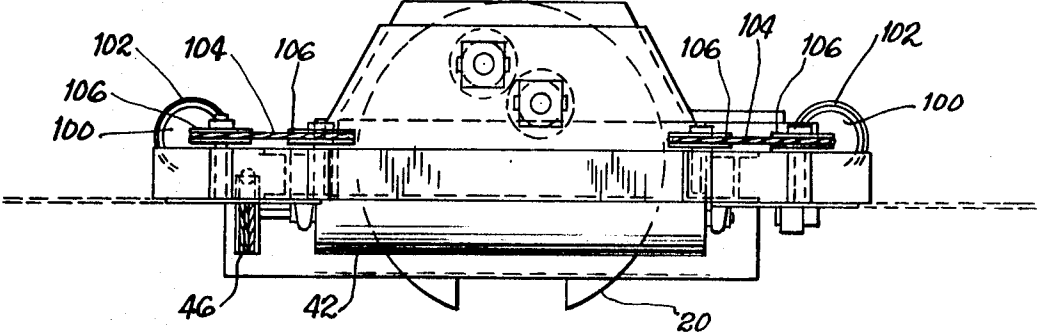


FIG. 9

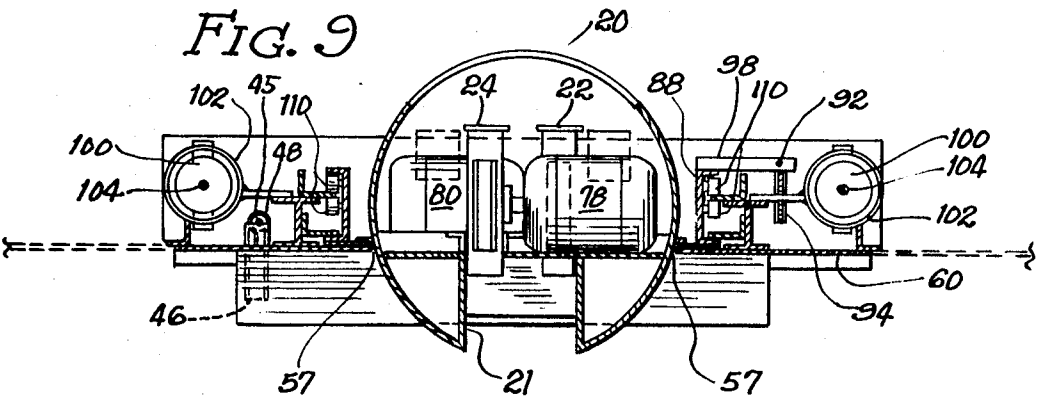


FIG. 10

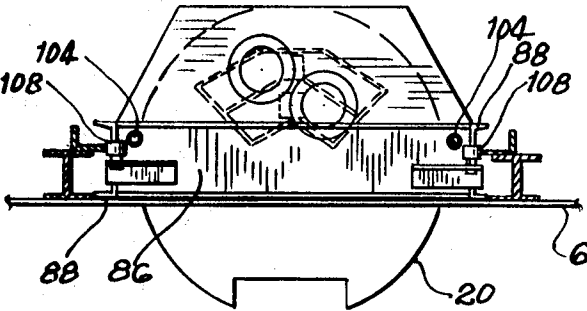
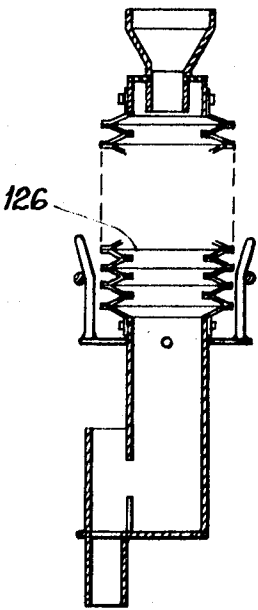


FIG. 11



BLAST MACHINE WITH AUTOMATIC BLAST WHEEL POSITIONER

BACKGROUND OF THE INVENTION

This invention relates to surface-treating apparatus. More specifically, it relates to such apparatus using throwing wheels to propel surface-treating material against a workpiece.

Machines for the treatment of the surfaces of fabricated metallic workpieces which blast or propel dry abrasive or other particulate material against those surfaces in order to clean, surface-harden, shot-peen or for producing matte or like finishes are in common use in industry. These machines usually include as basic elements a chamber in which the workpiece is disposed during treatment, a source of treating material and a throwing wheel connected to that source for propelling treating material against the surface of the workpiece.

Such machines are frequently called upon to handle workpieces of a large variety of shapes and sizes. Heretofore, the ability of a machine to have a great flexibility and versatility has been primarily dependent upon constructing the machine with a large number of throwing wheels mounted at different locations in the chamber and used selectively either singly or in various combinations to ensure treatment of the entire surface of a workpiece of unusual size or complexity. A machine so constructed is relatively complex and expensive to build and maintain. In addition, it has been found in a number of situations that it has not been possible to achieve the quality of treatment, be it cleaning or whatever, desired.

Therefore, it is an object of this invention to provide a novel surface-treating machine which while relatively simple in construction is very flexible and versatile with regard to kinds of workpieces that may be handled.

This and other objects of the invention are achieved in one embodiment of the invention by providing that there be relative movement between a workpiece and the throwing wheel or wheels with a number of degrees of freedom to ensure complete treatment of the entire surface of the workpiece. In another aspect of the invention a programmed automatic control is provided to minimize the need for operator intervention and to further enhance the machine's flexibility.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention and its various aspects for purposes of exemplification are described and shown in the accompanying drawing in which:

FIG. 1 is an isometric view of a surface-treating machine in accordance with the invention;

FIG. 2 is a schematic illustration of the interior of a surface-treating machine embodying the invention;

FIG. 3 is a block diagram illustration of an automatic program control in accordance with the invention;

FIG. 4 is a front view of a portion of a surface-treating machine in accordance with the invention;

FIG. 5 is a back view of the same portion of a surface-treating machine in accordance with the invention;

FIG. 6 is a view along the line 6-6 of FIG. 4;

FIG. 7 is a view along the line 7-7 of FIG. 4;

FIG. 8 is a top view of the apparatus shown in FIG. 4;

FIG. 9 is a view along the line 9-9 of FIG. 5;

FIG. 10 is a view along the line 10-10 of FIG. 5; and

FIG. 11 is an illustration of an alternative embodiment of an aspect of the invention

DETAILED DESCRIPTION

Referring first to FIGS. 1 and 2, it may be seen that a surface-treating machine embodying the invention comprises a chamber 2 having a top 4 and four sidewalls, three of which, 6, 8 and 10, are shown in these figures. In order to move the workpiece to be treated into the chamber 2, the sidewall 8 may be provided with a door opening 12. The door opening

may be closed by a rollup door 14 ranged to roll and unroll from a housing 16 across the upper end of the door opening 12.

In accordance with the invention, an opening 18 is provided in the sidewall 6. Mounted for up and down movement in this vertically extending opening is a housing or rounded turret 20. As may be seen particularly in FIG. 2, the turret 20 is provided with an opening 21 into the chamber and has mounted therein a pair of throwing wheels 22 and 24 which are used to propel surface-treating material against the surface of a workpiece being treated. It should be understood that whereas the embodiment illustrated and described has only one such opening 18 and turret 20, it is within the scope of the invention to provide more than one such opening and turret as, for instance, in the end wall 10 and sidewall (not shown) opposite the sidewall 6. Likewise, the number of throwing wheels in a turret may be varied so that one or more, as determined by a designer, may be used.

In addition to its up and down movement, as indicated by the arrow 26, the turret 20 is also arranged to be rotated or oscillated through a portion of a circle, as indicated by the arrow 28 so that the surface-treating material may be directed to any portion of the chamber as desired in order to cover the entire surface of the workpiece.

Movement of a workpiece, as represented by reference numeral 30, may be effected by providing a wheeled carriage 32 movable on tracks 34 so that the workpiece may be placed on the surface of the carriage and carried into the chamber and positioned in various locations therein as required. Movement of the carriage 32 may be provided for by means of the wheels 33, one set of which may be driven by a motor 35 connected thereto by any suitable transmission means such as the belt drive 37 shown.

Thus, FIG. 2 illustrates the range in vertical positions of the turret 20 and consequently the throwing wheels 22 and 24 and the range of rotating movement which may be achieved. Likewise, this Figure illustrates in solid and dotted lines the various positions the workpiece on the carriage 32 may assume.

Surface treating material may be supplied to the throwing wheels to be propelled against the surface of the workpiece by means of a flexible connection 36 from a reservoir or supply of such material. A more detailed showing of the manner in which a connection may be made from the supply of throwing material to the throwing wheels appears in subsequent figures and will be described in connection with those figures. It is not believed necessary to describe in detail the manner in which such treating machines recover the surface-treating material after it has been propelled by a wheel and return it to the reservoir for reuse for such means are well known in the art and are conventional elements in blasting machines.

In order to maintain the opening 18 sealed against the possible expulsion of surface-treating material from the interior of the chamber 2, there is provided a pair of roller curtains 38 and 40. One end of the roller curtain 38 is attached to the upper end of the turret 20 while its other end is attached to a roller 42 mounted in suitable supporting means on the top of the chamber 2. Likewise, one end of the roller curtain 40 is attached to a lower end of the turret 20 while its other end is attached to a roller 44 mounted at the bottom of the housing. A flexible cable 45 is wound on a reel 46 on the same shaft as the roller 44 but in a direction opposite to that in which the roller curtain 38 is wound. The free end of the cable 45 is connected to a coil spring 48 which in turn has its free end connected to another cable 50 wound on a reel 52 fixed to the same shaft as the roller 44 but wound in an opposite direction. By virtue of this arrangement tension is maintained on the rollers 42 and 44 to maintain the roller curtains taut and flush against the sides of the opening 18 to provide a sealing means to prevent treating material from being expanded from the chamber. Thus, as the turret 20 moves upwardly, the roller curtain 40 is unwound from the roller 44 as the cable 50 is wound on the

reel 52. At the same time the roller curtain 38 is wound on the roller 42 while the cable 45 is unwound from the reel 46.

As may be seen in FIGS. 5 and 7, guide rollers 51 and 53 are rotatably mounted on a supporting member 55 to press the sealing curtains inwardly against the sides of the opening 18 to maintain their seal.

In order to provide for the vertical and rotating movement of the turret 20 in the opening 18, the turret is pivoted in a frame 54 which is arranged to be lifted by a means to be described subsequently in connection with FIG. 4. As best seen in FIG. 9, a wiper seal 57 is provided in the frame 54 for the same purpose as roller curtains 38 and 40. The rotating movement of the turret 20 is permitted by pivoting it at its upper and lower ends to the frame 54 and is effected by providing a motor 56 connected to the lower pivot which motor is arranged to be driven in two directions so as to provide for oscillation of the housing as desired.

In the use of the invention a workpiece is positioned on the carriage 32 and the carriage is driven by the motor 35 thereon the interior of the chamber 2. Then, in accordance with a program, surface-treating material is supplied to the throwing wheels 22 and 24 to cause them to be propelled against the surface of the workpiece. Depending on the configuration and size of the workpiece the turret 20 may be rotated and lifted and lowered as desired. Likewise, the carriage 32 may be moved within the chamber to the extent necessary to insure treatment of the entire surface of the workpiece.

While all of these functions may be controlled manually by an operator in attendance on the machine, its versatility and flexibility can be considered enhanced by providing it with an automatic programming control as shown in FIG. 3. Such control may include a data storage medium 60 containing a program for the treatment of a particular workpiece. Such a data storage medium could be constituted by magnetic tape, punched tape or punched cards on which the information stored could be numerical information representing desired positions for the vertical and horizontal movement of the turret 20 and the position of the carriage 32. This numerical information could represent a distance in feet and inches or any other desired unit of measurement from some referred point. Alternatively, if extreme precision from the positioning of the turret 20 and carriage 32 is found to be unnecessary, the numerical information could represent merely arbitrarily assigned positions for each of these motions. The sequence in which the data appeared on the data storage medium would represent the program of positions desired for the turret 20 and carriage 32 and could include an additional command indicating how long these elements are to remain in the position commanded. The sequence in which these commands, that is, position and time, appeared on the data storage medium, would then constitute a program determined to be that necessary to provide the desired treatment for a particular workpiece. After use, it could, of course, be stored and reused if a workpiece of the same size and configuration were treated at some subsequent time.

The contents of the data storage medium are read or sensed by a data reader 62 and distributed to the various control channels by a distributor constituting a part of the data reader. As may be seen, a control channel is provided for each motion desired to be controlled. Since each of these channels are similar only one will be described in detail and those elements in the other channels which correspond will be given the same reference numeral distinguished by a' or a'' .

A position and time command, if such be included as part of the program, is supplied to an input command stage 64. These commands may be in the form of electrical signals, either analogue or digital, representative of the vertical position desired for the turret 20 and the time it is to remain in that position. In addition to receiving command data from data reader and distributor 62, the input command stage may be constructed to have a manual input 63 provided by pushbuttons or dials to be manipulated by an operator. In this manner, both automatic and manual control may be provided. The

input command is supplied from the input command stage 64 as one input to a comparator stage 66. The other input to the comparator stage is derived from a position-indicating device 72 which may be connected in any number of ways to the motor driving the turret in its vertical movement or to the turret itself as represented by the block designated 70. If the system is electrical, the position indicator stage will provide an electrical signal representative of the actual vertical position of the turret and supply this signal via a feedback loop 76 as the other input to the comparator stage 66. The comparator stage, in the manner well known in the art, will compare the input command signal and the feedback signal representative of actual position to derive an error or difference signal which may, if necessary, be amplified by an error signal amplifier 68 and used to energize the vertical drive motor 70. This motor is selected to be a reversible motor and so it will be driven in one direction or the other depending upon the polarity of the error signal and at a rate depending upon the magnitude of that signal. As the error signal is reduced towards zero as the turret moves toward the commanded position, the magnitude of the error signal will decrease approaching zero so as to cease the energization of the motor 70. As indicated, the control channels for the horizontal motion of the turret and the position of the carriage are similar and operate in the same manner.

In addition to programming the position of the turret and carriage, information may also be stored on the data storage medium to control what might be termed auxiliary functions 77. Other operations of this character such as the supply of heated air or gases, if it is desired to perform the surface treatment in atmospheres of this character, may likewise be controlled from commands maintained in the data storage medium.

In further accordance with the invention, attention is directed to the remaining figures of the drawing which show in detail the construction of the turret and its associated structure and various embodiments of portions thereof.

As may be seen in FIG. 4, the throwing wheels 22 and 24 are mounted in the turret 20 and each has associated therewith a drive motor 78 and 80 respectively. The surface-treating material is supplied to each throwing wheel by tubes 82 and 84 extending downwardly.

A storage hopper 1 containing surface-treating material (not shown) is located on top of chamber 2. At the bottom of said storage hopper are two tubes. One of these tubes leads to telescoping tube 120 and the other to telescoping tube 122. These telescoping tubes contract and expand as turret 20 moves up and down. An auxiliary hopper 124 is located at the bottom of tube 120 which in turn is connected to tube 82. A similar auxiliary hopper is located under telescoping tube 122 which is connected to tube 84. Surface-treating material flows from the overhead storage hopper down through the telescoping tubes 120 and 122, through the auxiliary hoppers, through tubes 82 and 84 and into throwing wheels 22 and 24.

Instead of telescoping tubes 120 and 122 other flexible tubes could be used such as the bellows-type tube 126 shown in FIG. 11.

As may be more clearly seen in FIG. 4, rotation of the turret 20 is effected by the motor 56 which is connected through a suitable coupling 85 to a bearing structure 87 on which the turret is pivotally mounted.

The frame 54 includes a horizontal member 86 and a pair of downwardly depending members 88. A sprocket 90 is mounted on a vertical support 91 and trained thereover is a sprocket chain 92. The chain 92 is also trained over a sprocket 94 mounted on the shaft of a reversible motor 96. The free ends of the sprocket chain are connected to an angle member 98 secured to a frame member 88 so that as the motor 96 is energized the sprocket chain will raise and lower the frame 54 and along with it the turret 20.

In this embodiment in order to reduce the size of the motor required to raise and lower the turret 20, there is provided a pair of counterweights 100 movable in guides 102 secured to the side of the chamber. Each counterweight is connected by a

cable 104 and is trained over a pair of pulleys 106 and connected to the horizontal member 86 of the frame 54. To provide for the vertical stability of the frame in one plane there are provided guide rollers 108 at each side of the upper and lower ends thereof. Vertical stability for the frame and turret in the direction normal to the plane of the wall of the chamber is provided by the use of guide rollers 110 mounted on the vertically extending frame members 88 and engageable with the surface of brackets secured to the sidewall of the chamber.

It is to be understood that changes may be made in the details of construction, arrangement, and operation without departing from the spirit of the invention, especially as defined in the following claims.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. Surface-treating apparatus comprising: a treating chamber; means for transporting a workpiece having a surface to be treated into and within said chamber; means for moving said workpiece-transporting means; at least one wall of said chamber having an opening therein; a turret mounted in said opening and having a dimension less than the dimension of said opening and having a central axis movable vertically within said opening to the limits of said opening dimension; at least one throwing wheel mounted in said turret for propelling surface treatment material against the surface of a workpiece; means for supplying surface treatment material to said throwing wheel; means for moving said turret to the limits of said opening dimension; and means for rotating said turret about said central axis within said opening.

2. The surface-treating apparatus of claim 1 wherein said turret has an opening into the interior of said chamber to provide access for material propelled by said throwing wheel to the surfaces of the workpiece.

3. The surface-treating apparatus of claim 1 including extensible and contractable sealing means connected to opposite ends of said turret so that upon movement of said turret within said opening said sealing means will extend and contract to maintain the portions of said opening not occupied by said turret covered to prevent surface-treating material from coming out of said chamber.

4. The surface-treating apparatus of claim 3 wherein said sealing means comprises a pair of flexible curtains, each curtain having one end on a roller and the other end movable from said roller as to wind and unwind and cover and uncover exposed portions of said opening as said turret moves therein.

5. The surface-treating apparatus of claim 1 wherein said turret has rounded sides and an opening into the interior of said chamber and engaged opposite edges of said turret so that the turret opening faces entirely within said chamber.

6. The surface-treating apparatus of claim 1 wherein said turret has rounded sides and an opening into the interior of said chamber, extensible and contractual sealing means connected to opposite ends of said turret so that upon movement of said turret within said opening said sealing means will ex-

tend and contract to the positions of said opening not occupied by said turret covered to prevent surface-treating material from coming out of said chamber and to prevent the entry of undesired material into said chamber.

7. The surface-treating apparatus of claim 6 wherein said sealing means comprises a pair of flexible curtains, each curtain having one end on a roller and the other end movable from said roller as to wind and unwind and cover and uncover exposed portions of said opening as said turret moves therein.

8. The surface-treating apparatus of claim 1 in combination with means for controlling the movement and rotation of said turret within said opening and the movement of said workpiece-transporting means comprising: means for supplying input command signals representing the position desired for each motion of said turret and for said workpiece-transporting means deriving a signal representative of the actual positions of said turret and said workpiece-transporting means; means for comparing said input command signals and said actual position signals and producing difference signals; and means for producing motion command signals in response to said difference signals and supplying said signals to said turret-moving means, said means for rotating said turret and said means for moving said workpiece-transporting means to move said turret and said workpiece toward said desired positions.

9. The surface-treating apparatus of claim 1 including means for supplying surface-treating material to said throwing wheel; and expansible and contractual means interconnecting said supply means and said throwing wheel to provide a continuous supply of treating material to said throwing wheel as said turret moves and rotates in said opening.

10. The surface-treating apparatus of claim 1 wherein said means for moving said turret in said opening comprises a reversible motor mounted at the upper end, said opening and flexible means interconnecting said motor and said turret and said means for rotating said turret comprises a reversible motor connected to one end thereof.

11. The surface-treating apparatus of claim 10 including vertically movable counterweights connected to said turret.

12. The surface-treating apparatus of claim 10 in combination with means for controlling the movement and rotation of said turret within said opening and the movement of said workpiece-transporting means comprising: means for supplying input command signals representing the position desired for each motion of said turret and for said workpiece-transporting means deriving a signal representative of the actual positions of said turret and said workpiece-transporting means; means for comparing said input command signals and said actual position signals and producing difference signals; and means for producing motion command signals in response to said difference signals and supplying said signals to said housing turret means, said means for rotating said turret and said means for moving said workpiece-transporting means to move said turret and said workpiece-transporting means toward said desired positions.