

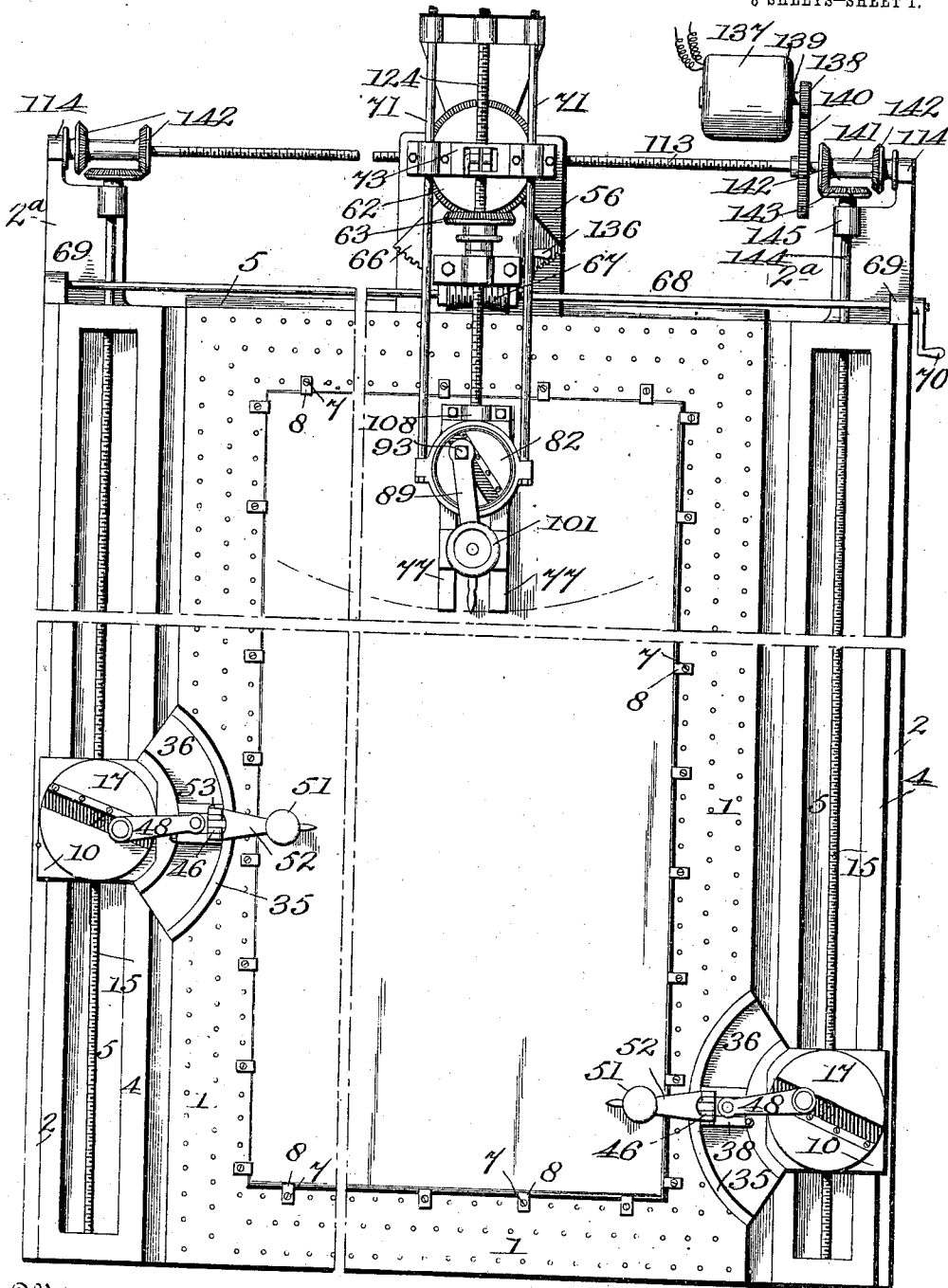
E. R. WILLIAMS & G. F. D. ROLLINGS.
BURNISHING MACHINE.

APPLICATION FILED JAN. 30, 1909.

Patented June 20, 1911.

995,749.

8 SHEETS—SHEET 1.



Witnesses
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8 SHEETS-SHEET 2.

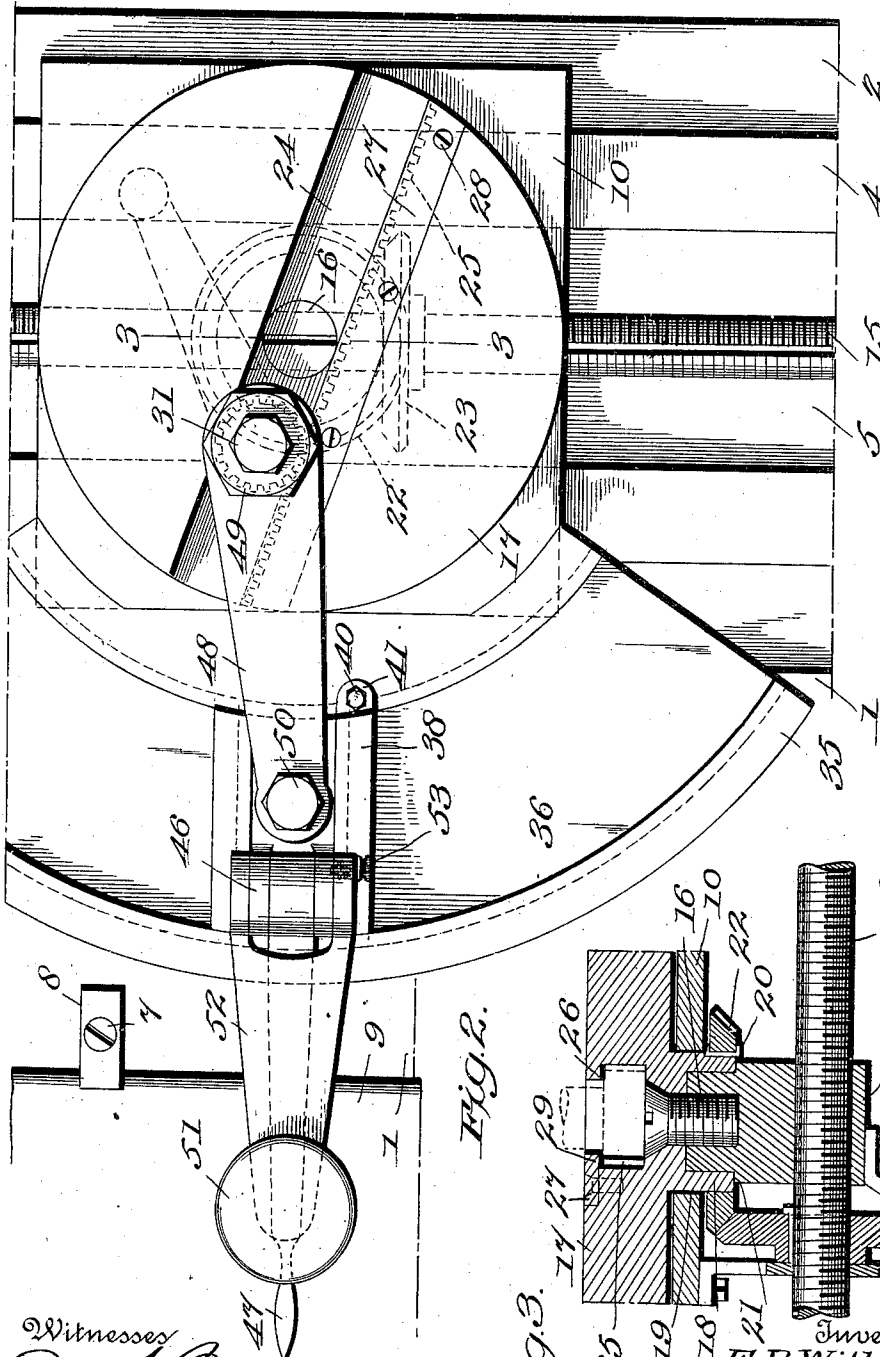


Fig. 2.

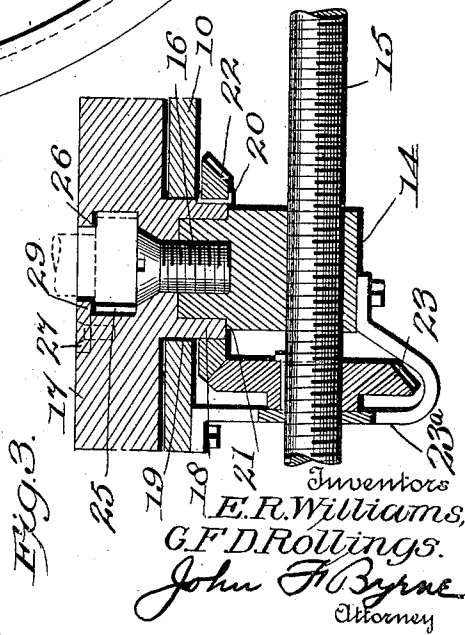


Fig. 3.

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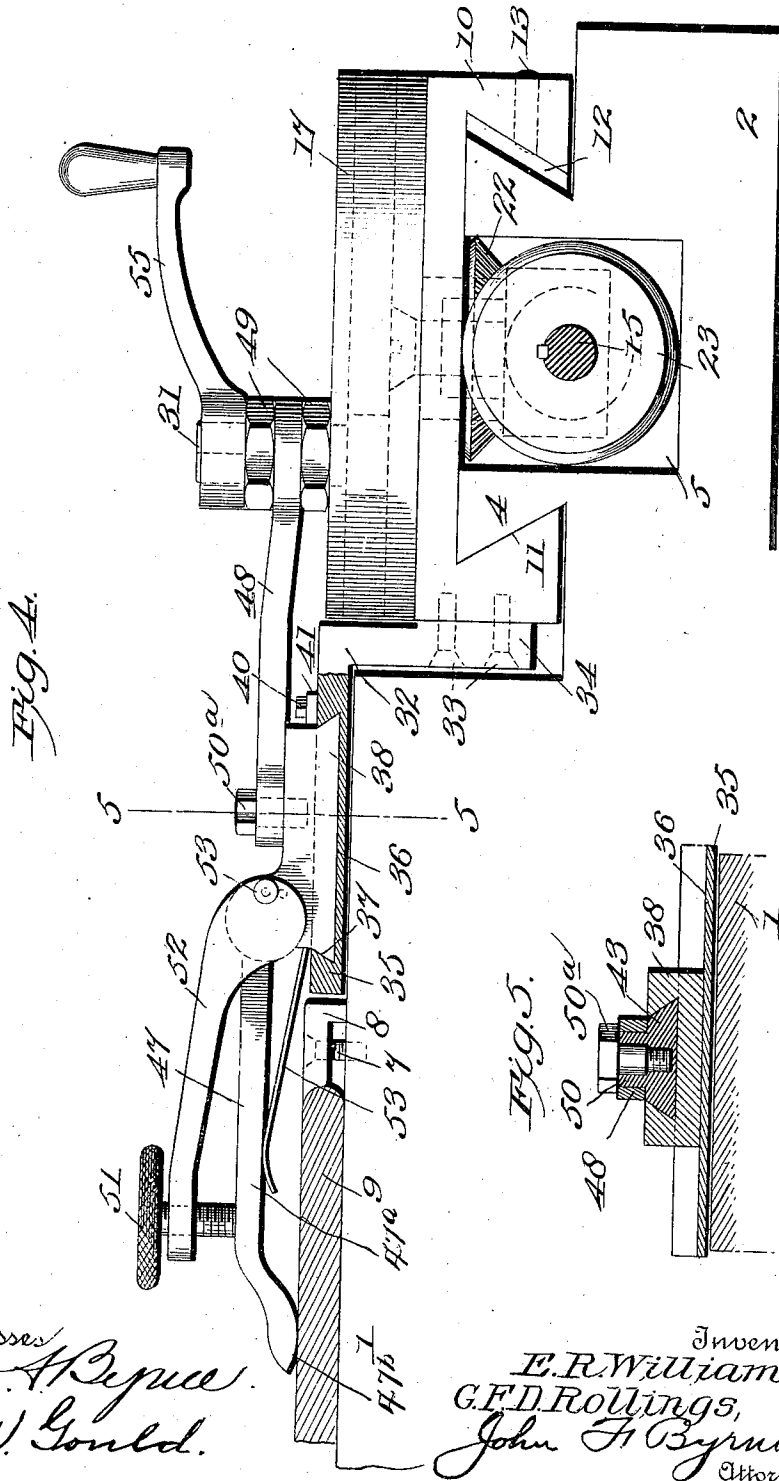
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8 SHEETS—SHEET 3.



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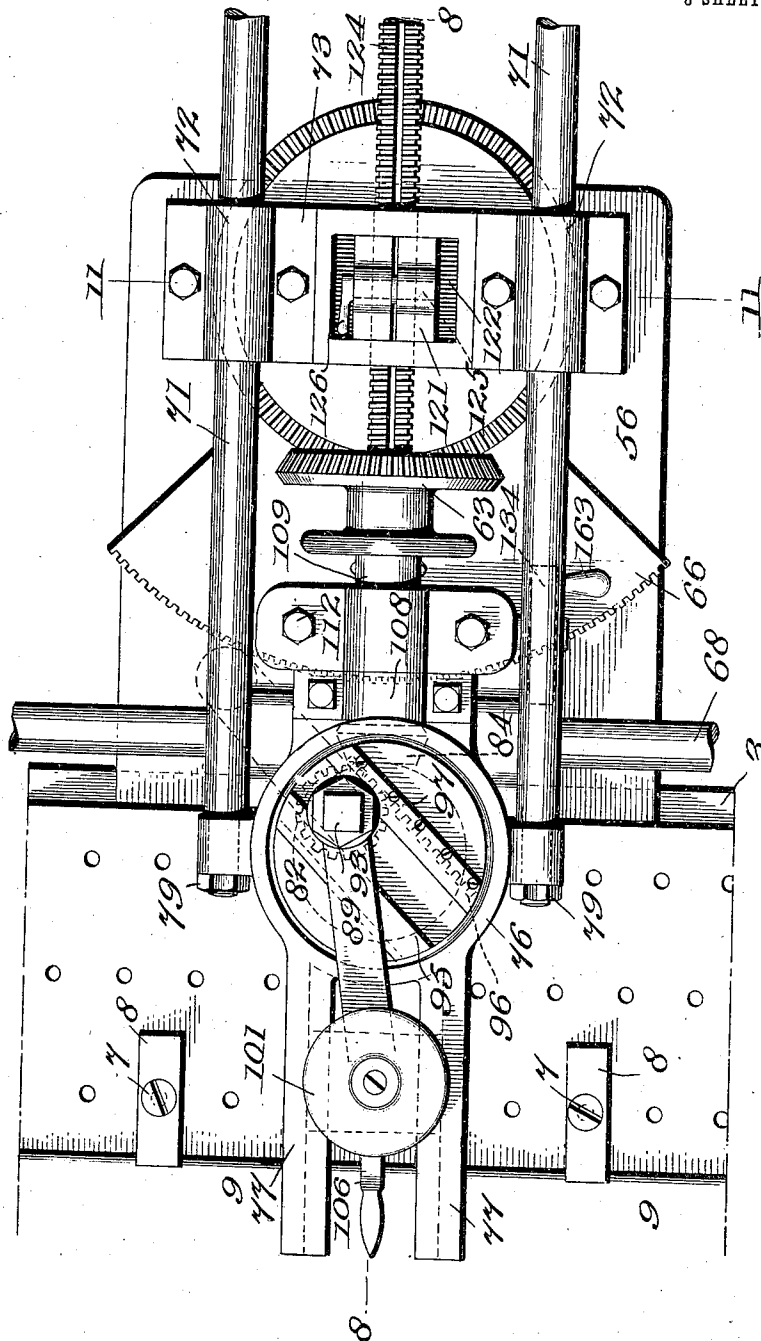
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8 SHEETS—SHEET 4.

995.749.

Fig. 6.



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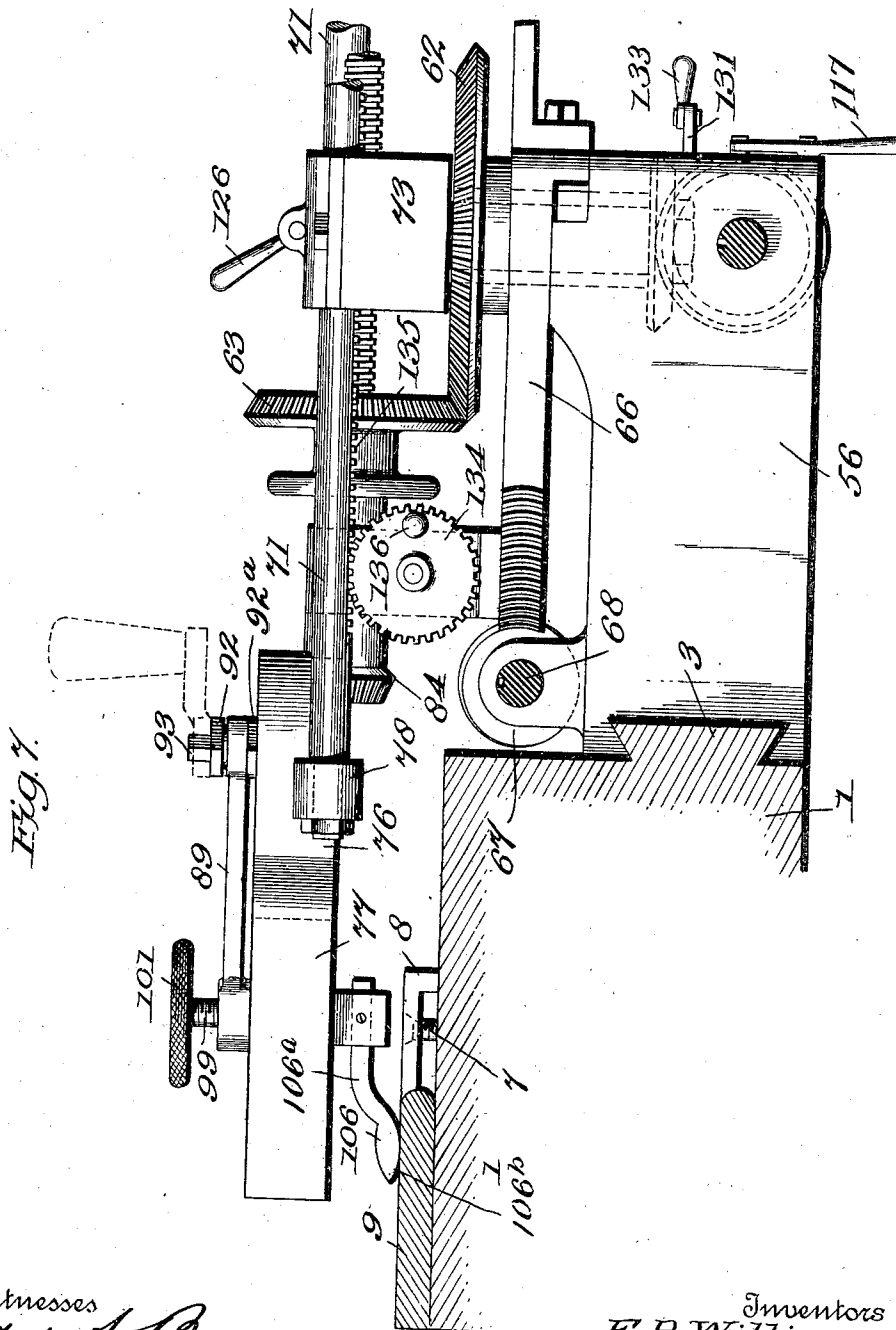
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8 SHEETS—SHEET 5.



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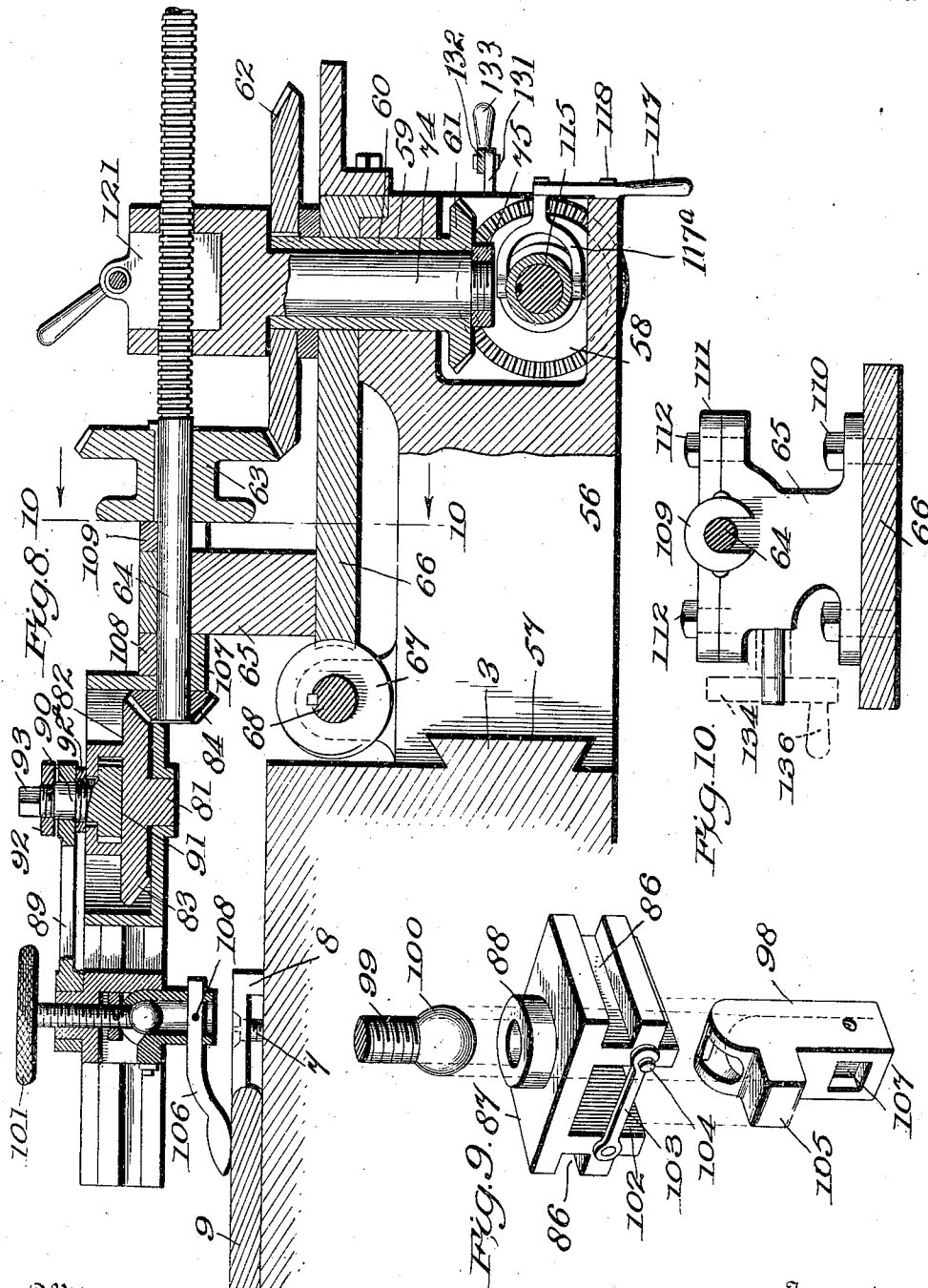
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8 SHEETS—SHEET 6.



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Fig. 11.

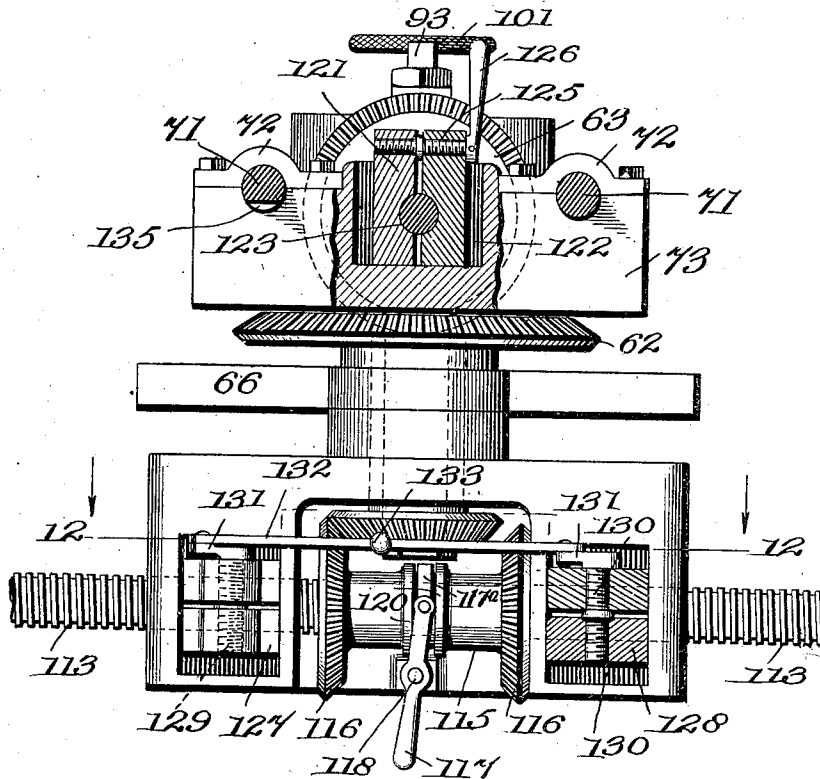
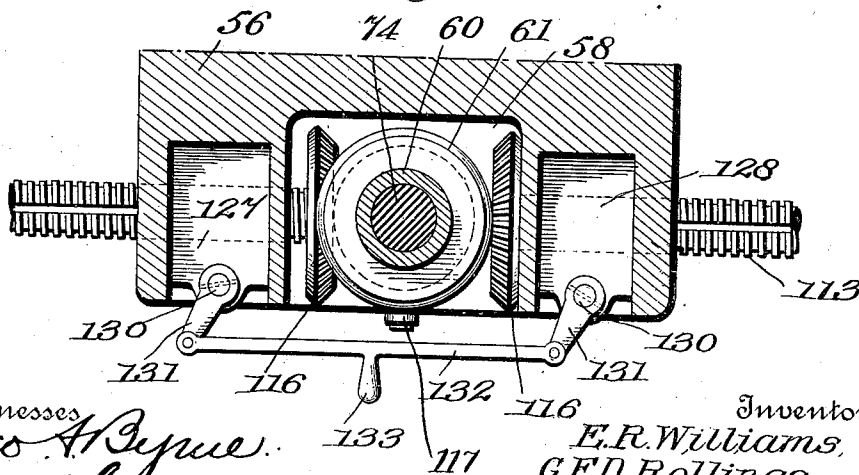


Fig. 12.



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8 SHEETS—SHEET 8.

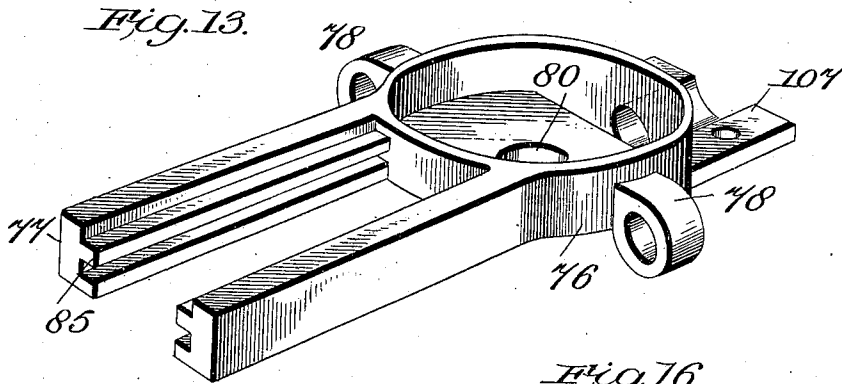


Fig. 16.

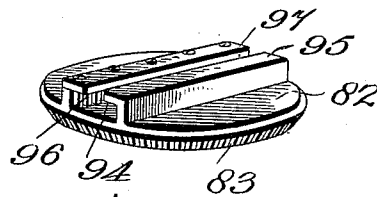


Fig. 14.

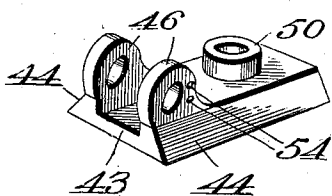


Fig. 15.

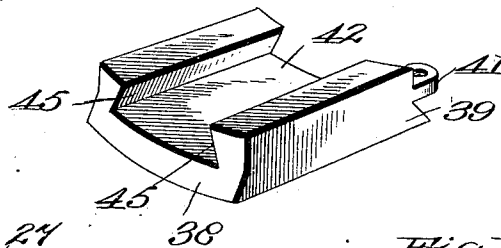


Fig. 17.

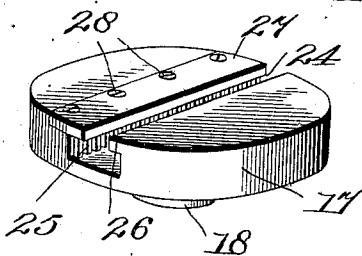


Fig. 18.

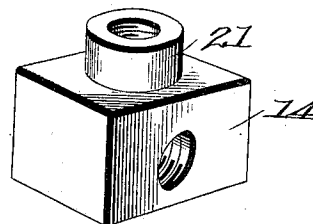
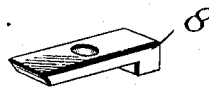


Fig. 19.



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UNITED STATES PATENT OFFICE.

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BURNISHING-MACHINE.

995,749.

Specification of Letters Patent. **Patented June 20, 1911.**

Application filed January 30, 1909. Serial No. 475,153.

To all whom it may concern:

Be it known that we, EDWARD R. WILLIAMS and GEORGE F. D. ROLLINGS, citizens of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Burnishing-Machines, of which the following is a specification.

To prevent the unengraved portions of an engraved plate from printing it is necessary to burnish such portions. The burnishing is at present done by hand with the aid of a hard metal tool which comprises a body having angularly related working edges and a handle secured to the body. At best hand burnishing is slow, tedious, and not productive of the best results.

The primary object of our invention is the provision of a machine which in operation will burnish the unengraved portions of an engraved plate.

A further object of the invention is the provision of a machine which in operation will simultaneously burnish the unengraved portions of several engraved plates.

A further object of the invention is the provision of a burnishing machine wherein the tools shall be under the full control of the operator at all times.

A still further object of the invention is the provision of a burnishing machine which shall be simple and durable of construction, and which may be manufactured and sold at a comparatively low cost.

With the above and other objects in view the invention consists in the construction, combination and arrangement of parts hereinafter fully described and claimed.

The preferred embodiment of the invention is disclosed in the accompanying drawings, wherein:—

Figure 1 is a top plan view of a burnishing machine constructed in accordance with our invention. Fig. 2 is a top plan view of one of the side burnishers. Fig. 3 is a sectional view taken on the vertical plane indicated on the line 3—3 of Fig. 2. Fig. 4 is a view in side elevation of one of the side burnishers, portions thereof being in vertical section. Fig. 5 is a sectional view taken on the vertical plane indicated by the line 5—5 of Fig. 4. Fig. 6 is a top plan view of

the end burnisher. Fig. 7 is a view in side elevation of the end burnisher, portions thereof being in vertical section. Fig. 8 is a sectional view taken on the vertical plane indicated by the line 8—8 of Fig. 6. Fig. 9 is a detail perspective view of the tool carrier of the end burnisher. Fig. 10 is a sectional view taken on the vertical plane indicated by the line 10—10 of Fig. 8. Fig. 11 is a sectional view taken on the vertical plane indicated by the line 11—11 of Fig. 6. Fig. 12 is a sectional view taken on the horizontal plane indicated by the line 12—12 of Fig. 11. Fig. 13 is a detail perspective view of the supporting casting of the end burnisher. Fig. 14 is a detail perspective view of the tool carrier of one of the side burnishers. Fig. 15 is a detail perspective view of the tool carrying block of one side burnisher. Fig. 16 is a detail perspective view of the power disk of the end burnisher. Fig. 17 is a detail perspective view of the power disk of one of the side burnishers. Fig. 18 is a detail perspective view of the feed block of one of the side burnishers, and Fig. 19 is a detail perspective view of one of the clamps through the medium of which an engraved plate is secured to the bed of the machine.

Broadly and generally speaking, the burnishing machine comprises a plate carrier or support, one side burnisher, and two end burnishers. As the side burnishers embody duplicate structures, a description of one will suffice for both.

The plate carrier or support is in the form of a horizontal rectangular bed 1 which is provided at its side edges with downwardly offset horizontal flanges 2 and at its rear end edge with a dovetailed guide rib 3. The flanges 2 are coextensive in length with the length of the bed 1 and are provided at their inner ends with rearwardly extending bearing brackets or extensions 2^a. The guide rib 3 is horizontally disposed, and it is coextensive in length with the width of the bed 1. A dovetailed guide rib 4 is formed upon the upper side and extends longitudinally of each flange 2. Grooves 5, which extend longitudinally of the flanges 2 and of the guide ribs 4, open out through the upper sides of the guide

ribs. In its upper side the bed 1 is formed with a plurality of threaded sockets 6 adapted to receive the screws 7 of clamps 8, said clamps securing an engraved plate 9 to the bed.

Each side burnisher comprises a carriage 10 which is provided in its under side with a dovetailed recess 11 receiving the dovetailed guide rib 4 to slidably mount the carriage upon the flange 2. To permit the carriage 10 to be readily applied to and removed from the guide rib 4, and to permit the wear between the carriage and the guide rib to be compensated for, a wear plate 12 is removably secured to one of the side walls of the recess 11 by bolts 13. A feed block 14 which threadedly engages a screw shaft 15, journaled in the groove 5, is secured to the carriage 10 through the medium of a bolt 16, the connection between the carriage and the shaft being such that the rotation of the shaft moves the carriage longitudinally of the bed 1, the feed block being illustrated in detail in Fig. 18 of the drawings. A power disk 17 is rotatably mounted upon the carriage 10 through the medium of a round stud 18 which is formed on the under side thereof and which fits in an opening 19 in the carriage, the disk being illustrated in detail in Fig. 17 of the drawings. The stud 18 is provided with a cylindrical socket 20 which receives a round boss 21 formed on the upper side of the feed block 14. The power disk 17 is secured in applied position against accidental displacement by the bolt 16. A bevel gear 22 is keyed to the stud 18 and meshes with a bevel gear 23 splined upon the shaft 15, the connection between the power disk and shaft being such that the rotation of the shaft rotates the power disk. The gear 23 is held in mesh with the gear 22 by a bracket 23^a which is secured to the carriage 10 and to the feed block 14. In its upper surface the power disk 17 is provided with a diametrically extending slot 24 which opens at its ends out through the edge of the disk. One side wall of the slot 24 is formed to provide a rack 25. A horizontally disposed shoulder 26 is formed on the other side wall of the slot 24 and a strip 27, which is secured in applied position by means of screws 28, provides a horizontally disposed shoulder 29 on the other side wall of the slot above the rack 25. The shoulders 26 and 29 secure a pinion 30 in the slot 24 against vertical displacement, the pinion meshing with the rack 25. A bolt 31 is formed on the pinion 30 and projects up through the slot 24. An angular support or bracket 32 is secured to the inner side of the carriage 10 by bolts 33 passing through the vertical member 34 of the bracket and entering the carriage. The horizontal supporting member 35 of

the bracket 32 is disposed above the bed 1 and it is preferably sector shape in outline. In its upper side the horizontal member 35 of the bracket 32 is provided with an arcuate slot 36 which has undercut side walls 37 and which opens at its ends out through the sides of the member. A member or block 38 is adjustably mounted in the slot 36 through the medium of its inclined end edges 39 which engage the undercut end walls 37 of the slot, said block being shown in detail in Fig. 15 of the drawings. The block 38 is secured in its adjusted position by means of a set screw 40, which is carried by an eye 41 formed on the block for engagement with the upper side of the horizontal arm 35 of the bracket 32. The block 38 is provided in its upper surface with a slot 42 which opens at its ends out through the ends of the block and in which is mounted for reciprocation a tool carrier 43, the tool carrier being illustrated in detail in Fig. 14 of the drawings.

The tool carrier 43 is secured in the slot 42 of the block 38 against vertical displacement through the medium of its inclined side edges 44 which engage the undercut side walls 45 of the slot. The carrier 43 is provided with a pair of relatively spaced perforated lugs 46 to and between which the inner end of the tool 47 which in its preferred embodiment comprises an elongated body 47^a having a working face 47^b, is pivotally secured, the working face of the tool contacting with the engraved plate 9. A pitman or connecting rod 48 is secured at one end to the bolt 31 through the medium of nuts 49, and the other end thereof is secured to a round stud 50 on the upper side of the block 38 by means of a bolt 50^a. The connection between the tool carrier 43 and the power disk 17 is such that the rotation of the latter will reciprocate the carrier. The reciprocation of the carrier operates, that is to say, imparts a reciprocatory endwise movement to the tool, and the connection between the tool and the carriage 10 is such that the movement of the carriage will impart a rectilinear sidewise movement to and feed the tool on the plate. The tool is operated in a plane coincident with its length, and its feed is in a plane at an angle to the plane of its feeding movement. The relation of the rectilinear motion of the tool to the reciprocatory motion thereof is approximately in the proportion of one to ten. The combined rectilinear and reciprocatory movements of the tool burnish the unengraved portions of the plate. The working face of the tool 47 is held in contact with the engraved plate 9 by a set screw or bolt 51 carried by an arm 52 and contacting with the tool. The pressure of the tool 47 on the engraved plate 9 may be regulated and

varied through the medium of the set screw 51. The arm 52 is pivotally secured to the lugs 46 and is adapted to be held in operative or inoperative position by a spring pressed pin 53, which is carried by the arm for engagement in one of a pair of sockets 54 formed in one of the lugs 46 of the tool carrier 43. When the arm 52 is moved into its inoperative position or when the bolt 51 is turned up a spring 53, secured at one end to the carrier 43 and bearing at its free end on the tool 47, will move and hold the tool up out of contact with the engraved plate 9 permitting the removal of the plate or the cleaning of the tool. The tool can be adjusted horizontally in the arc of a circle by moving the block 38 in the slot 36, and the length of the stroke of the reciprocatory or operating movement imparted to the tool through the rotation of the power disk 17, can be varied by adjusting the bolt 31 with respect to the center of the disk. The bolt 31 may be adjusted through the medium of a crank handle 55 which is secured thereto. As the pinion 30 of the bolt 31 meshes with the rack 25 the turning of the bolt moves it in the direction of or away from the center power disk 17, adjusting the length of the stroke of the operating motion of the tool. The feed and operation of the tool can be thrown out by moving the gears 142 out of engagement with the gear 143, said gears being hereinafter referred to.

Having fully described the side burnishers, we will now describe the end burnisher.

The end burnisher comprises a carriage 56 which is slidably mounted upon the dovetailed guide rib 3, a dovetailed groove 57 being formed on the inner side of the carriage for the reception of the guide rib. The carriage is provided with a recess 58 which opens out through the outer side thereof and with a bearing opening 59 which registers with the recess and which opens out through the upper side of the carriage. A tubular shaft 60 is journaled in the bearing 59 and is provided at its lower end with a bevel gear 61 which is located in the recess 58. A bevel gear 62 is keyed to the upper end of the shaft 60 and meshes with a bevel gear 63 splined upon a shaft 64. The shaft 64 is journaled in the bearing of a post 65 which is secured to and carried by a table or sector gear 66. The sector gear 66 is pivotally secured to the shaft 60 and meshes with a worm 67 keyed upon a shaft 68 journaled in bearings 69 and provided at one end with a removable crank handle 70, the bearings 69 being formed on the rear edges of the flanges 2.

A supporting member, frame or casting, shown in detail in Fig. 13 of the drawings, is secured to and carried by supporting elements or rods 71, said rods being slidably

mounted in bearings 72 in the head 73 of a bolt 74 rotatably mounted in the shaft 60, said bolt being secured in applied position by a nut 75. The casting comprises a hollow cylindrical body 76 and a pair of parallel arms 77. At diametrically opposite points the body 76 is provided with a pair of perforated lugs 78 to which the ends of the supporting rods 71 are secured by nuts 79. The bottom wall of the head 76 is provided with a bearing opening 80 which receives the stud 81 of a power disk 82, which is illustrated in detail in Fig. 16 of the drawings. On its under side the power disk 82 is provided with an annular series of gear teeth 83 which mesh with a bevel gear 84 secured to the shaft 64. The arms 77 of the casting are provided on their inner sides with guide ribs 85 which are received by guide grooves 86 of a block 87. The block 87 is provided on its upper side with a stud 88 to which one end of a pitman or connecting rod 89 is secured, the other end of the pitman rod or connecting rod being secured to the bolt 90 of a pinion 91. A nut 92 secures the pitman or connecting rod 89 to the bolt 90, and the upper end of the bolt is provided with an angular extension 93 to permit the pinion to be turned by a hand crank, not shown. The pinion 91 is mounted in a slot 94 which extends diametrically of the power disk 82 and which opens at its ends out through the edge thereof. One side wall of the slot 94 is provided with a horizontally disposed shoulder 95 and the other side wall thereof is provided with a rack 96, with which the pinion 91 meshes. A plate 97 is secured to said other side wall of the slot 94, and it and the shoulder 95 prevent the vertical displacement of the pinion 91. The connection between the block 87 and the power disk 82 is such that the rotation of the latter will reciprocate the former. By adjusting the pinion 91 with relation to the center of the power disk 82 the length of the stroke of the block 87 can be varied. The pinion 91 is held against accidental movement by a nut 92* carried by the bolt 90 and engaging the shoulder 95 and plate 97. A tool carrier 98 is secured to the block 87 by a bolt 99 threadedly engaging the boss 88. The bolt is provided with an enlarged head 100 upon which the tool carrier 98 is pivotally mounted, and with a milled operating wheel 101 by means of which the bolt may be turned to raise or lower the tool carrier. The tool carrier 98 is held against movement upon the head 100 of the bolt 99 by its engagement with the side walls of a recess 102 and by means of a latch 103. The recess 102 opens out through the front and bottom sides of the block 87, and the latch 103 is pivotally secured to the block so that it may be swung across the open front side of the recess. When in oper-

ative position the bolt engages a pin 104 on the block 87 and a projection 105 on the tool carrier. When it is desired to turn the tool carrier upon the bolt 99 it is only necessary to throw the latch 103 into inoperative position. A tool 106 which in its preferred embodiment comprises an elongated body 106^a having a working face 106^b is secured in openings 107 in the carrier 98 by a pin 108. As the tool carrier is pivotally mounted upon the bolt 99 the tool 106 may be thrown up out of engagement with the engraved plate 9 to permit the removal of the plate or the cleaning of the tool. As the bolt 99 threadedly engages the block 87 the pressure of the tool 106 upon the engraved plate 9 can be regulated and varied. On its rear side the body 76 of the casting is provided with a bearing extension 107 to which is removably secured a bearing cap 108, the shaft 64 passing through the bearing formed by the extension and the cap, see Figs. 8 and 13 of the drawings. The bevel gear 63 is spaced from the post 65 by means of a filler 109. The post 65 is secured to the sector 66 by means of bolts 110 and the bearing thereof in which the shaft 64 is journaled is covered by a removable plate 111 which is secured in applied position by bolts 112, as clearly shown in Fig. 10 of the drawings. A screw shaft 113, which is journaled in bearings 114 on the brackets 2^a, passes freely through the carriage 56, and it is provided with a sleeve 115 splined thereon and located in the recess 58. Beveled gears 116 are fixed upon the sleeve 115, and one or the other thereof is adapted to be meshed with the beveled gear 61 of the shaft 60, whereby the rotation of the shaft 113 rotates the shaft 60, shaft 64, and power disk 82, the rotation of the power disk reciprocating the tool carrier. The movement of the carrier operates the tool, that is to say, imparts a reciprocatory endwise movement thereto. The tool is operated in a plane coincident with the length thereof. The sleeve 115 is adapted to be adjusted upon the shaft 113 to move one of the gears 116 into and the other gear 116 out of engagement with the gear 61 by a hand lever 117. This hand lever is pivotally mounted upon the outer side of the carriage 56, as at 118, and is provided with a fork 117^a carried by a collar 119 loosely mounted between annular flanges 120 formed on the sleeve 115. In view of the gears 116 the direction of rotation of the shaft 60 can be changed.

The members of a split nut 121 are mounted in a recess 122 formed in and opening out through the upper side of the head 73. The members of the nut 121 are provided with threaded recesses 123 which engage the threaded portion 124 of the shaft 64, and are connected together by a bolt 125 which is provided with an operating handle 126.

The turning of the bolt 125 in one direction moves the members of the nut out of engagement with the threaded portion of the shaft and the turning of the bolt in the reverse direction moves the members into engagement with the threaded portion of the shaft. During the rotation of the shaft in one direction and when the members of the nut engage the threaded portion thereof, the casting is moved longitudinally and forwardly over the bed 1. This movement of the casting feeds the tool 106 longitudinally and forwardly on the engraved plate 9. When the shaft is rotating in the reverse direction and when the members of the nut engage the threaded portion thereof, the casting is moved longitudinally and rearwardly over the bed, feeding the tool longitudinally and rearwardly on the plate. The longitudinal feeds of the tool are each in a plane coincident with the plane of its operating movement. The casting in its forward and rearward feeds is supported and guided by the rods 71. The longitudinal feed of the tool 106 can be thrown out by moving the members of the nut 121 out of engagement with the shaft 64.

The members of split nuts 127 and 128 are respectively mounted in recesses 129 and 130 formed in and opening out through the rear side of the carriage 56. The members of the nuts 127 and 128 are provided with recesses having threads adapted to be engaged with the threads of the shaft 113. The members of the nuts 127 and 128 are connected together by bolts 130, which are provided at their upper ends with cranks 131, said cranks being connected by a rod 132 provided with a hand grip 133. When the rod 132 is moved in one direction the members of the nuts 127—128 are moved out of engagement with the shaft 113 cutting out the transverse movement of the end carriage 56 and the transverse feed of the tool 106. When the rod 132 is moved in a reverse direction the members of the nuts 127—128 are moved into engagement with the shaft 113, whereupon the shaft 113 will, during rotation, move the end carriage 56 transversely of the bed 1 and feed the tool 106 transversely on the engraved plate. The transverse feed of the tool is in a plane at an angle to the plane of its operating movement. This feed of the tool imparts a side-wise motion thereto. The transverse feed of the tool 106 can be thrown out by moving the members of the nuts 127 and 128 out of engagement with the shaft 113. When it is desired to change the direction of the movement of the carriage 54, and consequently the transverse feed of the tool 106, the motor, hereinafter referred to, is reversed.

It should be apparent that it is possible

to impart a longitudinal feed, a longitudinal and transverse feed, or a transverse feed to the tool 106. The tool during its longitudinal and transverse feed, its transverse feed, or its longitudinal feed, reciprocates. The feeds of the tool 106 are hereinafter termed rectilinear movements, and these and the reciprocatory or operating movements of the tool burnish the unengraved portions of the engraved plate. The relation of the rectilinear or feeding movements of the tool 106 to the reciprocatory or operating movements thereof, is approximately in the proportion of one to ten. The tool 106 may be horizontally adjusted in the arc of a circle by rotating the shaft 68, and it may be placed on any point of the plate and its position changed through the medium of a pinion 134, which is journaled on the post 65 for engagement with a rack 135 formed on the under side of one of the supporting rods 71, this adjustment of the tool being known as its longitudinal adjustment. The pinion is provided with an operating handle 136.

Before the machine is set in operation, the bolts are turned to force and hold the tools in contact with the plate under grain crushing pressure. In operation of the machine, the movements of the tools burnish the plate, and when found desirable the tools may, owing to their adjustability, be positioned to be operated or operated and fed at angles to the grains of the plate. As the feed of the carriage may be thrown out, the tool may be caused to reciprocate for any desired length of time on any portion of the plate. The means for operating this tool may be also thrown out, whereby to permit the tool to be positioned on different points of the plate.

In the operation of the machine, the side tools burnish the unengraved side marginal portions, and the end tool the unengraved end marginal portions of the plate. The tools also burnish those unengraved portions which are located between the unengraved side and the unengraved end marginal portions of the plate. The arcuate adjustability of the tools, the adjustability of the strokes of their reciprocatory or operating movement, and the longitudinal adjustability of the end tool, permit the tools to be adjusted with relation to any curved, straight, or angular engraved line of the plate, whereby during the operation of the machine the tools will burnish those unengraved portions located between the end edges and any of such line or lines of the plate and between any of such lines of the plate.

The machine is adapted to be operated by an electric or other motor 137. A pinion 138, which is keyed on the armature shaft 139 of the motor 137, meshes with a gear wheel

140 fixed on the shaft 113. Sleeves 141 are splined upon the shaft 113 and each is provided with a pair of beveled gears 142. One gear of each pair is adapted to mesh with a bevel gear 143 fixed on the rear extended end 144 of each shaft 15. The sleeves 141 may be moved upon the shaft 113 through the medium of levers (not shown). The connection between the shaft 113 and the shafts 15 is such that rotation of the former rotates the latter, and such that the direction of rotation of the shafts 15 may be changed at the will of the operator. The extensions 144 of the shafts 15 are journaled in bearings 145 formed on the upper side of the brackets 2^a.

It should be apparent from the above description, taken in connection with the accompanying drawings, that the shafts will when in operation move the side carriages longitudinally and the end carriage transversely of the bed; that the movements of the carriages impart rectilinear or feeding movements to the tools; that the rotation of the shaft imparts reciprocating or operating movements to the tools; that the reciprocatory and rectilinear movements of the tools burnish the plate; that the tools may be adjusted with relation to any engraved line of the plate; that the tool may be adjusted at an angle with relation to the grains of the unengraved portions of the plate; that the tools are under the full control of the operator at all times; that the tools may be readily and quickly moved up out of engagement with the plate when it is desired to clean them or remove the plate; and that the pressure of the tools on the plate may be regulated and varied. It should also be apparent that the machine is simple, durable, and efficient and that it may be manufactured and sold at low cost.

While we have described the invention, together with the construction which we now consider to be the best embodiment thereof, we desire to have it understood that the construction shown is merely illustrative and that such changes may be made when desired as are within the scope of the claims.

Having thus described our invention what we claim and desire to secure by Letters-Patent is:—

1. A burnishing machine comprising a work support, a burnishing tool mounted for movable contact with the work, means for reciprocating the tool on the work, and means for feeding the tool on the work, the feed of the tool carrying it on the work in the direction of its reciprocation.

2. A burnishing machine comprising a work support, a member mounted for arcuate adjustment, a burnishing tool mounted upon the member for reciprocation, the adjustability of the member permitting the tool to

be positioned at different points on the work, and means for reciprocating the tool on the adjustable member.

3. A burnishing machine comprising a work support, a member mounted for arcuate and longitudinal adjustment, a burnishing tool mounted upon the member for reciprocation, the adjustability of the member permitting the tool to be positioned at different points on the work, and means for reciprocating the tool on the adjustable member.

4. A burnishing machine comprising a work support, an adjustably mounted rod, means by which the rod may be adjusted, a burnishing tool movably mounted upon the rod, and means for moving the tool relative to the rod, the adjustability of the rod permitting the tool to be positioned at different points upon the work.

5. A burnishing machine comprising a work support, a movably mounted carriage, means for moving the carriage, a rod adjustably mounted upon the carriage, means by which the rod may be adjusted, a burnishing tool movably mounted on the rod, and means for moving the tool relative to the rod, the adjustability of the rod permitting the tool to be positioned at different points upon the work.

6. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, a supporting element adjustably mounted upon the carriage, means by which the supporting element may be connected to the power element for adjustment thereby, a burnishing tool movably mounted on the supporting element, and means for moving the tool relative to the supporting element.

7. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, a supporting element adjustably mounted upon the carriage, means by which the supporting element may be connected to the power element for adjustment thereby, a burnishing tool movably mounted on the supporting element, and a connection between the tool and the power element, whereby the operation of the power element moves the tool relative to the supporting element.

8. A burnishing machine comprising a work support, a movably mounted carriage, means for moving the carriage, a supporting element adjustably mounted on the carriage, means by which the supporting element may be adjusted, a member carried by the element, a burnishing tool movably mounted upon the member, and means for moving the tool relative to the member, the adjustability of the supporting elements permitting the tool to be positioned at different points upon the work.

9. A burnishing machine comprising a

work support, a movably mounted carriage, a power element adapted to move the carriage, a burnishing tool mounted on the carriage for movement relative thereto, and a connection between the burnishing tool and the power element to permit the power element to move the burnishing tool relative to the carriage.

10. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, a carrier mounted on the carriage for movement relative thereto, a burnishing tool mounted on the carrier, and a connection between the power element and the carrier to permit the power element to move the carrier relative to the carriage.

11. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, means adjustably mounted on the carriage, a burnishing tool mounted upon said means for movement relative thereto, the adjustability of said means permitting the tool to be positioned at different points upon the work, and a connection between the burnishing tool and the power element to permit the power element to move the burnishing tool relative to said means.

12. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, means mounted on the carriage for arcuate adjustment, a burnishing tool mounted upon said means for movement relative thereto, the adjustability of said means permitting the burnishing tool to be positioned at different points upon the work, and a connection between the burnishing tool and the power element to permit the power element to move the burnishing tool relative to said means.

13. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, means mounted on the carriage for adjustment longitudinally of the work, a burnishing tool mounted upon said means for movement relative thereto, the adjustability of said means permitting the tool to be positioned at different points on the work, and a connection between the burnishing tool and the power element to permit the power element to move the burnishing tool relative to said means.

14. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, means mounted upon the carriage for arcuate and longitudinal adjustments, a burnishing tool mounted upon said means for movement relative thereto, the adjustability of said means permitting the tool to be positioned at different points upon the work,

and a connection between the burnishing tool and the power element to permit the power element to move the burnishing tool relative to said means.

15 15. A burnishing machine comprising a work support, a power element, a movably mounted carriage, means by which the carriage may be connected with and disconnected from the power element, a burnishing tool mounted on the carriage for movement relative thereto, and a connection between the burnishing tool and the power element to permit the power element to move the burnishing tool relative to the carriage.

15 16. A burnishing machine comprising a work support, a movably mounted carriage, means for moving the carriage, a rod mounted upon the carriage, a frame carried by the rod, a burnishing tool mounted on the frame for movement relative thereto, and means for moving the burnishing tool relative to the frame during the movement of the carriage in one direction.

25 17. A burnishing machine comprising a work support, a burnishing tool mounted for movable contact with the work, means adapted to continuously advance the tool on the work, and means adapted to operate the tool on the work during the advancing thereof on the work.

35 18. A burnishing machine comprising a work support, a burnishing tool mounted for movable contact with the work, means adapted to continuously advance the tool on the work, and means adapted to reciprocate the tool on the work during the time it is being advanced on the work.

40 19. A burnishing machine comprising a work support, a pivotally mounted table, a burnishing tool mounted upon the table for movement relative thereto, and means adapted to move the burnishing tool relative to the table.

45 20. A burnishing machine comprising a work support, a pivotally mounted table, means adjustably mounted upon the table, a burnishing tool mounted upon said means for movement relative thereto, and means by which the burnishing tool may be moved relative to said first-named means.

50 21. A burnishing machine comprising a work support, a movably mounted carriage, means adapted to move the carriage, a table pivotally mounted upon the carriage, a burnishing tool mounted upon the table for movement relative thereto, the pivoting of the table permitting the tool to be positioned at different points upon the work, and means for moving the tool relative to said table.

22. A burnishing machine comprising a work support, a movably mounted carriage, means adapted to move the carriage, a table pivotally mounted upon the carriage, means

adjustably mounted upon the table, a burnishing tool mounted upon said means for movement relative thereto, the pivoting of the table and the adjustability of said means permitting the tool to be positioned at different points upon the work, and means for moving the burnishing tool relative to said first-named means.

23. A burnishing machine comprising a work support, a movably mounted carriage, means for moving the carriage, a frame mounted upon the carriage, a block slidably mounted upon the frame, means for moving the block relative to the frame, a bolt carried by the block, and a burnishing tool carried by the bolt.

24. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, means adjustably mounted upon the carriage, a burnishing tool mounted upon said means for movement relative thereto, a shaft rotatably and slidably mounted upon the carriage, a connection between the burnishing tool and the shaft for operating the tool, means connecting the shaft to the power element for rotation thereby, and means by which the shaft may be connected with the power element to permit the power element to impart a longitudinal movement to the shaft, the longitudinal movement of the shaft adjusting said first-named means.

25. A burnishing machine comprising a work support, a movably mounted carriage, means adjustably mounted upon the carriage, means adapted to connect said first-named means with the power element for adjustment thereby, a burnishing tool mounted upon said first-named means for movement relative thereto, and means connecting the burnishing tool with the power element for movement relative to the first-named means.

26. A burnishing machine comprising a work support, a power element, a movably mounted carriage, means by which the carriage may be connected to and disconnected from the power element, a burnishing tool movably mounted upon the carriage, and a connection between the tool and power element to permit the power element to move the tool relative to the carriage, the structure being such that the burnishing tool may be operated during the movement of the carriage and while the carriage is at rest.

27. A burnishing machine comprising a work support, a burnishing tool, a movably mounted carriage upon which the tool is mounted for reciprocation, means for moving the carriage, the movement of the carriage feeding the tool on the work, and means for reciprocating the tool relative to and during the movement of the carriage.

28. A burnishing machine comprising a

- work support, a burnishing tool, a movably mounted carriage, a member adjustably mounted upon the carriage and upon which the tool is mounted for reciprocation, the adjustment of the member permitting the tool to be positioned at different points upon the work, means for moving the carriage, the movement of the carriage feeding the tool on the work, and means for reciprocating the tool relative to and during the movement of the carriage, the feeding and reciprocating movements of the tool burnishing the work.
29. A burnishing machine comprising a work support, a burnishing tool, a movably mounted carriage, a member adjustably mounted upon the carriage and upon which the tool is mounted for reciprocation, the adjustment of the member permitting the tool to be positioned at different points upon the work, means for moving the carriage, the movement of the carriage feeding the tool on the work, means for reciprocating the tool relative to and during the movement of the carriage, the feeding and reciprocating movements of the tool burnishing the work, and means by which the member may be adjusted.
30. A burnishing machine comprising a work support, a burnishing tool, means upon which the tool is mounted for reciprocation, said means being mounted for arcuate adjustment and for adjustment longitudinally of the work, said adjustments permitting the tool to be positioned at different points on the work, and means for reciprocating the tool on said means.
31. A burnishing machine comprising a work support, a burnishing tool, means upon which the tool is mounted for reciprocation, said means being mounted for adjustment longitudinally and transversely of the work, and means for reciprocating the tool on the work.
32. A burnishing machine comprising a work support, a burnishing tool, a movably mounted carriage, a member mounted upon the carriage for adjustment longitudinally of the work, the tool being mounted upon the member for reciprocation, the adjustment of the member permitting the tool to be positioned at different points on the work, means for moving the carriage, the movement of the carriage feeding the tool on the work, and means for reciprocating the tool on and during the movement of the carriage.
33. A burnishing machine comprising a work support, a burnishing tool, a movably mounted carriage, a member mounted upon the carriage for adjustment longitudinally of the work, the tool being mounted upon the member for reciprocation, the adjustment of the member permitting the tool to be positioned at different points on the work, means for moving the carriage, the movement of the carriage feeding the tool on the work, means for reciprocating the tool on and during the movement of the carriage, and means for adjusting the member.
34. A burnishing machine comprising a work support, a pivotally mounted table, a burnishing machine mounted upon the table for movement relative thereto, means adapted to move the burnishing tool relative to the table, and means by which the table may be turned upon its pivot.
35. A burnishing machine comprising a work support, a supporting member, a block slidably mounted upon the supporting member, means for moving the block relative to the supporting member, a carrier mounted upon the block, and a tool secured to the carrier.
36. A burnishing machine comprising a work support, a supporting member, a burnishing tool movably mounted upon the supporting member, a rotatably mounted shaft, means for rotating the shaft, and a connection between the burnishing tool and said shaft whereby the rotation of the shaft moves the burnishing tool relative to the supporting member.
37. A burnishing machine comprising a work support, an adjustably mounted supporting member, a burnishing tool mounted upon the supporting member for movement relative thereto, and means for moving the burnishing tool relative to the supporting member, the adjustability of the supporting member permitting the tool to be positioned at different points upon the work.
38. A burnishing machine comprising a work support, an adjustably mounted supporting member, a burnishing tool mounted upon the supporting member for movement relative thereto, a longitudinally movable and rotatably mounted shaft, means for rotating the shaft, a connection between the shaft and the burnishing tool whereby the rotation of the shaft will move the burnishing tool relative to the supporting member, and means adapted to engage the shaft whereby to cause it to move longitudinally during its rotation, the longitudinal movement of the shaft adjusting the supporting member.
39. A burnishing machine comprising a work support, a movably mounted carriage, a power element adapted to move the carriage, a supporting member adjustably mounted upon the carriage, a burnishing tool mounted upon the supporting member for movement relative thereto, a shaft mounted upon the carriage for rotation and longitudinal movement, a connection between the shaft and the power element whereby the rotation of the power element

will rotate the shaft, a connection between the shaft and the burnishing tool whereby the rotation of the shaft will move the burnishing tool relative to the supporting member, and means by which the shaft may be caused to move longitudinally during the rotation thereof, the longitudinal movement of the shaft adjusting the supporting member.

40. A plate burnishing machine comprising a support upon which a piece of work is adapted to be secured, a carriage mounted for movement relative to the work, a burnishing tool mounted upon the carriage for movement relative thereto, means for moving the tool on the work relative to the carriage, and means by which the carriage may be moved to advance the tool on the work during its movement relative to the carriage.

41. A plate burnishing machine comprising a support upon which a piece of work is adapted to be secured, a carriage mounted for movement relative to the work, a burnishing tool mounted upon the carriage for reciprocation on the work relative to the carriage, means for reciprocating the tool, and means by which the carriage may be moved to advance the tool along the work during its reciprocation.

42. A plate burnishing machine comprising a support upon which a piece of work is

adapted to be secured, a carriage mounted for movement relative to the work, a burnishing tool mounted upon the carriage for movement relative thereto, means for moving the tool on the work relative to the carriage, and means by which the carriage may be moved to position the tool at different points upon the work.

43. A burnishing machine comprising a work support, a movably mounted carrier, means for moving the carrier, a burnishing tool, means for pivotally and adjustably securing the burnishing tool to the carrier, the pivotal connection between the burnishing tool and carrier permitting the burnishing tool to be lowered into and raised out of engagement with the work, the adjustable connection between the burnishing tool and the carrier permitting the burnishing tool to be forced into engagement with the work under various degrees of pressure, and means for forcing the burnishing tool into engagement with the work under various degrees of pressure.

In testimony whereof we affix our signatures, in presence of two witnesses.

EDWARD R. WILLIAMS.

GEORGE F. D. ROLLINGS.

Witnesses:

EDWARD KEEGIN,
JOHN F. BYRNE.