No. 732,803. PATENTED JULY 7, 1903.

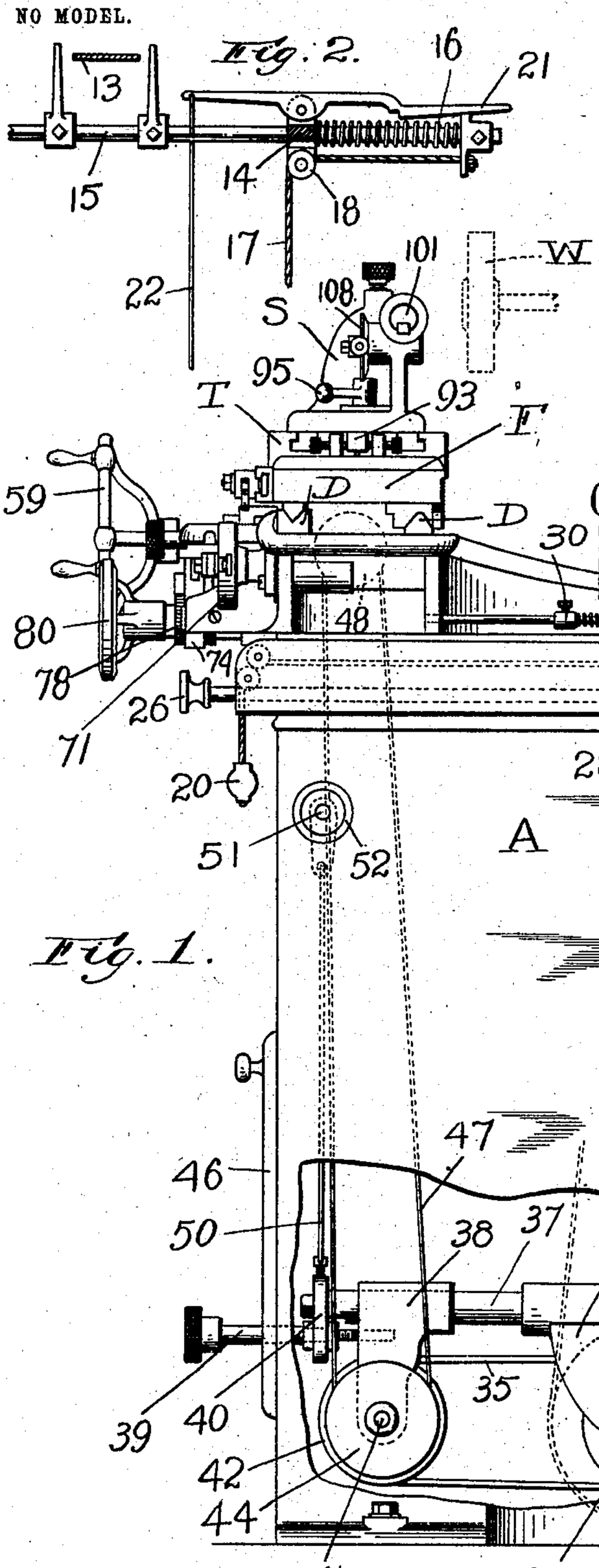
O. S. WALKER.

GRINDING MACHINE.

APPLICATION FILED MAR. 26, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 2.



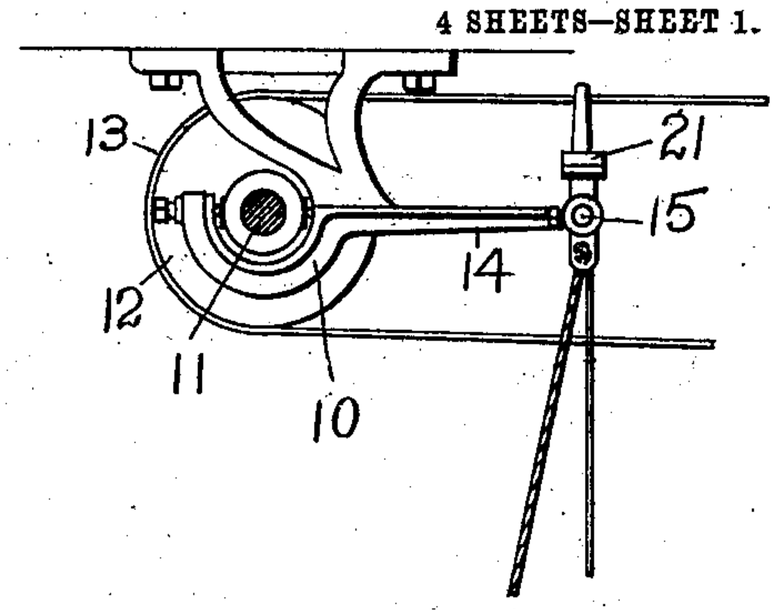


Fig. 1.

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NO MODEL. 4 SHEETS—SHEET 2.

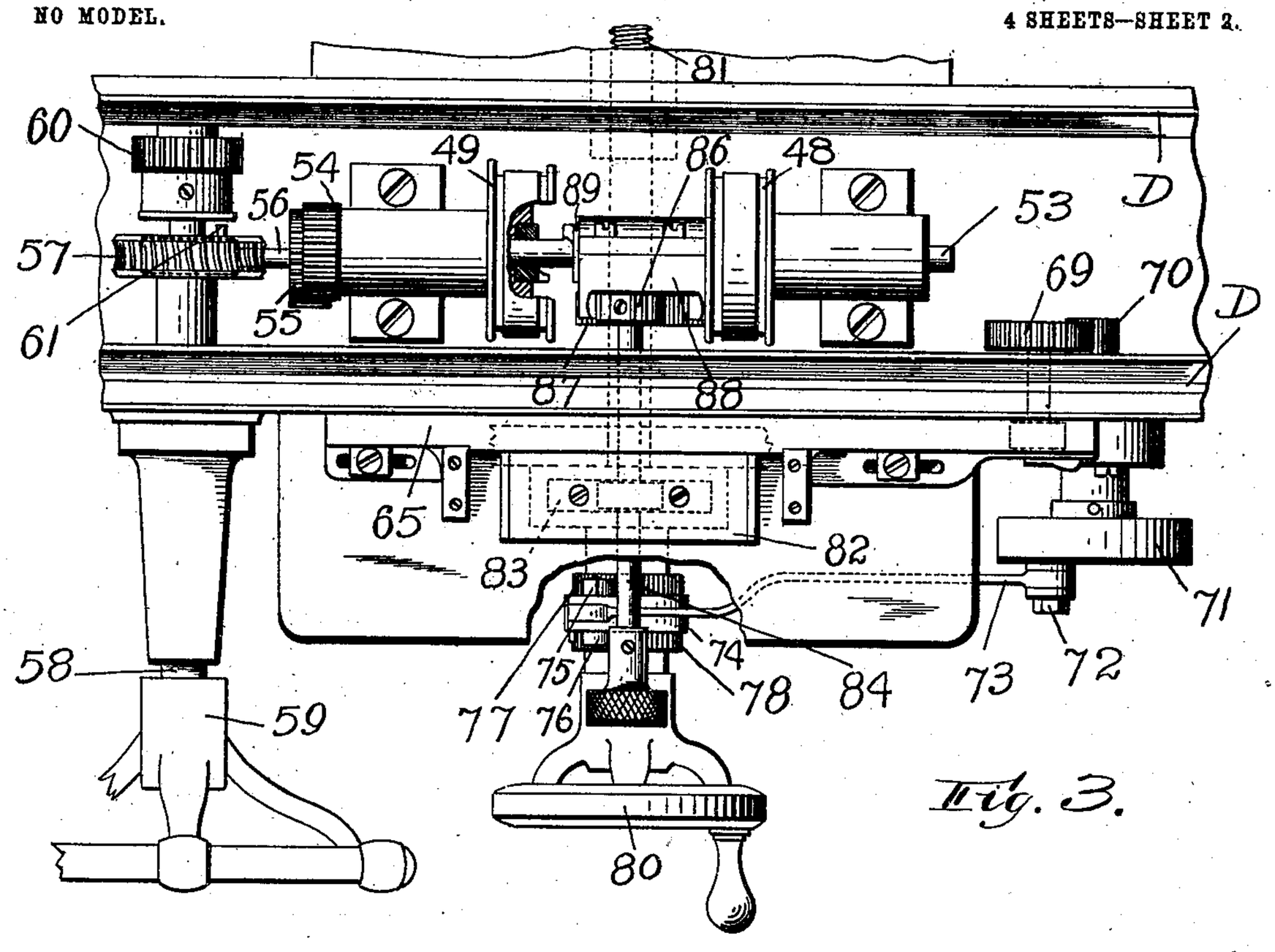

Fig. 3.

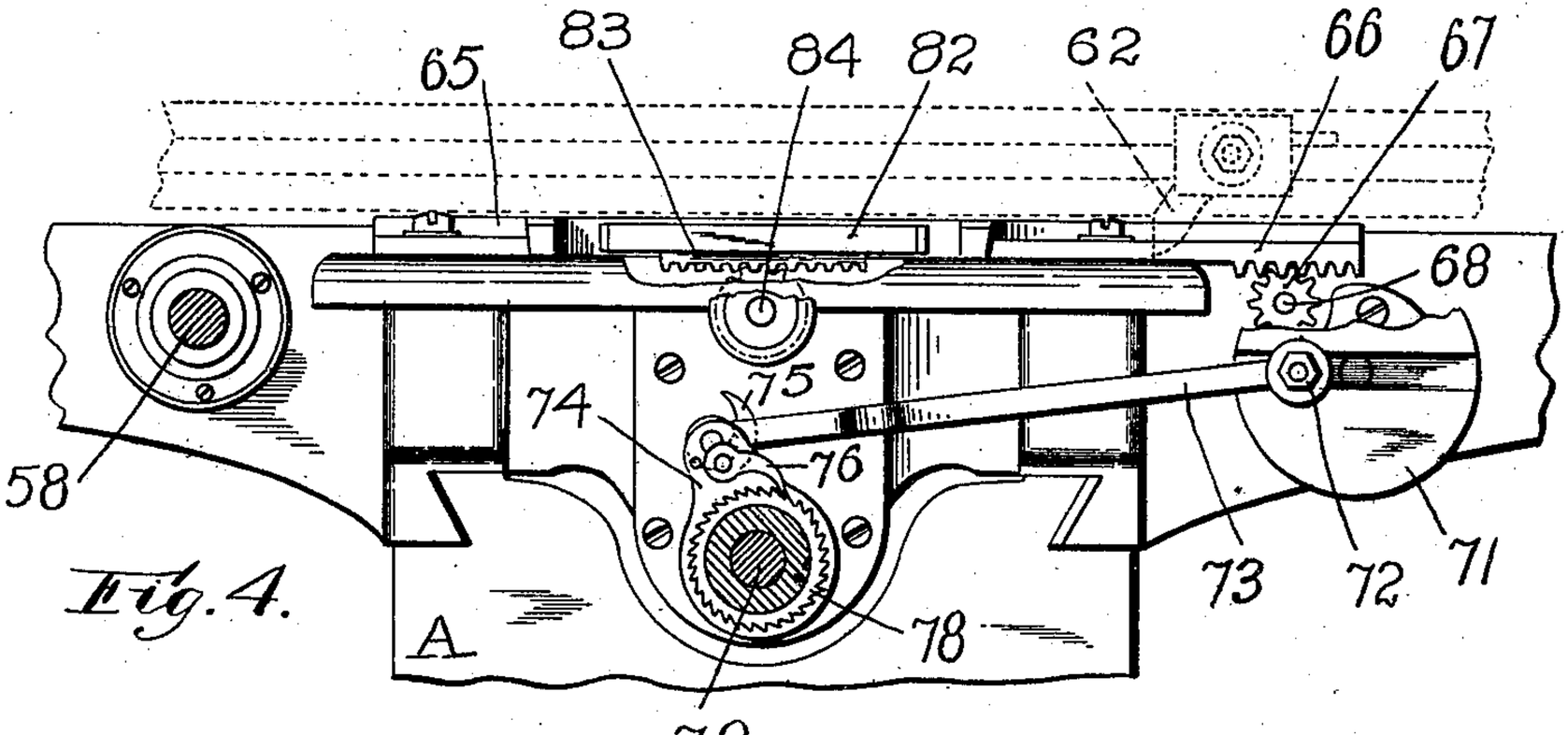

Fig. 4.

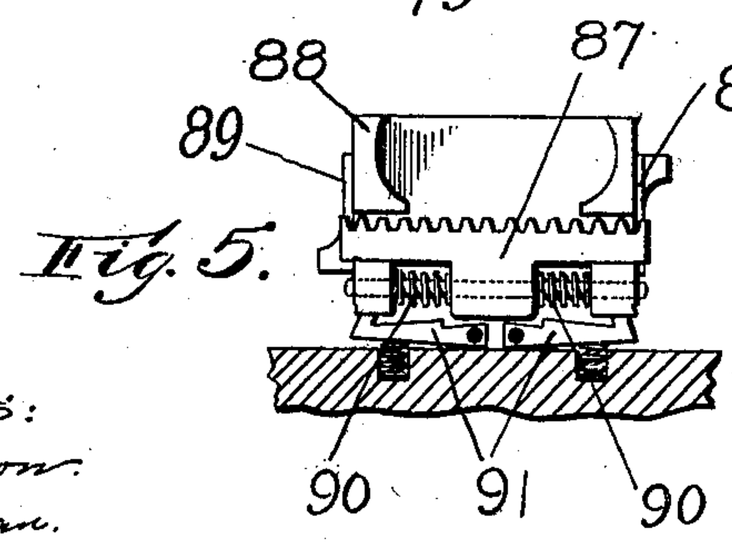

Fig. 5.

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NO MODEL. 4 SHEETS—SHEET 3.

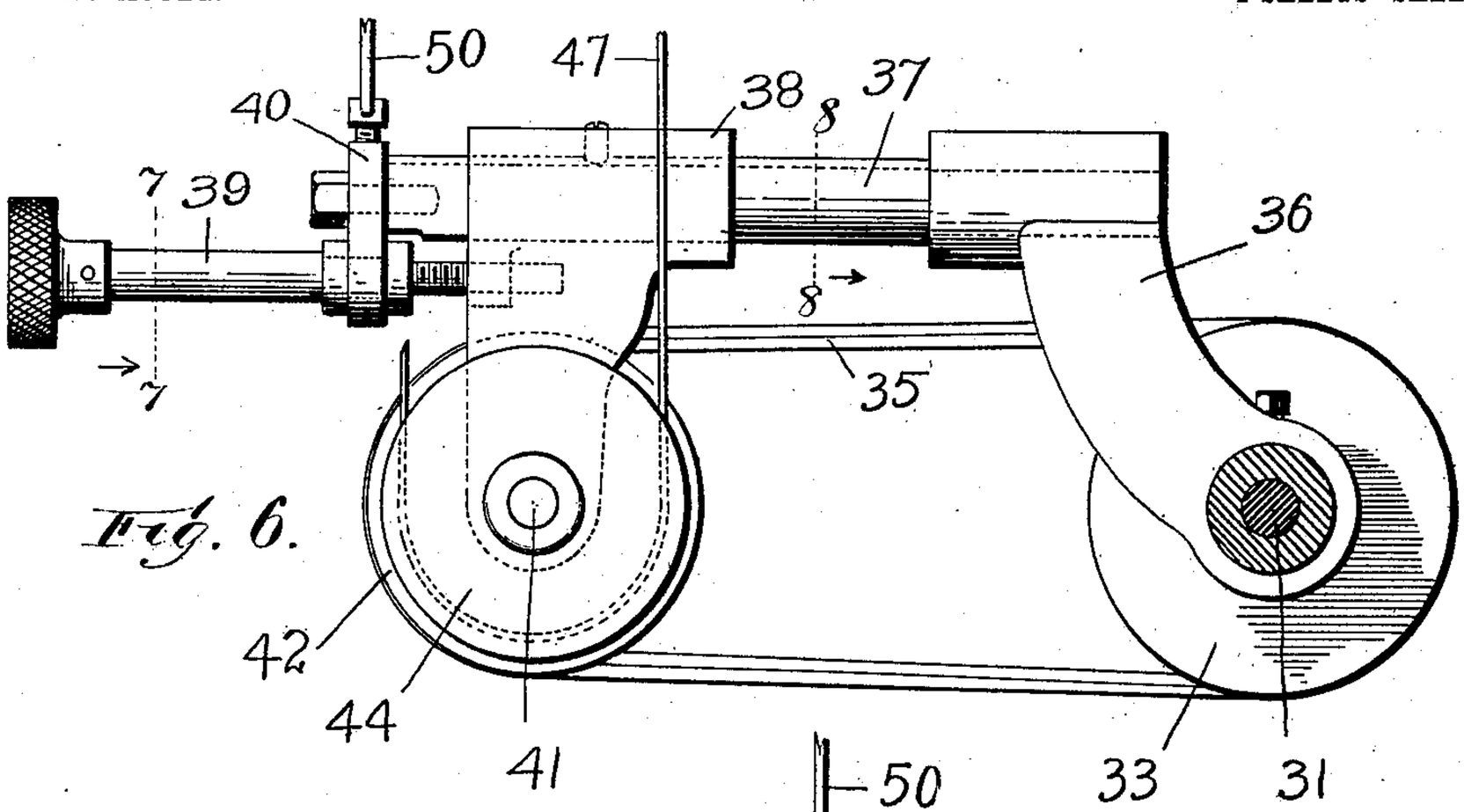

Fig. 6.

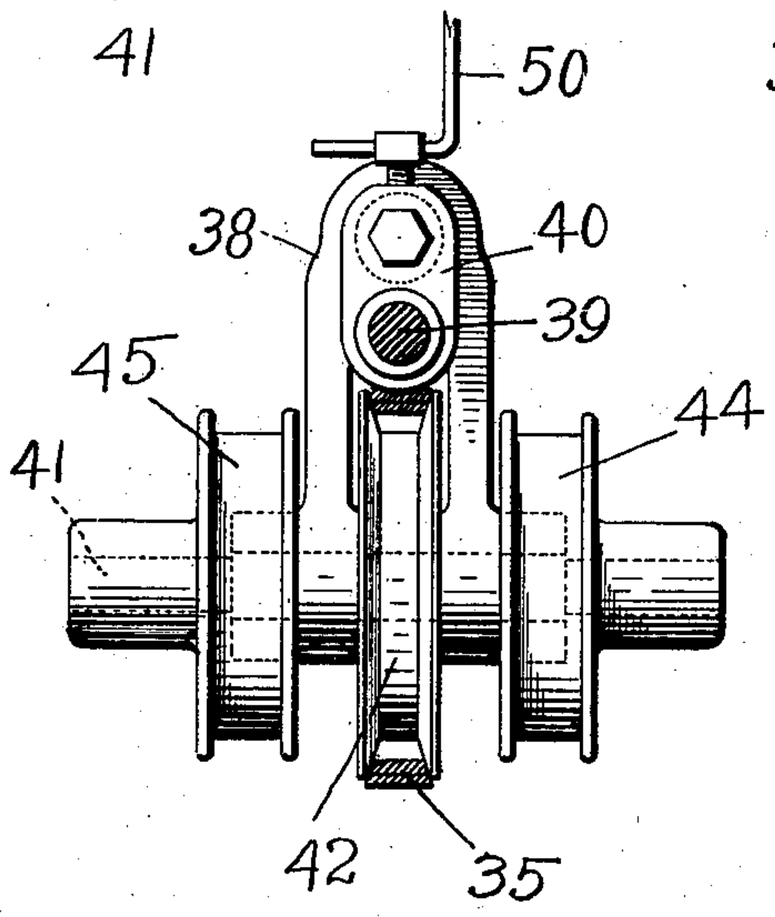

Fig. 7.

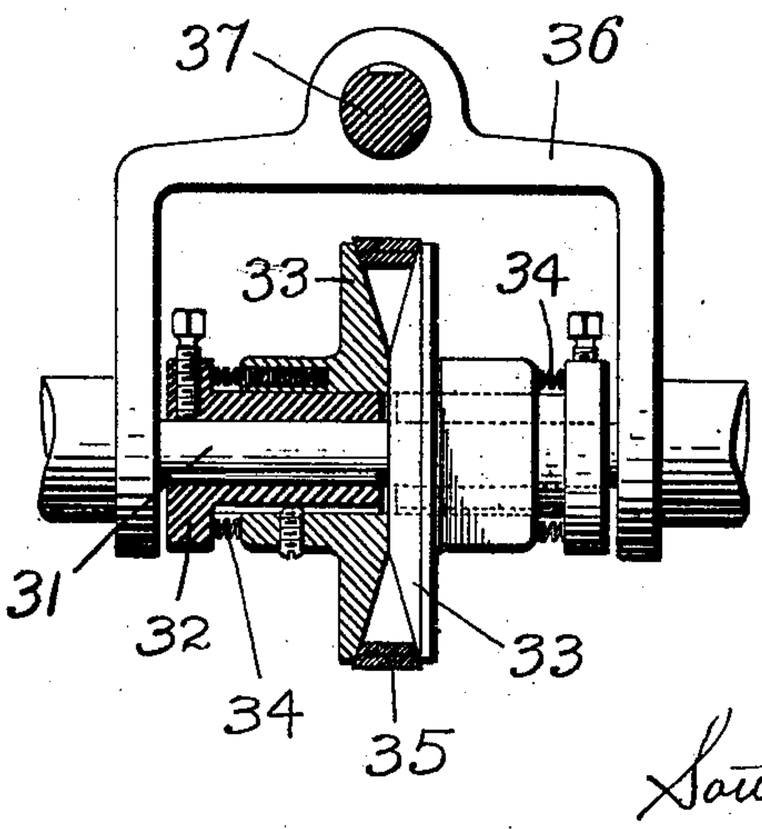

Fig. 8.

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GRINDING MACHINE.

APPLICATION FILED MAR. 26, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

Fig. 9.

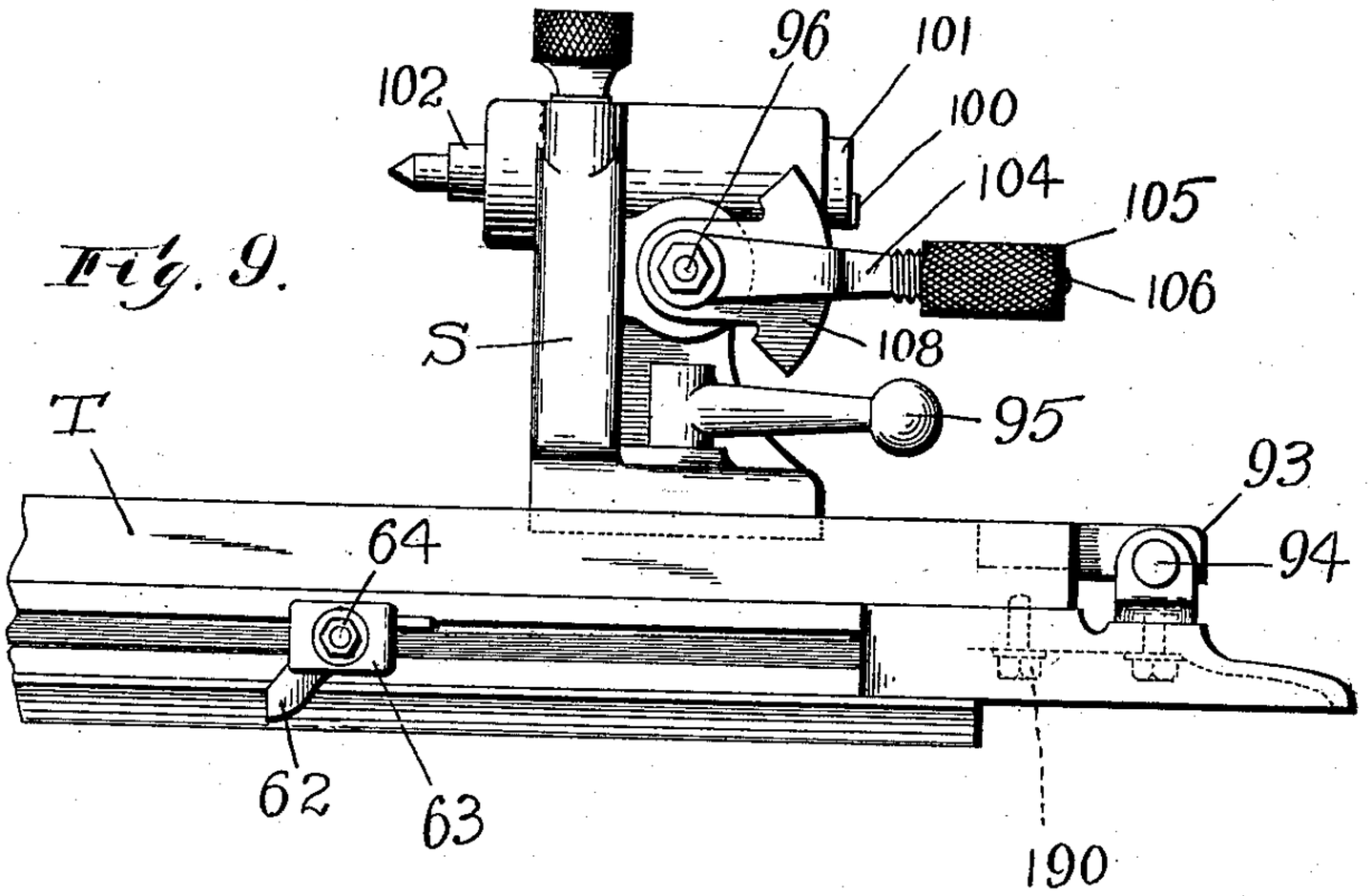


Fig. 10.

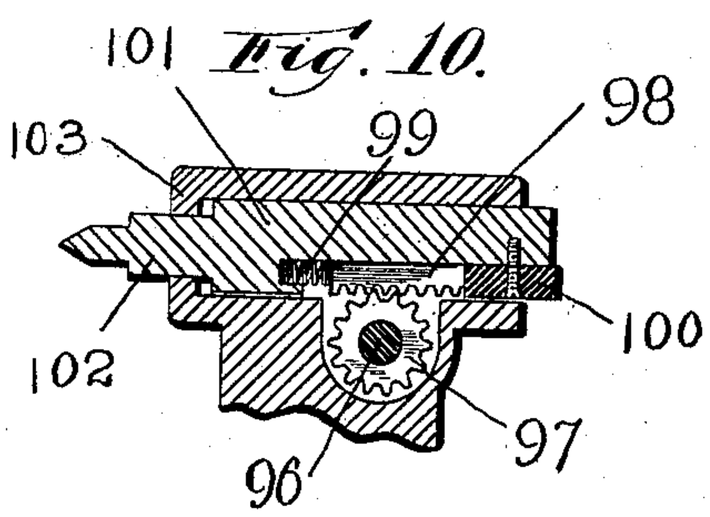


Fig. 11.

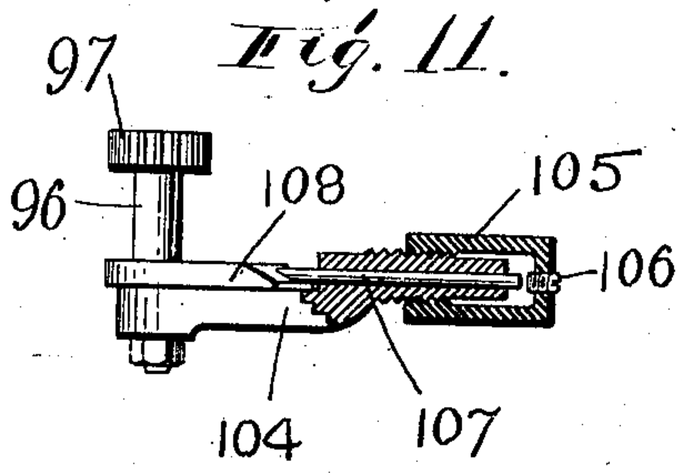
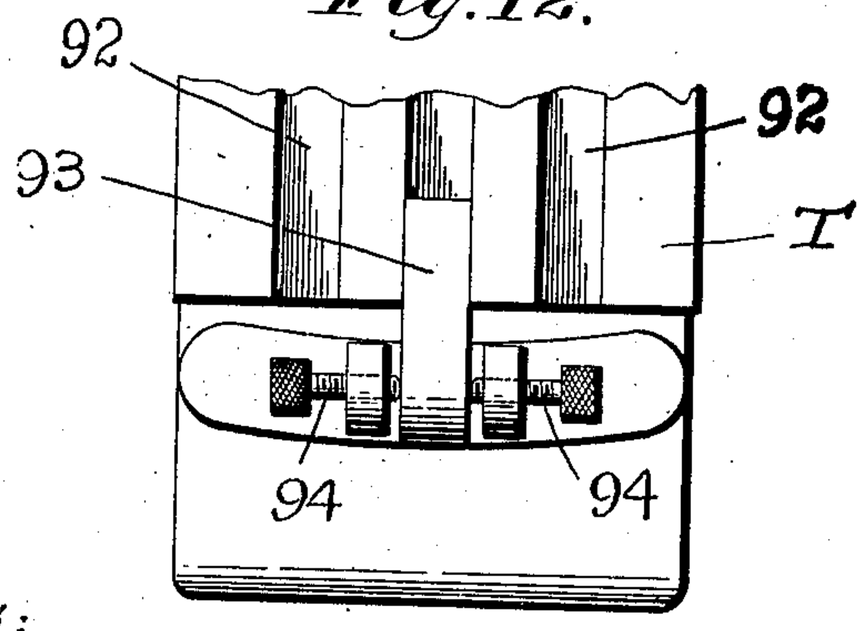


Fig. 12.



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No. 732,803. Patented July 7, 1903.

UNITED STATES PATENT OFFICE.

OAKLEY S. WALKER, OF WORCESTER, MASSACHUSETTS.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 732,803, dated July 7, 1903.

Application filed March 26, 1902. Serial No. 100,095. (No model.)

To all whom it may concern:

Be it known that I, OAKLEY S. WALKER, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Grinding-Machine, of which the following is a specification.

This invention relates to that class of universal grinding-machines in which the work is fed up to and presented to a grinding-wheel.

The especial object of this invention is to provide a strong, simple, efficient, and inexpensive universal grinder which may be adjusted and operated at varying speeds, which is provided with automatic feeding and reversing connections, and which has an automatic stopping device for stopping the operation of the machine upon the completion of any desired piece of work.

To these ends this invention consists of the universal grinding-machine and of the combinations of parts therein, as hereinafter described, and more particularly pointed out in the claims at the end of this specification.

In the accompanying four sheets of drawings, Figure 1 is a side view, partially broken away, of a universal grinding-machine constructed according to my invention. Fig. 2 is a detail view of the belt-shifting connections. Fig. 3 is a fragmentary plan view showing the form of feeding connections which I preferably employ in a universal grinder constructed according to my invention. Fig. 4 is a front view of the same. Fig. 5 is a detail view of the reversing-piece. Fig. 6 is an enlarged view of the adjustable train for varying the speed at which the machine is operated. Fig. 7 is a sectional view taken on the line 7 7 of Fig. 6. Fig. 8 is a sectional view taken on the line 8 8 of Fig. 6. Fig. 9 is a detail view of a portion of the carriage and of the tail-stock which may be mounted thereon. Fig. 10 is a sectional view illustrating the construction of tail-stock spindle preferably employed. Fig. 11 is a detail view of the clamping-handle for operating the tail-stock spindle, and Fig. 12 is a detail plan view illustrating the connections for setting over the work-table for grinding tapers or for similar purposes.

In producing the better grades of machine-work it is now well recognized that better and more reliable results can be obtained from grinding machinery than by the use of ordinary lathes, planers, or similar cutting-tools. Grinding operations are usually considerably slower than the ordinary cutting operations, and as grinding-machines as heretofore constructed have required the constant presence and oversight of an operator grinding machinery has heretofore been comparatively expensive to operate.

The especial object of my present invention is to provide a universal grinding-machine which is automatic in action, so that one operator can control several grinding-machines, thus reducing the cost of labor required and producing the desired quality of work at a less cost than has heretofore been possible. To accomplish this result, a universal grinding-machine constructed according to my invention is preferably provided with automatic stopping connections, which may be set to automatically stop the operation of the machine upon the completion of its work.

In practice the automatic stopping connections for a grinding-machine constructed according to my invention comprise a spring-pressed belt-shifter having a latch for holding the belt in operative position, which latch is released by the transverse travel of the main carriage of the grinder, so as to permit the driving-belt to be shifted onto a loose pulley when the work has been fed entirely past the grinding-wheel.

To operate a universal grinding-machine constructed according to my invention at different relative speeds, I have provided a novel form of change-speed driving connections.

The preferred form of change-speed driving connections for a universal grinding-machine constructed according to my invention comprises an expanding pulley secured on the operating-shaft and a driven pulley which can be moved back or forward to tighten or loosen the driving-belt, which is drawn down between the flanges of the driving-pulley, so as to change the diameter of the driving-pulley to secure the desired speed. The driven pulley and the feed-belt pulleys are preferably journaled in a yoke carried by a shaft pivoted in a piece which is loosely mounted

upon the operating-shaft, so that the weight of the parts will serve to tension the feed-belts and the relative tipping and oscillating will serve to equalize the tension of the two feed-belts.

To operate the transverse-feeding connections and the reversing-clutch, I preferably provide two sliding yokes or pieces which act successively, so that the longitudinal travel of the carriage first acts to produce a transverse feed and afterward operates the reversing connections.

In connection with the work-table of my universal grinding-machine I preferably employ a special construction for setting over the work-table when tapers are to be ground, a novel form of tail-stock spindle, and novel clamping connections for holding the tail-stock spindle in adjusted position.

Referring to the accompanying drawings for a detail description of a universal grinding-machine constructed according to my invention, as shown in dotted lines in Fig. 1, W designates a grinding-wheel which may be adjustably mounted and driven in any desired manner. Inasmuch as the manner in which the grinding-wheel is mounted forms no part of my present invention, I have not herein shown or described the same at length.

As illustrated, a grinding-machine constructed according to my invention may comprise a main frame or column A, having ways B, upon which a primary carriage or apron C is mounted. The primary carriage or apron C is provided with ways D, upon which is mounted the longitudinally-movable carriage F. Supported on the longitudinally-movable carriage F is a work-table T. The work-table T is preferably slotted or provided with ordinary T-grooves, so that the work may be clamped thereto, as to an ordinary planer-table, and the work-table is also preferably provided with head and tail stock constructions, which may be employed for supporting the work on centers, if desired. These parts may be of substantially the ordinary construction employed in universal grinding-machines and need not be herein shown or described at length.

The driving connections for my grinding-machine, as herein illustrated, comprise a shaft 11, journaled in boxes secured in shaft-hangers 10. Mounted on the shaft 11 are ordinary tight and loose pulleys 12, running on which is a driving-belt 13. Extending back from the shaft-hangers 10 are arms 14, and longitudinally movable through the arms 14 is a spring-pressed rod 15, having belt-shifting fingers for shifting the driving-belt 13. As shown most clearly in Fig. 2, the rod 15 is normally held by its spring 16, so that the driving-belt 13 will run on the loose pulley.

To start the machine in operation, I provide a belt-shifting cord 17, which extends down around pulleys 18 and is provided with a handle 20 near the front of the machine. By pulling the handle 20 the driving-belt may be shifted to operative position, and, as shown in Fig. 2, the belt-shifter may be held in operative position by a latch 21. Extending down from the latch 21 is a rod or wire 22, which is connected to a lever 23, which is notched at its front end to receive a roller 24, journaled in a sliding rod 25, having a handle 26 at its front end. By means of this construction by either pushing in or pulling out the handle 26 the roller 24 will act as a cam to pull down the rod or wire 22, releasing the catch 21.

Secured on the rod 25 is an arm 27. Engaging the arm 27 are springs 28 for holding the rod 25 in its normal position. Longitudinally movable through an eye in the upper end of the arm 27 is a rod 29, extending from the primary carriage C, and adjustably secured on the rod 29 are stops 30, having springs for engaging and shifting the arm 27 to actuate the releasing connections before described. By means of this construction by setting the stops 30 to proper positions my grinding-machine may be automatically stopped whenever the main carriage has been fed to any desired transverse position, and I regard this as an especially important feature in the use of my grinding-machines, as by means of this construction a single operator may be enabled to run several grinding-machines.

The variable-speed driving connections are most clearly illustrated in Sheets 1 and 3 of the drawings. As indicated by dotted lines in Fig. 1, an operating-shaft 31 is journaled in the base of the machine and is belted, so as to be driven from the driving-shaft 11. Secured on the operating-shaft 31 is a variable-sized pulley, the construction of which is most clearly illustrated in Fig. 8. As shown in this figure, sleeves 32 are secured on the operating-shaft 31, and keyed onto the sleeves 32 are pulley-flanges 33, which are normally forced toward each other by springs 34. The pulley-flanges 33 are adapted to receive a double belt 35, said parts being arranged so that the double belt 35 may be pulled to separate the pulley-flanges 33, thus decreasing the operative diameter of the pulley. Pivoted on the operating-shaft 31 is a yoke 36, and pivoted in the yoke 36 and extending forward toward the front of the machine is a shaft 37. Splined on the shaft 37 is a yoke or piece 38, journaled in the lower end of which is a shaft 41, carrying the driven pulley 42 and the feed-belt pulleys 44 and 45. To adjust the yoke 38 upon the shaft 37 in order to change the distance between the driven pulley 42 and the expansible pulley on the operating-shaft 31, I provide an adjusting-handle 39, which is journaled in a piece 40 and is threaded at its inner end in the yoke 38, as shown in Fig. 6. The adjusting-handle 39, as shown in Fig. 1, extends out through a vertically-movable slide 46, so as to permit the parts of the variable-speed con-

nection to swivel or turn about the operating-shaft 31. The feed-belt pulleys 44 and 45 are hung one in an open and one in a crossed feed-belt 47, the weight of the parts serving to tension the feed-belts 47, while the turning of the shaft 37 equalizes the tension of the two feed-belts 47. To stop the feed-belts 47, as shown in Fig. 1, I provide a rod or wire 50, connected to an arm extending down from a shaft 51, having a handle or knob 52, said parts being arranged so that by turning the knob 52 the change-speed driving connections will be lifted to leave the driving-belts 47 slack and the machine inoperative.

The feeding connections operated from the feed-belts are most clearly illustrated in Figs. 3 and 4. As shown in Fig. 3, the pulleys 48 and 49, which receive the feed-belts and which are driven thereby in relatively opposite directions, are loosely mounted on a power feed-shaft 53, which is provided at one end with a pinion 54, meshing with a gear 55, secured on a shaft 56, having a worm which meshes with and drives a worm-wheel 57, which is loose upon a longitudinally-movable shaft 58, having a hand-wheel 59 at its front end. At its rear end the shaft 58 is provided with a gear 60, which drives the carriage by meshing with the ordinary carriage-rack, which it is not necessary to herein show or describe. By means of this construction when the shaft 58 is pushed back to the position illustrated in Fig. 3 the carriage F may be moved by the handle 59. The hub of the gear 60 is provided with suitable holes or sockets for receiving a pin 61, projecting from the face of the worm-wheel 57, so that by pulling out the shaft 58 the gear 60 will be connected with the worm-wheel 57. The longitudinal motion of the shaft 58 required for securing this engagement is comparatively small and does not move the gear 60 out to mesh with the carriage-rack.

The connections which I preferably employ for successively operating, first, the transverse feed, and, second, the reversing connections from the travel of the carriage are most clearly illustrated in Figs. 3 and 4. As indicated by dotted lines in Fig. 4 and as shown most clearly in Fig. 9, the carriage F is provided at each end with an operating-dog 62, pivoted in a block 63, which may be fastened in different adjusted positions in the carriage F by a nut 64. Coöperating with the dog 62 of the carriage I provide a slide 65, which first operates the transverse feed and afterward shifts the slide 82 to reverse the direction of the travel of the carriage. As shown in Fig. 4, the slide 65 is provided at its end with a rack 66, which meshes with a small pinion 67, secured on a shaft 68, which shaft 68 is provided at its opposite end, as shown in Fig. 3, with a larger gear 69, meshing with a pinion 70 on a shaft having a slotted wrist-plate 71 at its front end. Adjustably secured in the slot of the wrist-plate 71 is a crank-pin 72, which is connected by a pitman 73 to a rocking piece 74. Pivoted on opposite faces of the rocking piece 74 are the feed-pawls 75 and 76, which coöperate with ratchet-wheels 77 and 78 on the transverse feed-shaft 79. One of the pawls, 75, acts to turn the transverse feed-shaft 79 in one direction, and the other pawl, 76, acts to turn the transverse feed-shaft 79 in the opposite direction. At its front end the transverse feed-shaft 79 is provided with a handle 80, and near its rear end the transverse feed-shaft is threaded, as shown at 81, to operate the apron or primary carriage C. The reversing-slide 82, as shown in Fig. 4, is provided with a rack 83, which meshes with a pinion secured on a shaft 84, which shaft 84 is provided at its rear end with a gear 86. The gear 86 meshes with a rack 87, which is connected by springs 90 to a shifting piece 88, journaled in which is a bushing 89, which is keyed onto the shaft 53 and has clutch-sections at its ends coöperating with the clutch-sections of the pulleys 48 and 49. Coöperating with the shifting piece 88 are latches 91, which prevent the motion of the shifting piece 88 until one of the springs 90 has been compressed to the desired extent, after which the latch is released to permit the operation of the shifting piece in the usual manner. By means of this construction I have provided for the successive action of the transverse feed and the reversing devices—that is to say, the carriage-dogs first act to shift the slide 65 and operate the transverse feed, after which the slide 65 picks up the slide 82 and causes the reversal—and I regard this as a feature of advantage in practice, as the resistance of these two operations does not have to be overcome at the same time.

The work-table-adjusting connections and the spring tail-stock spindle and its adjusting connections which I preferably employ are most clearly illustrated in the fourth sheet of the drawings. As shown in Fig. 12, the work-table T is provided with the usual T-grooves to enable the work to be clamped upon the table T, if desired, and in order to adjust the work-table T for the grinding of tapers or for similar purposes I provide a removable piece 93, which may be dropped down into one of the slots 92 and which is arranged to extend out so as to be engaged by set-over screws 94, threaded into lugs extending up from the carriage C, so that by means of this construction the tail-stock end of the work-table T may be set over to any desired extent and may be clamped in its adjusted position by the clamp-bolt 190, which extends up through a slot in the carriage T. (Indicated by dotted lines in Fig. 9.) The tail-stock casting S may be fitted to the grooves 92 of the work-table T in the ordinary manner and may be clamped in adjusted position by a clamping-handle 95. Journaled in the tail-stock casting S is a rock-shaft 96, which rock-shaft 96, as illustrated in Fig. 10, is provided with a pinion 97, meshing with a rack

98. The rack 98 fits loosely into a socket in the tail-stock spindle 101 and is held in place at one end by a fixed piece 100 and at its front end engages a spring 99, so that by means of this construction when the tail-stock spindle is set up it engages the work with spring-pressure, preventing any looseness of the work when the same is carried on centers. The tail-stock spindle 101 is provided at its end with a reduced portion 102, which extends out through a flange 103, which is intended to prevent the entrance of grit or emery-dust into the tail-stock barrel. Extending from the rock-shaft 96 is an operating-arm 104, and threaded onto the end of the operating-arm 104 is a clamping-handle 105, which has a screw 106 threaded therein to engage a longitudinally-movable clamp-rod 107, having a beveled end which may be set down into engagement with the beveled clamping-sector 108, and I regard this as an especially desirable connection for operating the tail-stock spindle, as the same handle is used for adjusting the tail-stock spindle and for locking or clamping the same in place.

The operations of the several parts of a universal grinder constructed according to my invention have been so fully described in referring to the detailed construction of the parts that a description of the operation of the machine as a whole is thought to be unnecessary.

I am aware that numerous changes may be made in practicing my invention by those who are skilled in the art without departing from the scope thereof as expressed in the claims. I do not wish, therefore, to be limited to the construction I have herein shown and described; but

What I do claim, and desire to secure by Letters Patent of the United States, is—

1. In a grinding-machine, the combination of a work-carriage, means for reciprocating said carriage, a transverse-feed mechanism for moving the carriage transversely to feed the work up to and past a grinding-wheel, and adjustable stopping connections for stopping the operation of the machine when the carriage has been fed transversely to the desired position.

2. In a grinding-machine, the combination of a frame, a transversely-movable apron or primary carriage, a reciprocating work-carriage mounted thereon, driving connections for automatically reciprocating the work-carriage and for feeding the primary apron transversely to carry the work up to or past the grinding-wheel, and adjustable stopping connections for stopping the operation of the machine when the primary carriage has been fed transversely to the desired position.

3. In a grinding-machine, the combination of a frame, an apron mounted on the frame and movable transversely thereon, a work-carriage mounted on the apron, feeding devices for reciprocating the work-carriage, means for moving the apron transversely with respect to the travel of the reciprocating work-carriage, a stop-rod carried by said apron, stops adjustably mounted on said stop-rod, and stopping connections controlled thereby for stopping the machine when the apron has been fed transversely to any desired position.

4. In a grinding-machine, the combination of a power feed-shaft, oppositely-turning feed-pulleys journaled thereon, a shifting piece for alternately connecting the feed-pulleys with the power feed-shaft to drive the power feed-shaft in alternate directions, a transverse shaft having a gear for meshing with the carriage-rack, a worm-wheel loosely mounted on the transverse shaft and driven from the power feed-shaft, and a clutch connection operated by pulling out the transverse shaft to connect the power feed-shaft to drive the transverse shaft when the carriage is to be fed by power, or which can be uncoupled when it is desired to feed the carriage by hand.

5. In a grinding-machine, the combination of a carriage, and a yoke operated from the carriage, and connected to first operate the transverse feed for the carriage, and then to operate a secondary yoke for reversing the direction of travel of the carriage.

6. In a grinding-machine, the combination of a carriage having feed dogs or pawls, a yoke arranged to be shifted by the feed dogs or pawls, a transverse-feed train arranged to be operated by a rack on said yoke, comprising a wrist-plate with a crank-pin adjustably secured therein, and connected to operate a rocking piece having pawls for turning the transverse-feed shaft, and a secondary slide operated by the first-named slide and connected to operate the carriage-reversing devices.

7. In a grinding-machine, the combination of a carriage, a work-table having undercut or T-shaped clamping-slots therein, a gaging and adjusting piece adapted to be dropped into one of the clamping-slots and to project therefrom, set-screws, one engaging each side of said piece to set over the work-table for grinding tapers or for similar purposes, and a clamp-bolt threaded into the work-table and extending through a slot in the carriage to hold the work-table in adjusted positions.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

OAKLEY S. WALKER.

Witnesses:
LOUIS W. SOUTHGATE,
PHILIP W. SOUTHGATE.