March 30, 1926.

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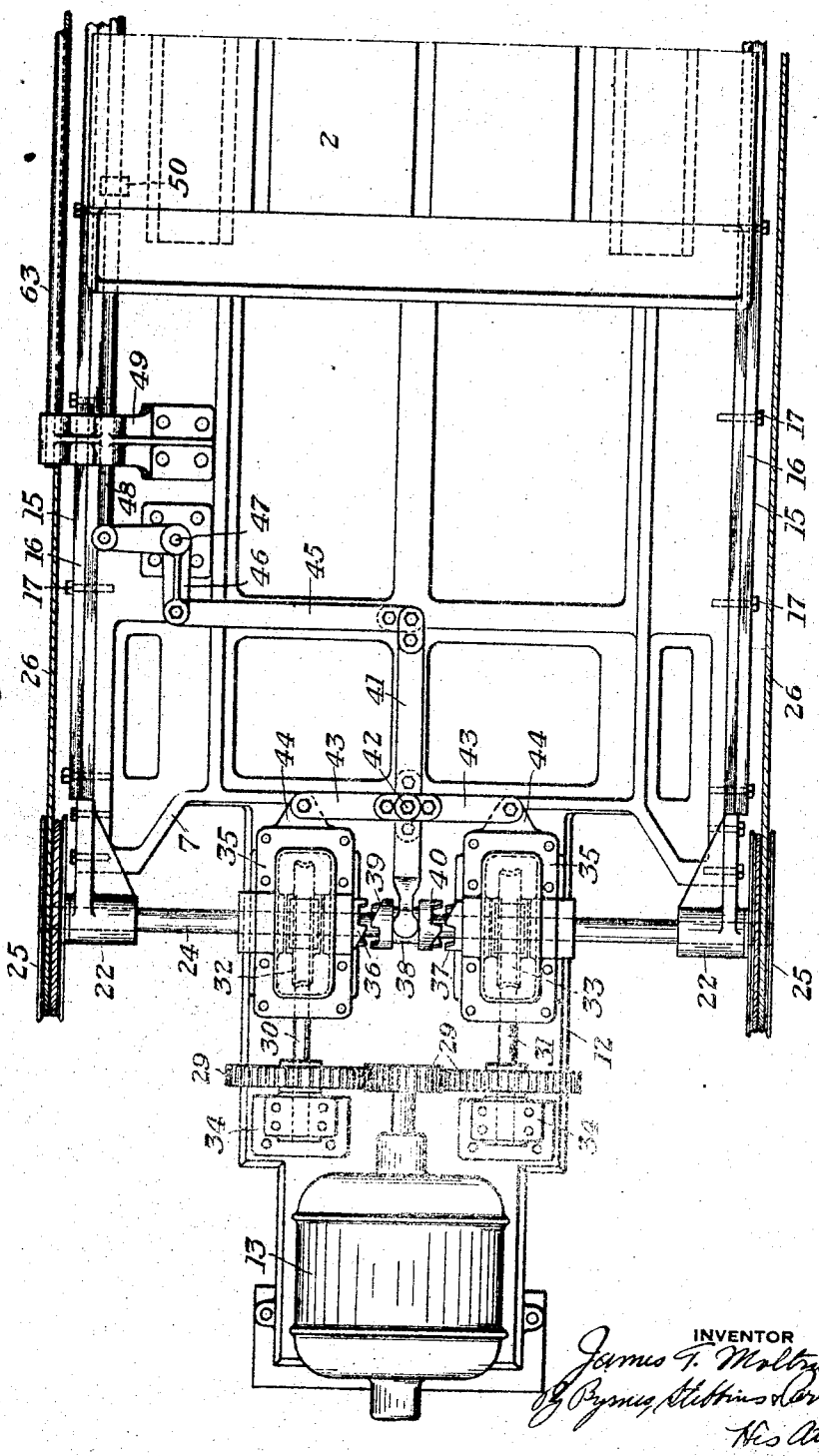
J. T. MOLTRUP

GRINDING APPARATUS

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7 Sheets-Sheet 1

Fig 1a.



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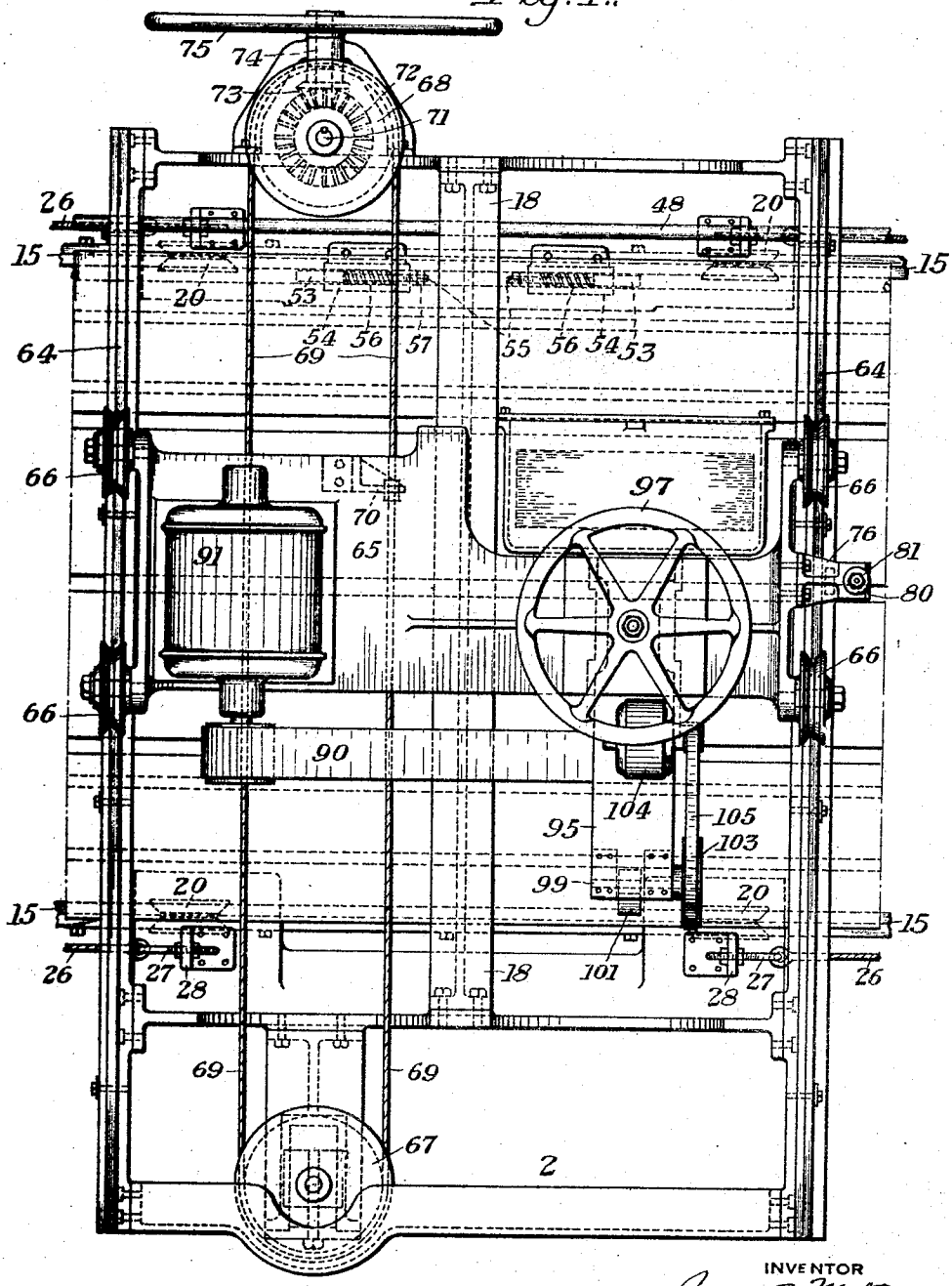
March 30, 1926. 1,578,342

J. T. MOLTRUP

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Fig. 1b.



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GRINDING APPARATUS

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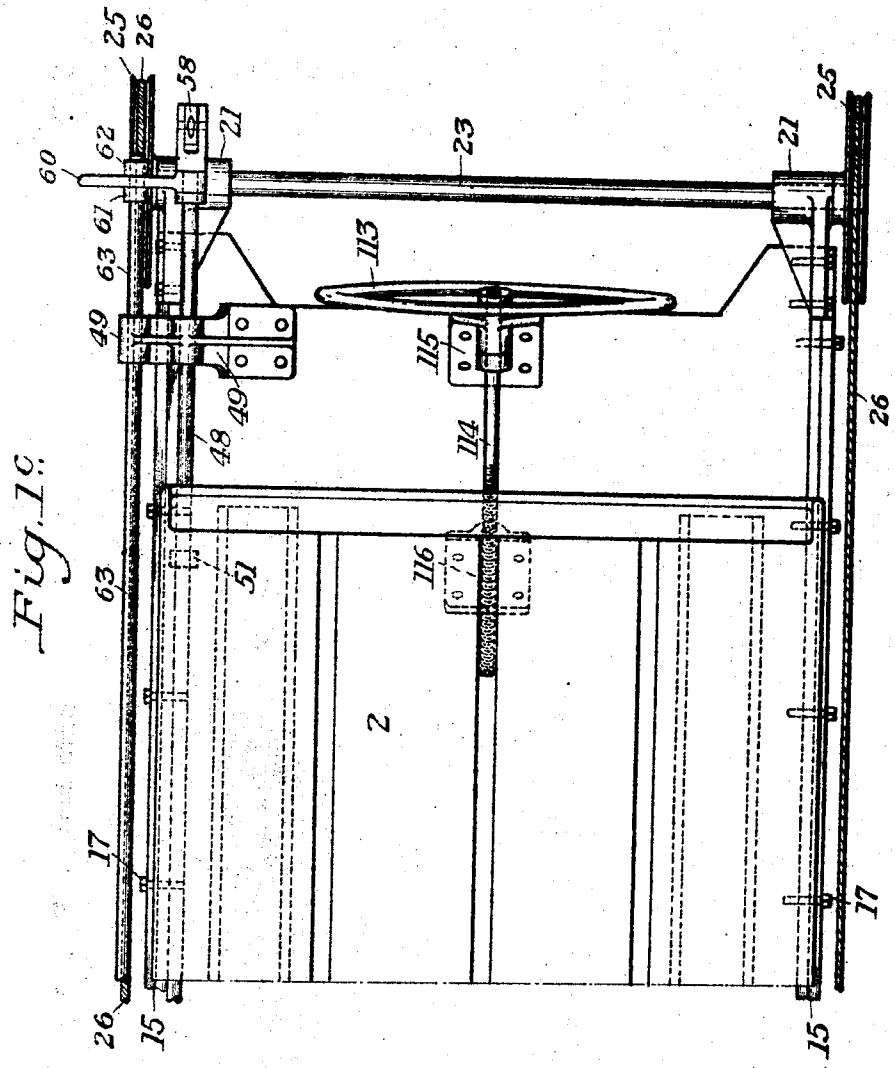


Fig. 1c.

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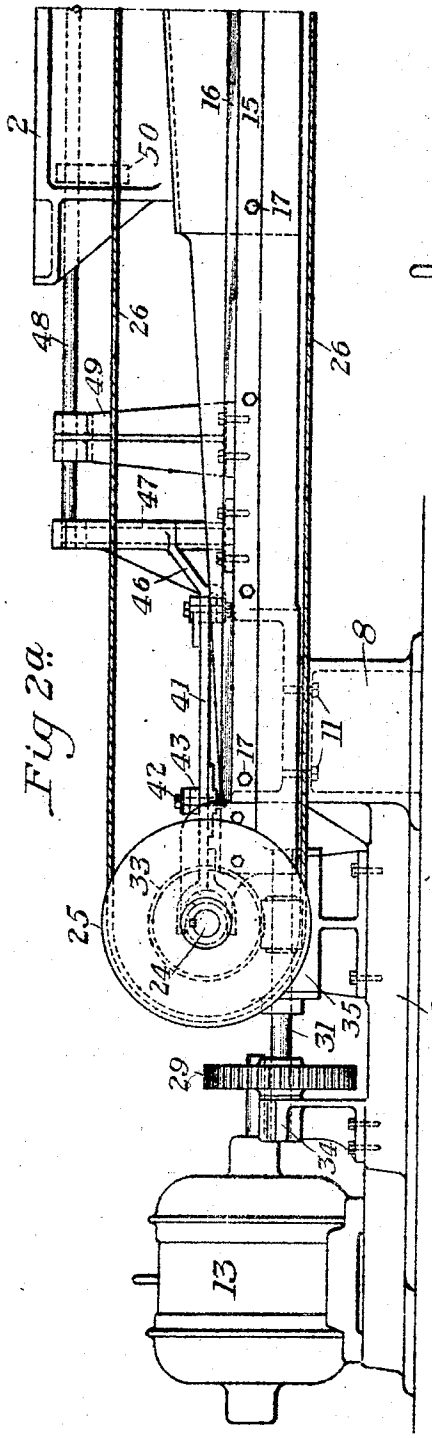


Fig 2a.

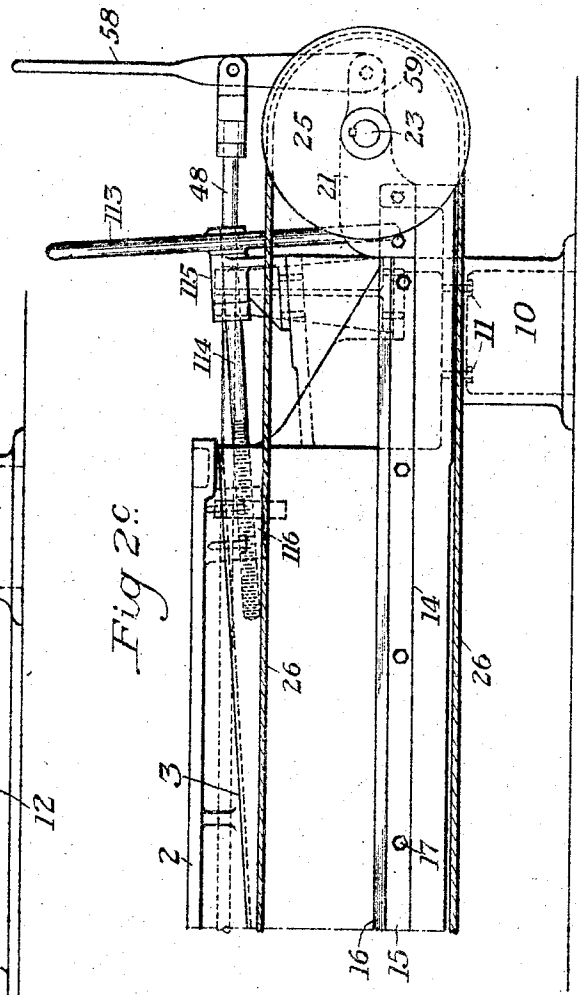


Fig 2c.

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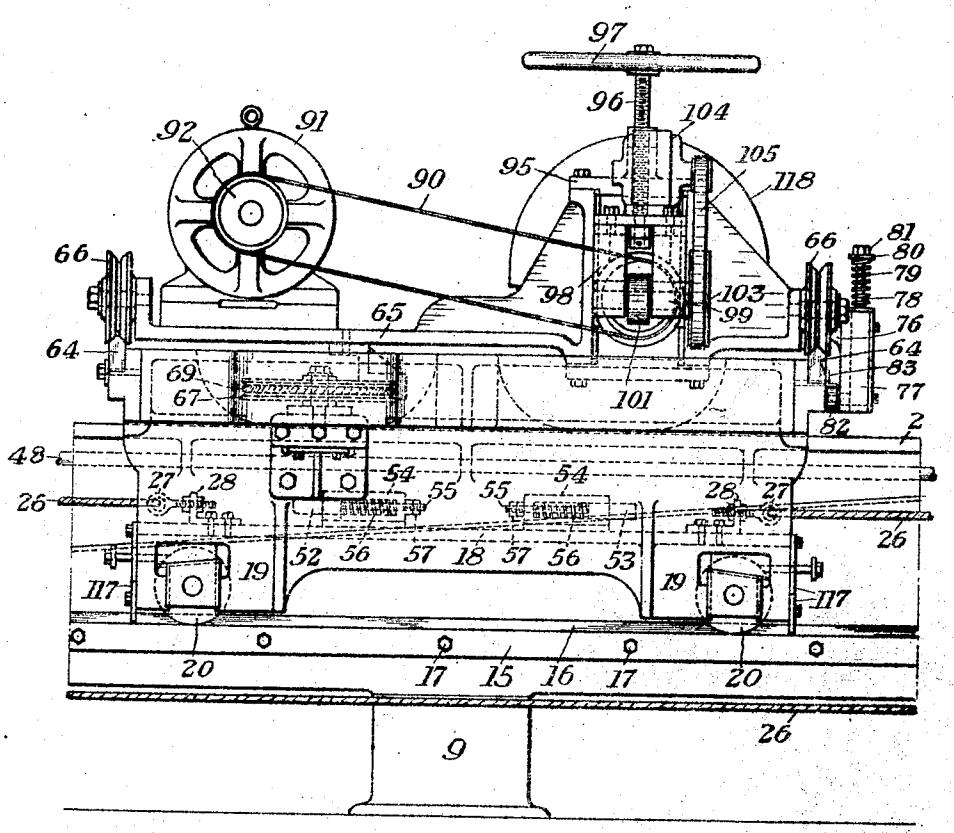
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GRINDING APPARATUS

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Fig 2b



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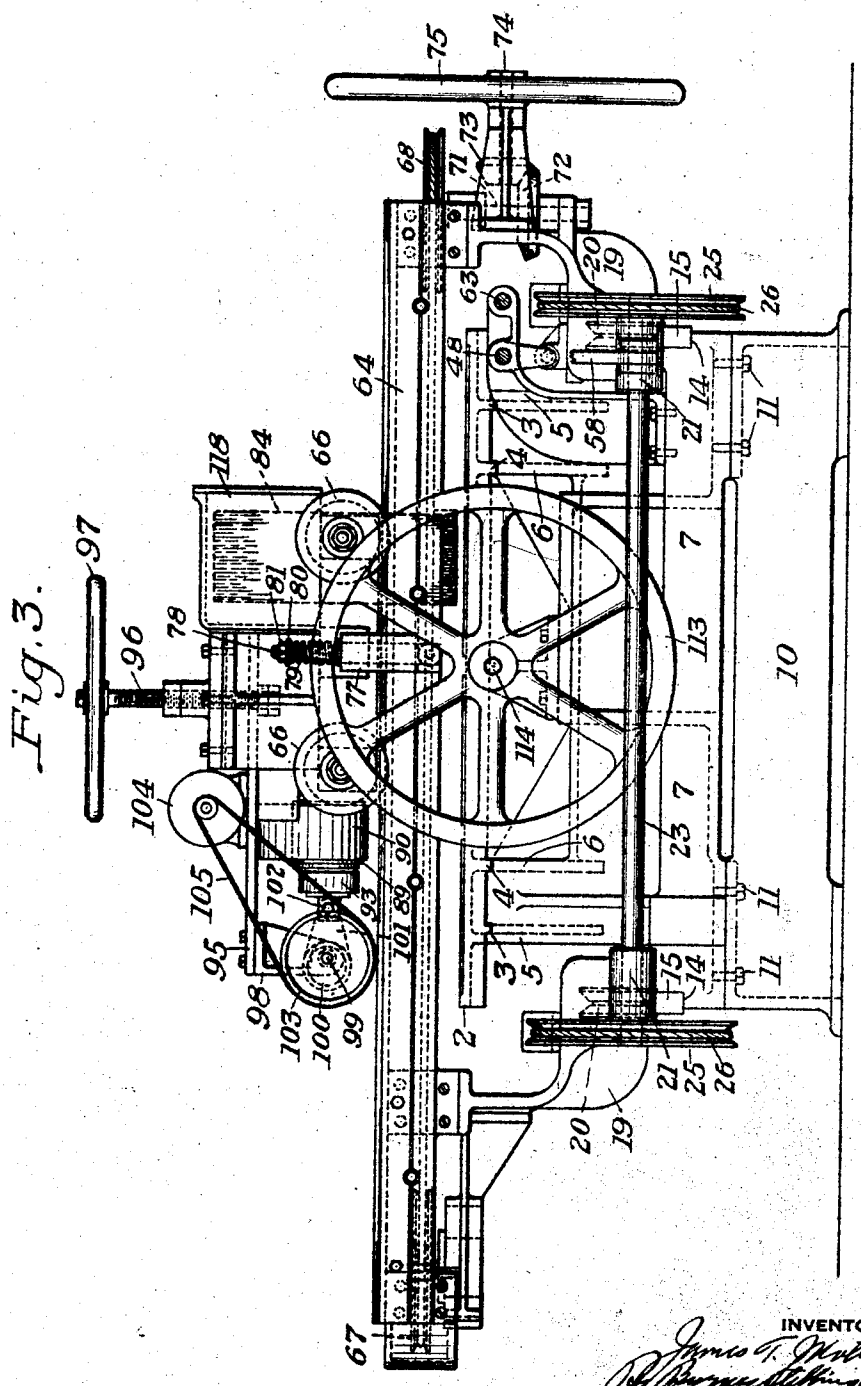
March 30, 1926. 1,578,342

J. T. MOLTRUP

GRINDING APPARATUS

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Fig. 3.



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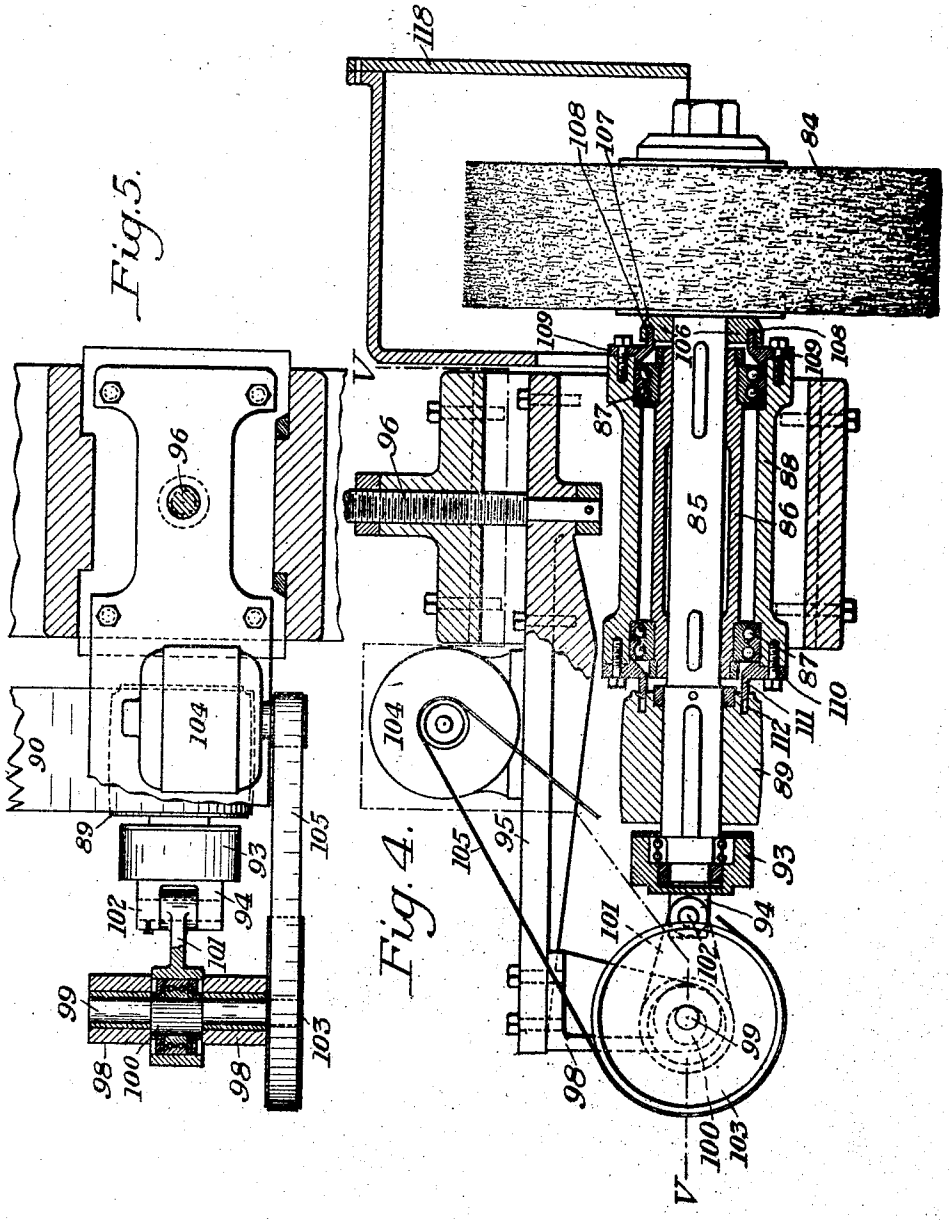
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March 30, 1926. 1,578,342

J. T. MOLTRUP

GRINDING APPARATUS

Filed June 5, 1924 7 Sheets-Sheet 7



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Patented Mar. 30, 1926. 1,578,342

UNITED STATES PATENT OFFICE.

JAMES T. MOLTRUP, OF BEAVER FALLS, PENNSYLVANIA.

GRINDING APPARATUS.

Application filed June 5, 1924. Serial No. 718,047.

To all whom it may concern:

Be it known that I, JAMES T. MOLTRUP, a citizen of the United States, residing at Beaver Falls, Beaver County, Pennsylvania, have invented a new and useful Improvement in Grinding Apparatus, of which the following is a full, clear, and exact description.

The present invention relates to grinding apparatus of the type in which the work is supported on a stationary table and the grinding wheel is given a combined rotary and reciprocating motion, the reciprocating motion being in a direction at right angles to the axis of the wheel and serving to traverse the latter back and forth over the work.

I have found that in the grinding of certain kinds of work, such as engraving plates, it is practically impossible to grind a level surface at a reasonable cost unless a comparatively soft, broad-faced grinding wheel is employed and the latter given an axial reciprocation simultaneously with the aforesaid combined motion. Preferably, the axial stroke should be equal in extent to only a fraction of the width of the wheel.

The purpose of the present invention, therefore, is to provide a grinding apparatus of the above type embodying means for giving the grinding wheel a relatively small axial reciprocation simultaneously with its combined rotary and traversing motion. The invention embodies in addition various improved constructional features which will be hereinafter fully described and covered in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which—

Figures 1^a, 1^b and 1^c illustrate, respectively, in plan, the left-hand portion, the central portion and the right-hand portion of the grinding apparatus;

Figures 2^a, 2^b and 2^c are views corresponding to Figures 1^a, 1^b and 1^c but showing the grinding apparatus in side elevation;

Figure 3 is an end view of the grinding apparatus;

Figure 4 is a vertical transverse sectional view on the line IV—IV of Figure 2^b; and

Figure 5 is a horizontal sectional view on the line V—V of Figure 4.

In the illustrative embodiment of the invention, 2 designates a work table having a horizontal upper surface for supporting the work. This work table is provided on its under side with tapering ribs 3 and 4 whose lower inclined edges engage the correspondingly inclined upper edges of ribs 5 and 6 on a base casting 7. It will be seen by reference to Figure 3 that the ribs 3 have interlocking engagement with the ribs 5, thereby preventing any lateral movement of the table with respect to the base 7.

The base 7 is supported adjacent to and intermediate its ends upon three transversely extending pedestals 8, 9 and 10, said base being secured to said pedestals by bolts 11. The pedestal 8 forms an integral part of an auxiliary casting 12 which supports an electric motor 13 and means driven thereby for reciprocating the main grinder carriage, as will be described in detail hereinafter.

The base 7 has a horizontal ledge 14 at each side thereof, and seated upon each of these ledges is a track member 15 formed of hardened steel. Each of these track members has an inverted V-shaped upper edge 16. The track members are removably secured to the sides of the base by bolts 17.

The main grinder carriage 18 is supported for reciprocation longitudinally of the work table on the tracks 15. This carriage has depending therefrom adjacent the opposite ends thereof housings 19 in which are journaled rollers 20 which travel on the tracks 15, these rollers having V-shaped peripheral grooves in which the upper edges of the tracks engage. In order to prevent grit from getting between the wheels 20 and the tracks 15, wipers 117 are bolted to the ends of the wheel housings 19.

Journaled in brackets 21 and 22, bolted to and projecting from the opposite ends of the base 7, is a pair of shafts 23 and 24. These shafts have sheaves 25 mounted on their opposite ends. Engaging these sheaves is a pair of cables 26. Each cable has its ends secured to eye bolts 27 mounted in brackets 28 bolted to the carriage 18. The shaft 24 is adapted to be driven in either direction by the motor 13 through a train of gearing 29, worm shafts 30 and 31 and worm wheels 32 and 33. The worm shafts 30 and 31 are journaled in bearings 34 and gear housings 35 bolted to the base 12, the shaft 24 being also journaled in the gear housings 35. The gear wheels 32 and 33 are loose on the shaft 24 and have associated therewith clutch members 36 and 37. Keyed to the shaft 24 for sliding movement between the clutch members 36 and 37 is a

clutch sleeve 38 having clutch members 39 and 40 formed on its opposite ends for co-operation with the clutch members 36 and 37. A clutch lever 41 having one end in operative engagement with the clutch sleeve 38 is pivoted at 42 to a spreader 43 which is secured at its opposite ends to lugs 44 projecting from the gear housings 35. This spreader 43 serves to tie the gear housings 35 together. A link 45 connects the other end of the clutch lever with one arm of a bell crank 46 which is pivoted at 47 to the base 7. The other arm of the bell crank 46 is connected to one end of a rod 48 which extends longitudinally of the base 7 at one side thereof and is supported for sliding movement in brackets 49 secured to the base. The rod 48 has secured thereto, adjacent the opposite ends of the work table 2, depending dogs 50 and 51. The main grinder carriage 18 has mounted therein at the end adjacent the rod 48 a pair of plungers 52 and 53. These plungers are slidably mounted in housings 54 and have stems 55 surrounded by coil springs 56 which urge the plungers outwardly. Outward movement of the plungers is limited by nuts 57 on the ends of these stems. Pivotally connected to the right-hand end of the rod 48 (Figure 2[c]) is an operating handle 58, the lower end of this handle being pivotally connected to a bracket 59 projecting from one of the bearings 21.

It will be apparent that by moving the handle 58 to the left (Figure 2[c]) the clutch sleeve 38 will be shifted in a direction to engage the clutch member 39 with the clutch member 36, and that by moving the handle 58 to the right, the sleeve 38 will be moved in the opposite direction to bring the clutch member 40 into engagement with the clutch member 37. Assuming the clutch sleeve 38 to be in the neutral position shown in Figure 1[a], the motor 13 is ineffective to move the carriage 18 in either direction, but by moving the handle 58 in one direction or the other, the motor 13 can be operatively connected to the shaft 24 to cause movement of the grinder carriage in one direction or the other. After the carriage has been put in operation in this manner, the clutch sleeve 38 will be automatically actuated to cause the carriage to alternately move in one direction longitudinally of the work table and then in the opposite direction by the co-operation of the plungers 52 and 53 with the dogs 50 and 51. If the carriage is moving to the left, when the plunger 52 strikes the dog 50, the plunger will be moved inwardly, thereby placing its spring 56 under compression. As soon as sufficient energy has been stored up in the spring in this manner, it will suddenly thrust the plunger 52 outwardly and thereby shift the clutch sleeve 38 in a direction to disengage the clutch member 40 from the clutch member 37 and move the clutch member 39 into engagement with the clutch member 36. This will cause the immediate reversal of the direction of movement of the carriage, causing it to move to the right until the plunger 53 strikes the dog 51, whereupon the clutch sleeve 38 will be shifted in the opposite direction and the movement of the carriage again reversed. The rod 48 can be locked with the clutch sleeve 38 in neutral position by means of a lever 60 pivoted on the rod adjacent the right-hand end thereof and adapted to be turned into a position to engage between collars 61 and 62 mounted on the end of a rod 63 mounted in the brackets 49.

Bolted to opposite sides of the main grinder carriage 18 is a pair of hardened steel track members 64 similar to the track members 15. An auxiliary grinder carriage 65 is mounted for reciprocation on these track members transversely of the work table. This auxiliary carriage carries wheels 66, similar to the wheels 20, for engagement with the track members 64. Journaled in the main carriage 18 adjacent opposite ends thereof is a pair of horizontal sheaves 67 and 68. A cable 69 engages these sheaves and is fastened to a bracket 70 carried by the auxiliary grinder carriage 65. The sheave 68 is mounted on a vertical shaft 71 which carries a bevel pinion 72 meshing with a bevel pinion 73 carried by a horizontal shaft 74. The shaft 74 has mounted on the outer end thereof a hand wheel, 75. It will be apparent that, by turning this hand wheel, the auxiliary carriage can be shifted in either direction transversely of the work table. Projecting from the right-hand end of the auxiliary carriage (Figures 1[b] and 2[b]) is a bracket 76 in which is slidably mounted a plunger 77 having a stem 78 projecting above the bracket and surrounded by a coil spring 79, the upper end of which engages a washer 80 held on the stem by a nut 81. The lower end of the plunger 77 carries a roller 82 which engages a flange 83 extending longitudinally of the main carriage 18, whereby the auxiliary carriage is yieldingly held against tendency to tilt upwardly with respect to the main carriage.

The auxiliary carriage 65 carries the grinding wheel 84 and the means for imparting rotation and axial reciprocation thereto. The wheel 84 is mounted upon a shaft 85 keyed to but slidably mounted within an inner sleeve 86. The inner sleeve 86 is journaled upon ball bearings 87 within a housing 88. Mounted upon the shaft 85 adjacent one end of the housing 88 is a pulley 89 which is driven through a belt 90 by a motor 91 having a drive pulley 92 mounted upon its armature shaft and en-

gaged by the belt 90. Journaled upon the end of the shaft 85 adjacent the pulley 89 is a head 93 having a bifurcated extension 94 at one end thereof. The housing 88 is carried by a frame 95 adjustable vertically in the auxiliary carriage by means of a screw 96 operated by a hand wheel 97. Bolted to one end of the frame 95 and depending therefrom is a pair of spaced brackets 98 in which is journaled a shaft 99. This shaft has a crank pin 100 journaled in one end of a connecting rod 101, said end extending between the brackets, the rod having its other end positioned between the bifurcations 94 and journaled upon a pin 102 fixed therein. Mounted upon one end of the shaft 99 is a pulley 103 which is driven by a motor 104 through a belt 105, the motor 104 being mounted upon the frame 95. The motor 104 is adapted, through the connections described, to impart an axial reciprocation to the grinding wheel 84. The extent of this reciprocating motion will preferably be only a fraction of the width of the grinding wheel. Assuming the width of the grinding wheel to be 6", the axial movement thereof may be $\frac{3}{8}$" to $\frac{1}{2}$". The upper portion of the grinding wheel is surrounded by a casing 118.

In order to prevent any dust or grit from entering the bearings of the shaft 85, the latter has a collar 106 mounted thereon at one side of the grinding wheel, said collar having an annular groove 107 therein in which an annular flange 108 on a ring 109 engages. This ring is bolted to one end of the housing 88. Bolted to the opposite end of the housing is a ring 110 having an annular flange 111 engaging in an annular groove 112 in the pulley 89. It will be seen that this construction permits the shaft 85 to have a slight reciprocating movement without the flanges 108 and 111 leaving the grooves 107 and 112. The bearings 87 are, therefore, completely protected at all times against the entry thereinto of dirt or grit.

As has already been explained, the frame 95 can be raised or lowered by turning the hand wheel 97, thereby raising or lowering the grinding wheel 84. The work table 2 is adapted to be adjusted vertically by moving it longitudinally of the base 7. This longitudinal adjustment of the work table is made by means of a hand wheel 113 mounted on a shaft 114. The shaft 114 is journaled in a bracket 115 mounted on the base 7 and has a screw-threaded end portion engaging a nut 116 bolted to the work table.

While the operation of the apparatus may be readily understood from the foregoing description, it may be briefly summarized as follows: Assuming the main grinder carriage 18 to be at rest and the lever 60 in the position shown in Figure 1c, the plate or the like to be ground may be placed upon the work table 2, the grinding wheel 84 having first been raised by turning the hand wheel 97. When the plate has been properly positioned, the hand wheel 97 will be turned to lower the grinding wheel 84 into engagement with the plate. Then the lever 60 will be thrown out of engagement with the collars 61 and 62 on the rod 63 and the handle 58 moved in a direction to throw one of the clutch members 39 or 40 into engagement with its co-operating clutch member 36 or 37, thereby operatively connecting the motor 13 to the shaft 24 and setting the main carriage 18 in motion. The carriage will thereafter be automatically moved back and forth longitudinally of the work table, thereby carrying the grinding wheel 84 from one end of the plate to be ground to the other. At the same time, the motor 91 will be imparting rotation to the grinding wheel 84 and the motor 104 will be imparting axial reciprocation thereto. By means of the hand wheel 75, the auxiliary carriage 65 can be shifted from time to time transversely of the work table so as to effect the grinding of the entire surface of the work. By manipulating the hand wheel 113, the operator can shift the work table 2 longitudinally of the base 7 to elevate the plate being ground in order to obtain at all times the desired pressure of the grinding wheel against the work. The roller 82 engaging the flange 83 prevents the auxiliary carriage from being lifted out of engagement with the right-hand track 64 when the work table is elevated in this manner.

While I have shown and described a preferred embodiment of my invention, it will be understood that changes may be made in the details of construction shown without departing from the spirit of the invention or scope of the appended claims.

I claim:

1. Grinding apparatus, comprising a work table, tracks at opposite sides of said table extending longitudinally thereof, a carriage having wheels engaging said tracks, a grinding wheel mounted on said carriage with its axis extending at right angles to the direction of movement thereof, means for reciprocating said carriage to move said wheel back and forth over said table, and a pair of electric motors mounted on said carriage for rotating said wheel and imparting axial reciprocation thereto, substantially as described.

2. Grinding apparatus, comprising a work table, tracks at opposite sides of said table extending longitudinally thereof, a carriage having wheels engaging said tracks, housings having said wheels journaled therein, wipers carried by said carriage and engaging said tracks in advance of the wheels, a grinding wheel mounted on said carriage with its axis extending at right angles to the direction of

movement thereof, means for reciprocating said carriage to move said wheel back and forth over said table, and means for rotating said wheel and imparting axial reciprocation thereto, substantially as described.

3. Grinding apparatus, comprising a work table, tracks at opposite sides of said table extending longitudinally thereof, a main carriage movable longitudinally of said table and having wheels engaging said tracks, tracks at opposite sides of said main carriage extending longitudinally thereof, an auxiliary carriage having wheels engaging said last-mentioned tracks and movable in a direction at right angles to the direction of movement of the main carriage, a grinding wheel mounted on the auxiliary carriage with its axis extending at right angles to the direction of movement of the main carriage, means for reciprocating the main carriage, means for adjusting the position of the auxiliary carriage transversely of the main carriage, and means mounted on the auxiliary carriage for rotating said wheel, substantially as described.

4. Grinding apparatus, comprising a work table, a main carriage movable longitudinally of said table, tracks at opposite sides of said main carriage extending longitudinally thereof, an auxiliary carriage having wheels engaging said tracks and movable in a direction at right angles to the direction of movement of the main carriage, a grinding wheel mounted on the auxiliary carriage with its axis extending at right angles to the direction of movement of the main carriage, means for reciprocating the main carriage, means for adjusting the position of the auxiliary carriage transversely of the main carriage, and means mounted on the auxiliary carriage for rotating said wheel and imparting axial reciprocation thereto, substantially as described.

5. Grinding apparatus, comprising a work table, a shaft adjacent each end of said table extending transversely thereof, sheaves mounted on said shafts adjacent the sides of the table, a carriage movable longitudinally of said table, a cable engaging the pair of sheaves at each side of said table and having its ends attached to said carriage, a motor for driving one of said shafts in either direction, a clutch for controlling the direction of rotation of said shaft, automatic means for operating said clutch to effect reciprocation of said carriage, a grinding wheel mounted on said carriage with its axis extending at right angles to the direction of movement thereof, and means for rotating said wheel, substantially as described.

6. Grinding apparatus, comprising a work table, a shaft adjacent each end of said table extending transversely thereof, sheaves mounted on said shafts adjacent the sides of the table, a carriage movable longitudinally of said table, a cable engaging the pair of sheaves at each side of said table and having its ends attached to said carriage, a motor for driving one of said shafts in either direction, a clutch for controlling the direction of rotation of said shaft, automatic means for operating said clutch to effect reciprocation of said carriage, a grinding wheel mounted on said carriage with its axis extending at right angles to the direction of movement thereof, and means for rotating said wheel and imparting axial reciprocation thereto, substantially as described.

7. Grinding apparatus, comprising a base having parallel ribs with inclined upper edges, a work table having a horizontal upper surface and having ribs with inclined lower edges engaging the upper edges of the ribs of said base, means for adjusting said table longitudinally of said base for effecting vertical adjustment of said table, a carriage movable longitudinally of said table, a grinding wheel mounted on said carriage with its axis extending at right angles to the direction of movement of the carriage, means for reciprocating said carriage, and means for rotating said wheel, substantially as described.

8. Grinding apparatus, comprising a work table, a carriage movable longitudinally of said table, a grinding wheel mounted on a shaft extending at right angles to the direction of movement of the carriage and journaled on ball-bearings within a housing carried by said carriage, means for reciprocating said carriage, means for rotating said wheel and imparting axial reciprocation thereto, and means for preventing dust or grit from entering said bearings, substantially as described.

9. Grinding apparatus, comprising a work table, a main carriage movable longitudinally of said table, an auxiliary carriage mounted on said main carriage and movable in a direction at right angles to the direction of movement of the main carriage, a grinding wheel mounted on a shaft extending at an angle to the direction of movement of said main carriage and journaled in a vertically adjustable frame carried by the auxiliary carriage, means for reciprocating said main carriage, and means carried by the auxiliary carriage for rotating said wheel, substantially as described.

10. Grinding apparatus, comprising a work table, a main carriage movable longitudinally of said table, an auxiliary carriage mounted on said main carriage and movable in a direction at right angles to the direction of movement of the main carriage, a grinding wheel mounted on a shaft extending at an angle to the direction of movement of said main carriage and journaled in a

vertically adjustable frame carried by the auxiliary carriage, means for reciprocating said main carriage, means carried by the auxiliary carriage for rotating said wheel, and means carried by said frame for imparting axial reciprocation to said wheel, substantially as described.

11. Grinding apparatus, comprising a work table, a carriage movable longitudinally of said table, means for reciprocating said carriage, a bearing on said carriage, a shaft mounted for rotation and reciprocation in said bearing and extending at an angle to the direction of movement of said carriage, a grinding wheel mounted on said shaft, means for rotating and reciprocating said shaft, and means for preventing dirt from entering said bearing, substantially as described.

12. Grinding apparatus, comprising a work table, a carriage movable relatively to said table, a support mounted in said carriage, means for adjusting said support vertically, a grinding wheel carried by said support, means mounted on said support for imparting axial reciprocation to said wheel, and means for rotating said wheel, substantially as described.

13. Grinding apparatus, comprising a work table, a carriage movable longitudinally of said work table, a grinding wheel mounted on said carriage with its axis extending at right angles to the direction of movement thereof, means for rotating said wheel, means for reciprocating said carriage over said table, a clutch for controlling the direction of movement of said carriage, and automatic means for operating said clutch to effect reciprocation of said carriage, comprising a sliding member having a pair of spaced dogs thereon and spring-pressed plungers mounted on said carriage for cooperation with said dogs, substantially as described.

14. Grinding apparatus, comprising a work table, a carriage movable longitudinally of said work table, a grinding wheel mounted on said carriage with its axis extending at right angles to the direction of movement thereof, means for rotating said wheel, means for reciprocating said carriage over said table, a clutch for controlling the direction of movement of said carriage, automatic means for operating said clutch to effect reciprocation of said carriage, comprising a sliding member having a pair of spaced dogs thereon, spring-pressed plungers mounted on said carriage for cooperation with said dogs, and means for locking said sliding member to hold the clutch in neutral position, substantially as described.

In testimony whereof I have hereunto set my hand.

J. T. MOLTRUP.