No. 707,543. Patented Aug. 26, 1902.

J. BATH.

GRINDING MACHINE.

(Application filed Mar. 3, 1902.)

(No Model.) 4 Sheets—Sheet 1.

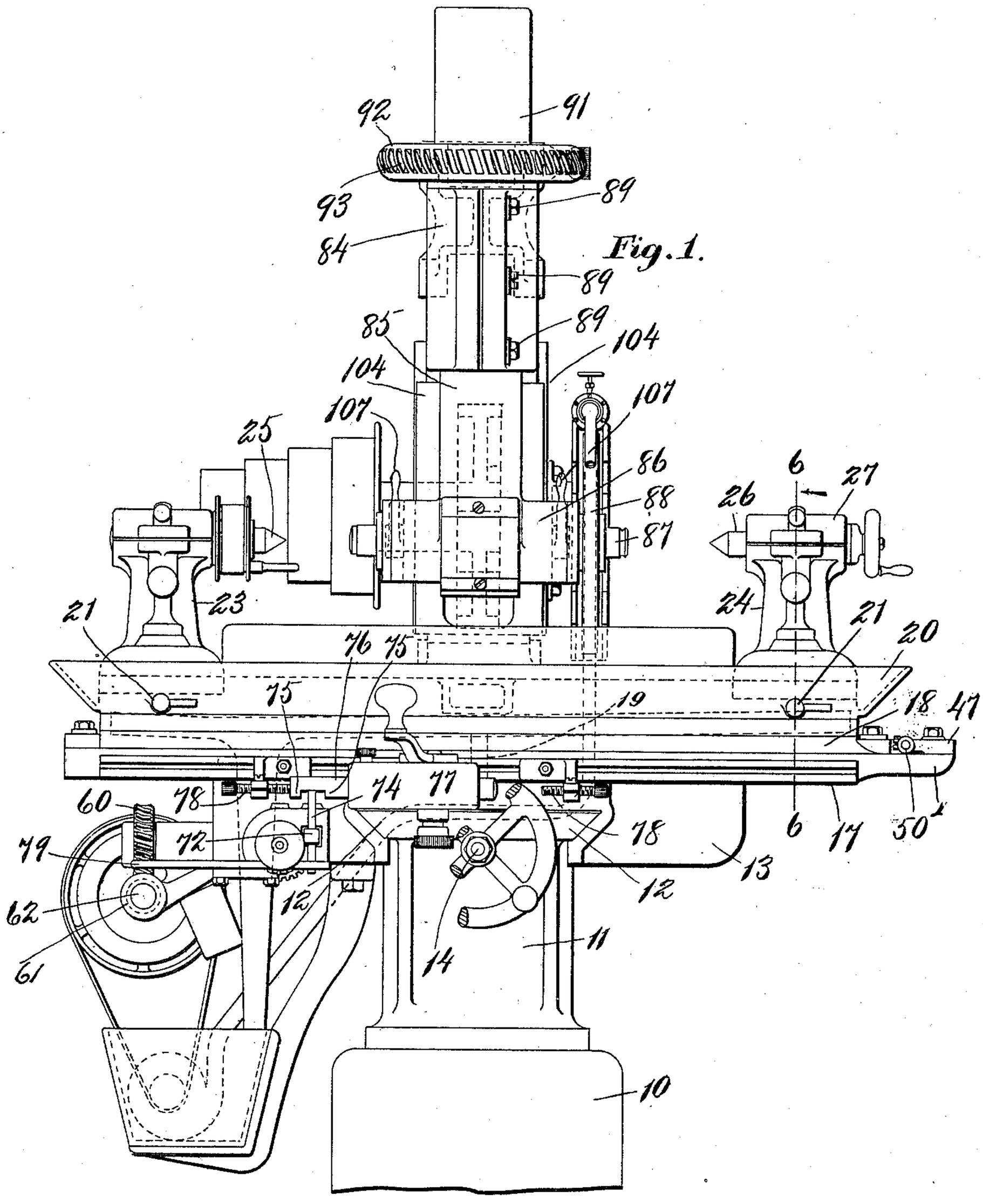

Fig. 1.

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(No Model.)

4 Sheets—Sheet 2.

Fig. 5.

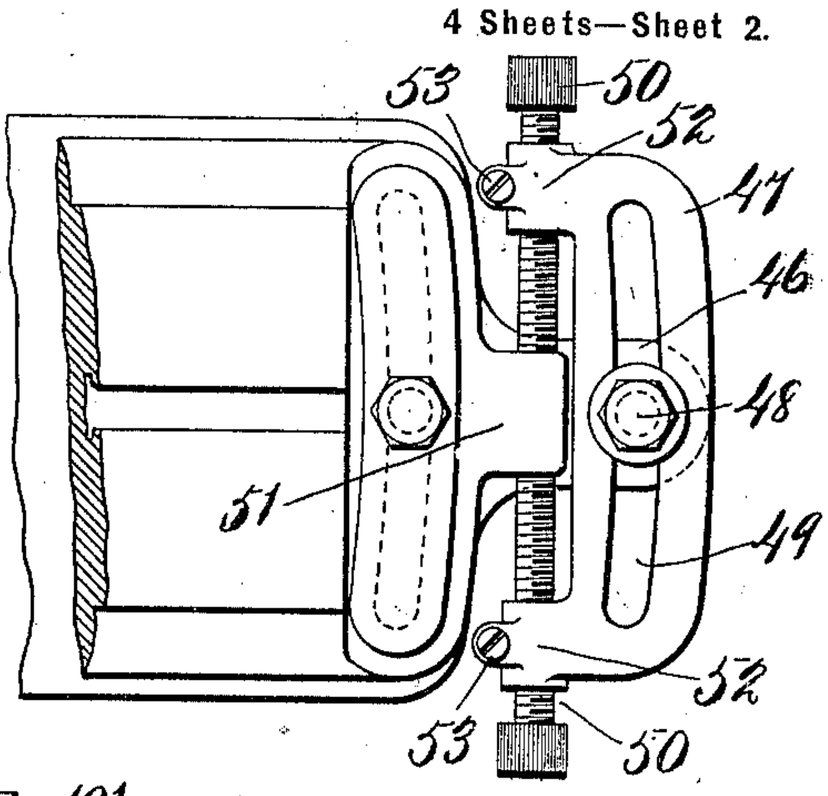

Fig. 2.

Fig. 4.

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GRINDING MACHINE.

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(No Model.) 4 Sheets—Sheet 3.

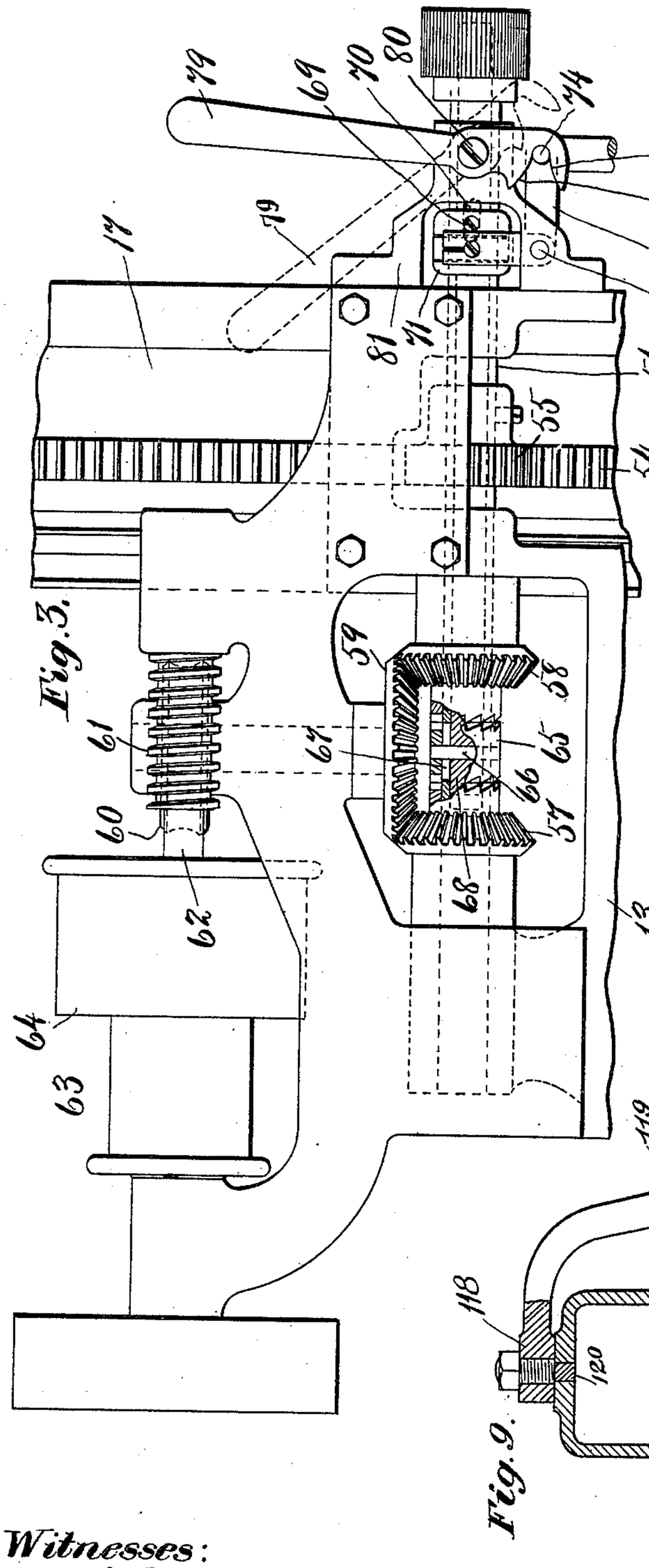

Fig. 3.

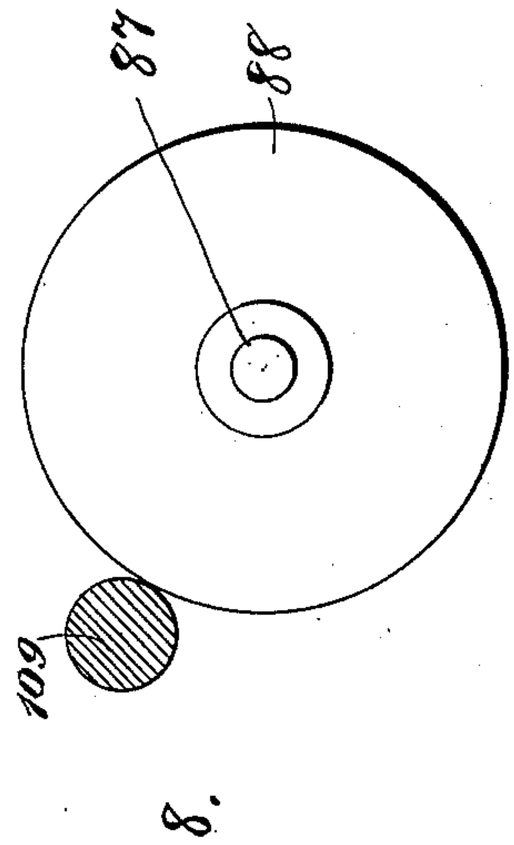

Fig. 8.

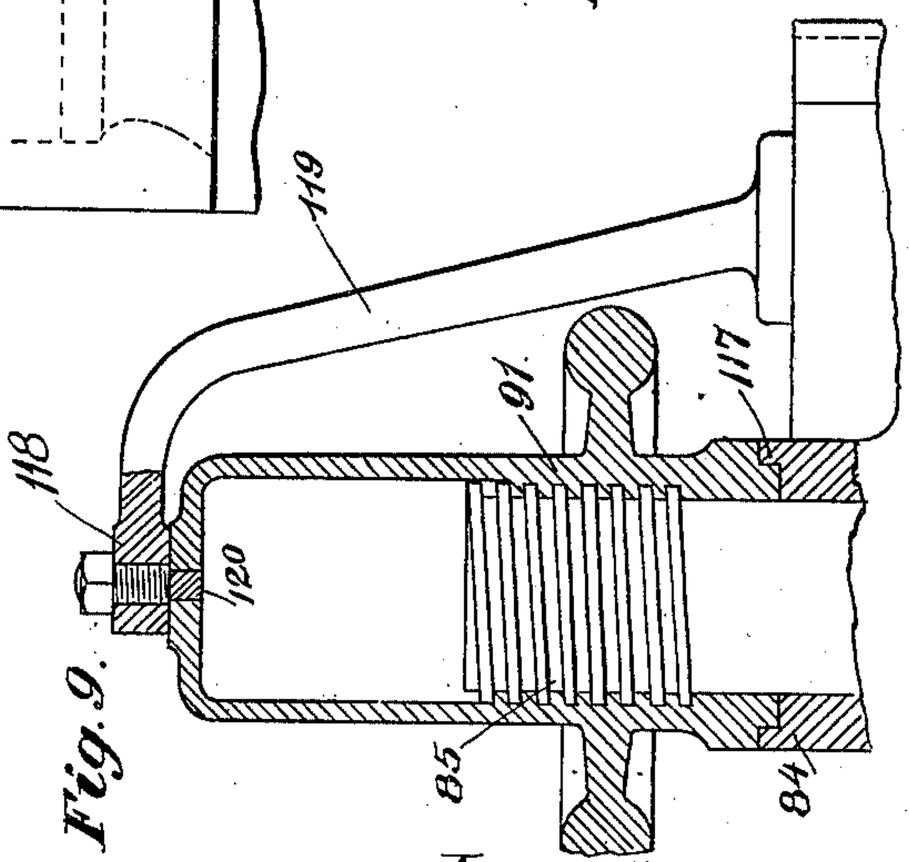

Fig. 9.

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GRINDING MACHINE.

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(No Model.) 4 Sheets—Sheet 4.

Fig. 6.

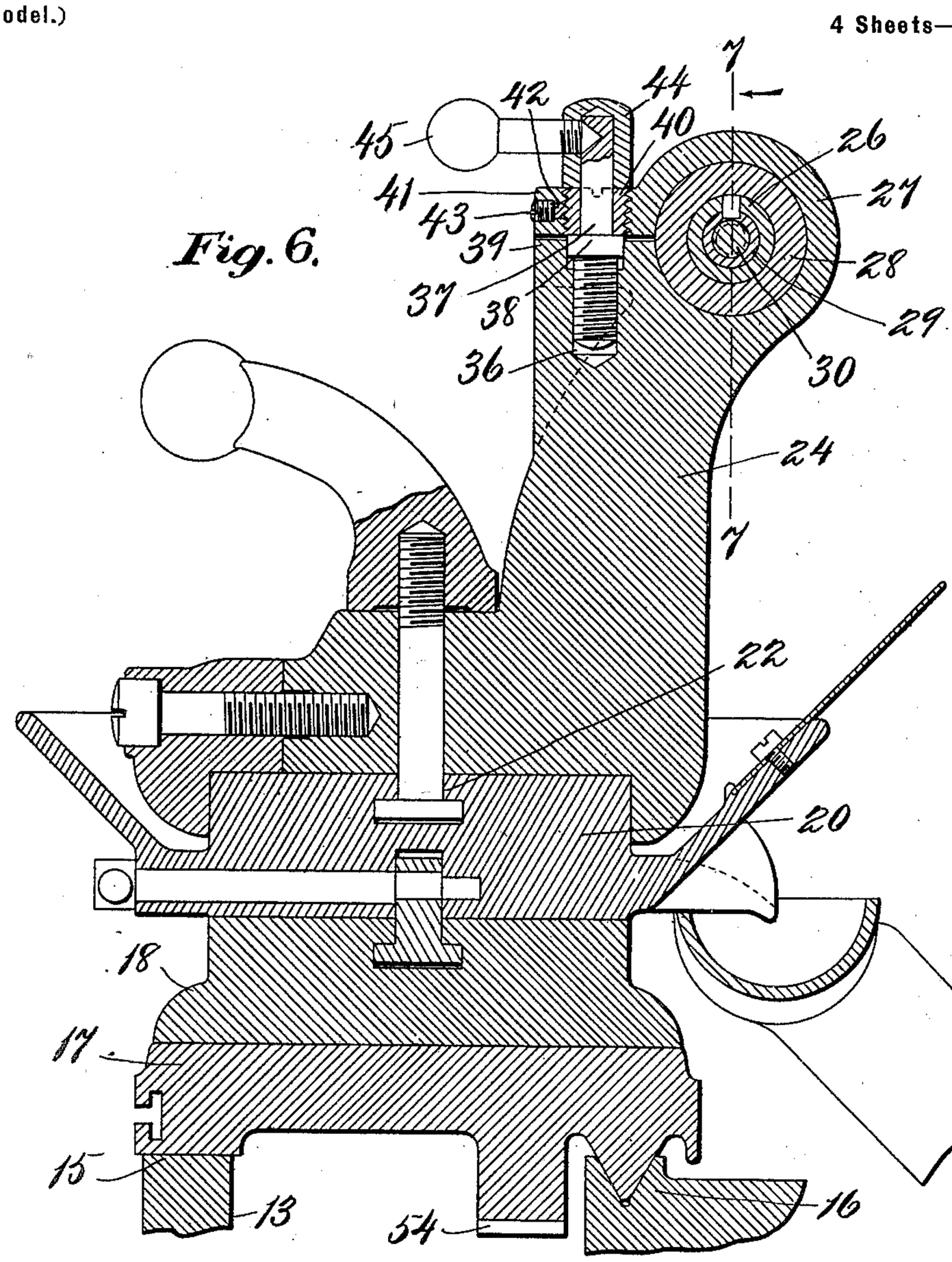
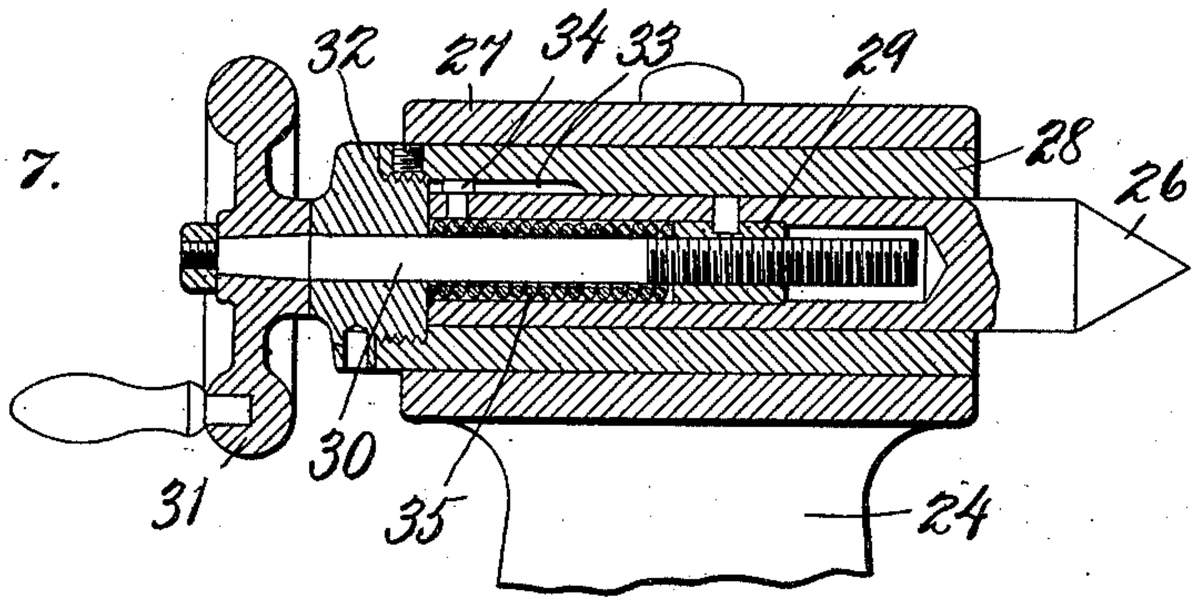


Fig. 7.



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UNITED STATES PATENT OFFICE.

JOHN BATH, OF WALTHAM, MASSACHUSETTS.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 707,543, dated August 26, 1902.

Application filed March 3, 1902. Serial No. 96,367. (No model.)

To all whom it may concern:

Be it known that I, JOHN BATH, of Waltham, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification.

This invention relates to grinding-machines, and is hereinafter described for the purpose of illustration in connection with a machine of the type shown in my prior patent, No. 683,194, of September 24, 1901, to which reference may be had for the general arrangement of the machine.

Of the accompanying drawings, Figure 1 represents a front elevation, partly broken away, of a grinding-machine provided with my improvements. Fig. 2 represents a right-hand side elevation of the upper part of the machine with parts in section. Fig. 3 represents a reverse plan view, partly in section, showing the carriage-feed mechanism. Fig. 4 represents a section on line 4 4 of Fig. 2. Fig. 5 represents a detail plan view of the stop-screw mechanism for the swinging table. Fig. 6 represents a section on line 6 6 of Fig. 1. Fig. 7 represents a section on line 7 7 of Fig. 6. Fig. 8 represents a side elevation showing one relation of the grinder to the work. Fig. 9 represents a vertical section showing a modification in the manner of mounting the combined cap and nut.

The same reference characters indicate the same parts in all the figures.

Referring to the drawings, 10 represents a base having a vertical stud on which is pivoted a swinging support or knee 11, as more fully shown in my said patent, said support having guides 12 12, on which is mounted a slide 13, movable horizontally by means of a feed-screw 14, Fig. 1. By means of the swinging adjustment of the support 11 the work may be adjusted to asume various angles with respect to the grinding-wheel arbor, which is mounted on a stationary part of the frame, as hereinafter described. The slide 13 is provided with horizontal guides 15 16, Fig. 6, at right angles to the guides 12, on which is mounted a sliding feed-carriage 17. On the upper side of this carriage is located a swinging table 18, pivoted or swiveled on a stud 19, Fig. 1, and carrying a slide 20, movable longitudinally of said table and adapted to be fixed in various positions thereon by clamping devices 21 21. On the upper side of the slide 20 is a T-slot 22, Fig. 6, in which may be fixed various attachments for holding the work or suitable tools.

In the drawings I have shown two heads 23 24, equivalent to head and tail stocks and having spindles or centers 25 26, adapted to support the work between them.

Fig. 7 shows the detailed construction of the head or tail stock 24. At its upper end is a split sleeve or clamp 27, in which is held a bearing-sleeve 28. The spindle 26 is mounted to slide longitudinally in the sleeve 28 and is provided internally with a block or nut 29, engaged by a feed-screw 30, having a hand-wheel 31 on its rear end and mounted in a bearing 32, detachably secured in the rear end of the sleeve 28. On the inner side of the latter is formed a spline-groove 33, occupied by a stud 34 on the spindle 26, which prevents the said spindle from rotating. A spring 35 is held under compression between the bearing 32 and the nut 29. It will be seen that the rotation of the screw 30 imparts a longitudinal adjusting movement to the spindle 26. In any position of said spindle to the right of its position shown in Fig. 7 the rear end of the spindle is separated from the bearing 32, and the spindle is adapted to be yieldingly retracted or pushed back by the exertion of sufficient force against the tension of spring 35 irrespective of the adjustment or screw 30. The latter during this yielding motion slides in the bearing 32. I thus provide for quick removal of the work or the expansion of the work upon being heated.

Fig. 6 shows a novel construction of the clamping device for controlling the split sleeve 27 or an equivalent sleeve on the head-stock 23. The tail-stock 24 is formed with a threaded socket 36, in which screws the threaded lower end of a bolt 37, having a flange 38 moving in a countersunk recess in the lower lip 39 of the split sleeve. The reduced upper part of the bolt passes through a sleeve 40, screwing into a tapped hole in the upper lip 41 of the split sleeve, whereby the sleeve 40 may be accurately adjusted with respect to said lip, said sleeve being frictionally held in place by a laterally-movable threaded block 42, backed by a set-screw 43.

The upper end of the bolt is fitted with a cap 44, into which is screwed a handle 45, having a countersunk fit in the upper end of the bolt. It will be seen that by screwing the bolt 37 down the lower end of the cap 44 abuts against the lip 41 and tightens the split sleeve 27 against the part which it holds, while by screwing the bolt upwardly the split sleeve 27 is positively opened by the raising of its lip 41 through the action of the upper shoulder on flange 38 against the lower end of sleeve 40.

Fig. 5 shows an improved manner of mounting the stop-screws for regulating the position of the swiveling table 18. 46 is an extension or arm on the carriage 17, on which is mounted a C-shaped plate 47, adapted to be held in various positions by a bolt 48 on the arm 46, occupying a slot 49 in the plate 47. In the arms of said plate are mounted two adjustable stop-screws 50 50, adapted to engage stop-abutments formed by the two sides of a projection 51 on the swiveling table 18. The table 18 is thereby movable between positive limits, which determine certain angular adjustments for the work or tools mounted above the table. I provide an improved mounting for the screws 50 by locating them in split sleeves 52, adjusted by bolts 53 53, whereby the screws may be frictionally clamped in any position in which they are adjusted, so as to insure the preservation of exact relative adjustments of the screws during the movements of the other parts.

To automatically feed the carriage 17 with relation to the grinding-wheel, mechanism is provided as follows: On the under side of the carriage is a rack 54, Figs. 3 and 6, meshing with a pinion 55, Fig. 3, secured to a hollow shaft 56, mounted in suitable bearings on the slide 13. Loosely surrounding the shaft 56 are a pair of bevel-gears 57 58, rotated constantly in opposite directions by a bevel-gear 59, on whose shaft is a worm-wheel 60, Figs. 1 and 3, meshing with a worm 61 on a shaft 62. Said shaft 62 is provided with pulleys 63 64, belted to a suitable power-shaft. 65 is a longitudinally-movable sleeve having on its two ends clutch members complemental to clutch members formed on the hubs of the gears 57 58. This sleeve 65 has a spline connection with the hollow shaft 56 by means of a pin 66, secured to the sleeve and passing through an elongated slot 67 in the shaft 56. By means of the pin 66 the sleeve 65 is attached to a rod 68, slidable longitudinally within the shaft 56 and connecting by a screw 69, passing through a slot 70 near the outer end of shaft 56, with a collar 71, mounted to slide on the outside of said shaft. Longitudinal movement of the collar 71 imparts a corresponding movement to the sleeve 65, and thereby connects the one or the other of the oppositely-rotating gears 57 58 with the shaft 56. In this way the carriage 17 is caused to move in one direction or the other. The sleeve 65 also has a median or neutral position in which it is disconnected from both gears. The collar 71 is engaged by the forked end of a bell-crank lever 72, pivoted at 73 to a bracket 81 on the slide 13 and having a pin 74, which extends above and below the outer arm of said lever, as seen in Fig. 1. The upper end of the pin is adapted to be engaged alternately by shoulders 75 75, formed on a sliding rod or bolt 76, mounted in a guide or bearing 77 on the slide 13. Adjustable abutments 78 78, adapted to be fixed at different positions apart on the carriage 17, are arranged to engage the bolt 76 at the limit of movement of the carriage in either direction, and when the bolt is thus engaged and moved it throws the lever 72 into the opposite position from that which it had occupied, and thereby throws in the other clutch than the one which was in action, and accordingly automatically reverses the direction of travel of the carriage.

To enable the carriage 17 to be stopped at any point in its travel without throwing off the power or disarranging the automatic reversing mechanism, I provide a hand-lever 79, pivoted at 80 on the under side of the bracket 81 on the slide 13, said lever having oppositely-acting cam-faces 82 82, converging to a narrow space just sufficient to accommodate the lower end of the pin 74. The arrangement is such that when the lever is positioned, as shown in Fig. 3, so as to throw the pin into this narrow space the sleeve 65 is brought from engagement with either of the gears 57 58 into its neutral position between said gears, whereby the carriage 17 is brought to a stop. The space between the outer ends of the cam-faces 82 is sufficiently wide to embrace the full range of movement of the pin 74, so that when the lever 79 is thrown to the dotted position shown in Fig. 3 to permit the lever 72 to have its oscillating movement during the automatic reciprocation of the table the one or the other of the cam-faces 82 will engage the pin 74 upon the lever being thrown into its full-line position, so that the carriage may be stopped in any position of the lever 72.

In Fig. 2 it is seen that the frame 83 of the machine continued upwardly from the base 10 is substantially C-shaped. The upper arm of the C is formed as a split bearing or guide 84 for a vertically-sliding stem or post 85, carrying at its lower end the bearing 86 for the arbor or shaft 87 of the grinding-wheel 88. The vertical adjusting movement of this bearing 86 is parallel to the axis of the swinging movement of the knee or support 11 and at right angles to the horizontal plane passing through the line of centers between the work-holding spindles 25 26. The split bearing 84 is provided with a series of three clamp-screws 89 89, located at different heights and giving an adjustment which secures an accurate fit of the bearing 84 to the post 85 throughout the length of said bearing. At its upper end the post 85 is formed with a screw-thread 90, engaged by a complemental thread formed

on the inner side of a combined cap-and-nut member 91. The member 91 is permitted to rotate, but held from longitudinal movement by a detachable ring 121 entering a groove near the lower end of the member 91. The lower part of this member having the thread constitutes a nut, while the upper part constitutes a cover inclosing the upper end of the post for excluding dust and grit from the screw and bearing surfaces of the post. The member 91 is formed with a hand-wheel 92, having worm-teeth 93, adapted to mesh with a worm 94, journaled in a pivoted carrier 95. This worm is adapted to be thrown into mesh when a slow adjustment of the post is desired and thrown out of mesh when a quick adjustment by the use of the hand-wheel 92 is desired. The arbor-bearing 86 is in two parts, between which is a pulley 96, Fig. 4, on the arbor 87, which pulley is connected by a belt 97, extending in a substantially horizontal direction, to a driving-pulley 98. The vertical movements of the spindle 87 vary the distance between the pulleys 96 and 98, and there is accordingly provided an idle pulley 99, acting as a belt-tightener on the upper stretch of the belt. This belt-tightener is journaled in a slide 100, mounted to slide vertically on a guide 101 on the rear side of the frame 83. Said guide has a T-slot 102, engaged by the head of a clamping-bolt 103, whereby the slide 100 may be fixed at any height. This arrangement avoids the vibration of the belt-tightener, which was an objectionable feature of the machine shown in my former patent, inasmuch as such vibration would be transmitted to the grinding-wheel and appear in the work. By virtue of the described adjustment I may, however, at times allow the belt-tightener to slide vertically.

On the rear side of the gap in the C-shaped frame 83 are located vertical guides 104 104, Figs. 1, 2, and 4, with which suitable bearing-faces 105, Fig. 4, on the arbor-bearing 86 coact. Eccentric clamps 106, having operating-levers 107 107, Figs. 1, 2, and 4, coact with longitudinal clamping-faces 108 on the rear sides of the guides 104 in fixing or clamping the arbor-bearing 86 to the guides 104 in any position to which the arbor-bearing may have been adjusted. This lateral bearing and clamping device for the arbor-bearing is an important feature of my invention, as it enables me to fix the arbor-bearing rigidly in any position, and thereby avoid any vibration of the grinding-wheel. Should the arbor-bearing be without this lateral bearing, it is evident that the tendency to vibrate would increase as the arbor 87 descended and left a greater portion of the post 85 unsupported by the bearing 84. The lateral bearing when arranged substantially as described also keeps the post 85 from turning.

It will be noted by reference to Fig. 1 and to Fig. 8, in which 109 represents work mounted between the heads 23 24 or in one of them, that the range of movement of the bearing 86 for the grinding-wheel arbor 87 is such as to carry this arbor across the horizontal plane between the line of centers of the work-holding means, whereby the grinding-wheel 88 is able to approach the work 109 either from above the work or from below the work, as seen in Fig. 8, by a suitable vertical adjustment of the post 85. Owing to the fact that I have provided adjusting and securing means, as described, for the arbor-bearing 86, which are independent of the means for adjusting the swinging support 18 and the parts supported thereon by which the work is held, I am enabled by feeding the grinding-wheel 88 up to the work 109 from a position below said work, as shown in Fig. 8, to secure an improvement in the adjustment of the machine and the quality of the work. This is because by feeding the grinding-wheel up from below I avoid all backlash in the adjusting-screw and other parts, whereby the adjustment is effected. The weight of the vertically-movable parts connected with the grinding-wheel is constantly exerted in a downward direction, so that as the grinding-wheel is moved up to its grinding position backlash of the screw is eliminated. Furthermore, by reason of the fact that the acting surface of the grinding-wheel approaches the work at a considerable angle instead of in a direction normal to the wheel periphery any backlash or lost motion which may exist in the mountings of the grinding-wheel in a direction transverse to the line of pressure between the work and grinding-wheel is of small relative value. The accuracy of this new method of feeding the grinder to the work will be appreciated by those conversant with the art.

In Fig. 2 I have shown the frame 83 as divided into a lower part 110 and an upper part 111, detachably secured thereto by screws 112 112. The upper part 111 is provided with a clamping-face 113, complemental to a clamping-face 114, formed on the upper side of the frame part 110. By splitting the frame at this point the upper part may be removed and mountings or attachments of a different character temporarily substituted therefor, if desired. The forward part of the clamping-face 114 is planed even with the rear part and forms an exposed flat rest or bed 115 for the attachment of tools or other devices for acting on the work or performing suitable operations accessory to the grinding operation. Such tools may be fixed by bolts entering threaded sockets, (indicated at 116.)

In Fig. 9 I have shown a modified arrangement for mounting the combined cap-and-nut member 91. In this instance the said member has a lower bearing 117 on the sleeve 84 and an upper bearing 118, formed on an arm or bracket 119, carried from the main part of the frame up over the member 91, whereby the member 91 is permitted to rotate, but is

prevented from longitudinal movement. A center pin 120 alines the upper end of the member.

I claim—

1. In a grinding-machine, the combination of a grinding-wheel arbor, a bearing therefor formed with a sliding bearing-face laterally opposite the arbor, a complemental fixed bearing face or guide, provisions for clamping said arbor-bearing to the guide on any point along the latter, a sliding stem or post connected with said arbor-bearing, a fixed guide or bearing for said post, and mechanism for imparting a longitudinal movement to said post.

2. In a grinding-machine, the combination of a guide for a grinding-wheel-arbor bearing, a support mounted for an angular or swinging adjustment about an axis parallel to said guide, heads provided with means for holding the work and mounted on said support with the line of centers of said means in a plane at right angles to the axis of movement of said support, a grinding-wheel arbor, a bearing therefor mounted to slide on said guide and capable of movement which carries said arbor across said plane, mechanism for imparting a longitudinal movement to said bearing along its guide, and provisions for clamping said bearing to the guide at any point along the latter.

3. In a grinding-machine, the combination of a grinding-wheel arbor, a bearing therefor, a stem or post connected with said bearing and formed with a screw-thread, a rotatable cap-and-nut member comprising a nut engaged with said thread and a cap covering the end of the post, and means for preventing axial movement of said nut.

4. In a grinding-machine, the combination of a grinding-wheel arbor, a bearing therefor, a stem or post connected with said bearing and formed with a screw-thread, a rotatable cap-and-nut member comprising a nut engaged with said thread and a cap covering the end of the post, a bearing engaged with said member on the end thereof nearest the arbor-bearing, and a second bearing engaged with the opposite end of the cap-and-nut member, said bearings preventing axial movement of the member.

5. In a grinding-machine, the combination of a C-shaped frame formed with a substantially flat tool-clamping rest on one arm of the C, a post guide or bearing on the opposite arm of the C, a post mounted to slide in said bearing and having an arbor-bearing located in the gap of the C, a grinding-wheel arbor mounted in said bearing, and a work-support mounted opposite the gap of the C.

6. In a grinding-machine, the combination of a C-shaped frame having a lower part provided with an upper clamping-face the forward part of which forms an exposed tool-clamping rest, an upper part detachably clamped to the rear part of said clamping-face, a grinding-wheel arbor, and a bearing therefor slidingly mounted on the upper part of said frame.

7. In a grinding-machine, a feed-carriage, opposite driving members connectible alternately with the carriage, carriage-actuated means adapted to connect and disconnect said carriage with the members and having a neutral or carriage-stopping position, and mechanism embracing the range of said means and having provisions for neutralizing said means in any part of its said range.

8. In a grinding-machine, a feed-carriage, opposite driving members connectible alternately with the carriage, carriage-actuated means adapted to connect and disconnect said carriage with the members and having a neutral or carriage-stopping position, said means including a reciprocating member, and a neutralizing lever, one of the last said two parts being formed with oppositely-acting cam-faces arranged to coact with the other part in any portion of the range of said reciprocating member, whereby to neutralize the said carriage-actuated means.

9. In a grinding-machine, the combination of a grinding-wheel arbor having a belt-pulley, a vertically-movable bearing carrying said arbor, a driving belt-pulley stationarily journaled, a substantially horizontal belt connecting said pulleys, a support having a vertical guide, a holder mounted to slide thereon, a belt-tightener mounted in said holder, and means for clamping said holder at any point along said guide.

10. In a grinding-machine, the combination of a support, a table pivoted thereon, work-holding means mounted on said table, stop-abutments on said table, relatively stationary oppositely-acting stop-screws coacting with said stop-abutments, and frictional clamping devices for securing said screws at any adjustment.

11. In a grinding-machine, the combination of a split clamping-sleeve having free lips, a stem screwing in one of said lips and having outer and inner shoulders embracing the other lip, the last said lips having a screw-threaded socket, a bearing-sleeve for the stem complementally threaded and screwing in said socket, and an adjustable frictional holding device acting laterally against said threaded sleeve.

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

JOHN BATH.

Witnesses:

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