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F. A. PRATT & J. JOHNSTON.

ROLL GROOVING MACHINE.

No. 504,172. Patented Aug. 29, 1893.

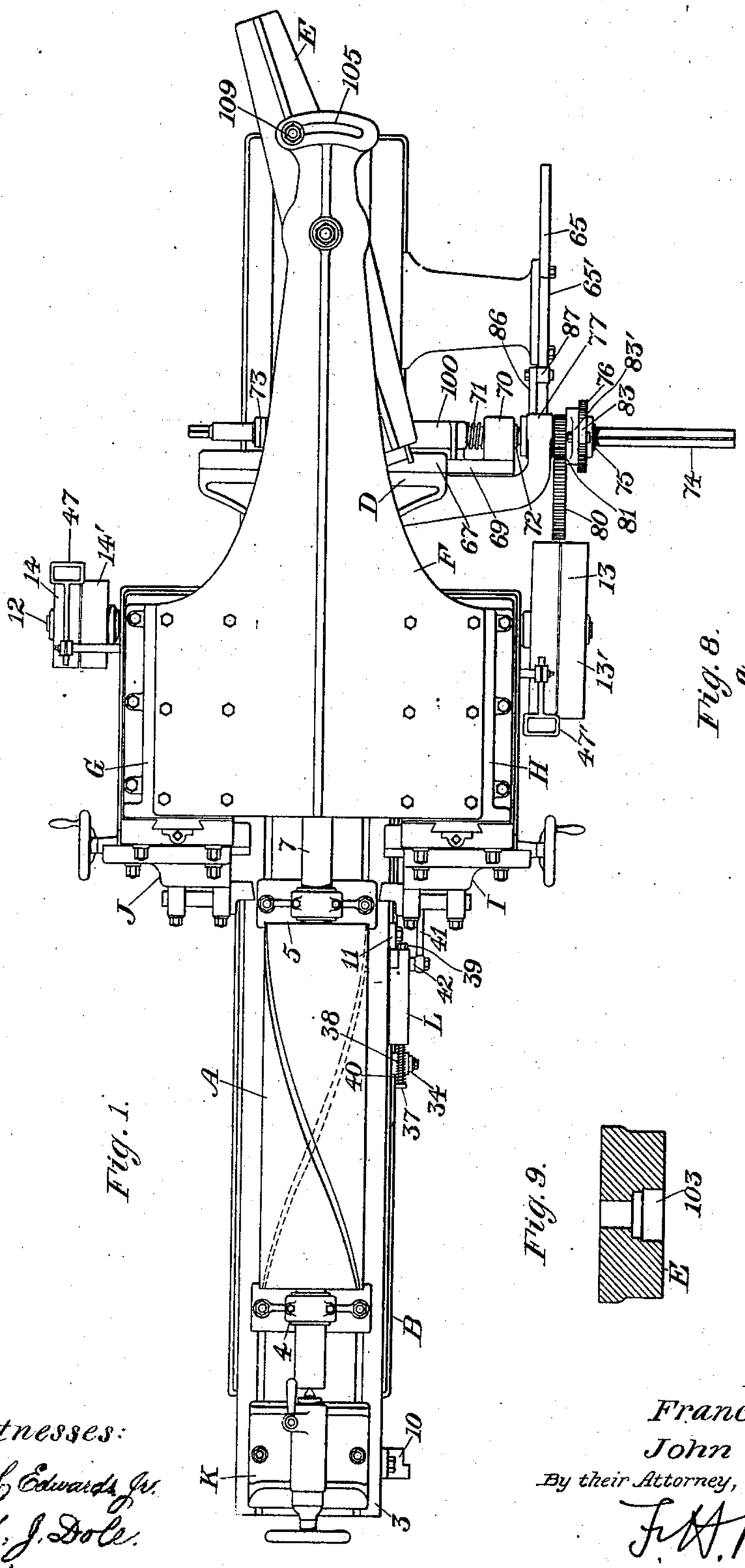

Fig. 1.

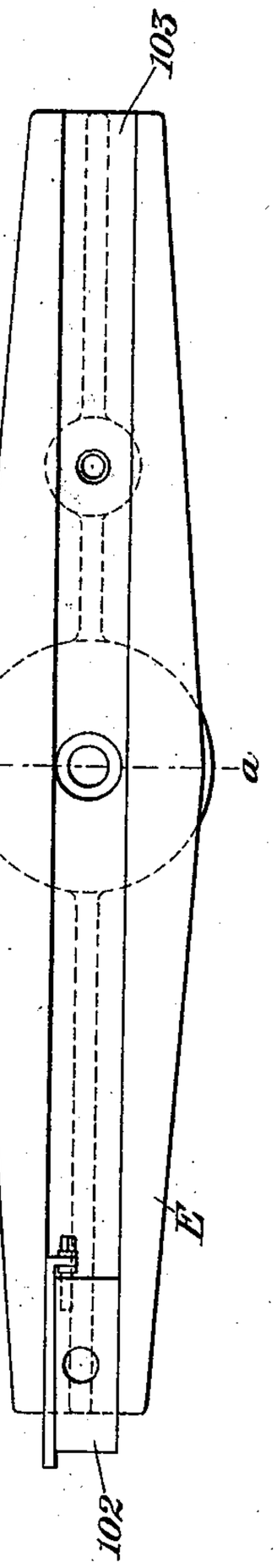

Fig. 8.

Fig. 9.

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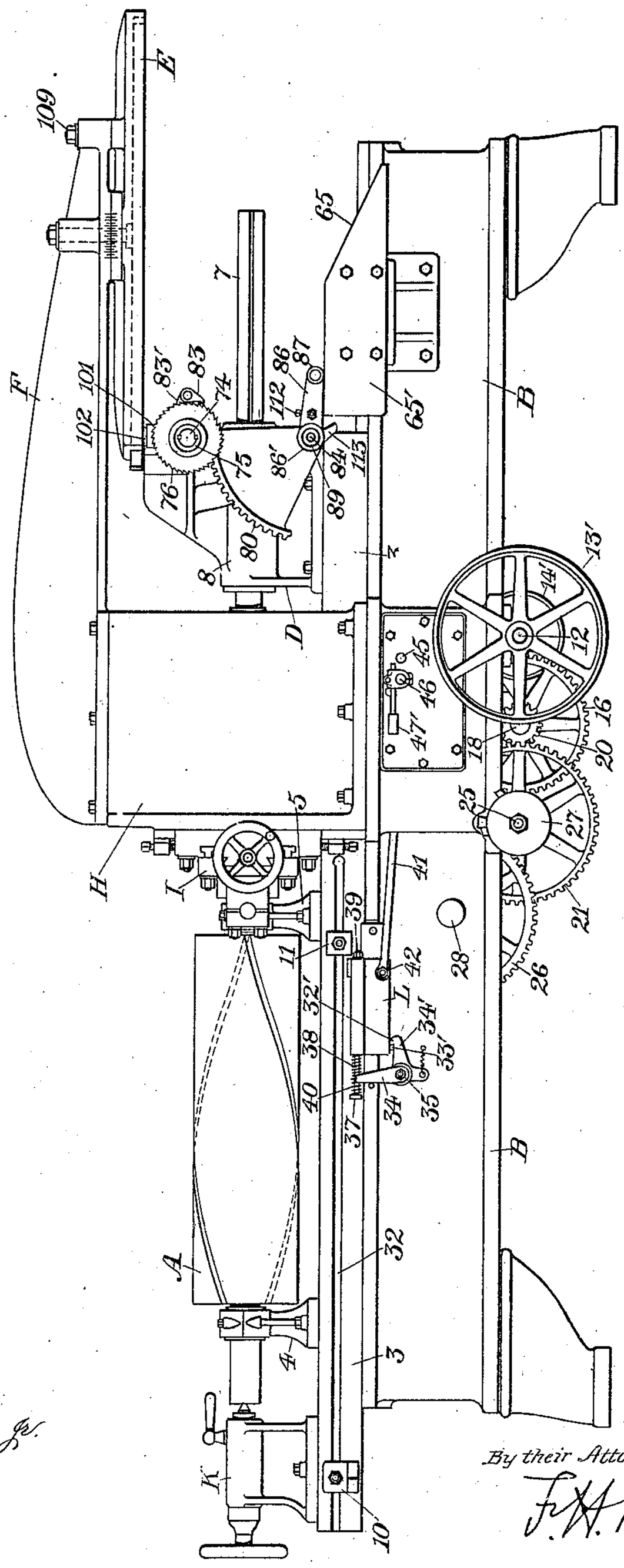
(No Model.) 6 Sheets—Sheet 2.

F. A. PRATT & J. JOHNSTON.

ROLL GROOVING MACHINE.

No. 504,172. Patented Aug. 29, 1893.

Fig. 2.



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(No Model.) 6 Sheets—Sheet 3.

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ROLL GROOVING MACHINE.

No. 504,172. Patented Aug. 29, 1893.

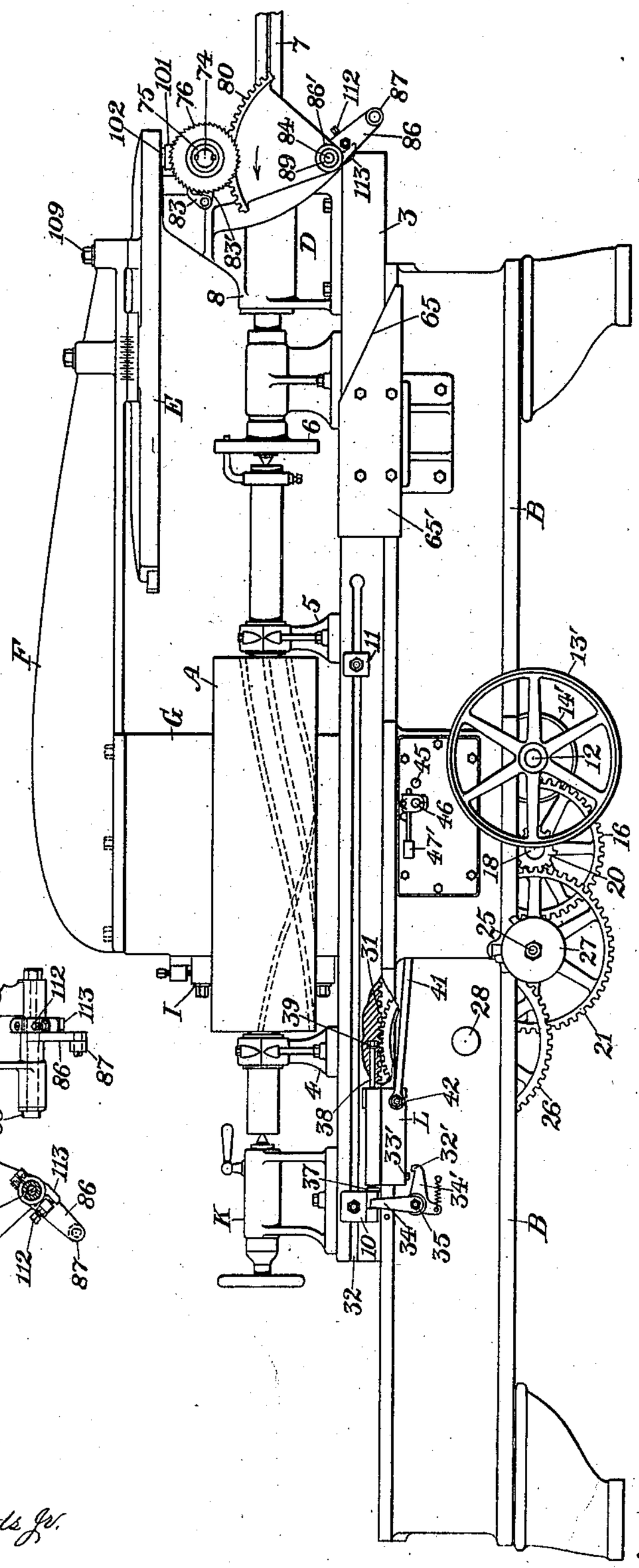

Fig. 3.

Fig. 10. Fig. 11.

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ROLL GROOVING MACHINE.

No. 504,172. Patented Aug. 29, 1893.

Fig. 4.

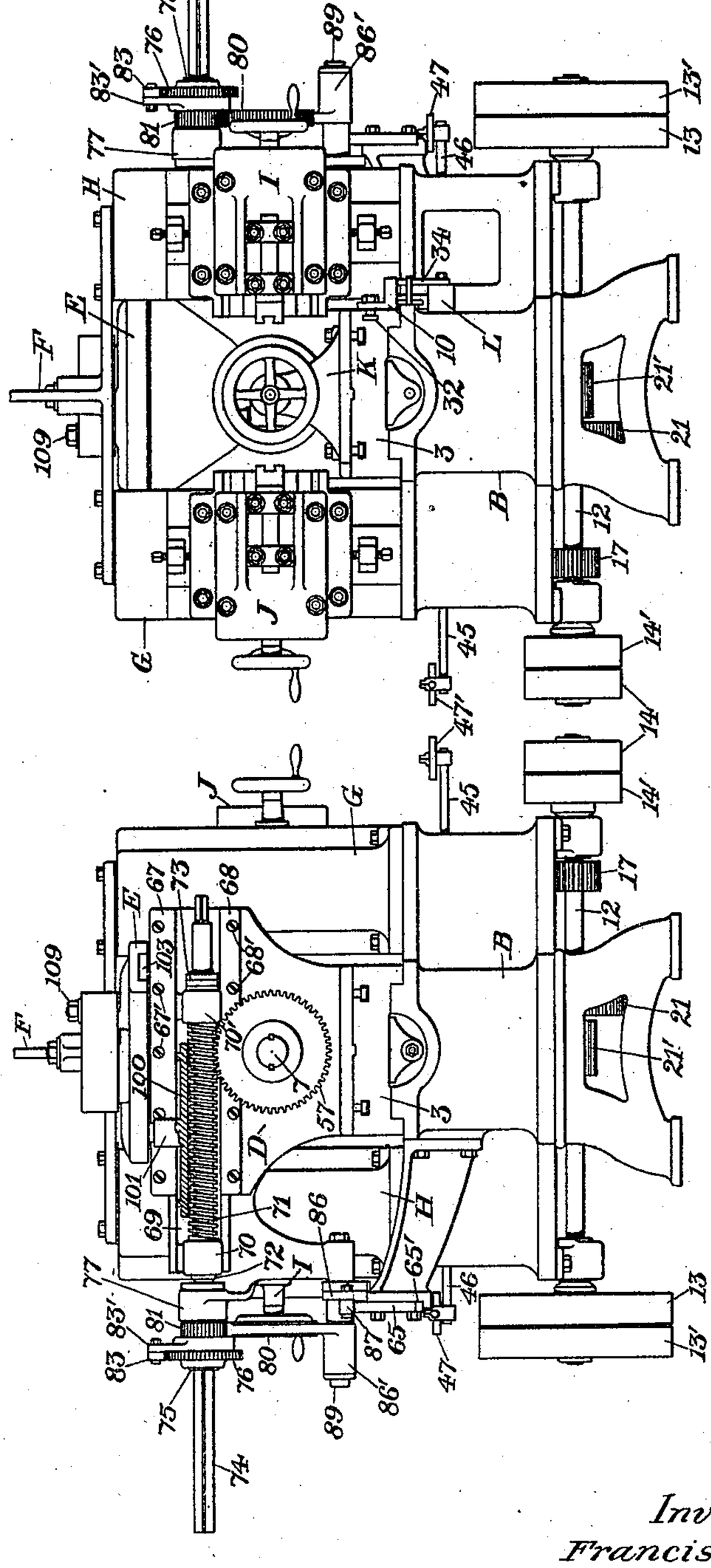

Fig. 5.

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ROLL GROOVING MACHINE.

No. 504,172 Patented Aug. 29, 1893.

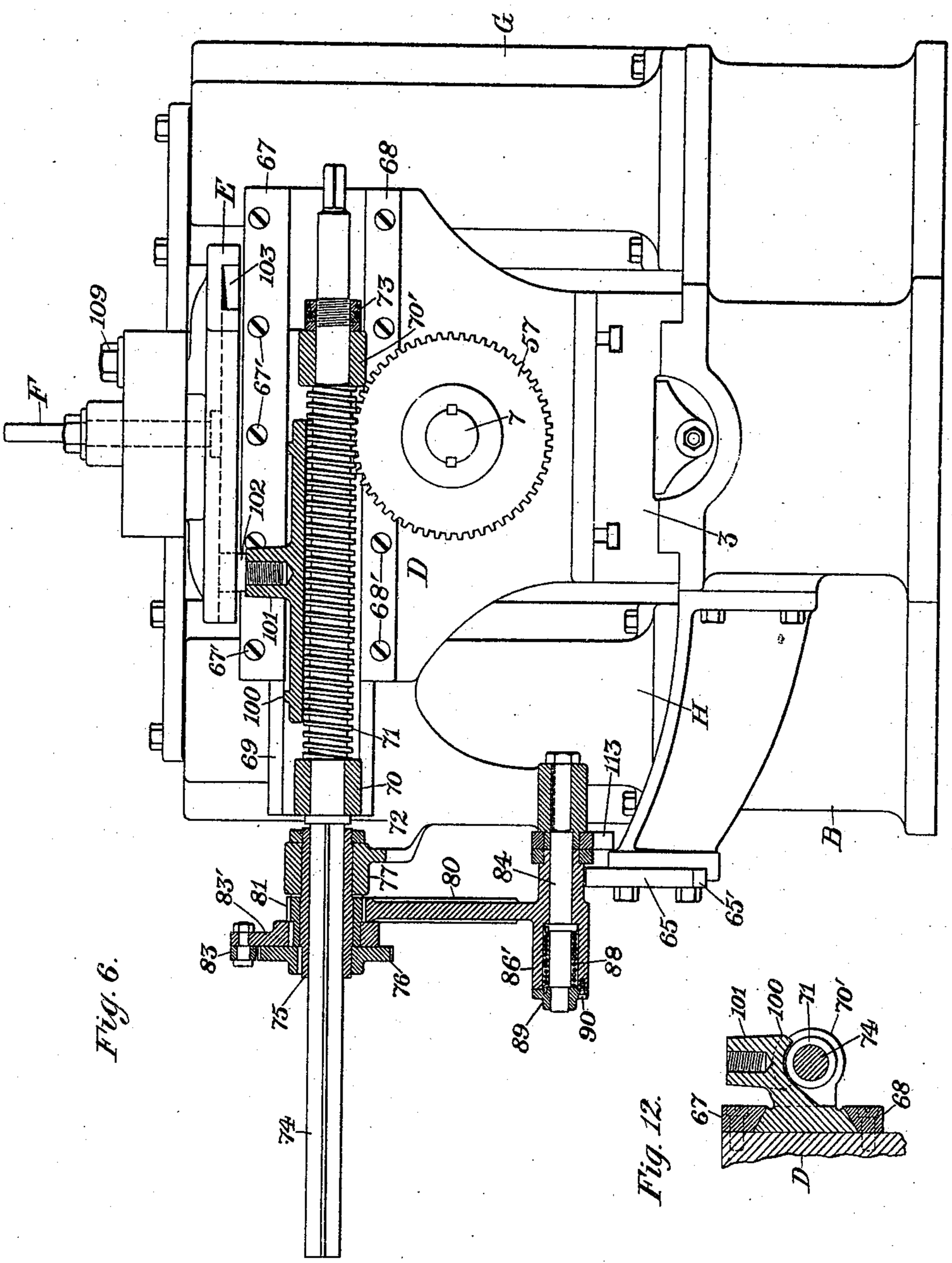

Fig. 6.

Fig. 12.

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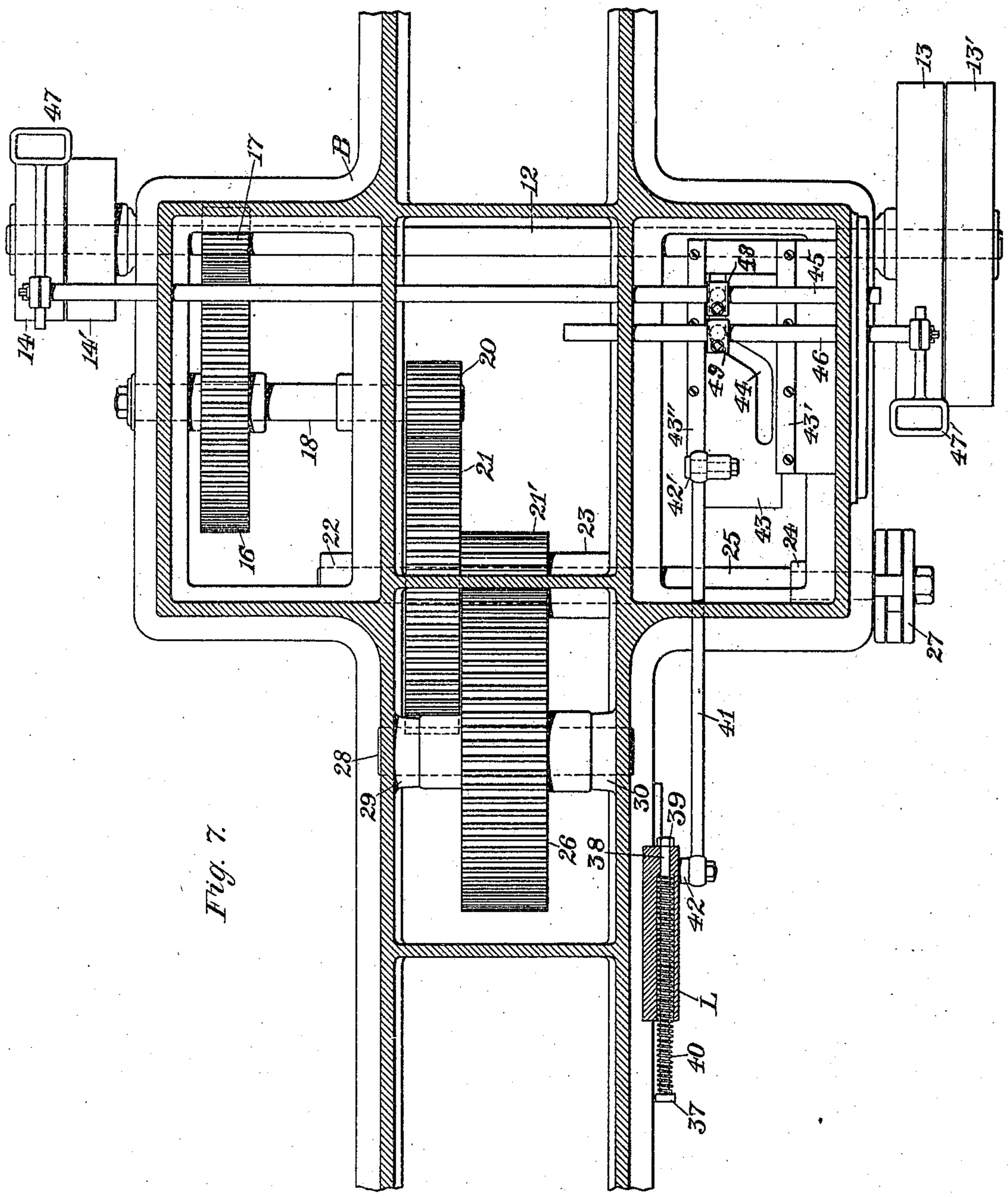

Fig. 7.

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UNITED STATES PATENT OFFICE.

FRANCIS A. PRATT AND JOHN JOHNSTON, OF HARTFORD, CONNECTICUT, ASSIGNORS TO THE PRATT & WHITNEY COMPANY, OF SAME PLACE.

ROLL-GROOVING MACHINE.

SPECIFICATION forming part of Letters Patent No. 504,172, dated August 29, 1893.

Application filed May 17, 1893. Serial No. 474,557. (No model.)

To all whom it may concern:

Be it known that we, FRANCIS A. PRATT, a citizen of the United States, and JOHN JOHNSTON, a subject of the Queen of Great Britain, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Roll-Grooving Machines, of which the following is a specification.

This invention relates to machines for spirally grooving rollers for grinding-mills; and it is, in part, in the nature of an improvement on the machine for a similar purpose described in Letters Patent of the United States No. 256,165, granted April 11, 1882, to John R. Reynolds, assignor to The Pratt & Whitney Company, of Hartford, Connecticut.

In the drawings accompanying and forming a part of this specification, Figure 1 is a plan view of a roll-grooving machine embodying our present improvements. Fig. 2 is a side elevation of the machine, as seen from below in Fig. 1; this view is from the "right-hand" side of the machine, and shows the table run back ready for beginning a cut upon the roll carried thereon. Fig. 3 is an elevation similar to Fig. 2, showing the table run forward as at the end of the cut; in this view the right-hand column is removed, for the purpose of more fully illustrating the arrangement and operation of the details. Fig. 4 is a front end-elevation of the machine, as seen from the left-hand in Figs. 1, 2 and 3. Fig. 5 is a rear end-elevation of the machine, as seen from the right-hand in Figs. 1, 2 and 3. Fig. 6 is an enlarged view of a portion of Fig. 5, showing some details in section, for illustrating the construction and operation of the same. Fig. 7 is a sectional plan view of the middle portion of the frame of the machine, together with the principal portions of the table driving and reversing mechanism. Fig. 8 is an enlarged inverted plan view of the traversing-bar. Fig. 9 is a section of the traversing-bar, in line *a a*, Fig. 8. Figs. 10 and 11 are detail views of parts of the spacing mechanism. Fig. 12 is a sectional end view of the worm, its carrier guides and support.

Similar characters designate like parts in all the figures.

The roll-grooving machine, as will be hereinafter more fully described, embodies some of the features or elements found in a double tool-post side-planer of ordinary construction; as herein shown it comprises the usual frame or bed B, having the uprights G, H, for supporting the tool-carriers I, J, a driving-mechanism for imparting a reciprocating movement to the table or bed 3, which driving-mechanism consists, essentially, of fixed and loose-pulleys with the requisite speed-reducing gears in communication with a rack fixed to the under side of the reciprocating table and having suitable bearings in the frame of the machine, and suitable reversing-mechanism, which may be substantially such as hereinafter more fully described.

The roll A, the surface of which is to be cut or grooved, has an end-bearing shaft which is supported at its ends between the centers of the tail-stock K and the revolving head 6. This head has a double-splined shaft 7, supported in bearings 8, all of which are of usual construction and secured to the table in the usual manner; supplemental bearings formed in the upper end of uprights 4, 5, adjustably secured to the table, are provided to support the shaft at points near the end of the roll.

Fixed to the rear end of the table 3, is a block D having a horizontal bearing 8 therein which forms a support for the hub of a worm-wheel 57, through which the end of the splined shaft 7 extends. This block forms a support for the mechanism that imparts a rotary movement to the roll A, as will be hereinafter more fully described.

Driving-mechanism.—The driving-mechanism for imparting a reciprocating motion to the table 3, consists, in the preferred form thereof herein shown, of the main-shaft 12 which extends horizontally and transversely through, and is journaled in suitable bearings attached to the frame of the machine; said shaft extending beyond the sides of the frame, and having the fast and loose-belt pulleys 13 and 13′ at one end, and the fast and loose pulleys 14 and 14′ at the opposite end, which pulleys are secured in place on the shaft in the usual way. A pinion 17 is shown keyed to the shaft 12, near the end, provided with pulleys 14 14′; a spur-wheel 26 is se-

cured to a shaft 28, mounted in bearings 29 and 30 upon the frame, as clearly shown in Fig. 7, in position to mesh with the teeth of the rack 31; and a train of speed-reducing-gearing is provided intermediate to, and in mesh with, the pinion 17 upon the main-shaft, and the spur-wheel 26, which train of gearing comprises a gear-wheel 16 in mesh with the pinion 17 and mounted upon a shaft 18 journaled in suitable bearings upon the frame, and having a pinion 20 at the inner end of said shaft in mesh with a gear-wheel 21 mounted upon the shaft 25, supported in bearings 22, 23 and 24 in the frame, which shaft has a pinion 21′ thereon that meshes with spur-wheel 26. This mechanism is, and may be, of any usual construction and arrangement. Secured to the outer end of the shaft 25, (as shown in Figs. 3 and 7,) at the outside of the frame is a wheel 27, upon which are two radiating teeth arranged at a suitable distance relative to each other, the function of which is to effect an outward impulse of the tool-carriers to throw them out of contact with the work at the end of the stroke and at the moment the shifting of the belt takes place to obviate the dragging of the tool on the return stroke. Said wheel will, in practice, be connected by means of a cord and pulleys, with the tool-carriers. The construction and operation of the device for accomplishing this end will be similar to that of other well known and like devices in ordinary circular boring mills and planers, and as it forms no essential part of my present invention, a detailed description thereof is deemed unnecessary.

Shifting-mechanism.—Formed longitudinally in the side of the bed or table 3, is a slot 32, and adjustably-secured in said slot are two dogs 10 and 11 which are arranged at the proper distance for the length of travel it is desired to secure to the roll being operated upon. Movably secured upon guides upon the framework, is a sliding block L which has, at one end, a stud 42 upon which is pivoted one end of an operating lever pivotally-secured at its opposite end, as at 42′, to a bearing upon a plate 43 supported in bearings 43′ and 43″, secured to the frame, which plate is capable of horizontal reciprocation in said slides. Formed in said sliding plate 43 is a cam-groove or slot 44, preferably of Z-shape, and movably seated in said groove 44, at the proper relative positions corresponding to the axial lines of the shipper rods 45 and 46, are guide-blocks 48 and 49. These guide-blocks, which may, if desired, have rollers to form anti-friction bearings in the slot 44, are secured to the shipper-rods 45, 46, which have bearings transversely in the frame and carry at their ends the belt-shifters or fingers 47 and 47′, respectively. By this construction and arrangement of shifting-mechanism, it will be seen that motion imparted to the sliding block L through contact therewith of the dogs 10 and 11, in either the forward, or return movement of the bed or table 3, will be be transmitted, through the medium of the lever 41, to the sliding-plate 43 moving it either backward or forward in the same direction that the table is moving; and the sliding-plate 43, through the medium of the slot 44 and the sliding block secured to the shipper rods moving in said slot, will move the shipper-rods transversely, inward or outward, together with the shifters 47 and 47′ which will shift the belt from one set of pulleys to the pulleys driven in the reverse direction, thus immediately imparting a reverse movement to the train of gearing in mesh with the main-shaft 12 and rack 31 upon the table which will move said table in an opposite direction. Mounted in the sliding block L upon the frame is a spring-controlled rod or plunger 38, which extends through bearings therein, and has a nut 39 at one end and a head 37 at its opposite end to limit its reciprocating movement. A spiral spring 40 around said rod and bearing against the head 37 and inner wall of the block L tends to retain the bolt in an outward position, or in the position shown in Fig. 7, the function of which will be hereinafter more fully explained. Formed upon, or secured to the under side of the sliding block L, is a projecting catch 33′, which, in the forward position of the bed, and during the operation of cutting the roll, is engaged by a catch 32′ upon the rearwardly projecting arm of a bell-crank lever 34 fulcrumed at 35 upon the frame of the machine. The catch upon the lever-arm is normally held in engagement with the catch upon the sliding block L by a spring secured at one end to the frame and at its other end to a projection upon the lever, as shown in Fig. 2. By reference to said Fig. 2, it will be seen that the spring-controlled rod 38 is projected forward with its head 39 abutting against the rear end of the sliding block, and that the upwardly projecting arm of the bell-crank is thrown forward and the catch upon the arm 34′ thereof is in engagement with the catch upon said block L. When the table 3 is near the rear end of its stroke, as shown in Fig. 3, a projection upon the dog 10, secured to the table as before described, will, after the spring-controlled rod 38 has been pressed backward almost the entire extent of its rearward movement by the dog 10, abut against the upwardly projecting arm of lever 34 and throw the catch upon arm 34′ out of engagement with catch 33′ upon the sliding-block L, which block being thus released is immediately driven backward by reason of the stress of the spring, thereby giving a quick impulse to the lever 41 in connection with the plate 43, and through the medium of the shipper-rods, quickly shifting the belts and obtaining an immediate reverse movement of the table 3. The dog 11 will, on the return movement of the table, at the proper time, or when near the extreme end of its stroke, come in contact with the rear end of the sliding block L which carries

said sliding block L forward to its former position, allowing the catch thereon to override the catch upon the arm 34′ of the lever 34. The catches, after passing each other, are interlocked through the medium of the spring at the lower end of the lever which prevents the accidental shifting of said block during the backward movement of the table, or while the roll is being operated upon.

Mechanism for rotating the roll.—As a means for imparting the requisite rotary movement to the roll A, the sliding table has adjustably secured to it near its rear end, a block D, of any suitable construction, having a horizontal bearing 8 formed therein, in which is supported the hub of a worm-wheel 57, through which extends the splined-shaft 7 which is connected at its forward end to the revolving head 6 that supports one end of the arbors of the roll A as before described. Secured to the rear face of the block B by means of screws 67′ and 68′ or equivalents, are two guide-plates 67 and 68, see Fig. 6, which receive between them a traverser or sliding-head 69, having at its ends oppositely projecting bearings 70 and 70′ which supports the journals of a worm or screw 71. This worm is held against longitudinal movement within its bearings by a shoulder 72 at one end, and a collar, or nut and washer 73 at its opposite end. The threads of the worm are in mesh with the teeth of, and impart a rotary movement to the worm-wheel 57, and, through the medium of the splined-shaft 7, rotates the roll A, as will be hereinafter more fully described. This worm has an extension or shaft 74 with longitudinal splines thereon, extending through grooves in a collar journaled, and free to rotate, in a bearing 77, secured to the block D, said construction and arrangement of the worm permitting a rotary and longitudinal movement to be imparted thereto, as will be hereinafter more fully explained. The traverser or sliding-head 69 will preferably have a laterally-projecting hood 100 which overhangs the worm 71, and formed upon said hood, centrally between its ends, and vertically central with relation to the axis of the worm, is an upwardly projecting boss 101, which receives the screw-threaded lower end of a stud or block 102, that has a sliding bearing at its upper end in a longitudinal groove 103 formed in the lower face of a traversing-bar E. This traversing-bar is pivotally-supported at its center in a bearing near the end of the overhanging, rearwardly-projecting arm F which is bolted to, and supported upon pillars G, H, or uprights near the center of the frame B, as shown in the drawings. Formed in the end of the overhanging arm F is a radial slot 105 which forms a bearing for the stud 109 which extends through the traversing-bar in the rear of its central support, which stud 109 is secured in the bearing-slot 105 by a nut. This connection between the traversing-bar and overreaching arm F at one side of the pivotal connection, forms a supplemental support for, and permits the said traversing-bar to be adjusted and secured in the adjusted position at any inclination with relation to a horizontal line drawn longitudinally through the center of the table 3, and axis of the roll A to be operated upon, such adjustment regulating, as will be hereinafter more fully explained, the transverse reciprocation of the worm 71, and consequently the rotation of the worm-wheel 57 and roll A which determines the extent of inclination or pitch of the grooves formed in the roll by the cutters. The sides of the over-reaching arm F, and the traversing-bar E near the point of their pivotal connection will preferably be curved as shown in Fig. 1, the radious being concentric to the axial center of the connection. Formed upon said curved portions are graduating marks to register, one with the other, by means of which the operation of adjusting the bar to the desired inclination to produce the requisite rotary movement of the roll and a given pitch to the grooves to be formed therein, is greatly facilitated. It will be observed, by reference to the drawings, that as the table that supports the roll is moved backward, the block 102 (being, we will assume, in the position in the traversing-bar E shown in Fig. 2,) will travel, in consequence of the inclination of said bar, longitudinally, but at an angle to the line of movement of the bed, which will impart a transverse movement to the traverser or sliding head 69 in the guides upon the supporting-block D, together with worm 71, which being in mesh with the worm-wheel 57 rotates said wheel, together with its splined shaft 7, and through it imparts a rotary movement to the roll A. The worm in this operation acts as a rack to impart movement to the worm-wheel. To change the pitch of the groove to be cut in the roll, it is simply necessary to loosen the nut upon the stud 109 in the radial bearing 105 at the extreme rear end of the over-hanging arm F, and turn said bar upon its axis to the proper degree of inclination (which can be determined by the indication marks) to insure a greater or less transverse reciprocation to the traverser as the block 102 which being seated in the groove 103 in the bar E, and connected with the said traverser, limits the backward and forward movement of the worm connected with the traverser as before described, and consequently limits the extent of the revolution of the worm-wheel shaft and roll A in a degree proportionate to the movement of the traverser.

Spacing-mechanism.—The spacing mechanism for imparting an intermittent rotary movement to the roll A, comprises, essentially, a ratchet-wheel 76 keyed to the collar or revoluble bearing 75 splined to the end of the worm-shaft 74, as shown in Fig. 6; a pawl 83 in engagement with said ratchet-wheel, and pivoted to the end of an arm 83′, secured to the hub of a pinion 81, loosely mounted upon said bearing 75, and a sector or toothed seg-

ment 80 pivotally mounted upon a shaft or stud 84 fixedly secured to a support upon the block D or table of the machine. Secured to the hub 86′ of the sector, is a sector-lever 86 having at its free end a stud upon which is mounted a friction-roller 87, which, as the table 3 is moved forward rises upon the incline or cam-face 65 of a plate 65′ bolted to the frame. The said cam-face moves the lever 86 upward and the sector on its axis toward the front of the machine, and, through the medium of the pinion 81, carries the pawl 83 around and imparts a rotary movement to the ratchet with which it is engaged, thereby revolving the shaft 74 the requisite distance for spacing. When the lever 86, through the backward movement of the table, is released from the incline it returns to its normal position which automatically rotates the pinion 81 and allows the pawl to take up another position upon the ratchet ready to turn it when the lever again acts by riding up the incline. The outer end of the hub 86′ is of sufficient internal area to permit the insertion of the spiral spring 88, which has a bearing at one end in the shaft 84, and at its opposite end, in a cap 89, herein shown as secured to the hub by a screw 90. The tension of this spring normally retains the sector 80 in the position shown in Fig. 3, until the roller 87 upon the sector-lever comes in contact with the inclined face 65 of the plate 65′, when the tension of the spring is overcome by the leverage, and the sector allowed to partially rotate on its axis. Fixed to the shaft 84 is a stop-arm 113 and upon the lever 86 is a stop-screw 112, which, in the movement of said lever contacts with the said stop-arm and regulates the throw thereof. By this arrangement of stop and stop-arm, the throw of the lever 86 and its sector 80, may be quickly adjusted, which adjustment will gage the distance between grooves upon the roll, as it limits the intermittent rotary movement of said roll. Both the stop-arm 113, and sector-lever 87, will preferably be secured, one to the shaft, and the other to the hub of the sector in such manner that they may be adjusted as may be desired relatively to each other. The spacing-mechanism is so constructed, arranged, and timed, in its movements, with relation to the other actuating parts of the machine, that it acts intermittently to rotate the roll the desired distance, said movement taking place only at the time the roll stops in its forward movement and just prior to the beginning of the cutting of the groove, at which time the devices hereinbefore described, for giving a continuous rotation to the roll, as the table travels backward and forward, are at rest.

The operation of the machine is as follows:—The roll or piece to be operated upon is placed with its shaft or arbor in the bearings 4, 5, and accurately centered by the center-points upon the tail-stock and revolving head, the forward end of the shaft being made fast to the revolving head by a dog or fastening piece in the usual manner. The carriage is then brought to its extreme forward position, as shown in Fig. 2, and the traversing-bar E is set to the proper degree of inclination with relation to the overhanging arm F and center of movement of the table to secure the proper rotation of the roll The tool is then set to take a slight scraping cut upon the roll, which roll is run backward to the complete end of its stroke. The roll is then brought back to its first position and turned a one-half revolution or one hundred and eighty degrees, (which may be accurately determined by suitable pointers or marks upon the worm-gear mechanism) which revolution will bring it in exact position to match the center line of the cutting-tool. This slight cut is then used as a gage whereby the other cutting-tool may be set which permits the tools to produce two cuts or corrugations diametrically opposite, which grooves, when the roll is reversed, will be symmetrically correct with respect to each cutting tool; that is,—the corrugations will come out as perfect as they would if only one tool were used, thus facilitating the work. By supporting the traversing-bar E to and under an overhanging arm secured to the frame of the machine and above the work-carrying parts, and supporting the sliding head which carries the worm that imparts a rotary movement to the shaft and roll to be operated upon, the lateral strain is equalized and the vibration of the shaft and roll, due to the lateral pressure of the cutters upon the roll, is materially reduced, if not entirely obviated; this is a great desideratum, as it insures an evenness and uniformity of cutting practically impossible with machines having no support for the upper parts of the carriage or devices which control the rotary movement of the roll being operated upon.

Having thus described our invention, we claim—

1. In a roll grooving machine, the combination with the main framework and with the work-carrying table sliding thereon, of an overhanging-arm, a traversing-bar pivotally supported and adjustably-secured to and under said arm, the work-actuating shaft carried on the table, the worm-wheel on said shaft, the sliding worm engaging said worm-wheel, means for sliding the worm by engagement with the traversing bar, and means for intermittently revolving the worm, substantially as described.

2. In a roll grooving machine, the combination with the main-frame having the side pillars, and with the table sliding on said frame, of an overhanging arm secured to pillars and extending rearwardly therefrom, the traversing-bar pivoted to and under said arm, the work-actuating shaft and mechanism for rotating said shaft supported between the traversing-bar and table and in engagement with said bar and shaft, substantially as described.

3. In a roll grooving machine, the combina-

tion with the frame B, the sliding table 3 thereon and work-operating shaft 7, of an overhanging-arm secured to the frame having a bearing for pivotally supporting a traversing-bar and having the radially slotted bearing 105, the grooved traversing-bar E pivoted to said overhanging-arm and having adjustable connection with the bearing 105, and mechanism, substantially as described, interposed between the bar E and table 3 and having a sliding connection with the bar E and shaft 7, all constructed and arranged substantially as described to impart a rotary movement to said shaft, substantially as and for the purpose specified.

4. In a roll grooving machine, the combination with the frame B, sliding table 3 and over-reaching arm F supported upon pillars or uprights secured to the frame B, of the slotted traversing-bar E pivotally and adjustably secured to the under side of the arm F; the block D having the bearing 8 therein; the worm-wheel 57, the hub of which is supported in the bearing 8; the splined shaft 7 supported in said hub; the worm 71 supported in bearings upon the traverser or sliding block 69 supported in slides upon a block D; a stud or block 102 secured to the said traverser as shown and having a sliding bearing in the groove in the traversing-bar, arranged as described to impart a rotary motion to the shaft 7, and mechanism connected with the shaft 74 and table to impart an intermittent rotary movement to the shaft 7 and connected roll, all substantially as, and for the purpose described.

5. In a roll grooving machine, the combination with the frame B and sliding table thereon, of the overhanging arm F; the slotted traversing-bar pivotally and adjustably secured thereto; the block D secured to the bed, the splined shaft 7 having a worm-wheel thereon supported in a bearing in the block D; the worm 71 supported in bearings in the traverser 69 sliding in guides transversely secured to the block D; the sliding connection 102 between the traversing-bar and traverser, and a pawl and ratchet mechanism secured to the end of the worm-shaft 74, and the devices to impart an intermittent rotary motion to the ratchet and worm-shaft, substantially as, and for the purpose described.

6. In a roll grooving machine, the combination with the frame B, sliding table 3 and the transverse worm-shaft, arranged as described, of a mechanism to impart an intermittent rotary movement to said shaft, comprising a spring-actuated toothed sector pivotally-secured to a stud or shaft fixed to the table; a pinion loosely mounted upon a sleeve secured to the worm-shaft in mesh with said sector; a pawl supported upon an arm fixed to the said pinion; a ratchet-wheel fixed to the sleeve secured to the said worm-shaft and engaged by said pawl; a lever secured to, or forming a part of, the sector, and a plate secured to the frame having an inclined face to lift the sector-lever and impart a rotary motion to the worm-shaft, substantially as described.

7. The combination with the pinion 81 and with a ratchet-mechanism secured to the worm-shaft, of the toothed sector loosely mounted upon a shaft secured to the table and having a spiral-spring secured at one end to the sector and at its other end to the shaft 84, and adapted to impart a return movement to the sector after it has been turned to rotate the shaft 74, substantially as and for the purpose described.

8. In a roll-grooving machine, the combination with the main frame-work, and with the work-carrying table sliding thereon, of the overhanging arm, the traversing-bar supported under said overhanging arm and adjustable thereon, the work-actuating shaft carried on the table, the worm-wheel on said shaft, the sliding worm engaging said worm-wheel, means for sliding the worm by engagement with said traversing-bar, and means for intermittently revolving the worm, substantially as described.

9. In a roll-grooving-machine, the combination with the main frame and the work-carrying-table sliding thereon, and with the work-actuating-shaft, of the overhanging-arm, the grooved traversing-bar pivotally and adjustably secured to said overhanging-arm, and mechanism intermediate to said traversing-bar and work-actuating-shaft, adapted for rotating said shaft at varying speeds, and mechanism for reciprocating the table, substantially as and for the purpose described.

10. In a roll-grooving-machine, the combination with the main framework and the work-carrying-table sliding thereon, and with the work-actuating-shaft, of the overhanging arm, the traversing-bar pivotally supported under said arm and adjustably secured thereto, intermediate mechanism movably connected with said traversing-bar and work-holding-shaft adapted for imparting a continuous rotary movement to said shaft during the longitudinal reciprocation of the table, for the purpose of forming grooves of uniform pitch in parallel lines, and independent operable mechanism in connection with the shaft-turning-mechanism aforesaid, and with the sliding table for intermittently rotating the work-holding-shaft for spacing the grooves formed in the work, substantially as described.

11. In a roll-grooving-machine, the combination with the main framework and the work-carrying-table sliding thereon, of an actuating-shaft journaled in suitable bearings and having a driving-wheel thereon, a traversing-bar pivotally and adjustably supported above said shaft, a rack intermediate to said traversing-bar and driving-wheel, and in position for rotating said shaft during the reciprocations of the table, all substantially as and for the purpose described.

12. In a roll-grooving-machine, the combination with the table sliding upon the frame-

work, and with the mechanism for imparting longitudinal movement to said table, of a longitudinally movable work-actuating shaft having a driving-wheel thereon and supported in suitable bearings; an adjustable traversing-bar pivoted above said shaft with its pivotal point in alignment therewith, a worm intermediate to and movably connected with said wheel and traversing bar, and supported in bearings so as to have longitudinal movement transverse to the axis of the shaft, substantially as and for the purpose described.

13. In a roll-grooving-machine, the combination with the main framework, and the table sliding thereon, of a work-actuating-shaft journaled in bearings so as to permit of longitudinal adjustment, and having a driving-wheel thereon, a traversing-bar adjustably carried by an overhanging arm above said shaft, a worm-rack intermediate to, and movably connected with, said driving-wheel and traversing-bar, and capable of movement transverse to the axis of said shaft and longitudinally of said traversing-bar, for continuously rotating said shaft, substantially as described, and mechanism connected with the shaft of said worm-rack, in position for engagement with the main frame of the machine for independently and intermittently rotating said worm-rack, substantially as and for the purpose described.

FRANCIS A. PRATT.
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Witnesses:
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