No. 896,355. PATENTED AUG. 18, 1908.

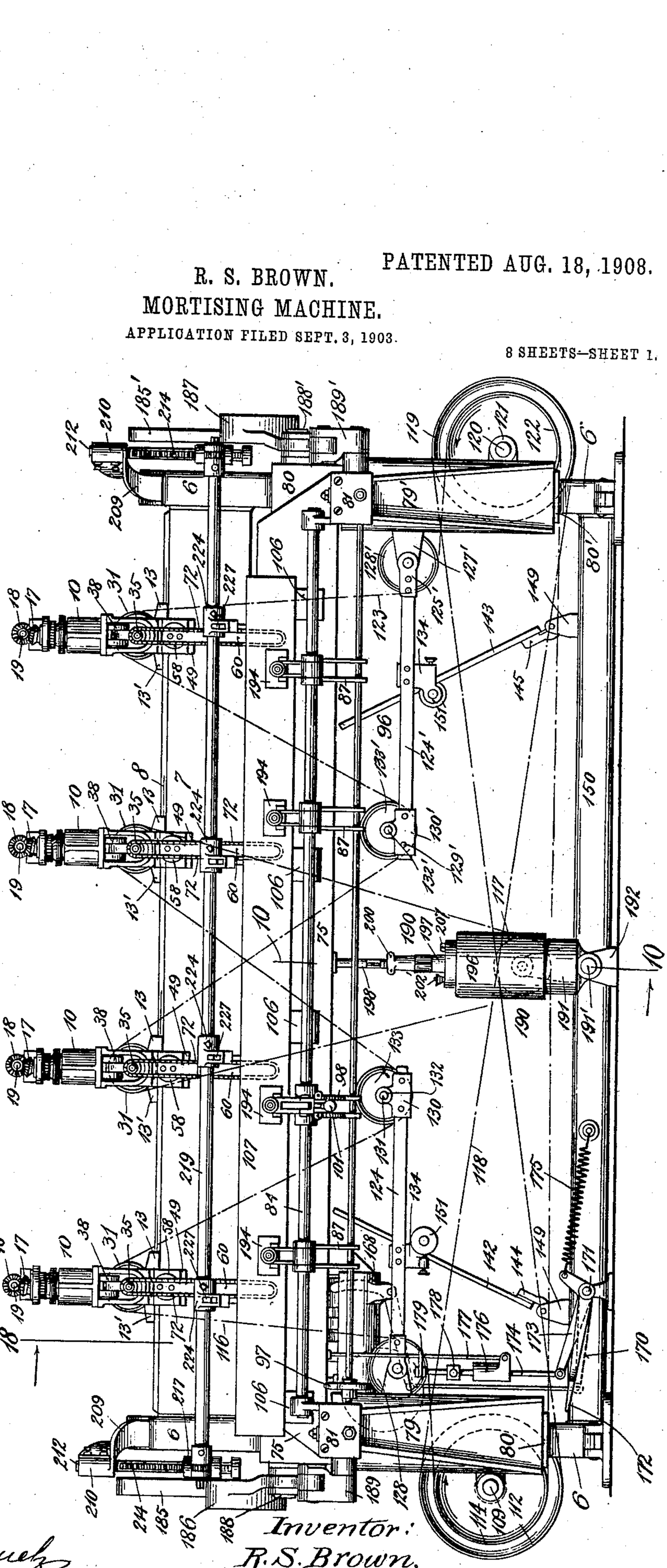
R. S. BROWN.

MORTISING MACHINE.

APPLICATION FILED SEPT. 3, 1903.

8 SHEETS—SHEET 1.

Fig. 1.



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8 SHEETS—SHEET 2.

Fig. 4.

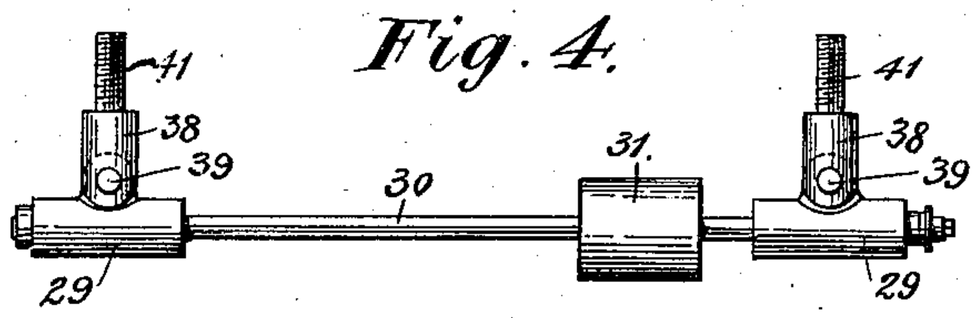


Fig. 3.

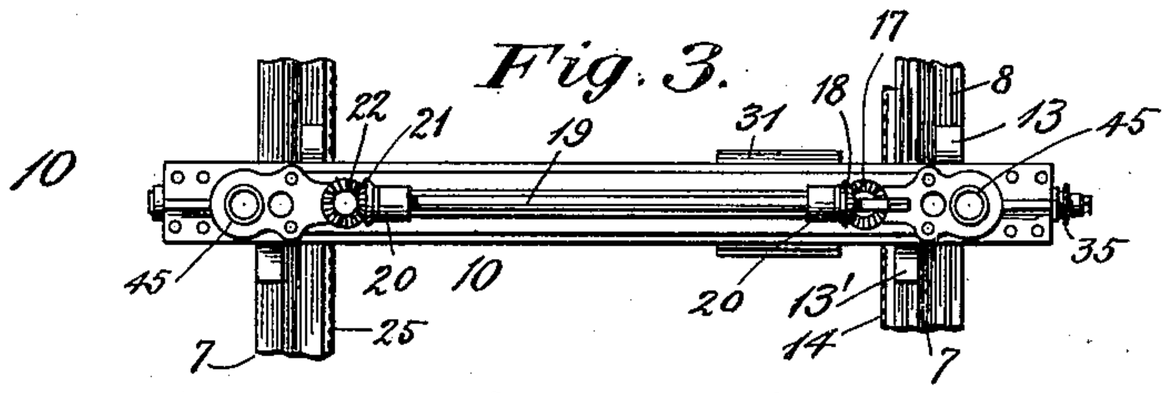
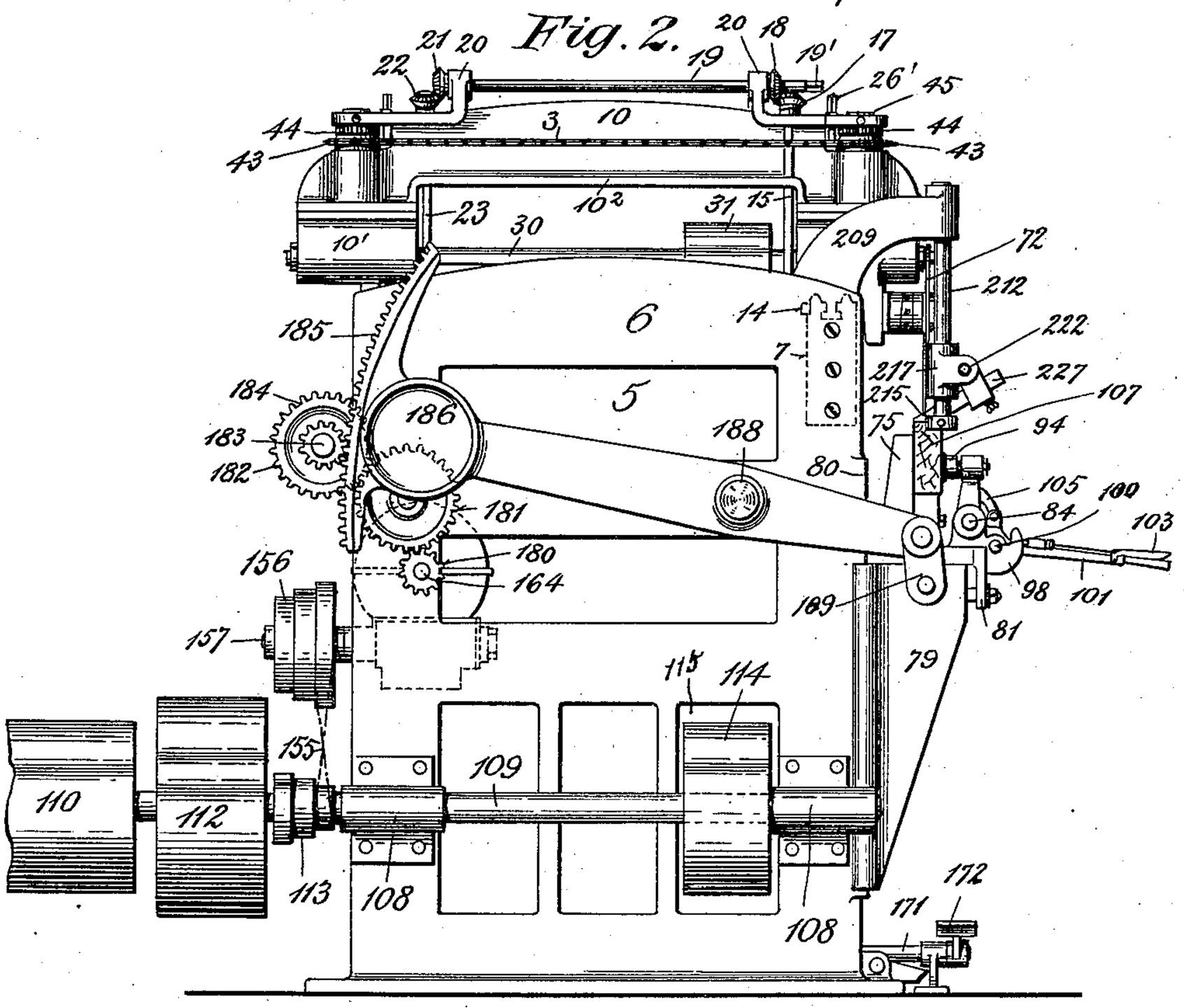


Fig. 2.



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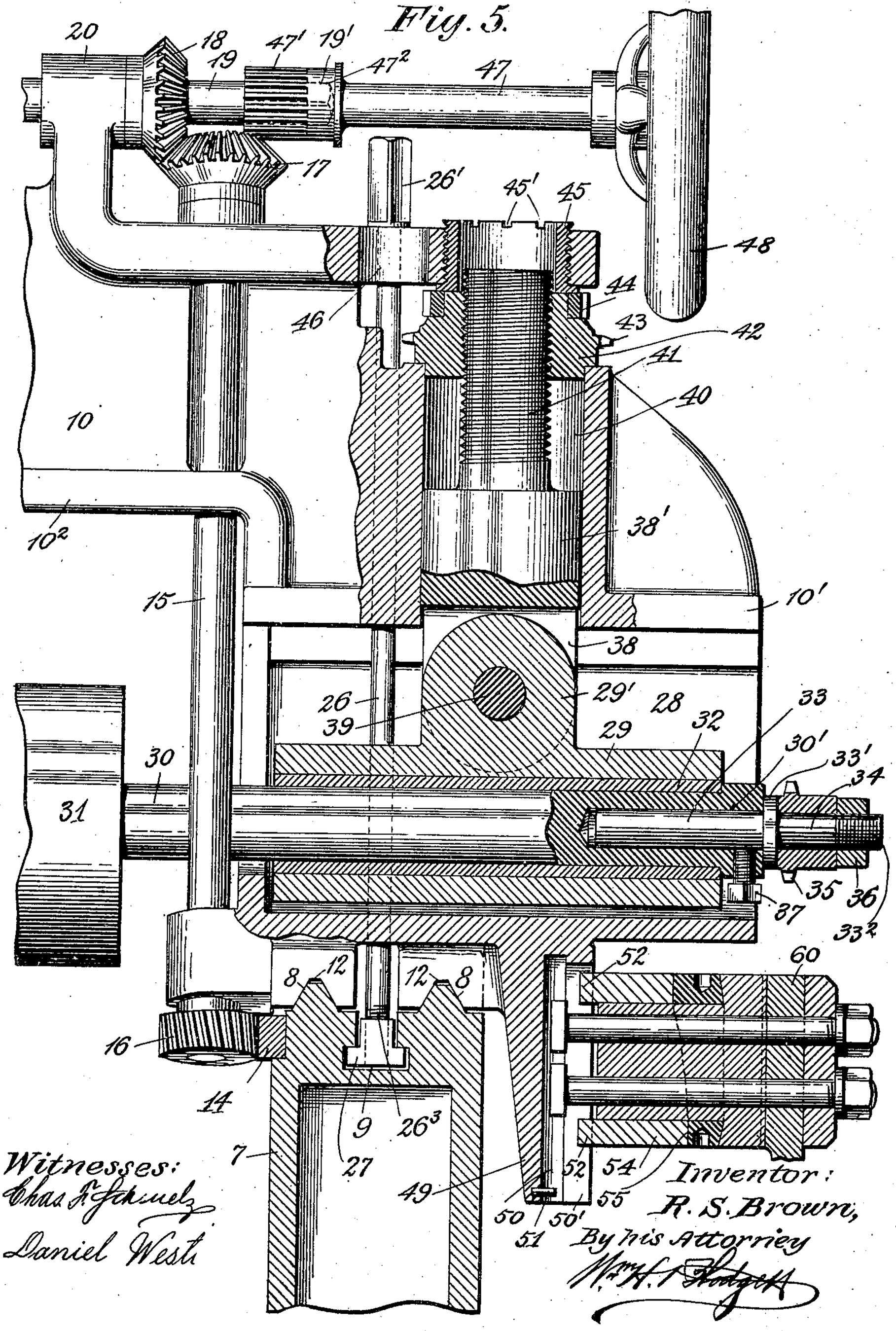
8 SHEETS—SHEET 3.

Fig. 5.



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8 SHEETS—SHEET 4.

Fig. 9.

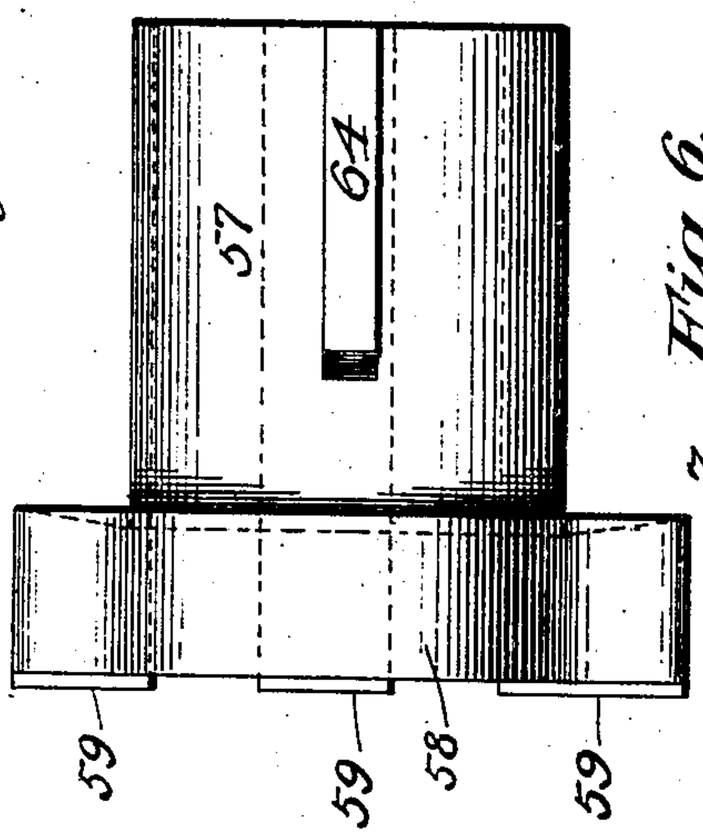


Fig. 6.

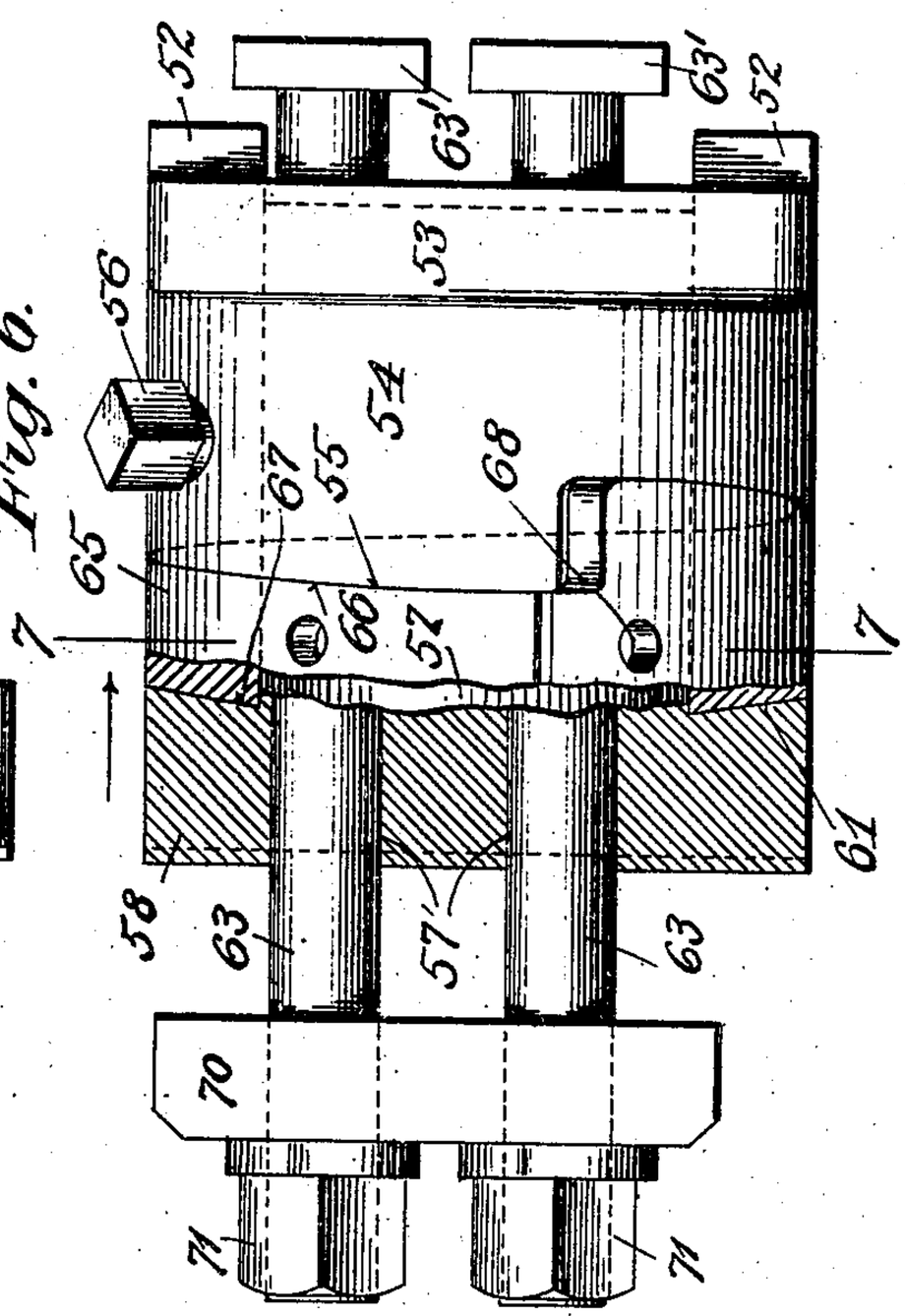


Fig. 8.

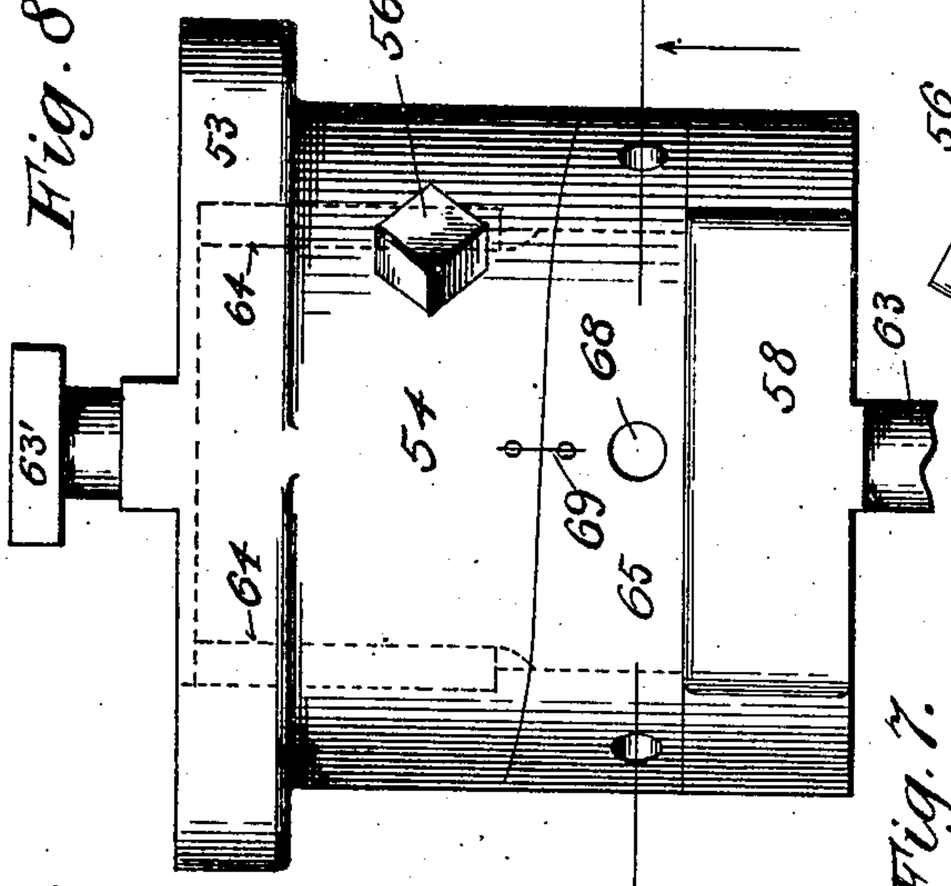
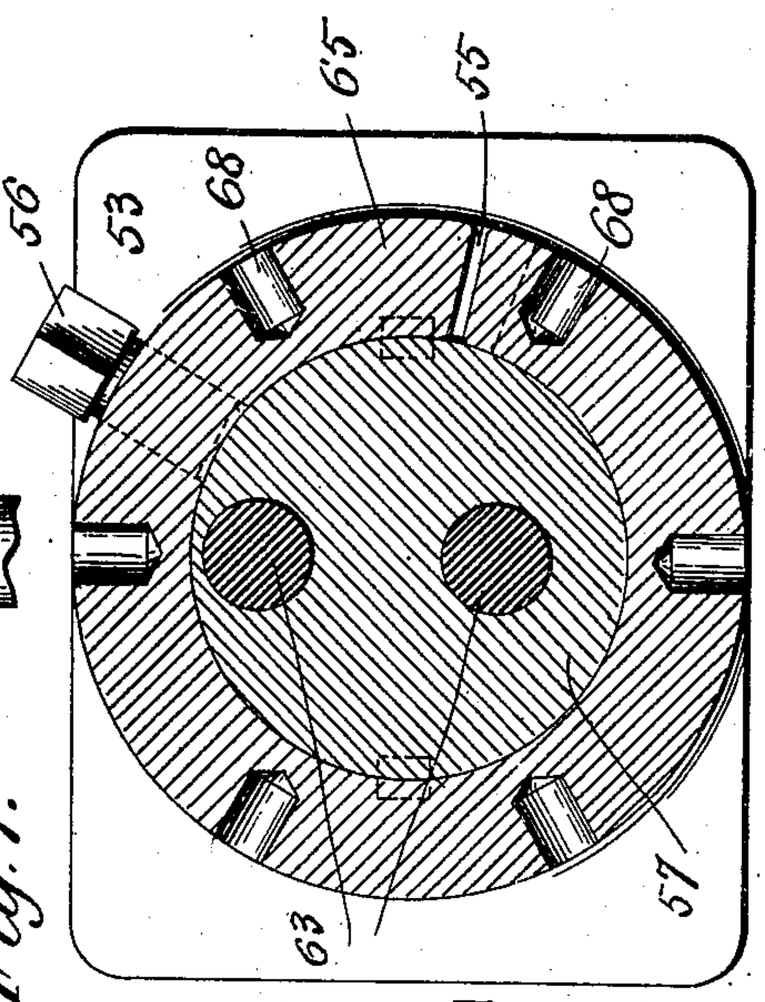


Fig. 7.



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8 SHEETS—SHEET 5.

Fig. 10.

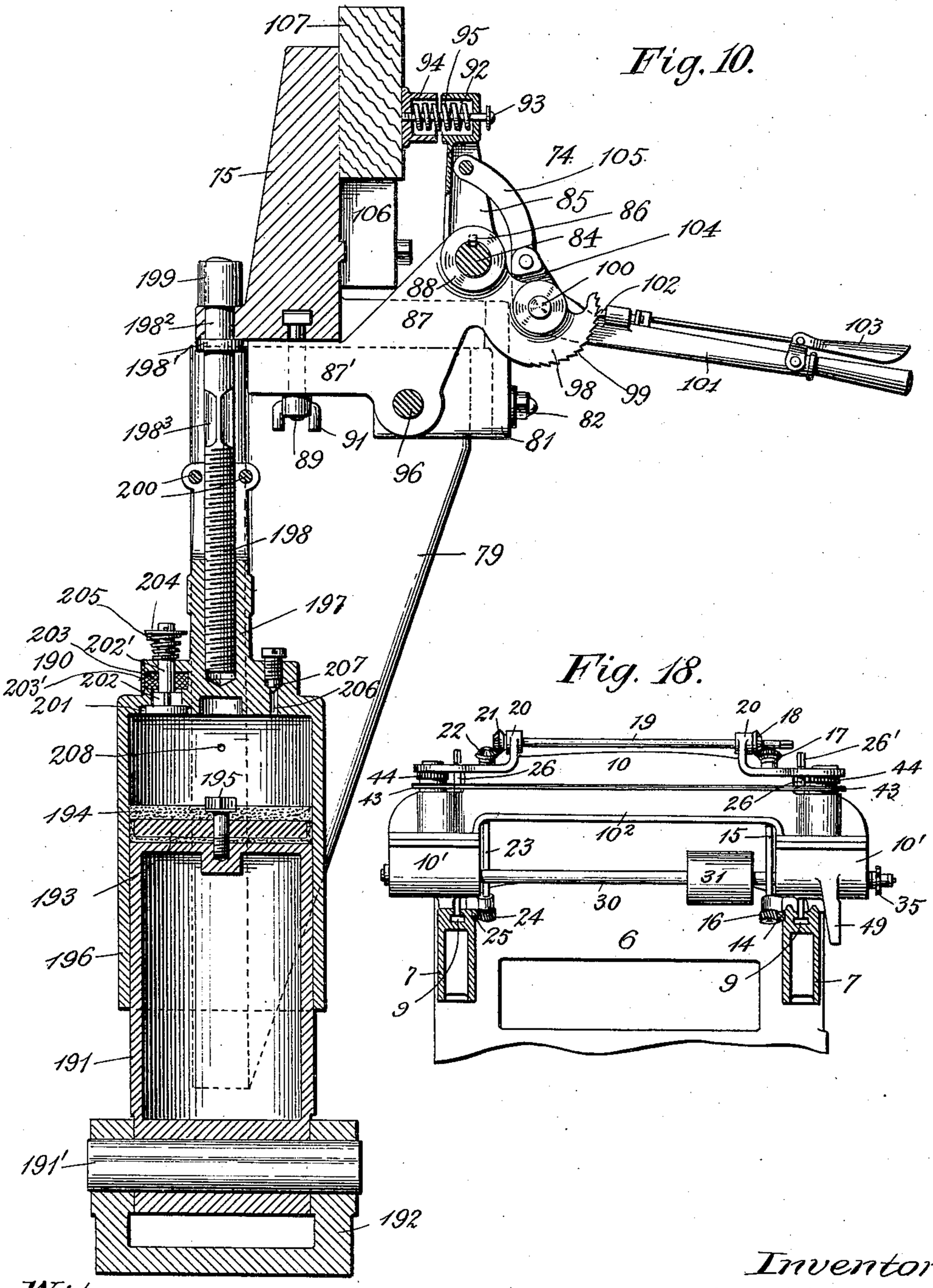

Fig. 18.

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8 SHEETS—SHEET 6.

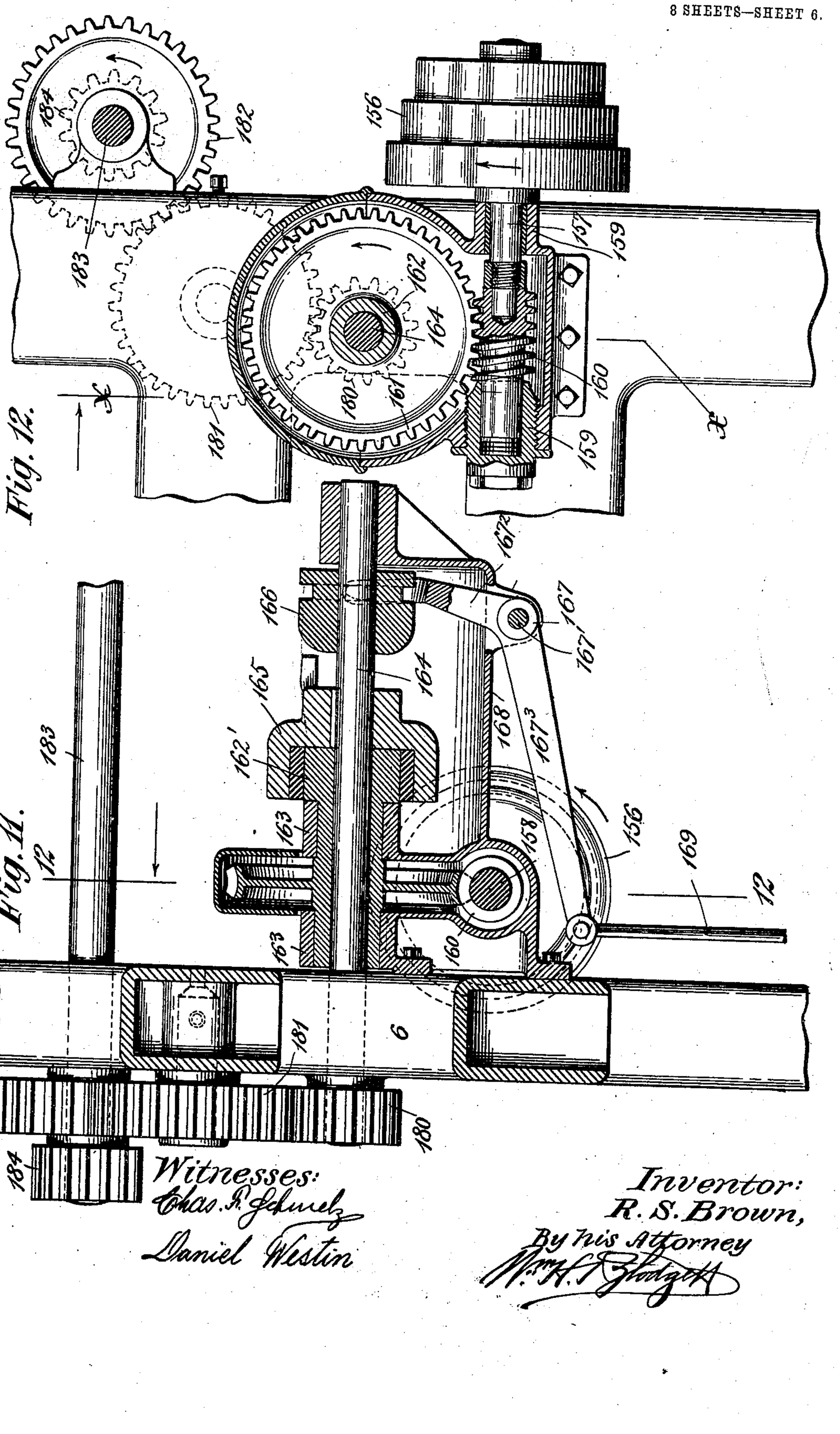

Fig. 12.

Fig. 11.

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Fig. 13.

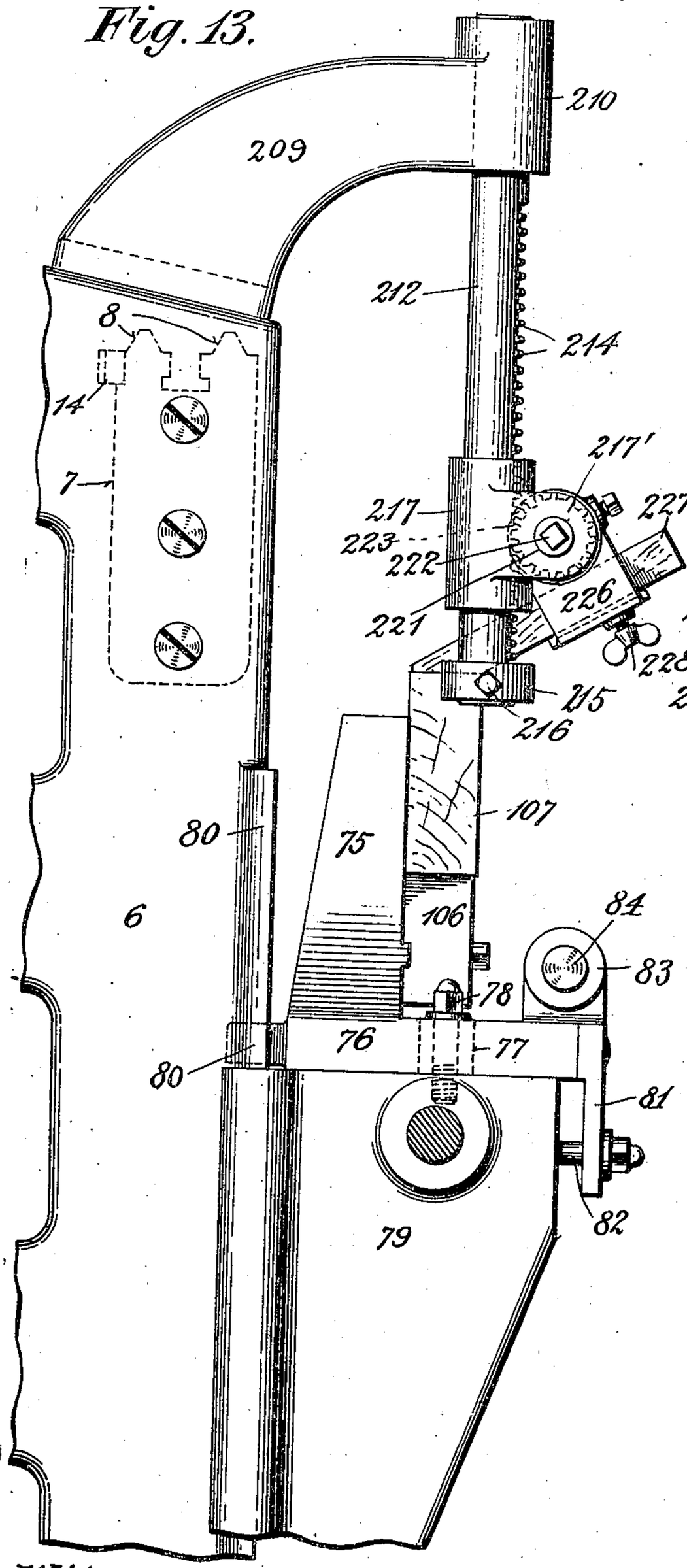
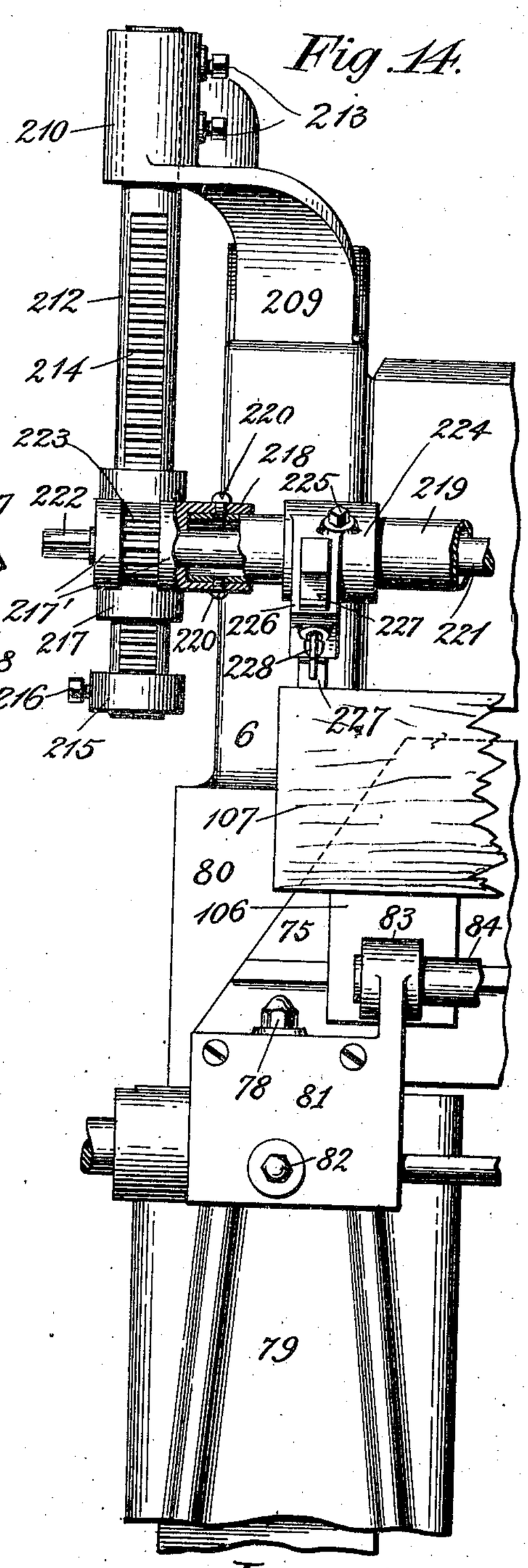


Fig. 14.



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8 SHEETS—SHEET 8.

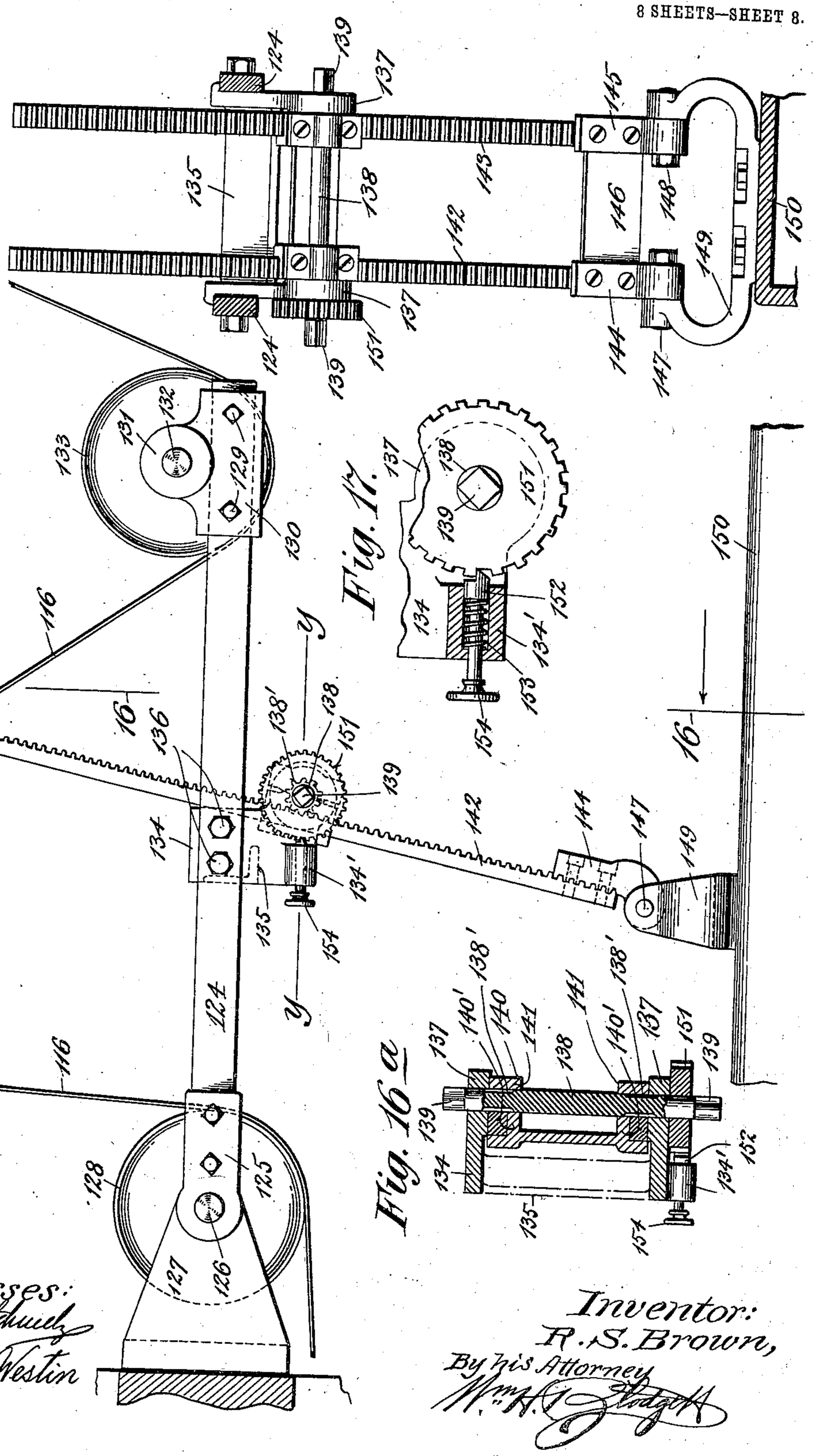

Fig. 15.

Fig. 17.

Fig. 16.

Fig. 16a

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UNITED STATES PATENT OFFICE.

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MORTISING-MACHINE.

No. 896,355. Specification of Letters Patent. Patented Aug. 18, 1908.

Application filed September 3, 1903. Serial No. 171,766.

To all whom it may concern:

Be it known that I, ROBERT S. BROWN, a citizen of the United States, residing at New Britain, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Mortising-Machines, of which the following is a specification.

My invention relates to "mortising machines" and has for its general object the provision of improvements in said machines, whereby they are rendered more efficient in operation, and various kinds of mortises may be rapidly and accurately formed.

A further object of the invention is the provision of means for tightening the slack of the cutting-chain by an upward movement of said chain.

A further object of the invention is the provision of improved devices for adjusting the chain-bars horizontally.

A further object of the invention is the provision of improved mechanism for actuating the chip-breaker.

Other objects of the invention will be disclosed in the detailed description, which now follows—

In the accompanying drawings, Figure 1 is a side elevation of a gang-mortising machine involving my invention. Fig. 2 is an end view of said machine. Fig. 3 is a plan view of one of the heads, showing part of the mechanism for adjusting the same along ways of the frame. Fig. 4 is a detached side elevation of one of the shafts for driving the cutter-chain, showing the improved bearings in which it is journaled. Fig. 5 is a longitudinal, vertical section of part of one of the heads showing the means by which it may be adjusted longitudinally of the machine, and also illustrating a form of mechanism which may be employed for vertically adjusting the bearing in which the shaft for driving the cutter-chain is mounted, to take up the slack of said chain, said section being taken on line 5 of Fig. 1, looking in the direction of the arrow. Fig. 6 is a side elevation partially in section of means employed for adjusting the bar over which the cutter-chain passes horizontally. Fig. 7 is a transverse section on line 7, 7 of Fig. 6. Fig. 8 is a side view of said means for adjusting the chain-bar horizontally. Fig. 9 is a detail view of the core on which the split-cam-ring, illustrated in Fig. 6 is mounted. Fig. 10 is a longitudinal, vertical section of a dash-pot, and of means for clamping the stile upon its support, certain parts being shown in elevation, and the section being taken on line 10, 10 of Fig. 1. Fig. 11 is a section taken on line x—x of Fig. 12, looking in the direction of the arrow. Fig. 12 is a section on line 12, 12 of Fig. 11. Fig. 13 is a side elevation of mechanism for actuating the chip-breakers. Fig. 14 is a partial front view of one end of the machine, further illustrating said mechanism for actuating the chip-breakers. Fig. 15 is a side view of an improved belt-tightener which may be employed. Fig. 16 is a transverse section on line 16, 16 of Fig. 15, looking in the direction of the arrow. Fig. 16^a is a section on line y—y of Fig. 15. Fig. 17 is a detail view partially in section, hereinafter described; and Fig. 18 is a cross-section of the top part of the machine, taken on line 18, 18 of Fig. 1.

Like numerals designate similar parts throughout the several views.

Referring to the drawings, the numeral 5 designates the frame of the machine which may be of any desired form, said frame being provided with end standards 6—6 united at its top by parallel cross-bars or girders 7—7, as illustrated more particularly in Figs. 1, 2 and 5, one of said cross-bars being provided on its upper surface with guideways 8—8, and each having a T- shaped slot 9, for purposes hereinafter described.

Designated in a general way by the numeral 10 is one of the improved heads of the machine, and inasmuch as all of said heads are alike in construction each is indicated by the same numeral. Each head 10 is provided on its under side with guide-grooves 12 fitted upon the ways 8 aforesaid, said guide-grooves being formed in lugs or projections 13—13′. These lugs or projections have their bearing-faces at opposite sides of the center-line of the head, so that while each end of the head is thus supported for a distance nearly double its width, yet two adjacent heads may be brought closely together, as fully set forth in Letters Patent No. 642,073 granted to me January 30, 1900, to which reference may be had.

Secured to the forward cross-bar or girder 7 is a rack 14, shown as having straight spur-teeth, although this is immaterial, for other

forms of gear may be employed, and journaled in bearings of the head is a shaft 15 carrying at one extremity a spiral-gear 16 in engagement with the rack 14, and at its opposite end a beveled gear 17, as illustrated in Fig. 5. This gear 17 is in engagement with a bevel-pinion 18 secured to a shaft 19 journaled in bearings 20, and having a squared end 19′ located outside of one or both of its bearings for the engagement of a wrench for turning said shaft. Shaft 19 is provided at its rear end with a bevel-pinion 21 in engagement with a like gear 22 on a shaft 23 which is a duplicate of shaft 15, and, like said shaft 15, is provided with a spiral pinion 24 in engagement with a rack 25 on the rear cross-bar or girder 7, as illustrated in Fig. 18.

Shafts 15 and 23 of each head are disposed at an angle, so that they will clear the chain-driving shafts hereinafter described. By turning the shaft 19 it will thus be seen that the pinions 16 and 24 will be simultaneously rotated to adjust the head to the desired position on the frame, and to lock the head after adjustment rods 26 having squared ends 26′ and threaded extremities 26^3 the latter engaging T-shaped nuts 27 in the slots 9 may be employed, as shown in Fig. 5.

In its depending sides 10′ each head is chambered at 28 to receive a bearing 29 in which the chain-driving shaft 30 is journaled, said shaft having a pulley 31 located in the space beneath the bridge 10^2 connecting the end portions of the head.

Each bearing 29 has a perforated lug or extension 29′, and carries the usual Babbitt-metal bush or lining 32 for the reception of the shaft 30, and the latter is chambered at its ends as at 30′ to receive a short shaft or spindle 33 known as a "sprocket-center" having an intermediate collar 33′, and an extension or journal 34 for the reception of a sprocket-wheel 35 for actuating the chain,—said sprocket-wheel being forced tightly against the collar by a nut 36 in engagement with a thread 33^2 of the shaft. A binding-screw 37 serves adjustably to retain the shaft 33 in the chamber of shaft 30, as shown in Fig. 5, so that when the chain-bar is adjusted the teeth of the sprocket-wheel 35 can always be alined therewith to keep the chain in its proper track. Furthermore, if variations should exist, as is frequently the case in different portions of the thickness of the chain-bar shank, whereby the cutter-chain guided by said chain-bar would travel in different lines toward or from the work, this can be compensated for by adjusting the sprocket-center 33 in or out of the socket 30′, and then securing it in place by the set-screw 37, thus bringing the cutter-chain to its proper central position with relation to the chain-bar to accomplish accurate work.

Designated by 38 is a fork the ears of which are perforated and fit over the lug 29′ of the bearing-box 29, the parts being united by a pin or bolt 39. Rising from the circumferential body 38′ of the fork, which fits snugly in a chamber 40 of the head, is a reduced, externally-threaded shank 41, and upon this shank is fitted a nut 42, rabbeted at its lower end to fit the bearing-chamber 40, and carrying sprocket-teeth 43, and a toothed annulus 44. Threaded into the top of the head is a tubular thrust-screw 45 having notches 45′ for receiving an implement by which it may be adjusted, the bore of said screw being of larger diameter than the stem 41, and the lower end of the screw bearing against the top of the sprocket-nut 42. In the top of the head adjacent to the opening in which the thrust-screw 45 is inserted, is a perforation 46 for the reception of a wrench 47 having a toothed end 47′ to engage the gear 44, and a socket 47^2 to fit over the squared end of shaft 19 (see Fig. 5)—said wrench having a manipulating wheel 48. In this way provision is made for circumferential adjustment of the bearing-box in a horizontal plane, should the sprocket wheel 35 and chain bar 60 be out of proper alinement.

It will be understood that each end of every arched head 10 will be equipped with like parts, and that the shafts 19 and 30 extend across the head,—the shaft 19 being supported in the bearings 20, and being in geared connection with the inclined shafts 15 and 23, and the shaft 30 being journaled in the pivoted boxes 29. A sprocket-chain 3 connects the sprocket-wheels 43 of each head. These bearing-boxes are self-adjusting and permit of a slight swiveling motion in any direction, the boxes turning in a vertical plane on the pivots 39 and the hubs of the forks 38 also turning in the bearing-chambers 40, in virtue of which if the belt-strain upon the pulleys and shafts should tend to deflect the latter, the bearing-boxes will accommodate themselves to this condition, and, therefore, prevent undue wear and heating.

As will be obvious when the shaft 19 is turned by wrench 47 it will, through the connections described, simultaneously and uniformly advance both ends of the head along the ways of the cross-girders without strain or torsion, thus preserving the parallelism of the heads.

Depending from each end of every head is an apron 49 having a T-shaped or equivalent slot 50, and a removable stop-lug or pin 51, said slot 50 being extended at 50′ for the reception of lugs 52 projecting from the base 53 of a fixed tubular block 54 having a cam-surface 55 at the end opposite said base, and being perforated and threaded for the reception of a binder-bolt 56, as illustrated in Figs. 6, 7, and 8. Fitted in this tubular cam-block 54, and extending into the base thereof, is a cylindrical stub or extension 57, which projects from a circular flange 58 hav-

ing lugs 59, for fitting into a groove or channel on the inner side of a chain-bar 60 hereinafter described. This flange 58 has on its inner side an inclined circumferential surface 61, and said flange and the stub or extension 57 are perforated at 57′ to receive bolts 63 having heads 63′ at one end which fit and are adjustable in the slot 50, and are prevented from dropping therefrom by the stop-pin 51. To prevent rotary movement of the stub-shaft 57 it is secured to the base 53 and tubular block 54 by keys 64, as shown by dotted lines in Fig. 8. Fitted between the cam-shaped end 55 of tubular block 54 and the flange 58 of stub-shaft 57 is a split annulus 65 bearing a cam-surface 66 in engagement with the complemental cam-surface 55. At its end opposite the cam-surface, said annulus is provided with an inclined or wedge-shaped wall 67 which rests against the inclined surface 61 of flange 58, and at intervals in the periphery of said annulus are formed sockets 68 for the reception of a tool by which the annulus may be adjusted. Graduating marks for indicating the degree of adjustment may be formed on the periphery of the annulus and tubular block if desired, one of said marks being shown at 69 in Fig. 8.

Sleeved upon the bolts 63 is a clamp 70, and threaded upon the ends of said bolts are nuts 71 for forcing said clamp against the bar 60 over which the chain 72 passes. This bar may be of a form to conform to the shape of either the "blind" or "through" mortise to be cut, and by actuating the cam-rings 65 the various chains may be so adjusted that they will produce a series of mortises exactly in line, or some of them out of line if desired. As will be obvious, the inclined bearing-surfaces 61 and 67 cause the annulus 65 closely to embrace the stub or extension 57 when the nuts 71 are tightened to force the clamp 70 against the chain-bar 60, and the annulus or circular wedge 65 affords a firm and full bearing-surface for the fixed and movable parts of the support for said bar 60, and causes all of said bars to be adjusted in parallelism with each other to the points desired. In this way a firm, rigid and easily adjustable support is provided for the chain-bar, and one that may be readily regulated to position said bar with reference to the width of the stile or other work undergoing operation.

As the chains 72 move with great speed, the friction due to the cutting operation causes them to expand or elongate, and, consequently, they must be adjusted to proper working tension with relation to the chain-bars to enable them to work properly. To overcome this objection, and thus produce mortises each of the same depth, determined by the position of the bars, the bearing-boxes 29 are simultaneously adjusted upward by inserting the wrench 47, or an equivalent geared rod, through the opening 46 until its teeth engage the gear-ring 44 of the sprocket-nut 42, and as said nut is connected by a sprocket-chain 3 with a like nut at the opposite end of the head, it will be seen that the pair of chains carried by the head will be simultaneously moved upward on their supporting bars to take up the slack and thus cause each chain to cut to the same exact depth in the material. This feature is of great importance, and enables accurate blind-mortising to be performed which could not be accomplished in the old styles of machines in which the slack of the chain was taken up by adjusting the chain-bar downward, and thus causing said chain to cut deeper than desired, and while particular mechanism is illustrated and described for accomplishing this upward movement of the chain or chains it is distinctly to be understood that the invention is not limited thereto.

Designated in a general way by 74 is the work-support of the machine, shown consisting of a back-plate 75 having lateral extensions 76 at its ends, said extensions being slotted at 77 for the reception of bolts 78 by which they are secured, with a capability of lateral adjustment, upon knees 79 fitted for sliding movement upon ways 80 of the end frames 6—6. To the front of each extension is secured a plate 81, and through each plate passes a screw-bolt 82, by which, when the screws 78 are loosened, the work-support may be laterally adjusted on the knees. Carried by each plate 81, is a bearing 83 in which is journaled a long rock-shaft 84, the latter carrying a series of clamping-arms 85 splined to the rock-shaft to be longitudinally adjustable thereon, as at 86, Fig. 10. Yokes 87, disposed at intervals along the work-support, are each provided with bearings 88 for sustaining the rock-shaft 84, and between each pair of said bearings a clamping-arm is mounted on said shaft. These yokes have lateral extensions 87′ passing beneath the back-plate 75, and a bolt 89, the head of which is inserted in a slot in said back-plate, passes through each of said extensions, and is provided with a wing-nut 91 by which the yokes may be secured after they have been adjusted longitudinally of the machine to the desired positions. In the free end of each arm 85 is a socket 92, and passing through said socket is a screw 93 to which is attached a cup-shaped cap 94 having a wide-bearing-surface for acting against the work.

A spring 95 surrounds each screw 93 and is received in the sockets of the cap and arm, so that the clamps will bear with yielding pressure against the work. A shaft 96 passing through the yoke-frames 87 is supported at its ends in the plates 81, and carries a hand-wheel 97 by which it may be turned. This shaft is connected by gearing (not shown) to the screws 82 for adjusting the work-support

laterally, as fully illustrated and described in my Patent #642,073 above mentioned, and to which reference may be had.

For actuating the rock-shaft 84 and its series of clamping-arms any desired means may be utilized, but I prefer to employ the improved mechanism now to be described. Projecting from one of the intermediate yoke-frames 87 are separated curved extensions 98 having ratchet teeth 99, and between said extensions is pivoted, on a short shaft 100, a hand-lever 101 to which is connected a sliding pawl 102, operated by a pivoted handle 103 in the usual manner, and said hand lever has an extension 104 projecting at an angle to its pivot. A toggle-link 105 is pivoted at one end to the extension 104 of lever 101 and at its opposite extremity to one of the clamping-arms 85, and as said arm is splined to the rock-shaft 84, it will be seen that when the handle 101 is manipulated said shaft 84 will be rocked and all of the clamps 94 will be simultaneously forced against the work, the toggle connection causing them to engage said work with great clamping-power, and the pawl 102 engaging the ratchet-teeth 99 and preventing back action of the parts.

Blocks 106 are secured to the back-plate 75 at intervals along its length, and upon these blocks (which may be the same as those disclosed in my patent aforesaid) the stile or other work 107 to be mounted is placed.

It is important to prevent sliding movement of the work in the direction in which a cutter-chain removes a chip, when a series of said chains is in use, that the shafts for driving the chains should be rotated in opposite directions, so that certain cutter-chains will act upon the work in one direction and the other chains will operate thereon in an opposite direction, whereby the cutting thrusts of said chains will be neutralized and all danger of splitting or splintering the work will be obviated, and while any suitable mechanism may be employed for accomplishing this result I have found the following arrangement to be useful.

As above stated, each chain-driving shaft 30 is provided with a pulley 31, and to rotate said shafts alternately in opposite directions sets of endless belting are employed said sets being driven in opposite directions by mechanism next to be described.

Journaled in bearings 108 on the left-hand end frame 6 of the machine is a shaft 109 having a driving-pulley 110, a pulley 112 adjacent to said driving-pulley outside of the frame, a cone of pulleys 113, and a pulley 114, the end frame being slotted at 115 to receive said pulley 114, as shown in Fig. 2. An endless belt 116 passes over said pulley 114, which is driven in the direction of the arrow thereon in Fig. 1, under an idler, over the first cutter-shaft actuating pulley 31, under a belt-tightener-pulley hereinafter described, over the third shaft-actuating pulley 31, under an idler-pulley 117 and back to said pulley 114, and it will thus be seen that every alternate cutter-chain is driven in the same direction by said belt. To drive the outer cutter-shafts in an opposite direction a crossed-belt 118 connects the pulley 112 with a pulley 119 on a shaft 120 journaled in bearings 121 on the right-hand end standard 6, and this shaft also carries a pulley 122 over which an endless belt 123 travels first under an idler pulley then over the pulley 31 of the shaft for rotating the right-hand cutter-chain, then over a belt-tightener-pulley, then over the pulley 31 of the alternate cutter-actuating shaft 30, then under an idler in alinement with the idler 117, and finally back to the pulley 122.

Coming now to the peculiar belt-tighteners employed, they are illustrated in Fig. 1 and in detail in Figs. 15 and 16, and each comprises a pair of arms 124—124′, respectively, projecting from sockets 125, 125′ pivoted on a shaft 126 126′, journaled in a forked bracket 127, 127′, projecting inwardly from each end frame 6. Journaled on the shaft 126 is an idler-pulley 128 under which the upper run of the belt 116 passes, after it leaves the driving-pulley 114, and journaled on the shaft 126′ is an idler 128′ under which the upper run of the reversely-driven belt 123 passes as it leaves its driving-pulley 122. Secured to each arm 124 by bolts 129 is a box 130, and in bearings 131 of said boxes is journaled a shaft 132 carrying tightening-pulley 133 for belt 116; and likewise secured to each arm 124′ is a box 130′ in bearings 131′ of which is journaled a shaft 132′ on which is mounted a tightening-pulley 133′ for belt 123. For either raising or lowering the arms 124, 124′ like mechanism is employed, and it consists, for the arm 124, of hangers 134 connected by an angle-iron tie 135, each hanger being secured to its arm by bolts 136, and each having an extension 137 perforated to receive a shaft 138 provided with angular ends 139.

Designated in a general way by 140 is a rack-and-pinion-box, shown more particularly in Fig. 16ª, and consisting of half-boxes 140′ slotted or grooved for the reception of racks hereinafter described. Shaft 138 carrying the pinions 138′ for engagement with the racks is secured in the half-bearings of said boxes by complemental half-bearings 141 fitting over said pinions 138′ and attached to the box in the usual manner.

Designated by 142 and 143 are racks connected by bolts or otherwise at their lower ends to toothed levers 144 and 145 united by a cross-bar 146, and pivoted at 147 and 148, respectively, to the arms of a yoke 149 secured to a bottom cross-bar 150 of the machine-frame. Pinions 138′ of the shaft 138

are in engagement with said racks, and as the hangers 134 are rigid with the pivoted arms 124, it is obvious that when the shaft 138 is turned said bars will be swung in the desired direction when it is desired either to relax or to tighten the belts, and by pivoting the racks in the manner described they will readily conform to the arc of movement of said arms. This rack-and-pinion box serves as a swinging binder to hold the parts in engagement.

Secured to the end of shaft 138 is a ratchet-wheel 151, and located in a hollow boss 134′ of one of the hangers 134 is a pawl 152, the stem of which is surrounded by a coiled spring 153 in the chamber of the boss, and is provided with a handle 154. As shown in Figs. 15 and 17 the pawl is in position to lock the ratchet and its shaft and pinions against downward movement on the racks, but should it be desired to relax the belts by moving the arms 124, 124′ and pulleys 133, 133′ upward the pawl may be readily reversed to permit of the proper movement of the shaft and ratchet-wheel and will thus lock the same after the desired adjustment has been made.

It is desirable to have the driving-belts loose when the heads 10 are adjusted along the rails or girders 7, and also when the chain-driving shafts are raised to take up the slack of the cutter-chains, and by the mechanism just described this result may be accomplished, or the belt-tightener pulleys 133, 133′ may be held and locked firmly in contact with the belts to produce the desired degree of tension thereon, if required.

To raise and lower the work-support 74, the cone-pulley 113 on driving-shaft 109 is connected by belting 155 with a cone-pulley 156 on a shaft 157 threaded into a short shaft 158 supported in bearings 159 of the frame, and carrying a worm 160 in engagement with a housed worm-wheel 161 carried by a sleeve 162, journaled in bearings 163, and loosely mounted on a shaft 164. This sleeve 162 is provided with a friction-clutch head 162′ with which a clutch 165 splined to the shaft 164 is adapted to be engaged by a sliding cone 166 in the usual manner.

For actuating the cone an angle-lever 167 is provided, said lever being pivoted to an inwardly-extending bracket 168 of the end frame 6 at 167′, and its short arm 167^2 having a fork in engagement with the clutch-actuating cone 166. To the long arm 167^3 of said lever is articulated one end of a rod 169 connected at its other extremity to an arm 170 (see dotted lines Fig. 1) projecting from a rock-shaft 171 journaled in bearings and carrying a treadle 172 and an angle lever 173 to the long arm of which a rod 174 is connected, while its short arm is attached to the end of a coiled or other spring 175. Mounted for sliding movement on the rod 174 is a sleeve 176 to an ear of which is connected a rod 177 depending from the back-plate 75, and on the rod 174 is an adjustable stop 178 for limiting the upward movement of the sleeve and a plate 179 perforated to receive and slide upon the rod 177. Carried by the clutch-shaft 164 is a pinion 180 in mesh with an idler 181, the latter intermeshing with a gear 182 carried by a shaft 183 extending longitudinally of the machine. This shaft carries a pinion 184 at each end, and each of said pinions is in engagement with a toothed segment 185—185′ carried by weighted levers 186, 187 pivoted to the end frames at 188, 188′, and connected by links 189—189′ to the knees 79, 79′ sliding upon the ways 80, 80′ of the end frames.

After a stile has been placed upon the blocks 106 and clamped against the back-plate 75 by the means described, the machine is started by depressing the treadle 172, thereby rocking the shaft 171 and the angle-lever 170, depressing the rod 169 and actuating the lever 167 to slide the cone 166 along shaft 164 and clutch the sleeve 162 carrying worm-wheel 161 to said shaft, and said worm-wheel, which is continuously driven by worm 158 will now drive the shaft 164 and through the gearing described, will rock the levers 186 and 187 thus elevating the knees and the work-supporting and clamping devices carried thereby until the cutter-chains have entered the stile or other work to the desired depth. As the work-support rises the rod 177 attached to back-plate 75 moves with it and slides the sleeve 176 along the rod 174 until said sleeve comes into contact with the adjustable stop 178, lifts rod 174 against the pressure of the foot on treadle 172, and through the rod-and-lever mechanism described shifts the cone 166 to the right, thus releasing the worm-wheel 161 and permitting said work-support to descend to its normal position. As will be observed, the spring 175 normally tends to rock the shaft 171 and attached lever 170 to the right, so that should the foot be withdrawn from the treadle 172 the cone will be immediately shifted to release the clutch 165 and stop the further upward movement of the work-support; and the extent of this upward movement may be regulated by adjusting the stop 178 along the rod 174 and then clamping said stop in place.

To check the descent of the work-support any suitable means may be employed, but I prefer to use a dash-pot designated in a general way by 190, and illustrated in Figs. 1 and 10. This dash-pot is similar to the one described in my former patent and consists of a hollow, stationary piston 191 pivoted at 191′ to a bracket 192 rising from the floor at a point about midway the length of the machine. On the top of the hollow piston 191 is a plate 193 and upon this plate is placed a

rubber-gasket and bumper 194, these parts being secured in place by a screw-bolt 195. Surrounding the piston is a cylinder 196 having a hollow, internally-threaded split-stem 197 for the reception of a screw-threaded rod 198, the upper end of which has a collar 198′, and above said collar a smooth portion 198^2 which enters a perforation in a flange of the back-plate 75, said rod being secured in place by a tubular washer 199, secured thereto by riveting or otherwise. To enable the cylinder to be adjusted on its piston the rod 198 is provided with a hexagonal portion 198^3 for the application of a wrench, and after the desired adjustment has been made the split-part of the stem 197 is clamped firmly around said rod by screw-bolts 200. In the top of the cylinder is an air-admission port 201, normally closed by a valve 202 having a stem 202′ passing through dust-excluding gauze 203′ in a chamber 203, and carrying between the top of the chamber and a washer 204 on said stem, a spiral-spring 205 which holds the valve normally against its seat. Also in the top of the chamber is a vent 206, the emission of air through which may be regulated by a screw-valve 207. I sometimes form another vent 208 in the cylinder, but this may be omitted if desired. Inasmuch as the action of dash-pot 190 is similar to that set forth in my former patent it is deemed unnecessary further to describe its mode of operation.

To prevent slivering it is necessary in chain-mortising machines to support the material on the edge of the mortise formed by the up-run of the cutter-chain, and so called "chip-breakers" are commonly employed for this purpose, one example being found in my patent aforesaid. These "chip-breakers" are in the nature of presser-feet which bear upon the wood adjacent to the up-runs of the chains, and, consequently, so support it at these points that the cutting-teeth will not break off a portion of its top-surface.

In my present invention a series of "chip-breakers" is provided, and as each is alike in construction and mode of operation they are designated by like numerals. Referring more particularly to Figs. 1, 13, and 14, 209 designates an over-hanging extension formed on each end frame 6, and 210 a bearing for the reception of a fixed rack-bar 212, which may be secured in said bearing by screws 213, or otherwise. These rack-bars are preferably three-quarters cylindrical, and have inner flat sides in which the rack-teeth 214 are formed, and at its lower end each said rack-bar is provided with a collar 215 removably secured in place by a screw 216. Surrounding each rack-bar is a sleeve 217 having perforated ears 217′, one of which has a hub 218 in which the end of a tube 219 is secured by screws 220. As shown in Fig. 1, this tube extends the length of the machine, and is supported at both ends by like devices, which are indicated by the same numerals. Located in this tube is a long shaft 221 having an angular portion 222 at each end for the application of a wrench, and on this shaft between each pair of ears 217′ is keyed a pinion 223 in mesh with the teeth 214 of the rack-bars 212.

Adjustable longitudinally on the tube 219 are sleeves 224 which may be secured to said tube at the desired distances apart, by screws 225.

Each sleeve is provided with a downwardly-inclined box-like hanger 226 in which a presser-foot or bar 227 is adjustably secured by a screw 228. Each presser-foot or bar 227 is located adjacent to the up-run of the chain 72 with which it is employed, and after material has been placed upon the blank-support a wrench may be applied to either squared end 222 of shaft 221 to rotate the same and thus cause the pinions 223 to advance along the rack-bars 212 and carry the presser-feet 227 down upon the work, the stop-collars 215 on each rack-bar limiting this downward movement. It will thus be seen that the series of "chip-breakers" may be simultaneously advanced toward, or withdrawn from, the work, when desired.

In the operation of my improved machine the work, such as a stile or other article in which mortises are to be cut, is placed upon the blocks 106 and against back-plate 75, after which the lever 101 is manipulated to rock the shaft 84 and its clamping-arms and force the yielding clamps 94 against said work, the lever being locked against return movement by ratchet 99 and pawl 102. Pressure is now applied to the treadle 172 and through the connections described the segments 185, 185′ are actuated to raise the blank-support and force the work vertically against the cutter-chains 72 until said chains have descended to the desired extent therein, when the parts will be automatically disconnected, as set forth, and the work-support will, under the influence of the dash-pot, gradually fall until it assumes a normal position, when the completed work will be removed, new work inserted, the operation repeated, and so on.

By employing interchangeable shafts or centers 33 for carrying the chain-driving sprocket-wheels 35, different sizes of sprocket-wheels may be readily carried by the same shafts 30, and, consequently, cutter-chains for forming mortises of any desired width may be readily employed with the machine.

In addition to the function of the tube 219 above stated, it also serves as a guard-rail to prevent accidents by a person's stumbling or falling into contact with the cutter-chains.

Any number of heads may be mounted on the ways of the rails or girders shown, the invention not being limited in this respect, and

any desired style of mortise (either "through" or "blind,") may be made by employing the proper chains and chain-bars.

Many of the details of the invention may be employed in other relations, the invention not being limited to their use with gang-machines.

Changes may be made in the form, proportion and arrangement of the parts, and different kinds of driving-gearing and clutch mechanism may be substituted for those shown and still be within the purview of the invention.

Like the machine of my former patent either one or two pieces of work may be mortised, the adjustable heads carrying duplicate cutter-chains, one at each end thereof, and the frame being adapted to receive a work-support and its actuating devices on each side, if desired.

No claim is made herein to the work-support, its clamps, and the mechanism for actuating said work-support, for this matter is fully described and claimed in my divisional application, filed April 9, 1904, Serial Number 202,365.

Having thus described my invention, what I claim is—

1. In a gang-mortising machine, the combination, with a series of stationary chain-bars, and with a series of cutter-chains, one chain for each bar, of a shaft for each cutter-chain; a pulley on each shaft; a sprocket-wheel on each shaft; means for individually adjusting each shaft with relation to the chain-bar with which the cutter-chain coöperates; and means for individually adjusting the chain-bars laterally, whereby the lower ends of said chain-bars may be alined, and a series of mortises, each of the same depth, formed in the work.

2. A gang-mortising-machine comprising supports; chain-bars carried by said supports; cutter-chains; shafts for driving the cutter-chains; spindles adjustably-mounted in bores of the shafts; and means for adjusting each shaft to move the cutter-chain longitudinally of its bar.

3. A gang-mortising-machine comprising a series of chain-bars supported in fixed relation to each other; means for adjusting each chain-bar laterally a series of cutter-chains; a series of shafts; a pulley on each shaft; a sprocket on each shaft; means for individually adjusting each shaft to adjust the cutter-chain driven thereby longitudinally of its chain-bar; and belts for driving the shafts in opposite directions.

4. In a gang-mortising machine, the combination, with a series of chain-bars, of means for individually supporting said chain-bars; means whereby the chain-bars may be adjusted vertically and laterally; a series of cutter-chains; means for adjusting said chains longitudinally with relation to the chain-bars; and means for driving the cutter-chains.

5. In a gang-mortising machine, the combination, with a series of chain-bars maintained in fixed relation to each other, of a series of cutter-chains; means, including axially-adjustable sprockets, for driving said cutter-chains in opposite directions; and means for adjusting each of the chains longitudinally with reference to its chain-bar.

6. The combination, with a head, of a pair of pivoted bearing-boxes carried by said head; cutter-chains; a shaft journaled in the bearing boxes; devices carried by the shaft for driving the cutter-chains; devices around which the chains pass; and means for simultaneously adjusting the bearing-boxes to take up the slack of the chains.

7. The combination, with a head, of a rotary shaft; universally movable boxes in which the shaft is journaled; gears carried by the shaft; cutter-chains driven by said gears; devices over which the chains pass; and means for simultaneously adjusting the boxes to take up the slack of said chains by an upward movement.

8. The combination, with a head having a chamber, of a bearing-box provided with a cylindrical extension fitted in said chamber, and beyond said extension with a threaded stem; a nut threaded on said stem, and bearing against the end of the chamber; a tubular screw bearing against the nut; a shaft journaled in the bearing-box; a cutter-chain driven by said shaft; and a chain-bar over which the cutter-chain passes.

9. The combination, with a head having a cylindrical chamber, of a bearing-box; means for supporting said bearing-box for rotary adjustment in a horizontal plane; means for securing the bearing-box after adjustment; a shaft mounted in the bearing-box; a cutter-chain driven by the shaft; and a chain-bar carried by the head.

10. The combination, with a head mounted on ways of the frame, of a pair of bearing-boxes mounted in said head for universal movement; a rotary-shaft journaled in the boxes; means for applying power to said shaft; and cutter chains driven by said shaft.

11. The combination, with a head mounted at each end on ways of the frame of a pair of bearing-boxes mounted in chambers of the head for universal movement; a rotary-shaft in said boxes; cutter-chains; and means controlled by said shaft for actuating the cutter-chains.

12. The combination, with a head, of a journal-box mounted in a chamber of said head; a shaft journaled in the box; a sprocket-wheel carried by the shaft; a chain-bar; means, including a cam-ring, for laterally-adjusting the chain-bar and a cutter-chain passing over said chain-bar and actuated by said sprocket-wheel.

13. The combination, with a chambered head, of bearing-boxes located in said head; devices having threaded stems, and to which said bearing-boxes are pivoted; a shaft located in said bearing-boxes; a belt for driving said shaft nuts engaging said threaded stems; means for connecting the nuts so that when one of them is actuated the other will be simultaneously rotated; and mortising mechanism actuated by the shaft.

14. The combination, with a head having a chamber and an extension of said chamber; of a bearing-box; a shaft journaled in said bearing-box; a device having a circular hub and a threaded extension, the bearing-box being connected to said hub; an adjustable nut closing the extension of the chamber and engaging the threaded extension; a tubular thrust-screw bearing against the nut, a cutter-chain actuated by the shaft; and a chain-bar over which said chain passes.

15. In a mortising machine, the combination, with a shaft, having a socket, of a spindle adjustably mounted in said socket, and having an extension for the reception of interchangeable sprocket-wheels; means for securing said spindle in its socket; a sprocket-wheel carried by said extension; a cutter-chain driven by the sprocket-wheel; and a chain-bar over which the cutter-chain passes.

16. In a mortising-machine, the combination, with a shaft having a socket; of a sprocket-center adjustable in said socket, the spindle thereof having a collar, and an extension beyond the collar adapted to receive interchangeable sprocket-wheels; means for clamping the spindle when adjusted; a sprocket-wheel secured to the extension; a cutter-chain driven by the sprocket-wheel; and a chain-bar over which said cutter-chain passes.

17. In a mortising-machine, the combination, with a shaft having a socket, of a sprocket-center adjustable in said socket, the spindle thereof having a collar, and an extension beyond the collar adapted to receive interchangeable sprocket-wheels; means for clamping the spindle when adjusted; a sprocket-wheel secured to the extension; a cutter-chain driven by the sprocket-wheel; a chain-bar over which said cutter-chain passes; and means for laterally adjusting said chain-bar.

18. The combination, with a head having a chamber and an extension of said chamber, of a bearing-box in said chamber; a circular hub to which the bearing-box is pivoted, said hub having a threaded stem; a nut closing the end of the extension of the chamber and in engagement with said threaded stem; a tubular thrust-screw for preventing endwise movement of the nut; a rotary shaft journaled in the bearing-box; and a cutter-chain driven by said shaft.

19. The combination, with a head having an opening for the reception of a tool, and also having a chamber, of a bearing mounted in said chamber; a shaft journaled in the bearing; means for supporting the bearing for universal movement; a threaded stem constituting a part of said means; a nut in engagement with said stem; a gear-surface on the nut adapted to be engaged by a tool inserted through the opening of the head; and a mortising device actuated by the shaft.

20. The combination, with framework, of a bearing; a shaft journaled in said bearing, and having a socket in its end; a sprocket-center having a spindle adjustable in the shaft-socket; a device for clamping the spindle in place; a sprocket-wheel carried by an extension of the spindle; a chain-bar; means for clamping and laterally adjusting said chain-bar; and a cutter-chain driven by the sprocket-wheel, and guided by the chain-bar.

21. The combination, with a cutter-chain, and with means for actuating the same, of a chain-bar; and means including a rotary cam for adjusting said chain-bar horizontally.

22. In a mortising machine, a chain-bar support comprising a block; a clamp for securing the chain-bar; and means including a rotary cam for horizontally adjusting the block.

23. In a mortising machine, the combination, with a block having a hub and a flange, of a device sleeved upon said hub; an adjustable cam between the flange and said device; and means for clamping the chain-bar to the flange.

24. The combination, with a flanged head having a hub, of a chain-bar; means for clamping the chain-bar to the flanged head; a device sleeved upon the hub; and a split cam-ring intermediate the inner ends of said device and flange.

25. The combination, with a cutter-chain, and with means for rotating the same, of a chain-bar; and means including a cam for laterally adjusting said chain-bar.

26. The combination, with a cutter-chain, and with means for rotating the same, of a chain-bar; means for clamping said chain-bar in position; a rotary cam-ring having an inclined end said cam-ring serving to adjust the chain-bar horizontally; and a device having a complemental cam-surface against which said cam-ring bears.

27. The combination, with a perforated hub having a flanged, perforated head, of bolts passing through the perforations of said hub and head; a clamp carried by the bolts; a chain-bar adapted to be locked against said head; a cam-ring surrounding the hub and in engagement with the inner side of the flanged head thereof; and a complemental cam-surface in engagement with the cam-ring and surrounding the hub.

28. The combination, with a hub having a

flanged head with an inclined under surface, of a split cam-ring surrounding the hub and having an inclined surface in engagement with that of the head; a sleeve having a cam in engagement with the cam-ring; a chain-bar; and means for clamping said chain-bar to the head.

29. In a mortising machine, the combination, with framework, of a head; means for adjusting said head longitudinally of the framework; a cutter-chain; mechanism carried by the head for driving said chain; a chain-bar over which the cutter-chain passes; and means including a cam having a spiral surface for laterally adjusting the chain-bar.

30. In a mortising machine, the combination, with framework, of a head longitudinally adjustable thereon; a rotary shaft carried by the head; a sprocket-wheel on the shaft; a cutter-chain; a bar over which the chain passes; a support for said bar; and means including a rotary cam for laterally adjusting the bar-support.

31. In a mortising machine, the combination, with framework having ways, of a head; means for adjusting said head on the ways; a shaft journaled in the head; a cutter-chain driven by the shaft; a chain-bar; means for adjusting the chain-bar laterally, said means including a rotary cam; a work support; and means for clamping the work against said support.

32. In a mortising machine, the combination, with a head, of a bearing-box carried by said head; a driven-shaft journaled in said bearing-box, and having a socket in its end; a sprocket-center adjustably mounted in the socket of the shaft; a sprocket-wheel carried by the sprocket-center; a block secured to the frame; a chain-bar carried by the block; and means for laterally-adjusting the chain-bar.

33. The combination, with framework having ways, of heads mounted on said ways, and each having universally-movable bearings; racks carried by the ways; inclined shafts journaled in the bearings; spiral pinions carried by the shafts, and in engagement with the racks; means for simultaneously rotating the shafts; mortising tools carried by each head; shafts journaled in the bearings of each head for actuating said tools; and a work-support coacting with the mortising-tools.

34. The combination, with a work-support; a mortising-tool and mechanism for actuating said tool; of a chip-breaker; a shaft carrying said chip-breaker, said shaft being located in front of the mortising-tool, and serving as a guard-rail; means for supporting each end of said shaft; and means for adjusting the shaft toward and from the work-support.

35. The combination, with a work-support, and with mortising mechanism, of a frame by which said parts are carried; a shaft mounted for vertical adjustment at each end of said frame, said shaft being located in front of the mortising mechanism, to serve as a guard-rail; a chip-breaker carried by said shaft, whereby both ends of said shaft may be moved in unison when the shaft is actuated to raise and lower the chip-breaker.

36. The combination, with a work-support and with framework upon which it is mounted, of a series of heads carried by the framework; mortising-tools carried by the heads; means for actuating said mortising-tools; a shaft extending longitudinally of the framework in front of the mortising-tools; chip-breakers carried by said shaft; and gearing at each end of the framework for actuating said shaft to carry the chip-breakers into and out of contact with the work.

37. The combination, with a work-support, of a shaft; a chip-breaker adjustably secured to said shaft; fixed racks; and means in engagement with said racks for advancing and retracting said shaft.

38. The combination, with a work-support, of a tubular shaft; a series of chip-breakers adjustably secured to said tubular shaft; a shaft within the tubular shaft; gears carried by said shaft within the tubular shaft; means for actuating said shaft; and racks with which said gears engage.

39. The combination, with framework, of a work-support; means for actuating said work-support; a tubular shaft; a shaft within said tubular shaft; a series of chip-breakers adjustably secured to the tubular shaft; gears on said shaft within the tubular shaft; and fixed racks projecting from the framework and with which said gears engage.

40. The combination, with framework, of a work-support; means for actuating said work-support; brackets carried by the framework; racks secured in said brackets; a tubular shaft having bearings sleeved upon the racks; a shaft within the tubular shaft, said shaft having an end shaped for the application of a wrench; pinions carried by said shaft in engagement with the racks; a series of chip-breakers; and means for adjustably connecting said chip-breakers to the tubular shaft.

41. The combination, with a horizontal shaft, and with means for adjusting the same; of a hub sleeved upon the shaft, and having a hanger; and a chip-breaker carried by the hanger.

42. The combination, with a work-support, of mortising-tools; means for actuating said tools; a horizontal shaft; means for advancing and retracting said shaft; and a series of chip-breakers carried by the shaft.

43. The combination, with a work-support, of cutter-chains; means for actuating said chains; a shaft; means for vertically actuating said shaft; and a series of chip-break-

ers, one located adjacent to the upper end of each cutter-chain, adjustably mounted on said shaft.

44. In combination, with stationary rack-bars; sleeves surrounding said rack-bars; pinions and their shaft journaled in the sleeves; a tube surrounding the pinion-shaft; and a chip-breaker carried by the tube, whereby when the shaft is actuated said chip-breaker may be either raised or lowered.

45. The combination, with a frame having bearings at each end, of rack-bars secured in said bearings; sleeves having ears slidable upon the rack-bars, one of each pair of ears being provided with a tubular extension; a tube secured in said extensions; a shaft mounted in the tube and having a wrench-receiving end; pinions secured to the shaft and located between the ears, and chip-breakers carried by the tube.

46. The combination, with a frame having brackets provided with bearings, of bars secured in said bearings; sleeves mounted on said bars; chip-breakers; and means carried by the sleeves for supporting and adjusting said chip-breakers.

47. A gang-mortising machine comprising the following instrumentalities in combination: a work-support; means for advancing said work-support; a device for retarding the retreat of the work-support; a series of heads; chain-bars carried by the heads; means for laterally adjusting the chain-bars; means whereby the chain-bars may be longitudinally adjusted; a series of cutter-chains; means for driving said chains; and means for taking up the slack of each of said chains by movement of the chain longitudinally of its chain-bar.

48. A gang-mortising machine, comprising the following instrumentalities in combination: a work-support; means for adjusting said work-support; means for advancing the work-support; a series of adjustable heads; shafts carried by the heads; cutter-chains driven by the shafts; an adjustable guard rail in front of the cutter-chains; chip breakers carried by the guard-rail; means for moving the shafts to tighten said chains; chain-bars; and cam-controlled devices for laterally adjusting said chain-bars.

49. The combination, with a series of heads, of means for adjusting said heads; a series of cutter-chains; means for operating said chains; a series of chain-bars; means whereby each chain-bar may be adjusted laterally and vertically; and means for taking up the slack of the chains by a separate movement of each chain longitudinally of its chain-bar.

50. In a gang-mortising machine, the combination, with a series of heads, of mortising-cutters carried by said heads; a guard-rail in front of the mortising-cutters; chip-breakers carried by said guard-rail; a work-support; and means for actuating the guard-rail toward and from said work-support.

51. The combination, with framework, of a head thereon; a cutter-chain; a shaft journaled in the head for actuating said cutter-chain; a guard-rail in front of the cutter-chain; a chip-breaker carried by the guard-rail; a work-support; and means for moving the guard-rail toward and from said work-support.

52. In a gang-mortising machine, the combination, with framework having guideways, of heads adjustably mounted on said guideways; sets of shafts journaled in the heads, and having pulleys, the shafts of one set alternating with those of the other set; cutter-chains driven by the shafts; an endless belt for driving one set of shafts in one direction; an endless belt for driving the other set of shafts in an opposite direction; a tightener for each belt; idler pulley for each belt; a driving-shaft having a pulley over one of which the driving-belt for one of said sets of shafts passes; a second driving-shaft having a pulley over which the other belt passes; and means for rotating said driving-shafts in opposite directions.

53. In a gang-mortising machine, the combination, with a series of chain-bars, and with a series of cutter-chains, one chain for each bar, of a shaft for each cutter-chain; a driving element on each shaft; a device carried by each shaft for actuating the cutter-chain; means for individually adjusting each shaft with relation to the chain-bar with which the cutter-chain coöperates; and means for individually adjusting the chain-bars, whereby the lower ends of said bars may be alined.

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

ROBERT S. BROWN.

Witnesses:

FRANCES E. BLODGETT,

WM. H. BLODGETT, JR.