No. 779,646. PATENTED JAN. 10, 1905.

G. GORTON.

GRINDING MACHINE.

APPLICATION FILED NOV. 9, 1903.

3 SHEETS—SHEET 1.

Fig. 1.

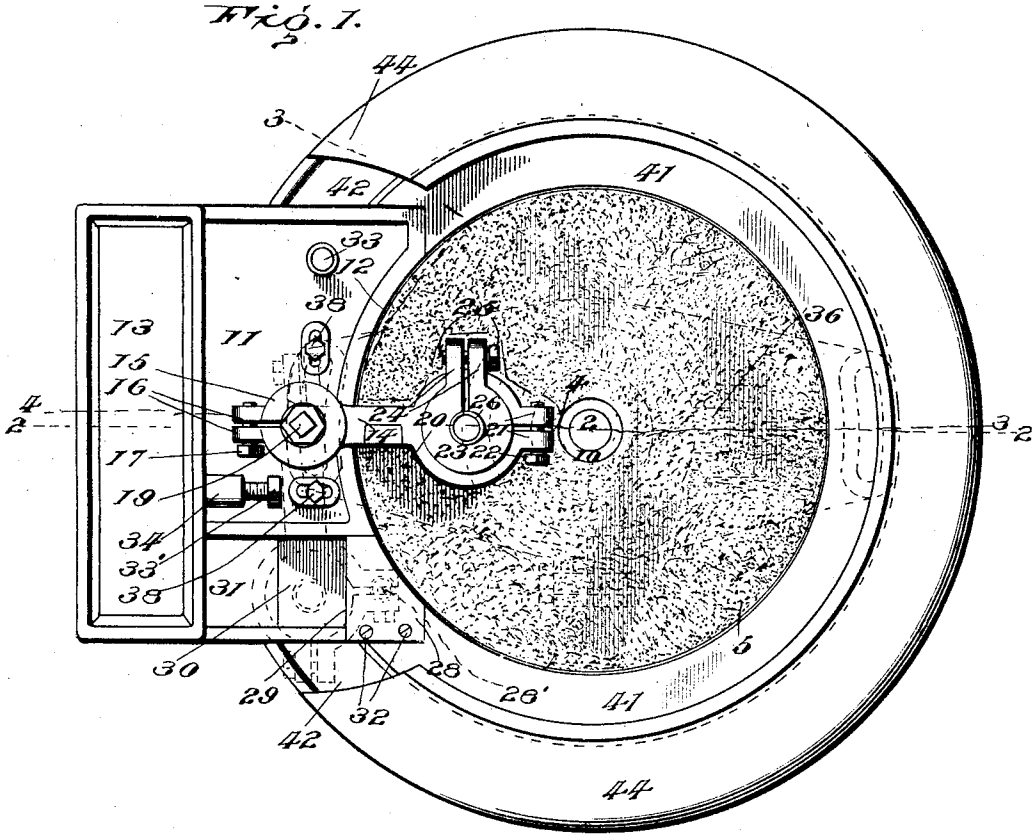
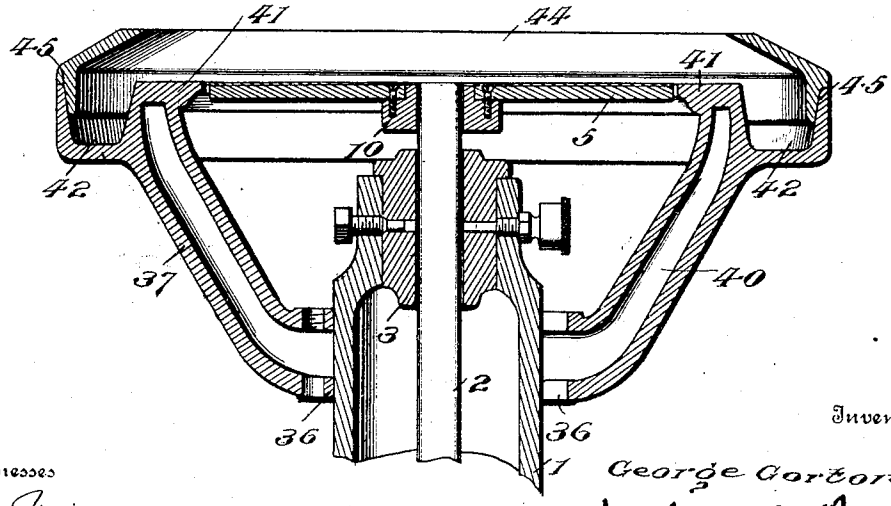


Fig. 3.



Witnesses

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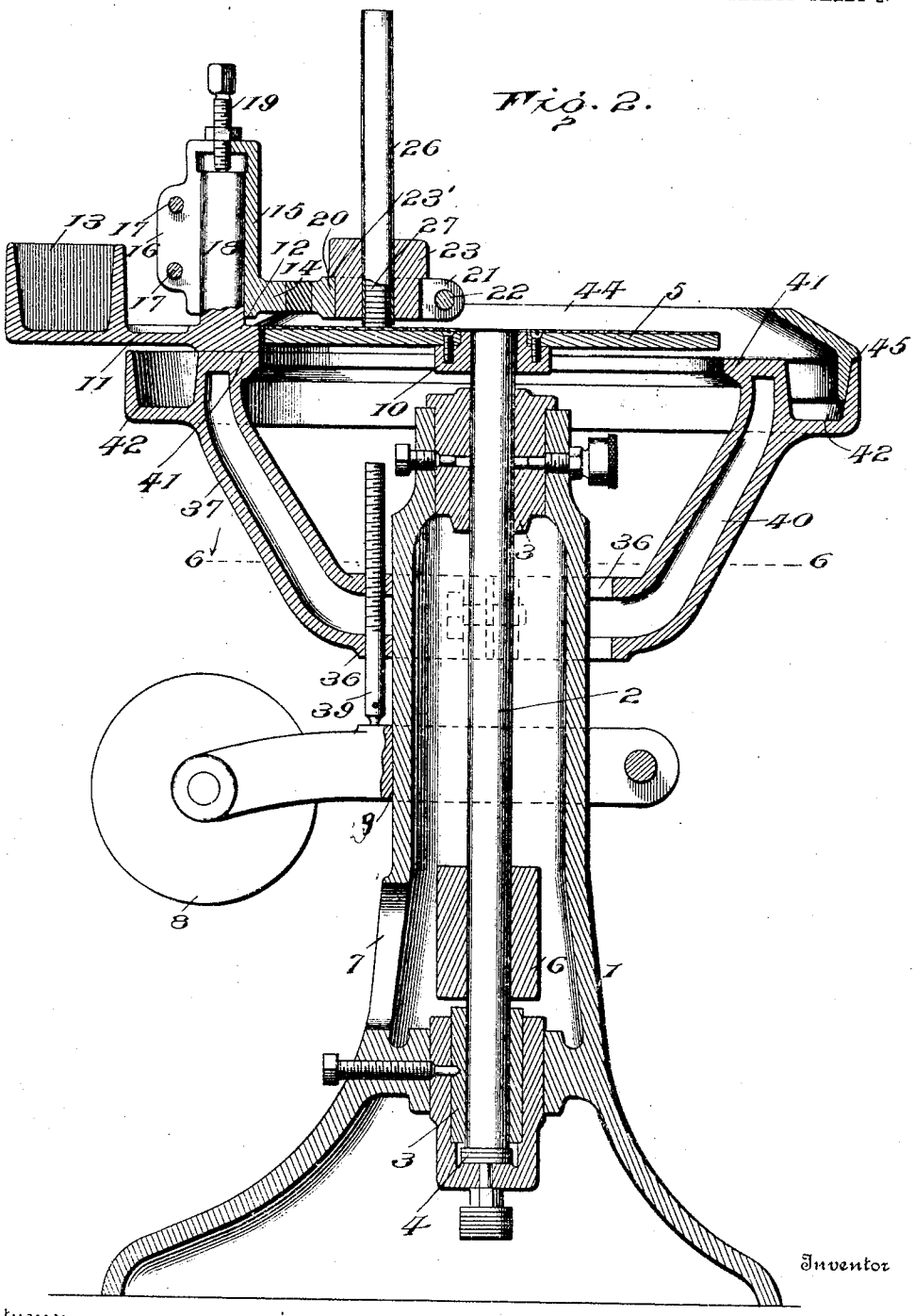
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3 SHEETS—SHEET 2.

Fig. 2.



Witnesses

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3 SHEETS—SHEET 3.

Fig. 4.

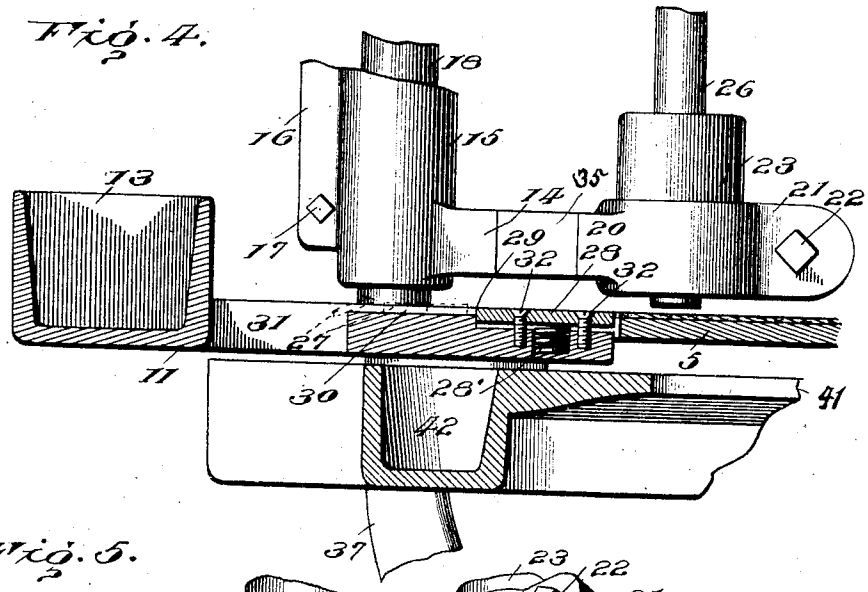


Fig. 5.

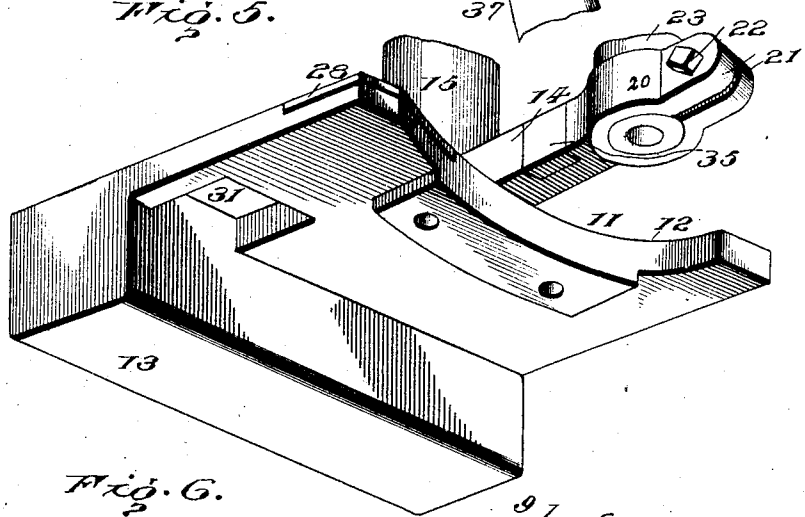
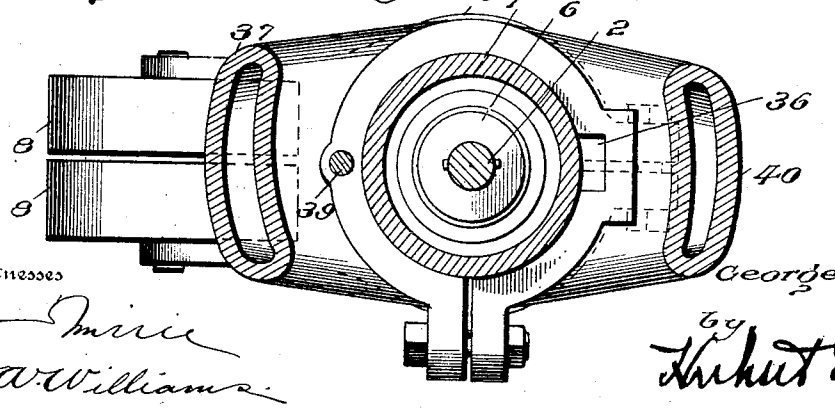


Fig. 6.



Witnesses

Inventor

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No. 779,646. Patented January 10, 1905.

UNITED STATES PATENT OFFICE.

GEORGE GORTON, OF RACINE, WISCONSIN, ASSIGNOR TO BUILDERS IRON FOUNDRY, OF PROVIDENCE, RHODE ISLAND.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 779,646, dated January 10, 1905.

Application filed November 9, 1903. Serial No. 180,398.

To all whom it may concern:

Be it known that I, GEORGE GORTON, a citizen of the United States, residing at Racine, Racine county, Wisconsin, have invented certain new and useful Improvements in Grinding-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain improvements in grinding-machines, and more particularly relates to what are generally termed in the trade "vertical-spindle grinding-machines."

An object of the invention is to provide improved means for feeding articles to be ground or polished to the grinding-surface and delivering the same one at a time from the grinding-surface, so that the flat faces of such articles can be ground at the angle or to the extent desired and can be fed to, held against, and removed from the grinding-surface without requiring the operator to bring his hands or fingers into dangerous proximity to the grinding-surface and without holding or handling the articles while heated by contact with the grinding-surface.

Another object of the invention is to provide improved means for preventing the escape of the metallic dust and the abrading-surface grit usually discharged by centrifugal action from the edge of the rapidly-rotating horizontally-disposed grinding-disk and to catch such dust and grit and collect the same, so that it can be gathered from the machine and utilized, if desirable.

The invention consists in certain novel features of construction and in combinations and in arrangements of parts, as more fully and particularly set forth and described hereinafter.

Referring to the accompanying drawings, which show a construction from among others within the spirit and scope of my invention merely as an example for purposes of illustration and explanation, Figure 1 is a top plan view of a vertical-spindle grinding-machine having the work-feeding device applied thereto and also showing a guard and dust-catching shield for the grinding-disk, dotted lines indicating the position of the work-magazine arm when at its limit of discharging swing. Fig. 2 is a vertical section in the plane of the line 2 2, Fig. 1. Fig. 3 is a vertical sectional view through the upper portion of the machine, the work-feeding device not being shown applied thereto. Fig. 4 is a detail vertical sectional view in the plane of the line 4 4, Fig. 1. Fig. 5 is a detail perspective view of the feeding attachment removed from the machine, portions being broken away. Fig. 6 is a cross-sectional view on the line 6 6, Fig. 2.

In the drawings, 1 is a suitable support, in the present instance shown in the form of a hollow pedestal having an enlarged base to rest on and be secured to the floor.

2 is the vertical rotary shaft or spindle arranged longitudinally within the pedestal and at its upper end projecting above the same to receive the horizontal grinding-disk 5. The spindle is mounted in the pedestal in any suitable manner and by any suitable means. In the specific example illustrated I show the same turning in boxes 3, confined in the pedestal, usually at or near the end portions of the spindle, with the lower end of the spindle mounted on or in a step-block 4.

6 is a driven pulley rigid on the spindle opposite an opening 7 through the pedestal to permit passage of the driving-belt to and from said pulley 6.

8 represents two idler-pulleys which can be employed, if necessary, to guide the driving-belt where it changes from the vertical to the horizontal to pass into the pedestal and around pulley 6.

The pulleys 8 are mounted on a horizontal axis or shaft carried by arms projecting outwardly from a split clamping-collar 9, embracing the pedestal and clamped thereto by the bolt uniting the ends of the split collar. By loosening said bolt the collar can be adjusted vertically on the pedestal.

If desired, the grinding-disk 5 can consist of a flat circular metal plate having a suitable abrading-sheet cemented or otherwise secured on its horizontal flat top surface. The disk is

shown with a central opening receiving the hub of a collar 10, fixed on the upper end of the spindle 2, so that the disk can be removably secured to the collar, and different grinding-disks can be used interchangeably in the machine.

The particular features of my present invention involve what might be termed a "semi-automatic" device for feeding separate pieces of work to the grinding-surface, a peculiar guard arranged around the grinding-disk, and a dust gathering or catching shield arranged around the grinding-disk and extending above the horizontal plane of the grinding-disk.

In connection with the first feature named—viz., the work-feeding device—it might be stated that it is often desirable to employ a flat-surface-grinding machine in smoothing or grinding down large numbers of small metal castings or forgings of such shapes and sizes that it is very difficult and sometimes dangerous to properly hold them individually to the rapidly-moving grinding-surface by hand. It is desirable that these small articles be ground off accurately and with rapidity; but it is difficult, if not impossible, to do so merely by using the fingers to hold the articles to the grinding-surface, as the articles become heated and there is great liability of cutting the fingers by engagement with the grinding-surface. Portable hand-holders can be provided to separately grip each article and hold the same to the grinding-surface; but such a process is too slow for the economical handling of the small articles in large quantities, as much time is wasted in placing the articles separately in and removing the same from such a holder, and the articles vary so greatly in size and shape that many different hand-holders would be required. This feature of my invention contemplates the employment of what might be termed a "magazine" to receive a large number of similar articles to be ground and which presents the articles one at a time to the grinding-surface and from which the articles are discharged one at a time after being ground to permit the movement successively of the unground or unfinished articles to the grinding-surface. In this connection 11 is a horizontally-disposed table arranged at the edge of the grinding-disk and extending outwardly therefrom, and usually, although not necessarily, concaved at its inner edge 12 to conform to the edge of the grinding-disk, and to approach close to the edge of the grinding-disk. Any suitable means can be provided to support this table, which may constitute a permanent part of the machine or may form an attachment to be applied to and removed from a grinding-machine, as desired. I usually provide vertically-adjustable supporting means for the table, so that the same can be adjusted vertically with respect to the grinding-disk, as hereinafter set forth.

13 is a trough open at the top and formed across the top face of the outer end of the table to receive tools, the work to be ground, or to serve any purpose to which it is adapted, and it is obvious that my invention does not require the employment thereof in the attachment or machine.

14 is a horizontally-swinging radial arm carried by the table, plate, frame, or support 11, so that its free end can swing across the flat top face of the grinding-disk, said arm in the specific example illustrated having a range of movement from a point over one end of plate 11 across the working face of the disk to a point over the opposite end of the plate 11.

Various means can be provided for pivoting or mounting the swinging arm 14, although in the drawings I show the pivoted end of said arm formed with a vertically-elongated hollow hub 15, open at the lower end and closed at the upper end and longitudinally split. The longitudinal ends of the split hub are formed with vertical ears or flanges 16, united by bolts or screws 17, so that the hub can be contracted to take up wear or for other reasons or can be loosened on its bearing-post or pivot, if desired. This hub is mounted and turns on a vertical cylindrical post 18, rigid with and extending up from an intermediate portion of the plate 11. Means can be provided to determine the vertical position of the hub on the post. For instance, I show a vertical screw 19, screwed vertically through a hole tapped in the upper closed end of the hub, so that the lower end of the screw rests on the upper end of the post 18 and turns thereon with the hub and upholds the hub usually with its lower end raised slightly from the top face of the plate 11. By turning the screw to the right or left the hub and its radial arm can be moved vertically. If desired, a jam-nut can be located on said screw to lock the same in the desired adjustment.

The outer or free end of the arm 14 is shown formed with a horizontally-disposed split clamping-ring or collar 20 at its outer end formed with lateral ears 21, connected by a tightening-screw 22, so that said collar can be contracted or allowed to expand.

23 is a removable split hub at its lower end fitted in said collar 20 and usually extending above the collar and having a shoulder 23′ resting on the upper edge of the collar. The hub is formed with lateral ears 24 above the collar 20, and said ears 24 are connected by a screw 25 for contracting the hub. The hub is formed with a vertical central opening therethrough formed to receive the lower end of a removable vertical magazine-tube 26, open at its ends.

27 indicates the work or small castings or other articles which are stacked one on the other in said magazine for grinding and several of which are shown on the plate or table after being ground and discharged from the magazine.

The magazine is of any desired length to receive the desired number of pieces of work 27 and is of any suitable shape in cross-section to properly receive and hold the pieces of work and permit the column of pieces of work to feed down while maintaining said pieces in the proper grinding position with respect to the grinding-surface.

The hub 23 and magazine-tube 26, as shown in the drawings, are particularly adapted to receive and properly feed and maintain similar pieces of work of a general flat circular shape; but it is often necessary to grind large numbers of pieces of work which for the proper feeding thereof will require a tube of a special size or shape in cross-section. Hence I have formed the hub 23 adjustable to vary the size of its bore or central opening and have also removably mounted the magazine-tube in its holder or hub. Magazine-tubes of different sizes and shapes can be interchangeably used in the device, and also different hubs or holders 23 to receive the particular magazines can be used interchangeably in the device, the collar 20 being adjustable in size and provided with clamping means to permit removal of the hubs therefrom.

When the magazine is to be loaded, the arm 14 can be swung over the plate or table 11, usually to its limit of movement to the left, so that the lower end of the magazine will be closed by the top face of the table, which is approximately flush with or in the same horizontal plane with the top face of the grinding-disk. The magazine is then loaded with the separate pieces of work, each with its face to be ground at its under side in the position it is desired to present the same to the grinding-surface, the lower piece in the open lower end of the magazine resting on the top face of the plate or table 11, and thereby upholding the column of pieces in the magazine, said pieces resting one on the other and feeding or moving down by gravity as the bottom pieces are successively removed.

When the magazine has been loaded with the separate pieces of work properly arranged therein, the magazine-carrier (in this specific example the arm 14) is moved over the rapidly-rotating grinding-surface with the bottom piece of work resting on said surface and held down thereon by the weight of the column of pieces of work. The operators soon become expert in determining the length of time necessary to properly grind the surface of each piece of work, and sometimes it is only necessary to move the arm 14 across the face of the grinding-disk from the left-hand end of the table 11 to the right-hand end thereof in order to insure the proper grinding of a piece. When the bottom piece has been ground, the arm is swung to the right from the grinding-disk and over the face of the table, which then sustains the columns of pieces of work with the ground bottom disk resting on the usually vertically adjustable horizontal plate 28, having its upper face flush with the top surface of the grinding-disk and its inner concaved edge arranged close to the edge of the grinding-disk, so that the piece of work can easily slide without being obstructed from the face of the grinding-disk to the top face of the plate 28. The rear or outer usually straight edge 29 of the plate 28 forms a shoulder or abutment and also forms the inner edge wall of a depressed surface, seat, or way 30, the outer end of which can, if desired, terminate in a discharge opening or passage 31 through the plate or table 11.

The height or thickness of the shoulder 29 is the same or preferably slightly less than the thickness of each piece of work in the magazine, so that the surface 30 is a distance below the top surface of plate 28 equal to or slightly less than the thickness of the piece of work, the pieces of work loaded in the magazine at any one time being similar in size and shape.

When a piece of work is to be discharged, the magazine is moved over the plate 28, and as the bottom piece of work in the magazine passes over the edge 29 its edge engages the edge of the previously-discharged piece of work on the surface 30 and pushes said piece toward the discharge 31 until said bottom piece drops from the magazine onto surface 30 behind edge 29, and thereupon the magazine is moved toward the grinding-disk and a fresh piece of work drops onto plate 28, while the piece just discharged is held on the surface 30 by the edge or shoulder 29. The continued movement of the magazine to the left slides the bottom piece of work across the plate 28 and onto the grinding-surface, and as soon as said piece has been ground as desired the magazine is again moved to the right, sliding the ground piece of work onto the plate 28 and across the same to the depression 30 and the operation of discharging the ground piece is repeated, as hereinbefore described. The ground pieces are moved step by step across the depressed surface 30 and dropped through the discharge-opening into a suitable receptacle placed on the floor or otherwise. Of course the invention is not limited to the discharge-opening, as the finished or ground pieces of work can be otherwise taken care of as they are discharged from the magazine, and I do not wish to limit the broad feature of my invention to the specific construction shown for successively releasing the ground pieces of work from the magazine, and thereby successively presenting the unground pieces of work into operative position for action by the rapidly-moving grinding-surface, and also I do not wish to limit the broad feature of my invention to a magazine-carrier which swings to and from the grinding-surface, as the carrier for the magazine

might be otherwise movable to and from the grinding-surface and the releasing or discharging point for the ground pieces of work. Also I do not wish to limit the broad feature of my invention to the specific construction described for removably securing the magazine in the magazine-carrier, nor to a magazine wherein the column of pieces of work is fed to the grinding-surface by gravity.

Any suitable means can be provided for vertically adjusting the plate 28 with respect to the depression 30, according to the thickness of the pieces of work being ground. In the specific example illustrated I show adjusting-screws 32 passing down through the plate 28 into the table 11 to permit the vertical adjustment of said plate either by the insertion or removal of spacing sheets or plates between the face of the table and the under side of the plate 28, or an upwardly-pressing spring can be interposed between the table and the under surface of the plate 28 and constantly tending to elevate said plate, the vertical position of the plate being determined by the screws 32. Such a spring 28′ is shown by dotted lines in Fig. 1. After the plate 28 has been adjusted to form the shoulder or edge 29 of the desired height with respect to the thickness of the particular pieces of work to be acted on the table 11 is adjusted vertically to bring the top surface of the plate 28 flush with or in the same horizontal plane with the top surface of the grinding-disk.

The magazine-tubes can be easily bent from sheet metal to any desired shape or form in cross-section to accommodate snugly and yet so as to permit a free downward movement therein of a column of similar pieces of work.

It is desirable that the magazine-carrier and the lower ends of the magazine-tube and its clamping-hub 23 be held from contact with the grinding-surface and yet close enough thereto so that the bottom piece of work will be held in the lower end of the magazine and in the proper position with its bottom face on the grinding-surface. The adjusting-screw 19 holds these parts from contact with the grinding-surface and permits vertical adjustment thereof when necessary, according to the thickness of the particular pieces of work being acted on.

33 is a stop to engage the swinging arm or magazine-carrier 14 and limit its swing to the left. Suitable means are also provided to limit the outward movement of the magazine-carrier when discharging, and in the specific example illustrated to prevent the magazine moving outwardly to the discharge-opening 31. For instance, I show an adjustable stop 33′, consisting of a screw horizontally disposed and adjustable longitudinally in a projection 34, rigid with the table 11. The head of the screw 33 is arranged to abut against the magazine-carrier about at the abutment 35 thereof and limit the outward movement of the magazine-carrier to the right.

Any suitable means can be provided to support the table 11 and provide for the vertical adjustment thereof with respect to the grinding-disk or other grinding-surface. As a means which might be employed for this purpose I show a split collar or sleeve 36, normally embracing and rigidly clamped to the upper portion of the pedestal 1 at a point below the upper end thereof and at a distance above the clamping-collar 9. The split sleeve 36 is formed with two outturned ears or flanges connected by an adjusting-screw, as heretofore described in connection with the collar 9, so that the sleeve 36 can be loosened and adjusted vertically on the pedestal 1 and then be tightened and rigidly clamped thereon in the desired vertical position. The clamping-sleeve 36 is provided with a rigid upwardly and outwardly extending arm 37, to which the table 11 can be secured by bolts 38, passed down through the table. It will hence be observed that the table 11, with its attached parts, is vertically adjustable with and by the sleeve 36. The accurate adjustment of the sleeve 36 can be effected, if so desired, by the employment of an adjusting screw or rod 39, vertically disposed and at its lower end resting on and abutting against the top edge of the collar 9, the screw 39 from thence extending upwardly through the sleeve 36 and being screw-threaded and passing through a correspondingly-threaded opening in the sleeve 36. After the sleeve 36 has been loosened on the pedestal the screw 39 can be rotated to accurately move the sleeve 36 and attached parts vertically to the desired position, and when adjusted to the desired position the sleeve 36 is clamped on the pedestal. Any suitable means can be provided for turning the screw 39. For instance, holes can be provided therein to receive a pin. However, I do not wish to limit myself to the employment of the screw 39, nor, so far as the broad feature of my invention is concerned, do I wish to limit myself to the specific securing and adjusting means shown for the table 11.

With reference to the other features of my invention hereinbefore referred to it is desirable to provide a guard or support around the edge of the horizontal grinding-disk of the vertical-spindle grinder to serve as a rest for tools for the work and for the hand of the operator while manipulating the work during the process of grinding, and also to serve as a protection against accidental contact with the edge of the grinding-disk.

In the operation of vertical-spindle grinding-machines there is a stream or sheet of grit and metallic dust thrown centrifugally from the edge of the grinding-disk, sometimes having the appearance of a stream of sparks. A rapidly-rotating grinding-disk will throw

this refuse a considerable distance. Where precious metals are being ground down or polished by such a grinding-disk, there is a considerable waste of the precious material unless the metallic dust can be caught, gathered, and saved. It is a feature of my present invention to prevent this waste of metallic dust and to prevent this exceedingly objectionable throwing of hot refuse broadcast from the grinding-disk, whether or not the refuse contains valuable material and whether or not the grinding-machine is provided with a feeding attachment or device such as hereinbefore described.

Where the machine is provided with devices in accordance with the last-named features of my invention, I can provide the sleeve 36 with another upwardly and outwardly extending arm 40, corresponding to and arranged diametrically opposite the arm 37. The two arms 37 and 40 are rigid, with a circular table or ring-like guard 41, having a central opening with an internal diameter approximately equal to or slightly greater than the external diameter of the grinding-disk, so that the grinding-disk rotates within the central opening of said guard, with the edge of the grinding-disk closely adjacent to the inner edge of the guard. The guard is formed with the flat top face adjacent to the grinding-disk and usually maintained about flush with the top surface of the grinding-disk, and around said flat top surface the guard is preferably formed with a ring-like depressed trough or receptacle 42, having the approximately vertical side walls usually concentric and the flat closed bottom. The trough 42 can serve as a receptacle to receive the work and to receive the dust and refuse discharged from the grinding-disk during operation of the machine. If desired, the trough can contain water to cool the heated work after being ground and the refuse gathered thereinto and to prevent the refuse being blown therefrom by currents of air. The guard just described can be, if desired, formed of one piece of metal, as by a single casting.

The guard is adjusted vertically and is supported by the sleeve 36, and as the guard is open at the center the grinding-disk can be easily removed from the spindle and new disks placed thereon as it becomes necessary in the operation of the machine. If it is desired to use the guard in connection with the feeding attachment or device hereinbefore described, the table 11 can be bolted on the guard, covering a portion thereof, or a segmental portion of the guard can be cut out to receive the table 11 and permit the table 11 and the remaining portion of the guard to both rest flush with the top face of the grinding-disk.

44 is a ring-like upwardly-projecting shield concentric with the grinding-disk and extending usually from the outer vertical wall of the trough 42 upwardly and inwardly to a plane a distance above the horizontal plane of the grinding-disk to form an annular passage between the top face of the guard or table 41 outwardly and downwardly into the trough 42. The inner face of the shield 44 is inclined downwardly and outwardly to the trough and in effect forms a deflector which catches all of the refuse discharged from the surface of the grinding-disk and works and deflects the same down into and gathers the same in the trough. In the specific example illustrated the shield is in the form of what might be termed a "truncated cone," formed in one piece and removably fitted on the upper portion of the outer vertical wall of the trough 42. In this instance the outer portion of the lower edge of the shield is rabbeted at 45 to form a shoulder bearing down on the top edge of said outer wall of the trough and a vertical portion extending down in engagement with the inner face of said outer wall of the trough, although it is obvious that the shield might be otherwise formed than in a separate piece and might be otherwise supported than in connection with a trough. However, this specific feature is sometimes advantageous, as in some machines it is desirable to provide a removable shield, so that the shield can be removed from the machine under certain circumstances. Where the shield is used in connection with a feeding device, as hereinbefore described, a segment of the shield will be removed to receive the table 11, so that the shield will extend from one end of the table 11 to the other end thereof, as shown in Fig. 1 of the drawings. However, where the feed device is not employed the shield will usually be in the form of an annulus or unbroken ring extending completely around the grinding-disk, as shown in Fig. 3, and where a guard is employed it will be in the form of an annulus or unbroken ring, preferably extending around the grinding-disk and in the relation thereto about as shown in Fig. 3, and the shield and guard, or either, are not limited to employment in connection with the work-feeding device; nor do I wish to limit the work-feeding device to employment in connection with a guard and shield such as shown, although advantages are attained by the employment of the same in connection with said feeding device.

I do not wish to limit my invention to the employment of the collar 9 and idlers carried thereby, as it is obvious that any suitable means or arrangement can be provided for driving the grinding-disk spindle other than by a belt and pulleys, or other arrangements of belt and pulleys can be provided.

It is evident that various changes and modifications might be resorted to in the forms, construction, and arrangements of the parts described, and that various elements might be omitted and that elements can be added there-

to without departing from the spirit and scope of my invention. Hence I do not wish to limit myself to the specific constructions shown, but consider myself entitled to all such variations as fall within the spirit and scope of my invention.

Having thus fully described my invention, what I claim is—

1. In a grinding-machine, the combination of a grinding-surface, a magazine-carrier movable over the grinding-surface to contain pieces to be ground and having its end open to present such pieces to the grinding-surface, and means to successively discharge the ground pieces from the magazine, substantially as described.

2. In a grinding-machine, the combination of a grinding-surface, a table closely adjacent to the grinding-surface and approximately flush therewith, a magazine-carrier movable over the table and grinding-surface to contain pieces to be ground and having its end open to present such pieces to the grinding-surface, and means to successively discharge the ground pieces from the magazine, substantially as described.

3. A grinding-surface, in combination with a table, and a swinging magazine-carrier with its free end provided with a magazine movable over the faces of the table and grinding-surface, substantially as described.

4. In combination, a grinding-surface, an arm movable over the grinding-surface, a removable magazine mounted in the arm, and means by which magazines of various shapes and sizes may be secured in said arm, substantially as described.

5. In combination, a movable grinding-surface, a table, a swinging magazine-carrier movable over the grinding-surface and table, a removable magazine mounted in the free end of the magazine-carrier, means removably securing said magazine to said carrier, and means for successively discharging the pieces of work from said magazine, substantially as described.

6. In combination, in a grinding-machine, a horizontal grinding-surface, a table, means for adjusting the same vertically, a vertically-adjustable plate on the table and normally flush with the grinding-surface and closely adjacent thereto, a movable magazine-carrier, and a vertical magazine-tube carried thereby and movable therewith over the plate and grinding-surface with its open lower end closely adjacent thereto, substantially as described.

7. In combination, a grinding-surface, a horizontal table approximately flush therewith and closely adjacent thereto, and having a depression and shoulder, and a movable magazine-carrier provided with a magazine-tube with its end open to present pieces to the grinding-surface, said carrier being movable to carry the open end of the magazine over the grinding-surface and table and over said depression and past said shoulder, whereby the lower piece in the magazine may be removed therefrom, substantially as described.

8. In a grinding-machine, the combination of a grinding-surface, a horizontal table arranged close to said surface and having a portion thereof depressed to form a shoulder, an arm movable over the grinding-surface and shoulder of the table, a magazine mounted in the arm and having its end open to present the pieces contained therein to the grinding-surface, and means for varying and adjusting the relative vertical positions of the magazine and of several portions of the table to permit the shoulder to properly remove from the magazine pieces of different thicknesses, substantially as described.

9. In a grinding-machine, the combination of a grinding-surface, a horizontal table arranged close to said surface and having a portion thereof depressed to form a shoulder, an arm movable over the grinding-surface and shoulder of the table, a magazine mounted in the arm and having its end open to present the pieces therein to the grinding-surface, and means for varying the height of the shoulder to properly remove from the magazine pieces of different thicknesses, substantially as described.

10. In combination, a pedestal, a horizontally-disposed rotary grinding-disk having its vertical spindle mounted in said pedestal, a vertically-adjustable sleeve normally clamped on said pedestal and provided with a supporting-arm, a table carried and supported by said arm and arranged horizontally beside said disk, and a movable magazine-carrier mounted on said table and provided with a magazine movable thereby over the table and disk.

11. In a vertical-spindle grinding-machine, in combination, a frame, a horizontal flat rotary grinding-disk, a vertical spindle on the upper end of which said disk is removably secured, a guard or table around the disk and in close proximity to the edge thereof and approximately flush with the top surface thereof, and a vertically-adjustable support for said guard or table.

12. In a grinding-machine, in combination, a support, a horizontal rotary disk having a top grinding-surface, an annular guard-table around said disk and having a horizontal annular surface normally about flush with said grinding-surface and a trough around and depressed below the plane of said surface, and means for upholding said table from said support.

13. A horizontal rotary flat-surface-grinding disk, in combination with a guard or table around the same and closely adjacent to the edge thereof and having a flat top surface normally flush with the top surface of said disk, and vertically-adjustable supporting means for said table.

14. In a grinding-machine, in combination, a pedestal, a vertical rotary spindle mounted therein, a horizontal flat-surface-grinding disk carried by said spindle, a vertically-adjustable clamp on the pedestal, and an annular guard-table around the disk and carried by said clamp.

15. In combination, a rotary horizontal grinding-disk and its supporting devices, a support around and adjacent to the edge of the disk and formed with a trough or depression, and an annular shield extending upwardly and inwardly from the outer wall of the trough and adapted to catch the refuse thrown from the disk and gather the same into said trough.

16. In combination, a horizontal rotary grinding-disk and its supporting and driving means, a horizontally-disposed annular guard-table around the disk and closely adjacent to the edge thereof, and a vertically-disposed ring-like shield removably resting on said table and extending upwardly therefrom to a plane above the horizontal plane of the disk.

17. In combination, a pedestal, a vertical spindle mounted therein, a horizontal grinding-disk mounted on the upper end of the spindle, an annular horizontal guard-table around the disk, a vertically-adjustable support for the guard mounted on said pedestal, said guard having its upper face normally flush with the top face of the disk and having the vertically-disposed wall extending upwardly from its outer portion and forming an annular shield or deflector adapted to catch the refuse thrown from the disk.

18. In combination, a rotary grinding-surface, a guard or table around the same, formed with a depressed ring-like trough, supporting means for the disk and guard, and a ring-like shield having its lower end formed and shouldered to removably fit within said trough and rest on the outer wall thereof,

19. In combination, a pedestal having an exterior stop, a vertical spindle mounted in the pedestal, a rotary grinding-surface carried by the upper end of the pedestal, a horizontally-disposed table arranged beside the grinding-surface, a vertically-adjustable clamp on the exterior of the pedestal and provided with an arm carrying said table, and a vertical adjusting-screw adjustable in said clamp and at its lower end abutting against said stop.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE GORTON.

Witnesses:
MAUDE MORRIS,
C. R. CARPENTER.