W. LE R. BRYANT.

METAL GRINDING MACHINE.

APPLICATION FILED MAY 31, 1912.

1,051,483.

Patented Jan. 28, 1913.

4 SHEETS—SHEET 1.

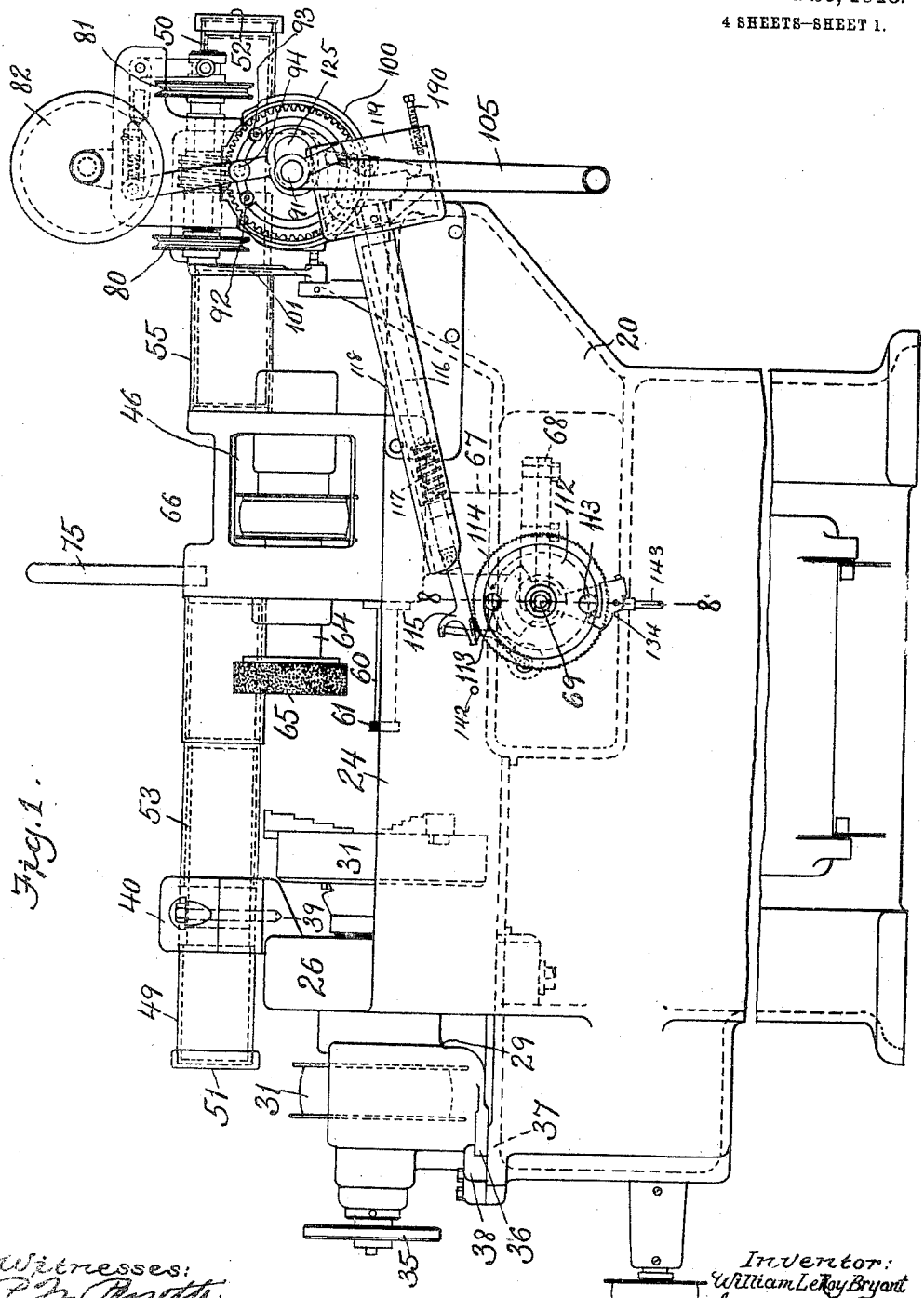


Fig. 1.

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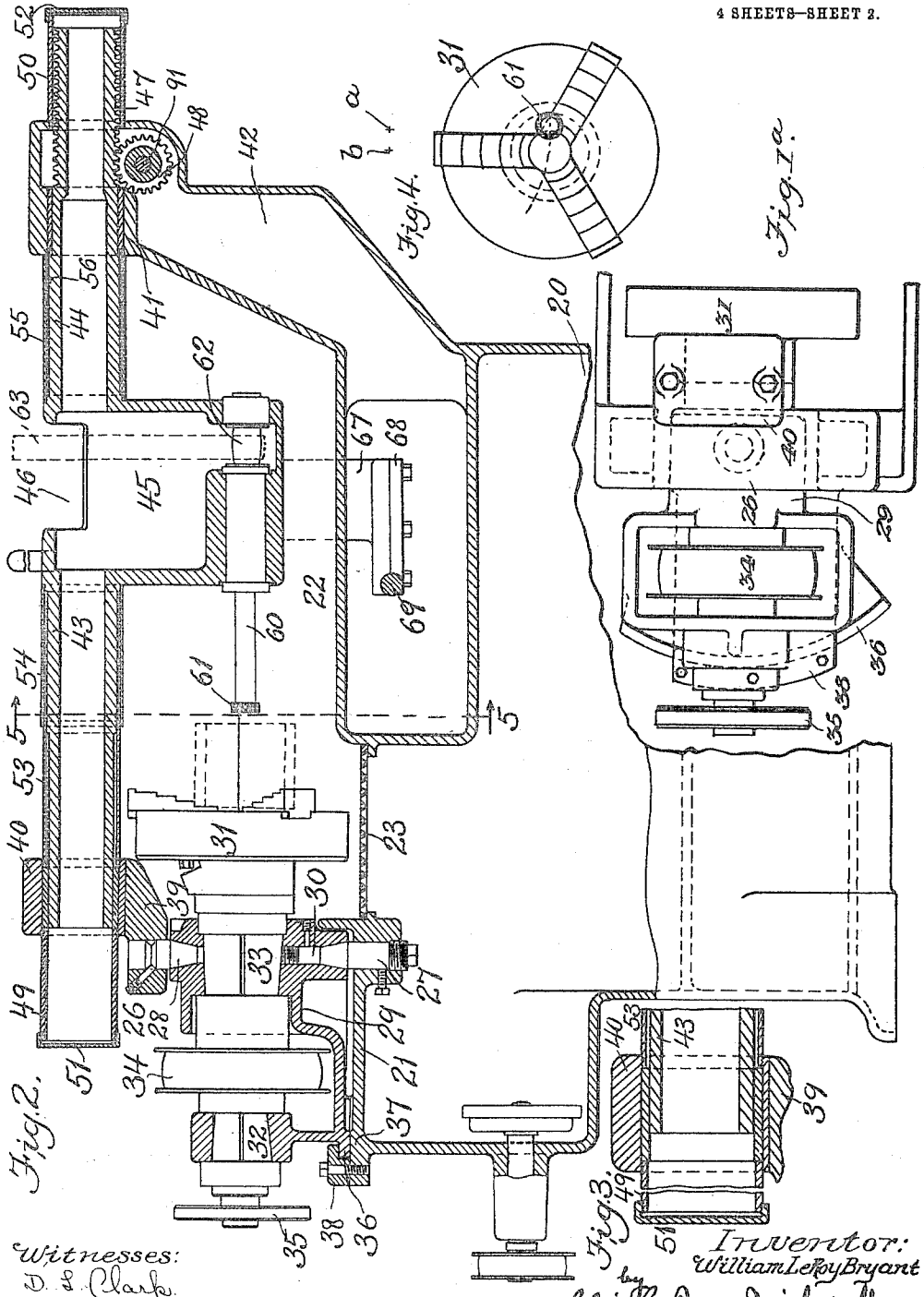
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4 SHEETS—SHEET 2.



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4 SHEETS—SHEET 3.

Fig. 7.

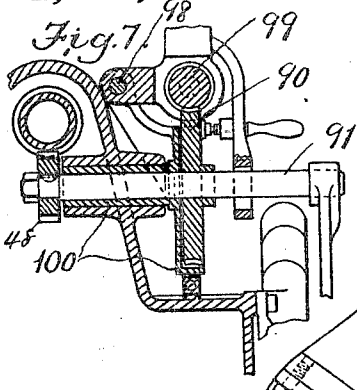


Fig. 5.

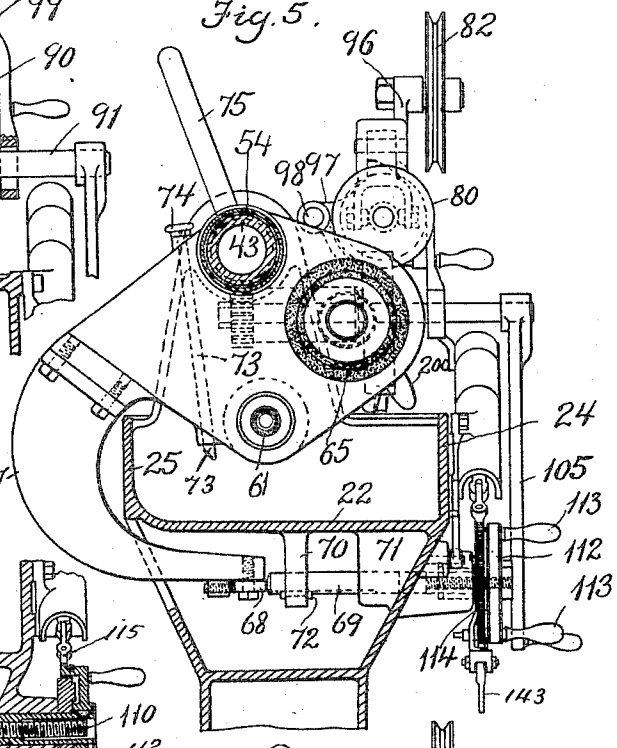


Fig. 8.

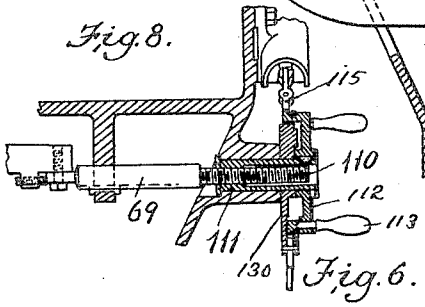
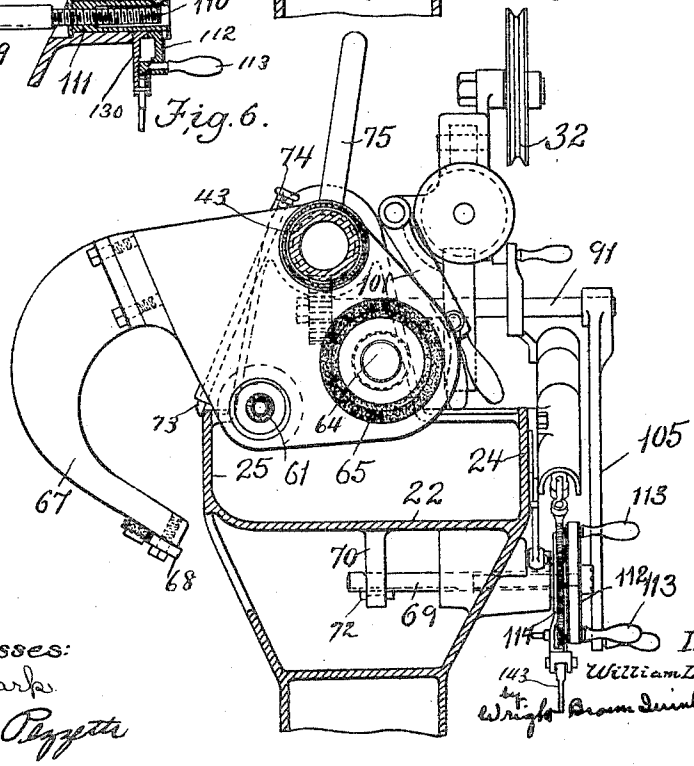


Fig. 6.



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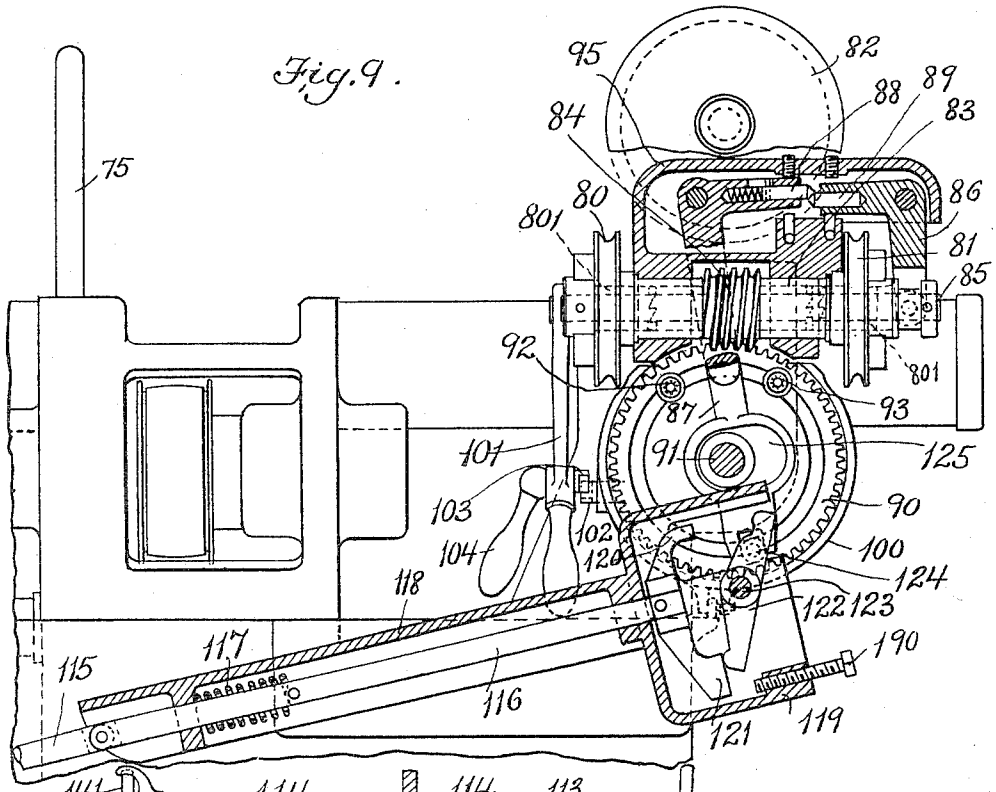
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4 SHEETS—SHEET 4.

Fig. 9.



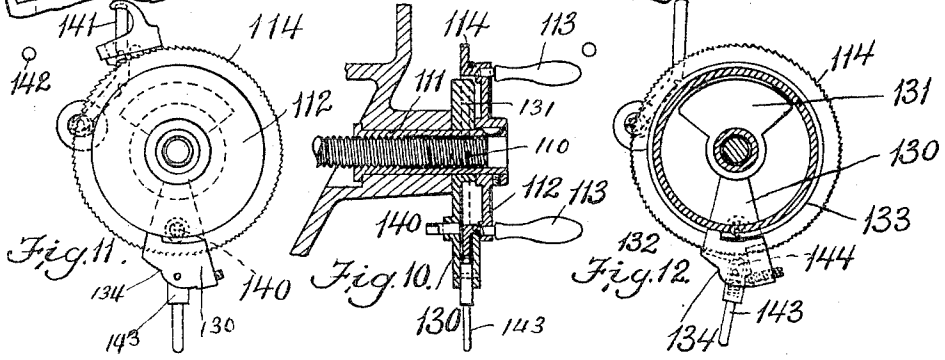


Fig. 11.

Fig. 10.

Fig. 12.

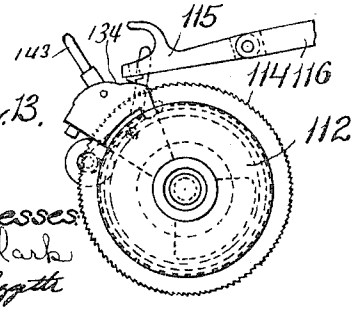


Fig. 13.

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UNITED STATES PATENT OFFICE.

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METAL-GRINDING MACHINE.

1,051,483. Specification of Letters Patent. Patented Jan. 28, 1913.

Application filed May 31, 1912. Serial No. 700,731.

To all whom it may concern:

Be it known that I, WILLIAM LE ROY BRYANT, a citizen of the United States, and resident of Springfield, in the county of Windsor and State of Vermont, have invented certain new and useful Improvements in Metal-Grinding Machines, of which the following is a specification.

This invention has relation to machines for grinding metal and more particularly to that class of machines in which the metallic part to be ground is secured in a chuck so as to be ground exteriorly or interiorly as may be needed.

The object of the invention is to provide a machine of this character which will be durable and accurate, and in which it is possible to preserve the alinement of the tool and the work.

A further object of the invention is to provide a simple machine having few parts, in which the usual cross-slide is eliminated, while at the same time a direct diameter-control is obtained.

Inasmuch as one of the difficulties met with in grinding machines is the wear of the parts due to the deposit of grit and dust upon the faces which are in sliding contact, another object of the invention is to so construct the machine as to prevent any possibility of the grit or dust finding an entrance between the movable tool carrier and its support.

In carrying out my invention, I provide a machine in which the tool carrier consists of an oscillatory member mounted in relatively remote bearings, so that, by swinging this member about its axis, the tool may be moved transversely of the work, and, by sliding said member in its bearings, the tool may be moved longitudinally of the work. In this manner, I eliminate the necessity of employing a cross-slide for the tool. The bearings for the pivotally mounted tool carrier, in the present embodiment of my invention, are protected by telescopic covers which prevent the access of dust and grit thereto.

The tool carrier may in very simple forms of the invention be provided with but one tool, and in more complex forms it may be provided with several tools each of which may be brought, by swinging the tool carrier about its axis, into predetermined relation with the work for interior and exterior grinding or for facing the work.

In addition to the features which I have thus briefly adverted to, the invention includes other features of construction and arrangement which are illustrated in the accompanying drawings, described in the following specification and pointed out in the claims.

Referring to said drawings,—Figure 1 represents a front elevation of the machine embodying the invention. Fig. 1ª illustrates a portion of the work carrier. Fig. 2 represents a longitudinal section through the machine. Fig. 3 represents a slightly enlarged sectional view of the left end of the tool carrier and the bearing therefor. Fig. 4 represents an end elevation of the chuck and illustrates diagrammatically the path of movement of one of the tools. Fig. 5 represents a vertical transverse section through a portion of the machine on the line 5—5 of Fig. 2. Fig. 6 represents a similar view with the tool carrier swung to a position to permit the facing tool to operate upon the work. Fig. 7 illustrates a sectional detail of a portion of the feeding mechanism. Fig. 8 represents a section on the line 8—8 of Fig. 1. Fig. 9 represents a longitudinal sectional view illustrating the feeding mechanism. Fig. 10 represents a section, similar to Fig. 8 but enlarged to show the parts more clearly. Figs. 11, 12 and 13 are detail views illustrating the same mechanism as that shown in Fig. 10.

On the drawings, 20 indicates the base or bed of the machine which is preferably of the hollow cabinet or box type having the usual front, rear and end walls. At the left end of the machine there is a substantially flat table portion 21 upon which is mounted the work carrier and its support. Toward the right-hand end of the machine there is another flat table-like portion 22 separated from that at 21 by a grid or sieve 23 through which water may pass into the hollow portion of the frame. This water, which is used in the grinding operation, may be pumped from the base of the machine and carried by suitable conduits to the point of application of the tool to the work. In front and in rear of the substantially flat portions 21, 22 and 23 of the bed, there are front and rear vertical webs or walls 24, 25, as shown in

Figs. 1, 5 and 6, forming a trough-like construction which partially incloses the work and serves to catch to some extent the grit and particles of metal resulting from the grinding operation. At the left end of the machine, there is a ring-like bracket 26 through which vertical pivot pins 27, 28 are passed to form a pivotal connection for the work carrier or support 29 for the chuck spindle. The pivot pins 27 and 28 are tapering at their ends to enter complemental apertures formed in the carrier 29, said pivot pins being adjustable in any approved way, the supporting pin 27 abutting against the hardened pin 30 adjustably secured in the support 29.

The chuck, which is indicated as a whole at 31, is constructed in any convenient way and its spindle is mounted in the bearings 32, 33 in the carrier 29, and is equipped with a belt pulley 34 by which it may be rotated, there being at the end of the spindle a hand wheel 35 which by a convenient mechanism controls the jaws of the chuck. The support 29 has a segmental base flange 36 which rests upon a complemental way or track 37, so that the support and the work-carrying spindle may be adjusted about the axis of the pivot pins 27, 28. Suitable gibs 38 are employed for clamping the base flange 36 against movement after the work-carrying spindle has been adjusted to proper position. The annular bracket 26 is provided with an extension 39, which, with the cap 40, constitutes one bearing for the tool-carrying member. At the right-hand end of the machine, another bearing 41 is afforded by an upwardly projecting hollow bracket 42. The two bearings are in alinement and receive the tool support now to be described. Said tool support comprises two spindles or trunnions 43, 44 which project in opposite directions and which are connected at their adjacent ends by a hollow box-like structure indicated as a whole at 45, and which has at its upper portion openings or apertures 46, as shown in Figs. 1 and 2. This box-like structure 45 has end walls and a peripheral or circumferential wall, and it and the trunnions 43 and 44 may be all formed in one integral part or casting and is referred to herein as the tool carrier. The tool carrier may move longitudinally in its bearings and for this purpose is equipped at its right-hand end with peripheral ribs 47 which constitute teeth to be engaged by a pinion 48, the rotation of which in one direction or the other advances or retracts the tool carrier toward and from the work. The tool carrier as a whole may likewise be oscillated in its bearings for the purpose of positioning the tool at a predetermined distance from the axis of the work.

For the purpose of protecting the spindle portions or trunnions of the tool carrier and the bearings therefor from grit and dust, I secure in the bearings tubes or sleeves 49, 50 which are respectively provided with caps 51, 52 so that the ends of the trunnions 43, 44 may project into the tubes and be covered thereby. Between the bearings and the box-like portion of the carrier, I insert telescoping tubes 53, 54 and 55, 56 respectively, one tube of each pair being secured to the adjacent bearing and the other tube being secured to the hub of the box-like portion 45. By means of the tubular casings thus provided by the tubes or sleeves, it is impossible for grit or particles of metal to have access to the bearings and consequently there is substantially no wear of the parts and the tools may be always moved in exact alinement with the work or in exact paths as desired. It will be observed that the trunnions of the tool carrier are located in a horizontal plane above the chuck, and that, when the chuck spindle is arranged parallel with the trunnions of the tool carrier, the axis of the tool carrier is in a vertical plane a short distance in front of a vertical plane through the axis of the chuck spindle. In Fig. 4, the axis of the tool carrier is indicated at *a* and is a short distance in front of a line *b* which is in the vertical plane passing through the axis of the chuck spindle. In the box-like portion of the tool carrier there are provided bearings for a tool spindle 60 having upon its end a grinding wheel 61 of relatively small diameter so that it may be used for interior or exterior grinding. The work spindle is provided with a pulley 62 so that it may be driven by a belt 63 from a countershaft. In simple forms of the machine but one tool spindle will be provided. On the drawings, however, I have illustrated the tool carrier as being provided with a second spindle 64 having a face-grinding wheel 65 and also having a belt pulley 66 which may be driven by a belt from the countershaft. By swinging the tool carrier about its axis, either of the two tools may be brought into operative relation to the work.

I provide means for holding the tool carrier against oscillatory movement while it is being fed to move the tools relatively to the work. From examination of Figs. 5 and 6, it will be seen that the box-like portion of the tool carrier is provided at its rear with a downwardly and inwardly extending arm 67 adapted to project through an aperture in the rear wall of the bed. At its end, the said arm is provided with a hardened steel bar 68 secured thereto and adapted to be adjusted relatively thereto by any suitable form of adjusting device. When the grinding tool 61 is operating upon the work, the bar 68 engages the end of a sliding rod 69 adapted to slide in bearings

70, 71 in the bed of the machine. This rod is grooved to receive a key or spline 72, as shown in Figs. 5 and 6. By advancing or retracting the rod 69, the tool carrier will be swung about its pivot in one direction or the other, the weight of the arm 67 serving to hold it firmly against the end of the rod 69. The rod 69 may be moved by hand and also may be moved automatically as will be subsequently explained.

When the face-grinding wheel is to operate upon the work, I provide a separate device for holding the tool carrier against oscillation. This device consists of an elongated pin 73 which is passed through the carrier, as shown in Figs. 5 and 6, and which is provided with a head 74 by which it may be lifted. The lower projecting end of the pin is beveled, so that, when the tool carrier is swung about its axis to move the arm 67 rearwardly and upwardly, the pin 73 will ride up over the upper edge of the wall 25 and then drop down behind the upper edge of said wall so as to lock the tool carrier against movement in the opposite direction. The edge of the wall 25 thus serves as a guide for the tool carrier, as shown in Fig. 6. By lifting the pin 73, the tool carrier may be allowed to swing in the opposite direction. For manually moving the tool carrier to bring either of the two tools into operative relation to the work, it is provided with a handle 75 projecting upwardly and rearwardly therefrom.

Any convenient feed and knock-off mechanism may be utilized for the machine for the purpose of feeding the tools longitudinally of the work and for feeding them transversely thereto. I have illustrated mechanisms for this purpose which I have found to be suitable. Referring to Figs. 1, 2, 5, 7 and 9,—80, 81 indicate two oppositely moving belt pulleys which are driven by a belt which may pass around an idler pulley 82 (the belt is not shown). Each of the two pulleys may be clutched in any suitable way to an integral sleeve 83 having thereon a worm 84 so that the worm may be driven in one direction or the other. As a practical matter, the pulley driven clutch members may be formed on the ends of sleeves 801 splined to the pulleys and moved in one direction or the other by a spindle 85 which may be shifted back and forth by a bell crank 86, see Fig. 9. The bell crank is operated by what is called in shop parlance a "load and fire mechanism," which comprises the bell crank 87 having the spring-pressed pin 88 adapted to engage the pin 89 in the bell crank 86. The worm 84 engages and drives a worm wheel 90 fast upon a shaft 91, the last-mentioned shaft 91 being provided with the pinion 48, hereinbefore referred to, which slides the tool carrier back and forth. The worm wheel 90 has two stops 92, 93 adapted to alternately engage a stop 94 on the bell crank 87 so as to move it in one direction or the other and thus unclutch one of the belt pulleys 80 from the worm and clutch the other pulley 81 thereto, or vice versa. With this construction, the tool carrier will be automatically moved forward and back to cause the tool to be moved longitudinally of the work.

The worm 84, which I have previously referred to, and the two bell cranks are all mounted in a head 95 which also carries a bracket 96 in which the idler pulley 82 is journaled. This head has one or more ears 97 which are secured upon a rock shaft 98. Said rock shaft is, as shown in Fig. 7, journaled in upwardly projecting arms 99 formed on a guard 100 which partially incloses the worm wheel 90 and which is formed with a sleeve inserted in an aperture in the bed to form a bearing for the shaft 91. The guard is also secured at its lower end to the bed. Secured to the rock shaft 98 there is a lever 101 by which the shaft may be rocked to lift the head upwardly to move the worm out of engagement with the worm wheel. The guard or casing 100 has a knife-edged pin 102 which forms a stop to be engaged by a knife-edged rocking stop pin 103 mounted in the handle 101 and having itself a handle 104 by which it may be rocked. The handle 104 and pin 103 may be rocked to permit the two stops to be disengaged so that the handle 101 may be forwardly moved to lift the head and thereby disengage the worm from the worm wheel, after which the handle 104 may be released so that the stop pin 103 will engage in front of the stop pin 102 and hold the worm in its disengaged position. When the worm is disengaged from the worm wheel, the worm wheel shaft 91 may be rotated in one direction or the other by a hand lever 105 which is secured upon the end thereof in front of the worm wheel.

In grinding the periphery of the work or in grinding an internal surface on the work, it is necessary that for each reciprocation of the tool carrier it should be oscillated one step, and consequently I provide mechanism for accomplishing this purpose, and thereby securing a transverse feed to the tool relatively to the work. The mechanism which I utilize for securing the cross-feed is actuated from the feeding mechanism by which the carrier is reciprocated. I have already explained that the tool carrier has a longitudinally arranged guide member 68 with which is engaged a longitudinally movable bar 69 arranged transversely of the axis of oscillation of the tool carrier. Referring to Figs. 8 and 10, it will be noted that the bar 69 is provided with a forwardly projecting screw 110 with which is engaged a rotatable sleeve nut 111 journaled in the bed. On its

front end there is keyed to the sleeve nut a wheel 112 having one or more handles 113 by which it may be manually rotated. In Figs. 1, 6 and 8, there is but one handle shown, but in Fig. 10 I have illustrated two handles for rotating the wheel to thereby effect a rotation of the nut and a longitudinal movement of the bar 69. I also provide means for imparting a step-by-step rotation to the sleeve nut. This mechanism comprises a ratchet annulus 114 which is formed on or secured to the wheel 112. A pawl 115 is pivoted to the end of a plunger 116, see Figs. 1 and 9, which said plunger is held to the left by a spring 117. This plunger is mounted to slide within a casing 118 having an open head or enlargement 119. By reciprocating the plunger, the ratchet will be advanced with a step-by-step movement. The plunger is equipped with a cross-head having two arms 120, 121 adapted to be engaged by the respective arms of a rocking lever 122 on a cross shaft 123 mounted in the head 119. Projecting from the lever 122 is a pin 124 which extends into a slot in the end of the bell crank arm 87, so that, each time the bell crank is rocked in one direction or the other, one or the other of the arms of the lever 122 will engage one of the arms 120, 121 so as to move the plunger 116 to the left against the tension of the spring 117, and consequently the ratchet 114 will be advanced one step each time the tool carrier reaches the end of its advancing or receding stroke. The bell crank 87 has an enlarged aperture 125 through which the shaft 91 extends, the aperture being large enough to permit the head 95 to be raised to disengage the worm from the worm wheel.

In order to stop the inward movement of the guide member 69 when the tool has been advanced transversely of the work substantially as far as it may be desired to move it, I provide the following mechanism: Mounted loosely on the sleeve nut 111 there is an arm 130 having a counterweight 131, see Fig. 12. The arm 130 bridges over the periphery of the ratchet and extends down in front of the face thereof, and it is provided with a finger 132 which lies between the ends of a split annular spring 133 which is arranged in a groove in frictional engagement with the annular ratchet 114, so that ordinarily the ratchet and the arm 130 will move together by reason of the frictional engagement of the spring with the ratchet and the engagement of the ends of the spring with the finger 132 on the arm 130. It will be seen by examining Fig. 12 that the arm is formed with a cam portion or face 134 which may engage the pawl 115, as shown in Fig. 13, and lift it out of engagement with the ratchet so as to stop the rotation of the ratchet wheel and sleeve nut. When the arm reaches the position to lift the pawl, the arm itself is also stopped from rotation, and to this end it is provided with a pin 140 adapted to engage a notch in a lever 141 which is pivoted in front of the bed of the machine and in the path of the pin 140. The notched lever, when its use is not desired, may be moved back into engagement with the pin 142 projecting from the bed. When the pin 140 is engaged with and locked by the notched lever 141, the ratchet wheel may be moved step-by-step by hand and hence for this purpose there is pivoted in the arm 130 a small hand lever 143 having a spring-pressed pawl 144; and, by rocking the hand lever about its pivot on the arm, the ratchet wheel may be advanced step-by-step as will be readily understood.

I have explained somewhat generally the mechanism for effecting the longitudinal feeding movement of the tool carrier and for effecting the transverse feeding movements of the tool carrier, but I desire to have it understood that the invention is not limited to the particular mechanism which I have described.

More especially, my invention resides in the tool carrier which, as explained, is provided with oppositely extending spindles or trunnions journaled to slide and rotate in separated bearings on the bed. This construction is rigid, strong and durable; it permits no yielding of the parts, and, inasmuch as the trunnions and the bearings are covered, there is no danger of their being so worn as to permit of any lost motion or to destroy the desirable alinement of the tools with the surface of the work. Two pairs of guide members are provided for guiding the tool carrier during its length-feeding strokes. Each pair of guide members consists of a guide or way arranged longitudinally of the path of movement of the tool carrier, to wit, the wall 25 in the one case and the bar 68 in the other case, and a transversely arranged rod, 73 in the one case and 69 in the other case. It is not necessary, when the facing grinding tool is being used, to feed the tool crosswise of the work, and for this reason no mechanism is provided for moving the guide member 73 when it is in engagement with its coacting guide member 25. When the diameter-reducing tool is being used, however, it is necessary to move the guide member 69 and this may be done by the mechanism which I have illustrated and described, or by any other mechanism which is suitable for the purpose.

It is obvious that the invention may be embodied in a variety of different forms of grinding machines and that with slight changes a greater number of tools may be employed than I have illustrated upon the drawings.

Having thus explained the nature of my said invention and described a way of mak-

ing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, what I claim is:

1. In a grinding machine, a tool carrier having oppositely projecting trunnions, a tool thereon out of alinement with said trunnions, and bearings in which said trunnions are mounted to slide and to oscillate.

2. In a grinding machine, an oscillatory tool carrier having oppositely projecting trunnions, a grinding tool on said carrier movable bodily thereby through the arc of a circle, bearings for said trunnions, and means for moving said tool carrier longitudinally in its bearings.

3. In a grinding machine, an oscillatory tool carrier having oppositely projecting trunnions, bearings for said trunnions, coacting guide members for holding the carrier against oscillation, and means for moving said carrier to bring said guide members into engagement.

4. In a grinding machine, an oscillatory tool carrier having oppositely projecting trunnions, bearings for said trunnions, coacting guide members for holding the carrier against oscillation, means for moving said carrier to bring said guide members into engagement, and means for moving said carrier longitudinally while guided by said guide members.

5. In a grinding machine, a bed having separated bearings, a tool carrier having oppositely projecting trunnions mounted in said bearings, means for moving said carrier axially in its bearings, and a handle on said carrier for oscillating it in its bearings.

6. In a grinding machine, a bed having separated bearings, a tool carrier having oppositely projecting trunnions mounted in said bearings, a grinding tool spindle mounted on said carrier eccentrically of said trunnions, automatic mechanism for reciprocating said carrier in its bearings, and mechanism for rocking said carrier in its bearings.

7. In a grinding machine, a bed, separated bearings on said bed, a reciprocatory carrier having trunnions slidingly and rotatably mounted in said bearings, and coacting guide members on said bed and said carrier for guiding said carrier longitudinally.

8. In a grinding machine, a bed, separated bearings on said bed, a reciprocatory carrier having trunnions slidingly and rotatably mounted in said bearings, coacting guide members on said bed and said carrier for guiding said carrier longitudinally, and means for moving one of said members to swing the carrier about its axis.

9. In a grinding machine, a bed, separated bearings on said bed, a reciprocatory carrier having trunnions slidingly and rotatably mounted in said bearings, coacting guide members on said bed and said carrier for guiding said carrier longitudinally, one of said members consisting of a longitudinally movable rod arranged transversely of the axis of the carrier, and the other consisting of an elongated track or way which is engaged by the rod.

10. In a grinding machine, a bed, separated bearings thereon, a tool carrier having trunnions journaled to slide and to oscillate in said bearings, coacting guide members on said bed and carrier respectively, one of said members being arranged axially of said carrier and the other being arranged transversely thereto, means for moving the last-mentioned member to swing the carrier about its axis, and means for sliding said carrier in its bearings.

11. In a grinding machine, a bed having separated bearings, a tool carrier having trunnions slidingly mounted in said bearings, a grinding tool on said carrier out of alinement with said trunnions, and casings for covering said trunnions and protecting them and the bearings from grit.

12. In a grinding machine, a bed having separated bearings, a tool carrier having trunnions slidingly mounted in said bearings, and telescopic casings between the tool carrier and the bearings and inclosing said trunnions.

13. In a grinding machine, a bed having separated bearings, a tool carrier having trunnions slidingly mounted in said bearings, a grinding tool on said carrier movable bodily thereby in a curved path, and closed tubular casings projecting from the bearings to receive the ends of the trunnions.

14. In a grinding machine, a bed having separated bearings, a tool carrier having trunnions slidingly mounted in said bearings, closed tubular casings projecting from the bearings to receive the ends of the trunnions, and telescopic casings between the tool carrier and the bearings for inclosing said trunnions.

15. In a grinding machine, a bed, a rotatable work carrier, a support on the bed therefor, a tool, and an oscillatory and slidable tool carrier journaled on an axis above the work carrier, and separated bearings for the work carrier in which it can both slide and oscillate.

16. In a grinding machine, a plurality of parallel grinding tool spindles, a tool carrier in which said spindles are journaled, means for rotating said spindles, a bed having separated bearings, and trunnions on said carrier out of axial alinement with said spindles rotatable and longitudinally movable in said bearings.

17. In a grinding machine, a bed, a tool carrier longitudinally movable on said bed, an upright annular head on said bed, a work spindle, a work carrier for said spindle

having a segmental base flange slidably supported on said bed, substantially vertical oppositely projecting pivots for pivoting said work carrier in said annular head to permit it to swing sidewise, and means for clamping said base flange to said bed.

In testimony whereof I have affixed my signature, in presence of two witnesses.

WILLIAM LE ROY BRYANT.

Witnesses:

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PETER W. PEZZETTI.