No. 771,242. PATENTED OCT. 4, 1904.

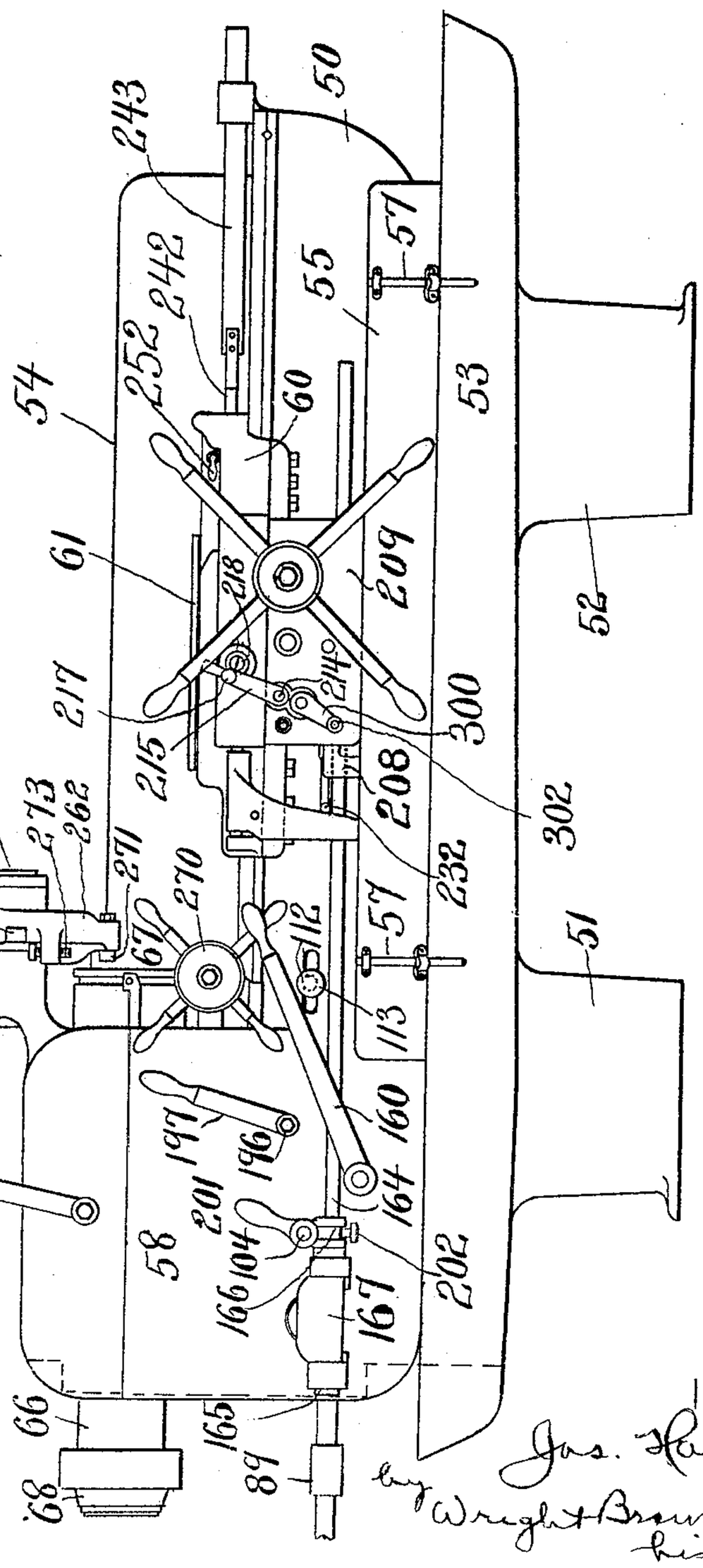
J. HARTNESS.

TURRET LATHE.

APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 1.

FIG. 1.



WITNESSES:
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No. 771,242. PATENTED OCT. 4, 1904.

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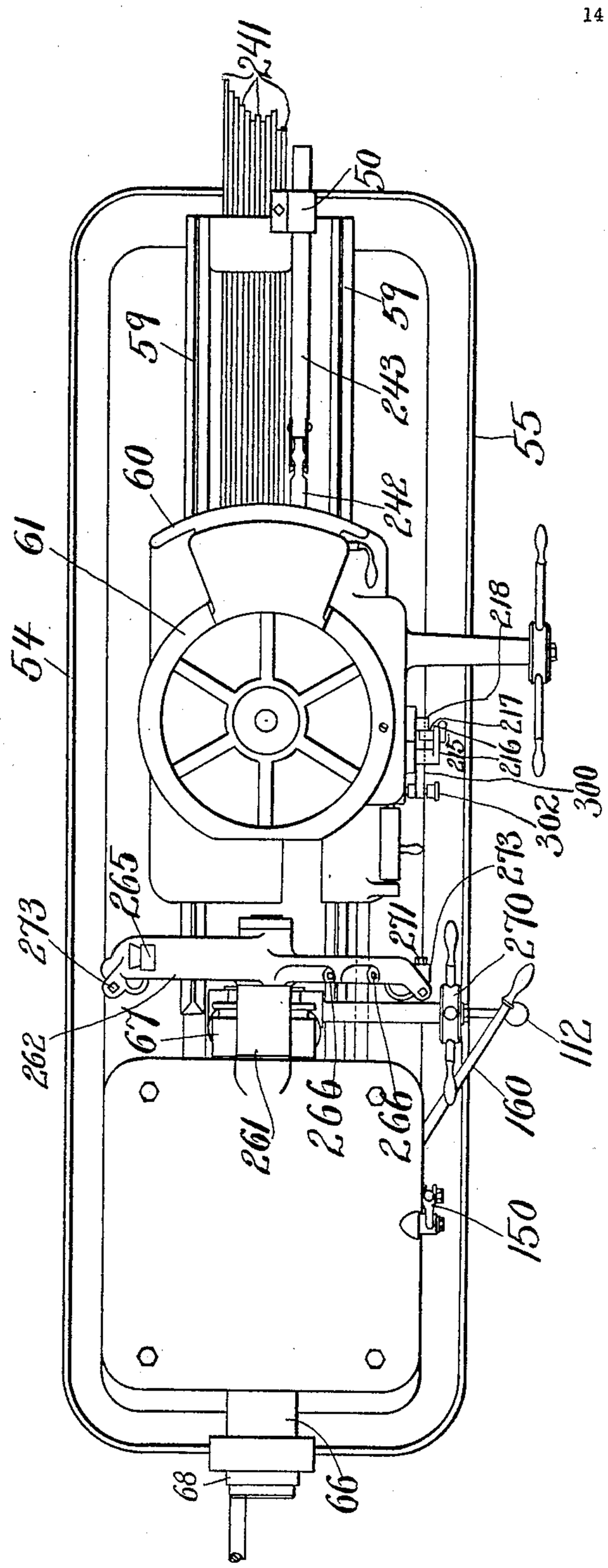
NO MODEL. 14 SHEETS—SHEET 2.

FIG. 2.



WITNESSES:
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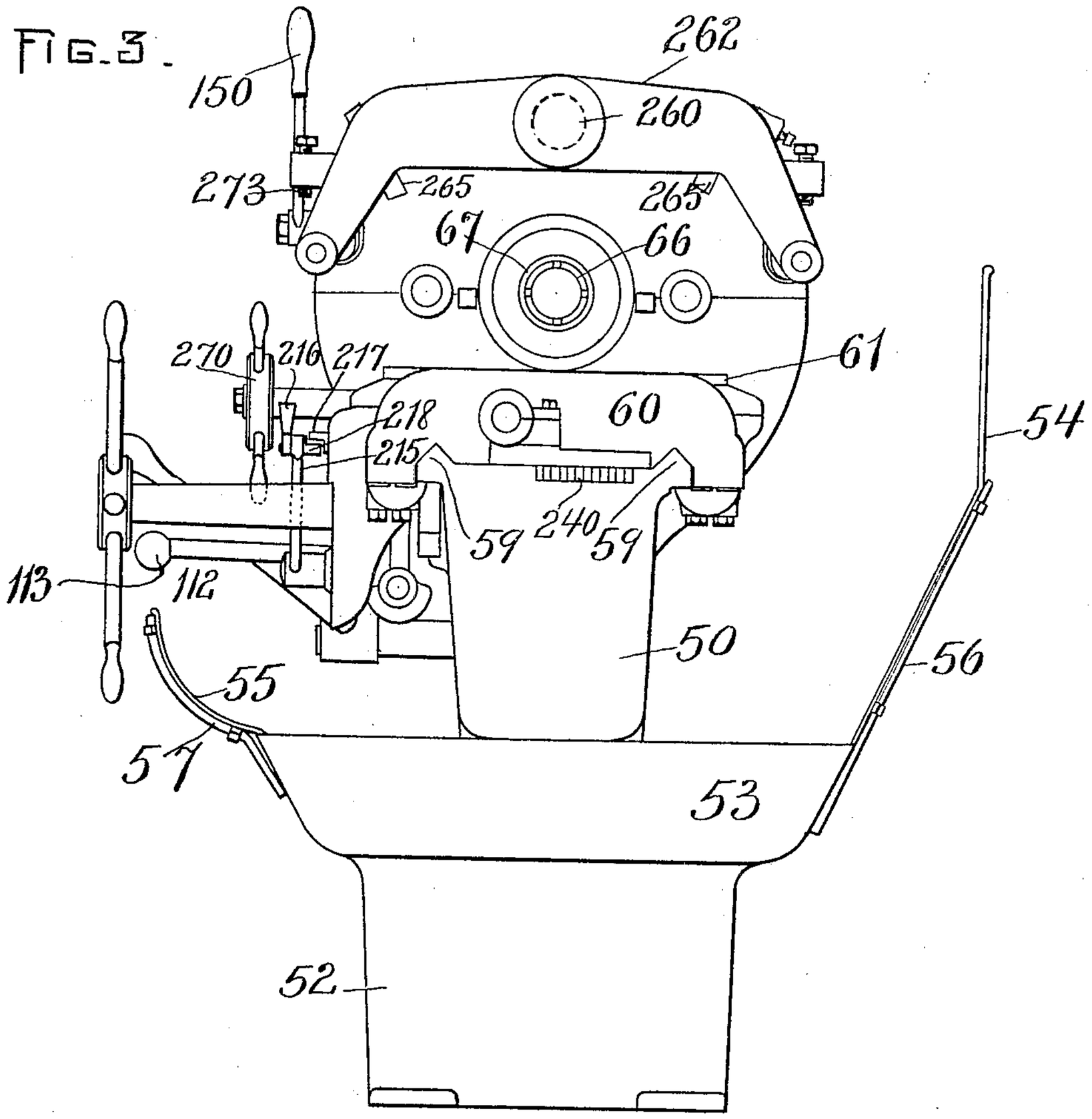
APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 3.

FIG. 3.



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No. 771,242. PATENTED OCT. 4, 1904.

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APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 4.

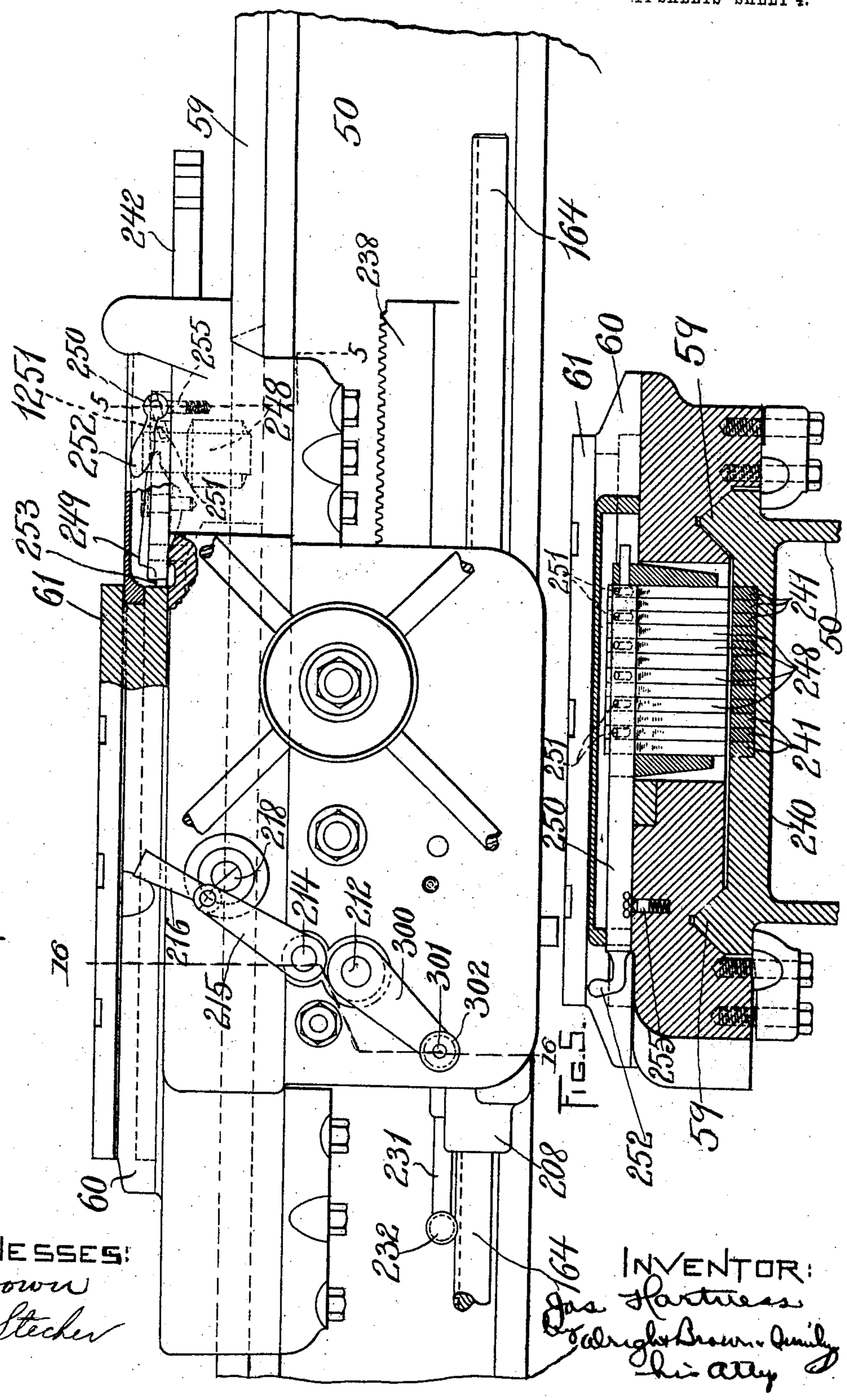

FIG. 4.

FIG. 5.

WITNESSES:
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No. 771,242. PATENTED OCT. 4, 1904.

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APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 5.

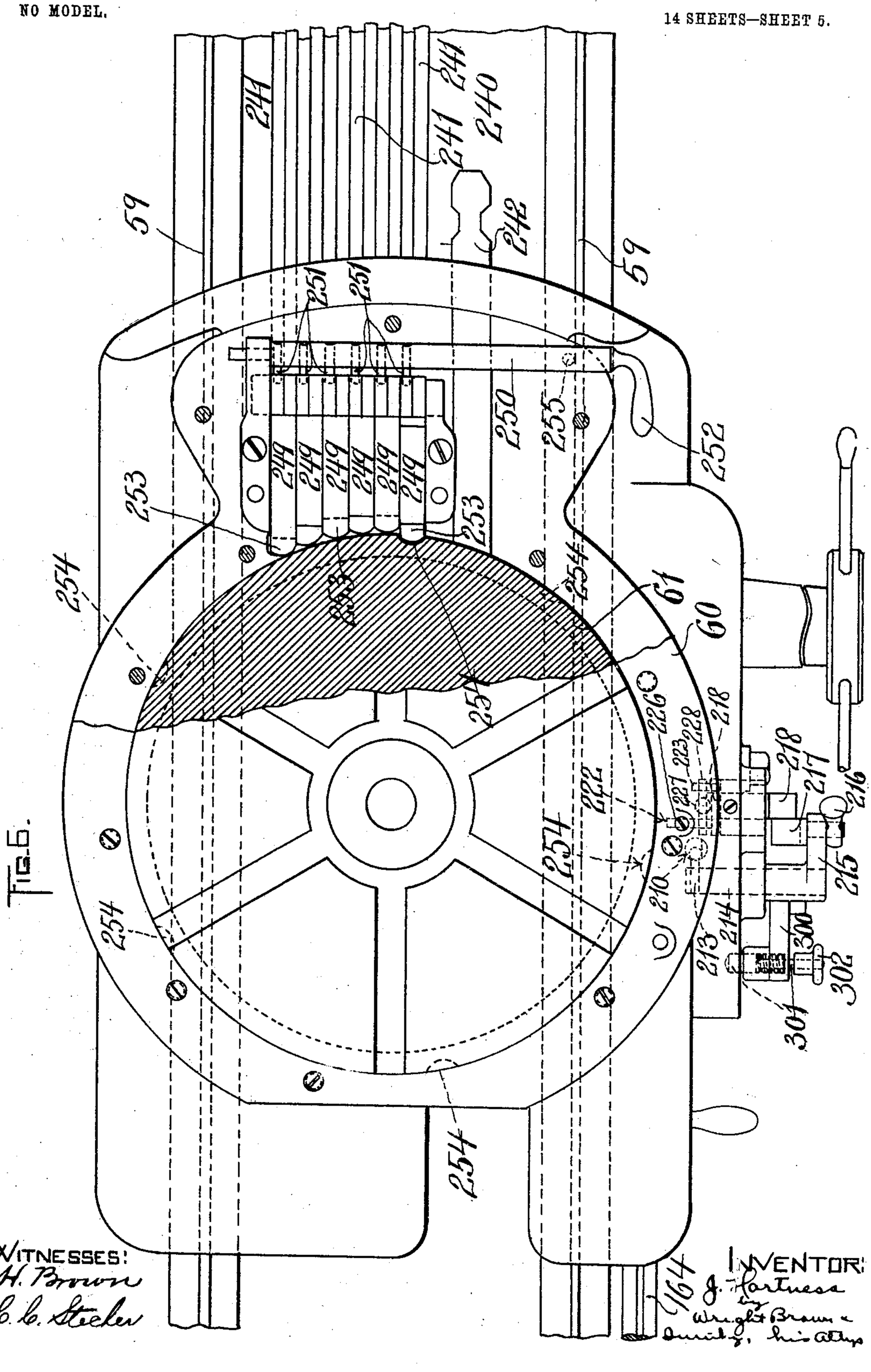

Fig. 6.

WITNESSES:
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No. 771,242. PATENTED OCT. 4, 1904.

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TURRET LATHE.

APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 6.

FIG. 7.

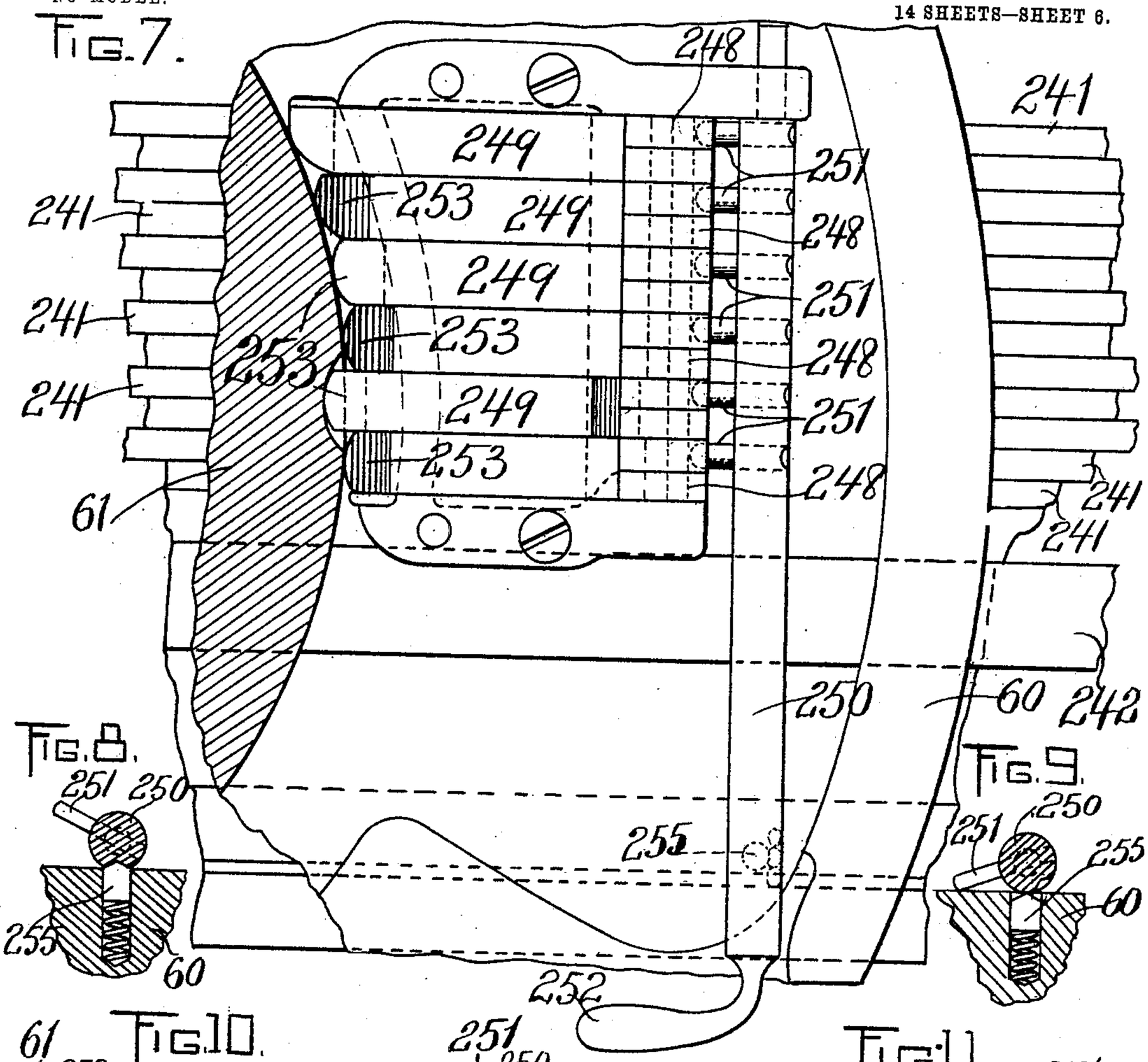


FIG. 8.

FIG. 9.

252

FIG. 10.

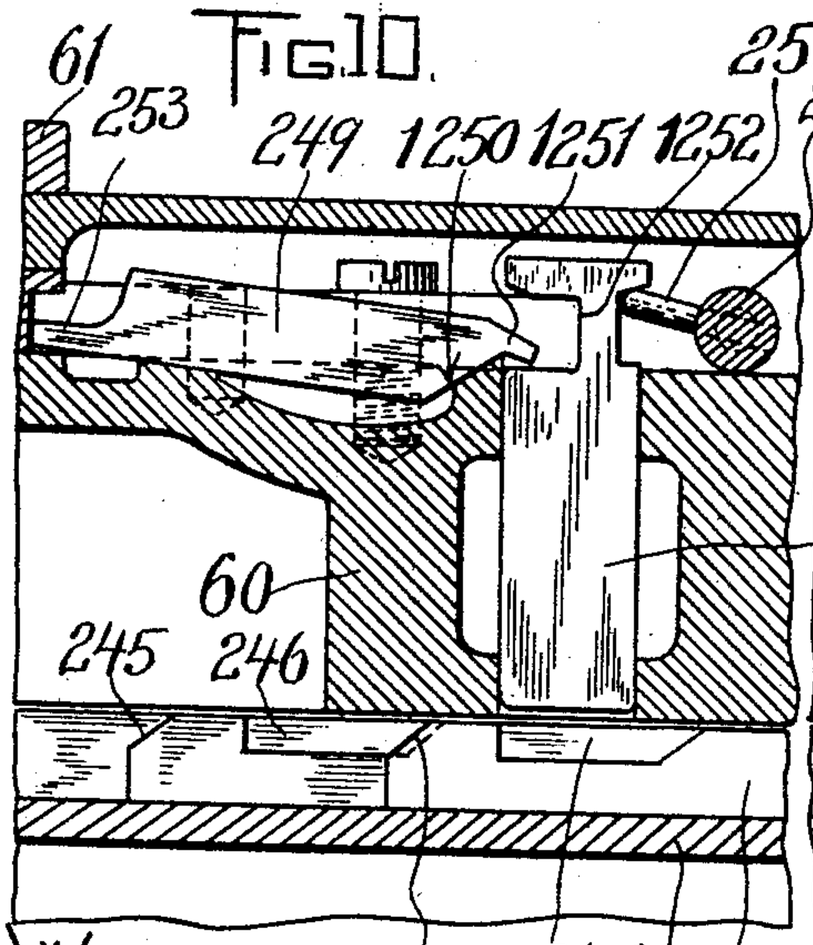
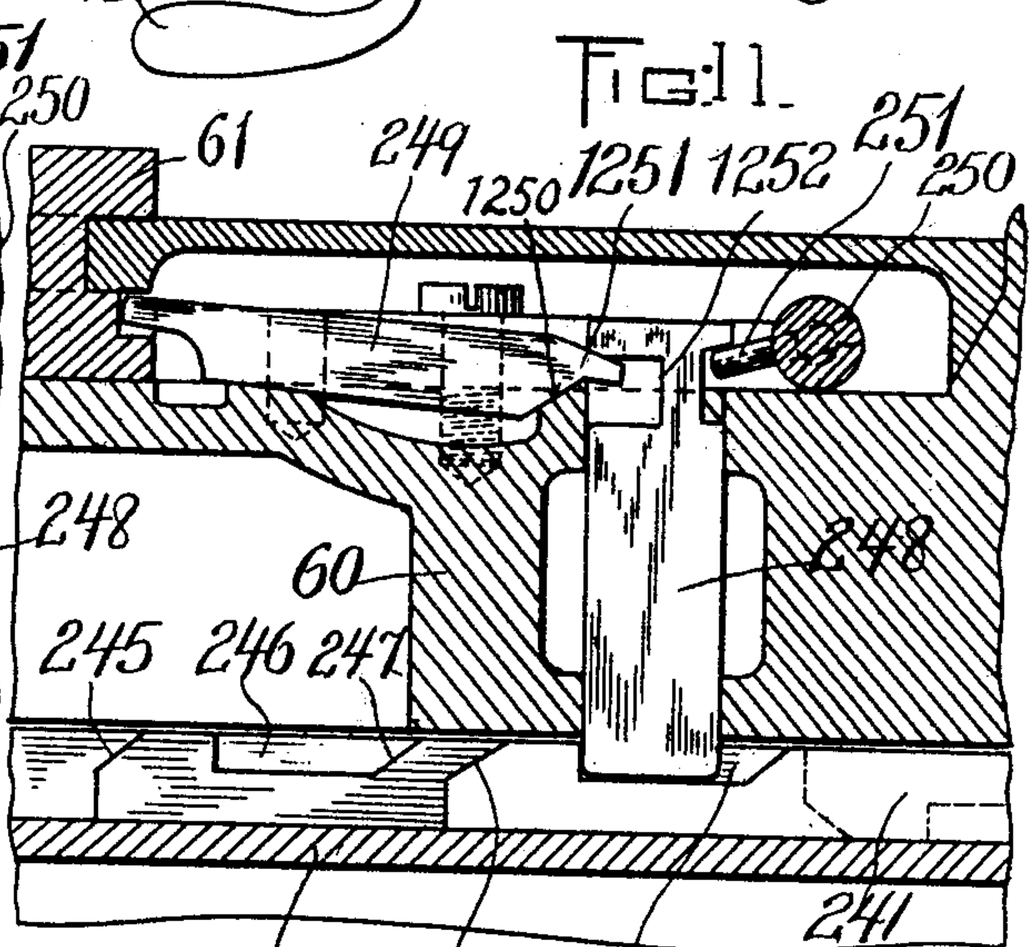


FIG. 11.



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No. 771,242. PATENTED OCT. 4, 1904.

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APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 7.

FIG. 12

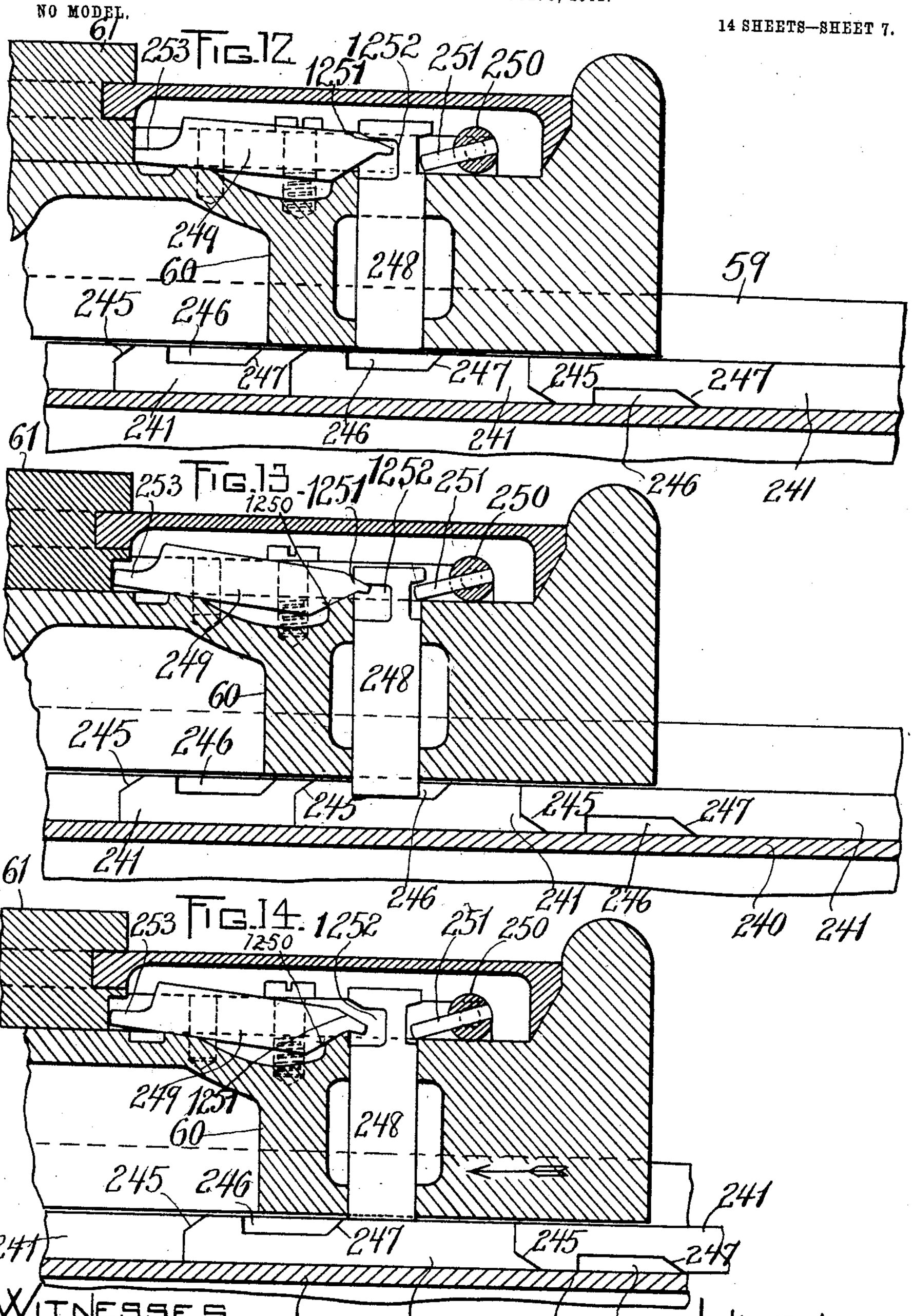

FIG. 13

FIG. 14

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No. 771,242. PATENTED OCT. 4, 1904.

J. HARTNESS.

TURRET LATHE.

APPLICATION FILED OCT. 9, 1902.

NO MODEL.

14 SHEETS—SHEET 8.

Fig. 14.

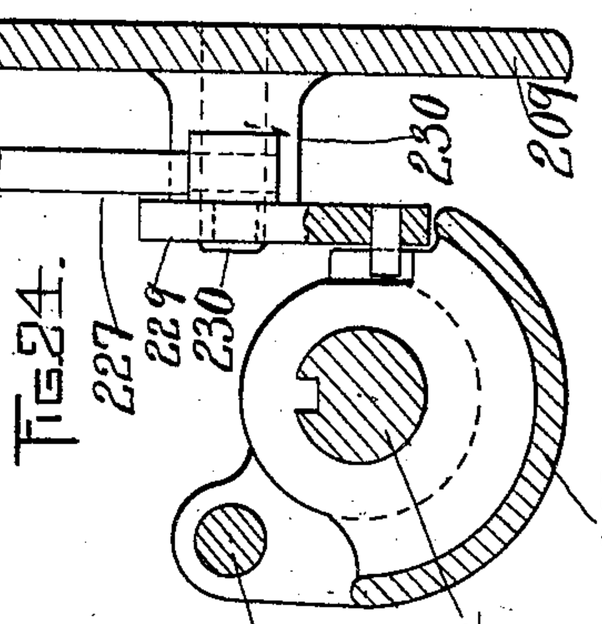

Fig. 23.

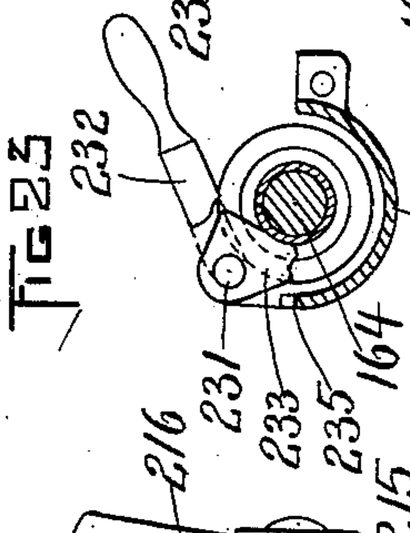

Fig. 15.

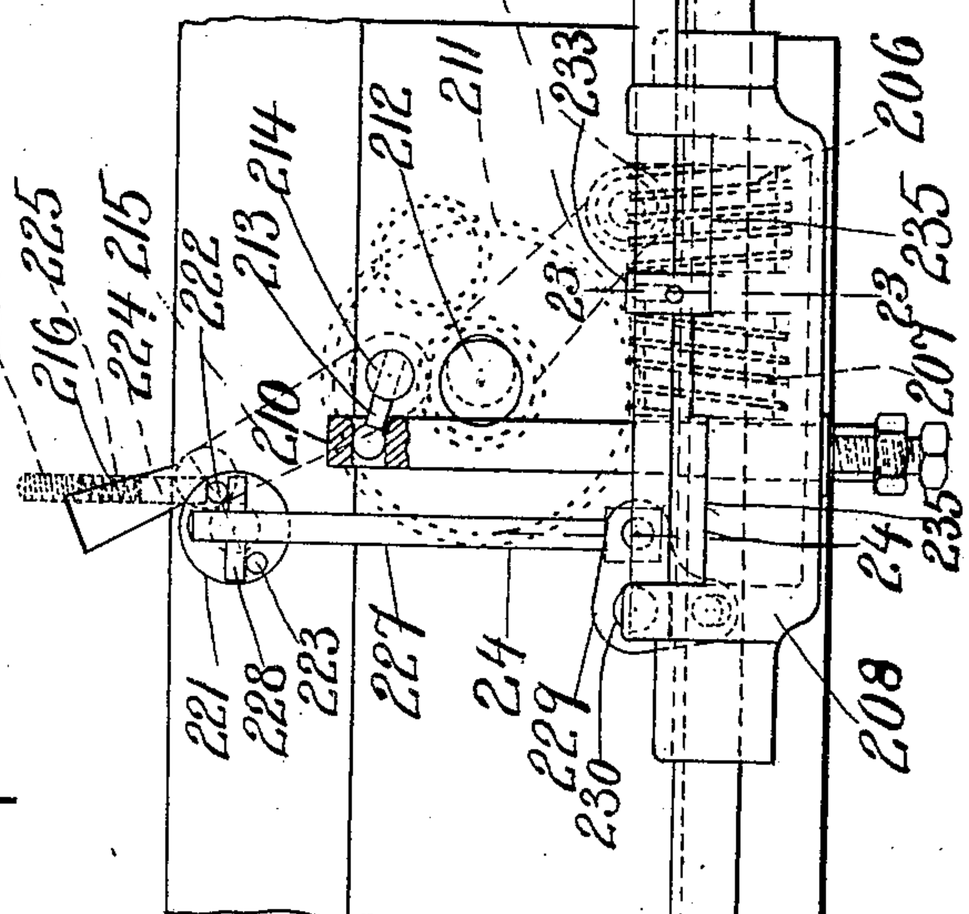

Fig. 16.

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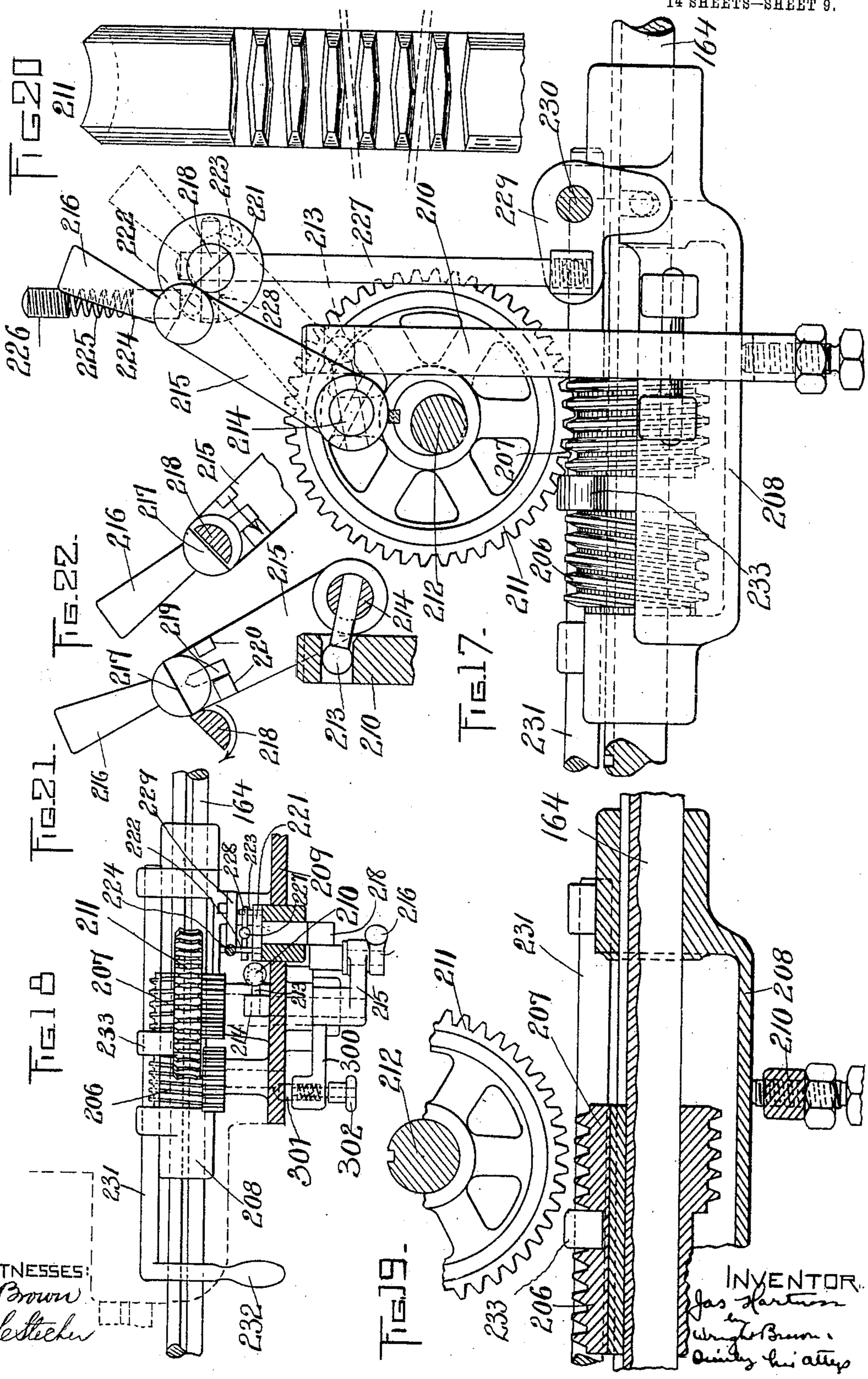
No. 771,242. PATENTED OCT. 4, 1904.

J. HARTNESS.

TURRET LATHE.

APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 9.



No. 771,242. PATENTED OCT. 4, 1904.

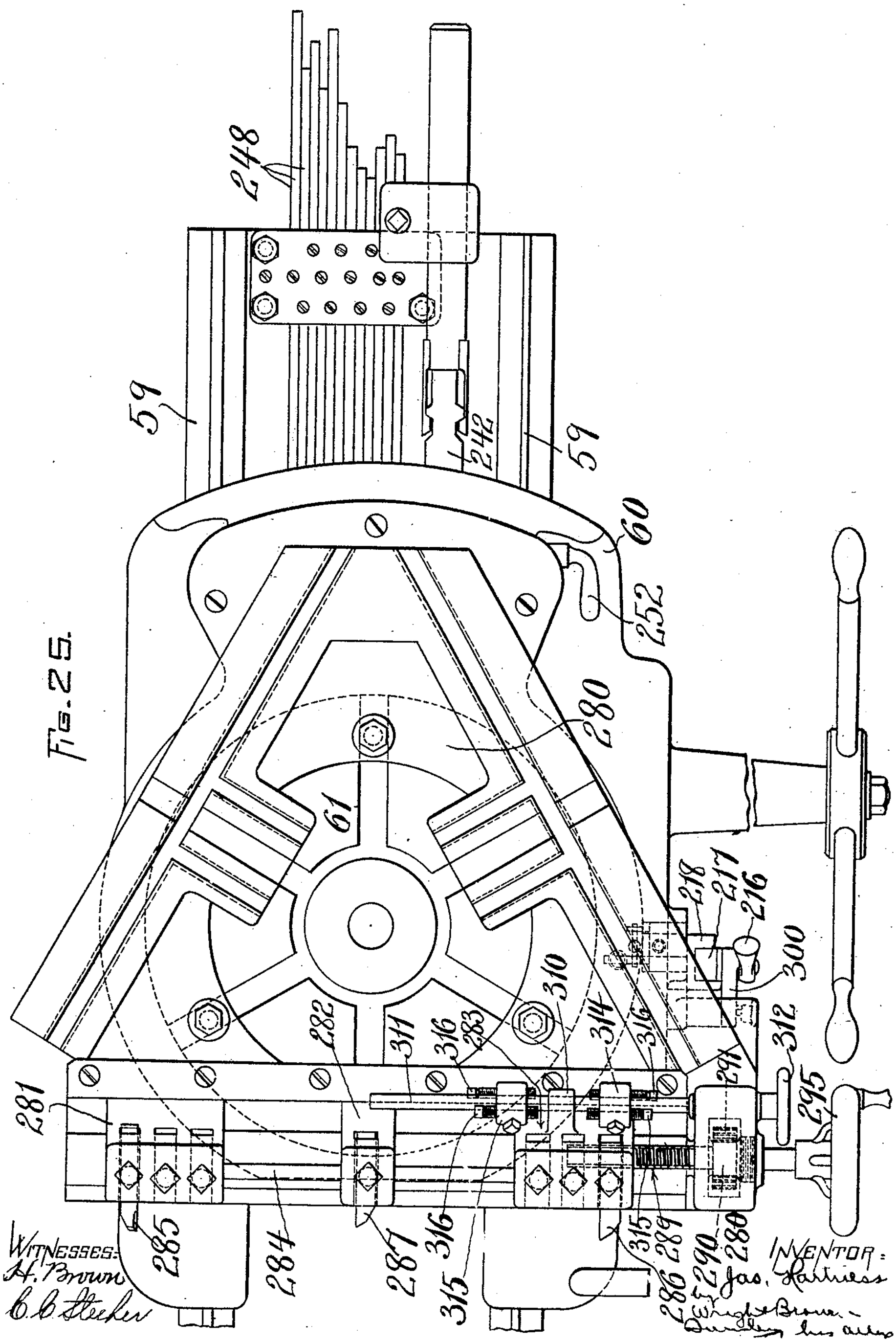
J. HARTNESS.

TURRET LATHE.

APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 10.

FIG. 25.



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No. 771,242. PATENTED OCT. 4, 1904.

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APPLICATION FILED OCT. 9, 1902.

NO MODEL.

14 SHEETS—SHEET 11.

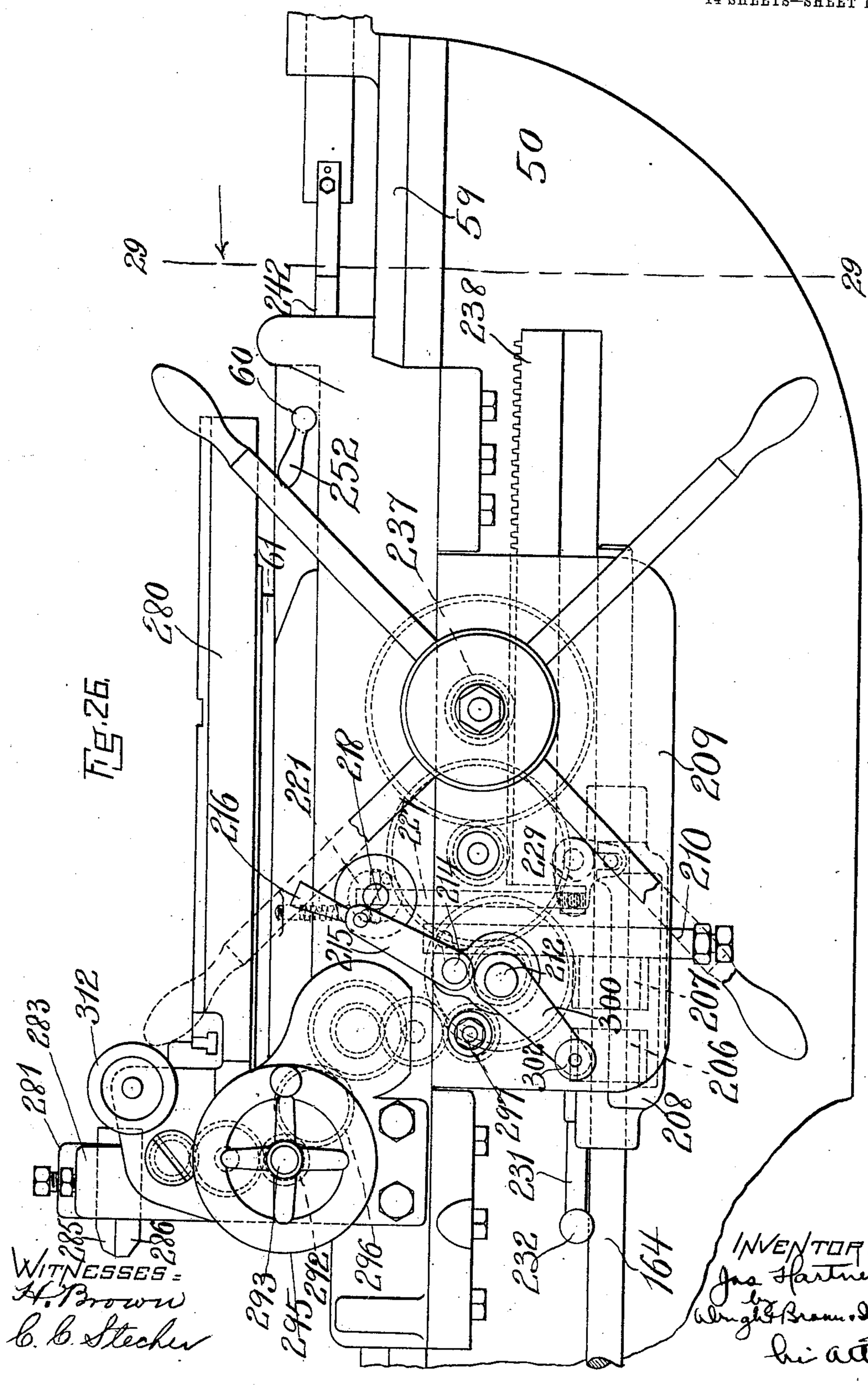

FIG. 26.

WITNESSES:
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No. 771,242. PATENTED OCT. 4, 1904.

J. HARTNESS.

TURRET LATHE.

APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 12.

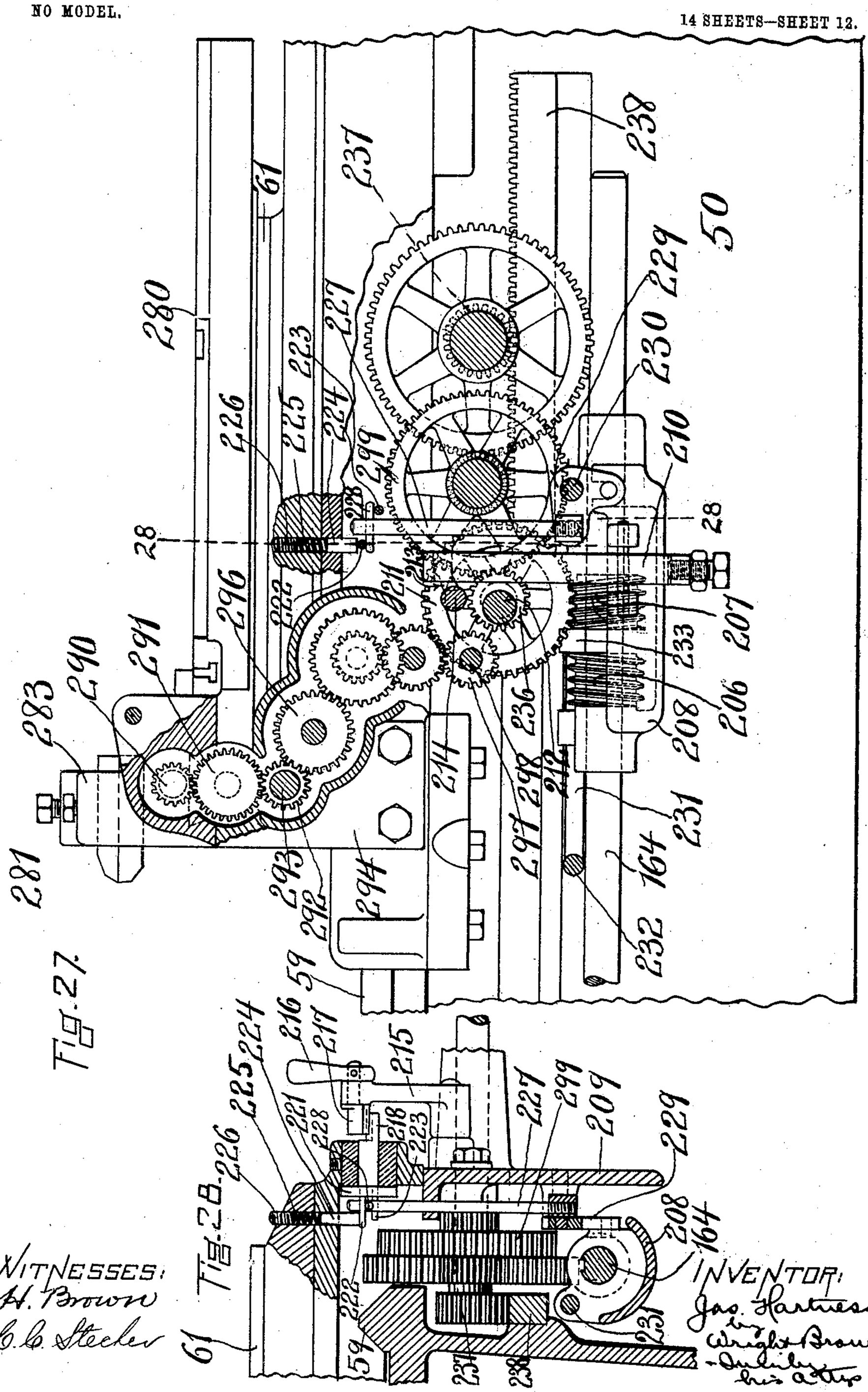

FIG. 27.

FIG. 28.

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No. 771,242. PATENTED OCT. 4, 1904.

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TURRET LATHE.

APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 13.

FIG. 29.

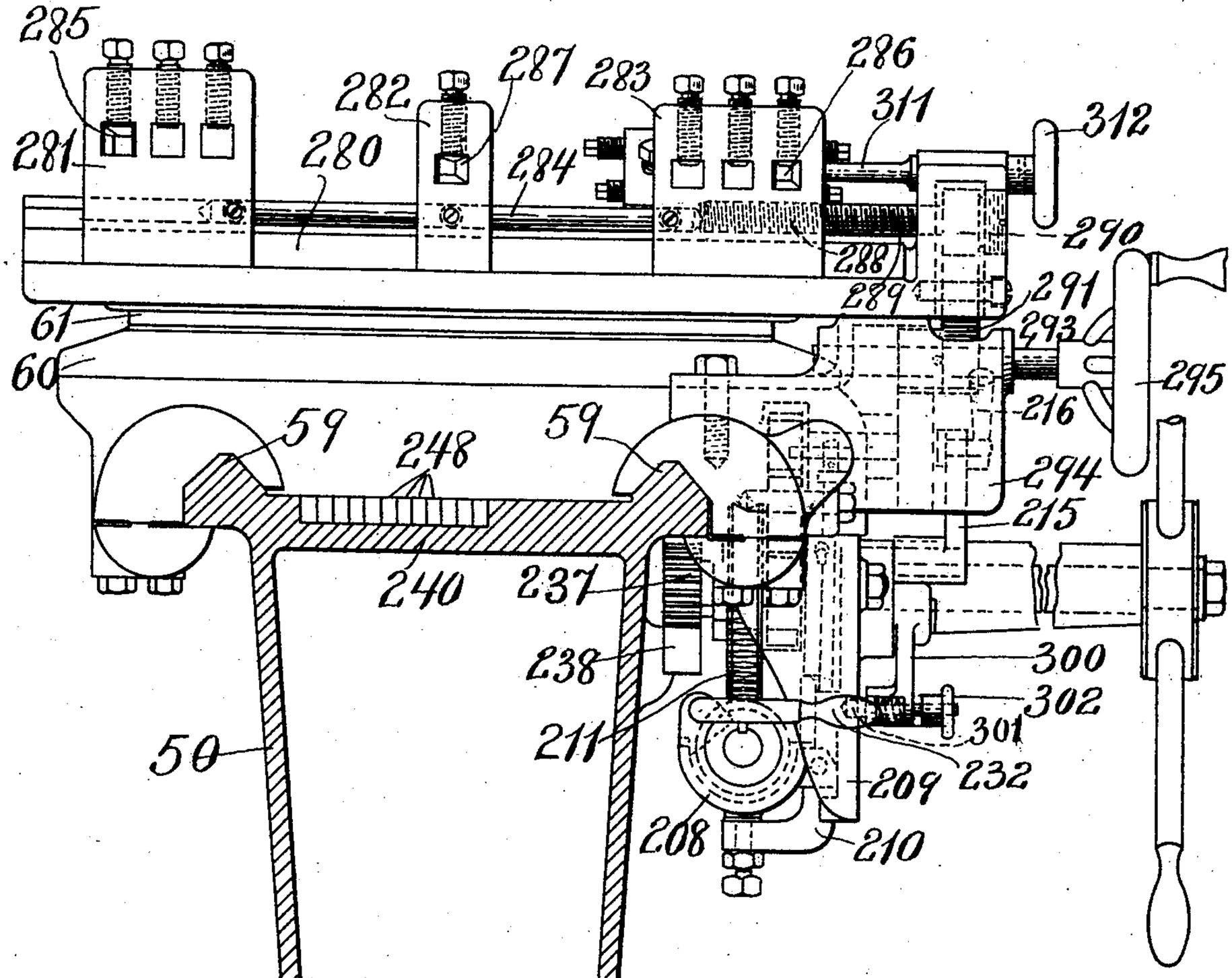


FIG. 30.

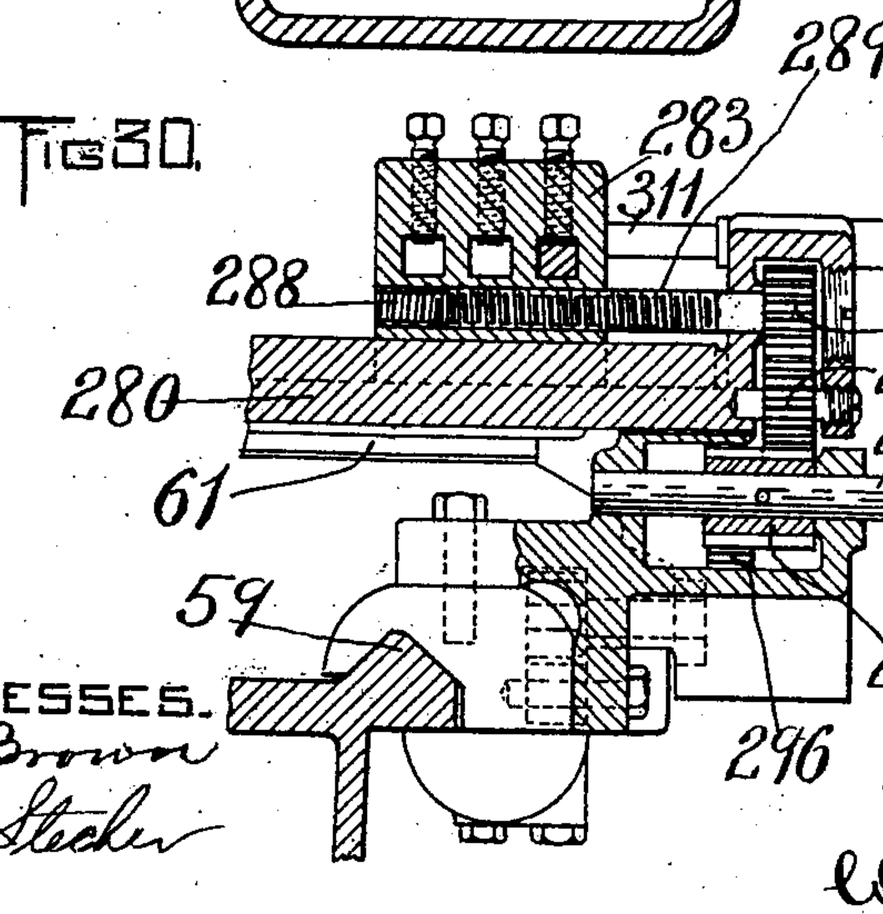
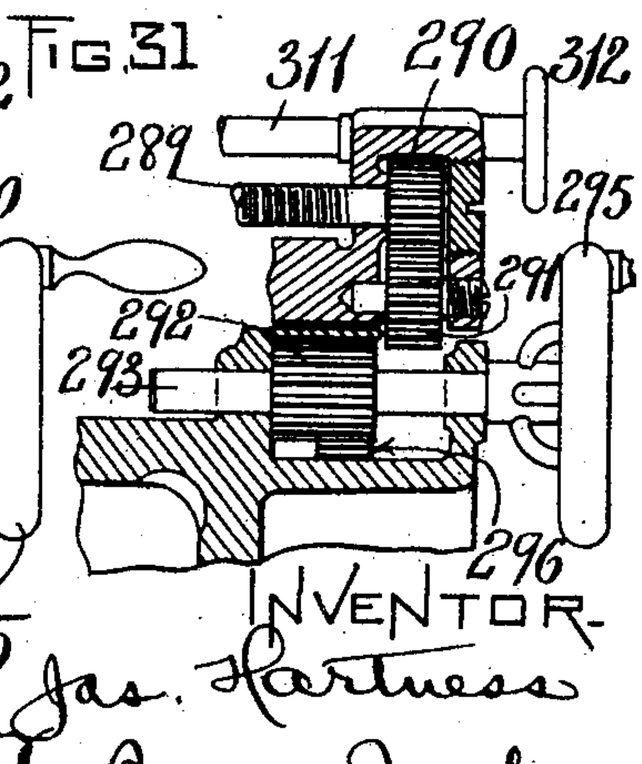


FIG. 31.



WITNESSES.

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No. 771,242. PATENTED OCT. 4, 1904.

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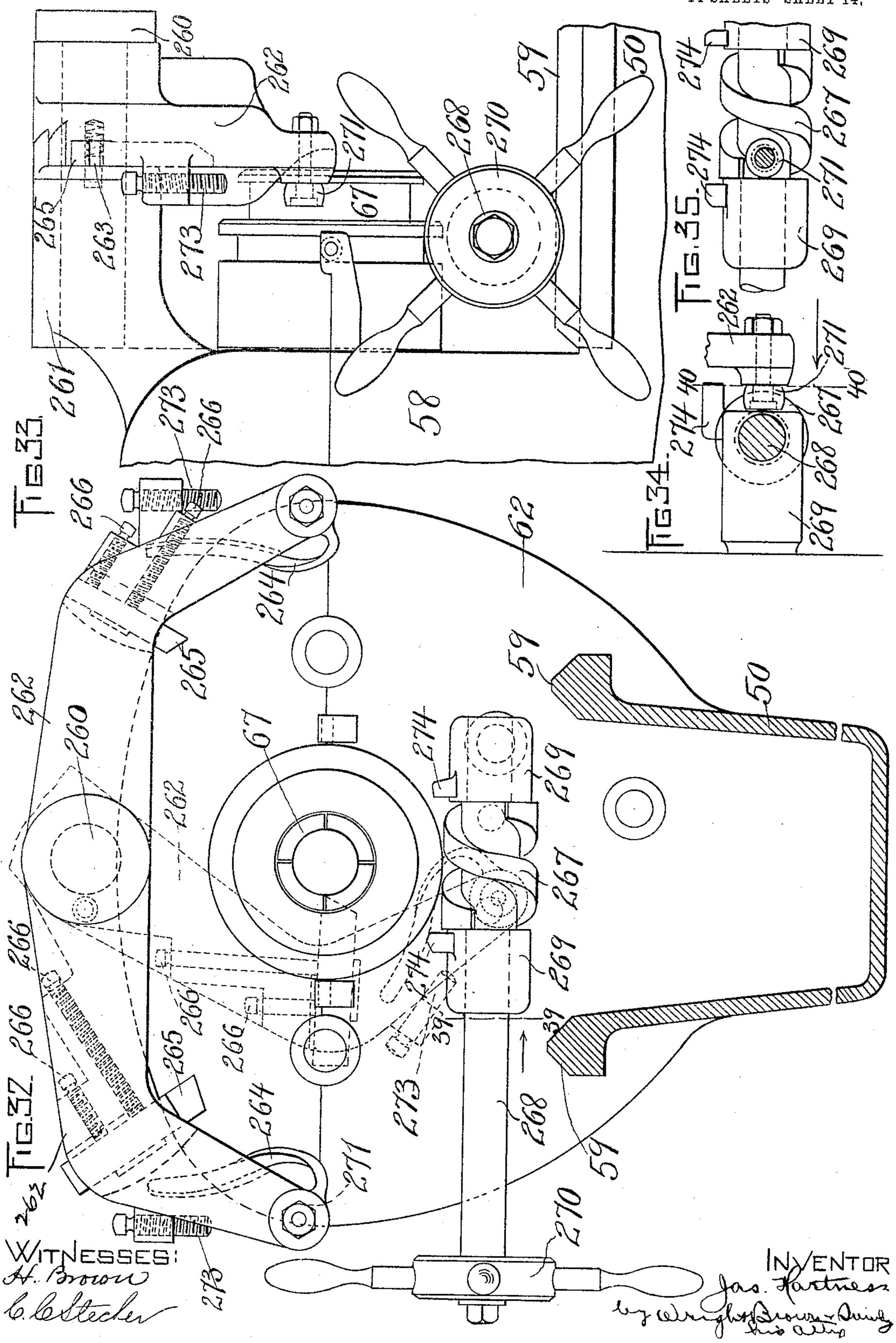
TURRET LATHE.

APPLICATION FILED OCT. 9, 1902.

NO MODEL. 14 SHEETS—SHEET 14.



No. 771,242. Patented October 4, 1904.

UNITED STATES PATENT OFFICE.

JAMES HARTNESS, OF SPRINGFIELD, VERMONT.

TURRET-LATHE.

SPECIFICATION forming part of Letters Patent No. 771,242, dated October 4, 1904.

Application filed October 9, 1902. Serial No. 126,517. (No model.)

To all whom it may concern:

Be it known that I, JAMES HARTNESS, of Springfield, in the county of Windsor and State of Vermont, have invented certain new and useful Improvements in Turret-Lathes, of which the following is a specification.

This invention has relation to bar-working lathes of the general character of that illustrated in my prior patent, No. 457,967, dated August 18, 1891.

The invention has primarily for its object to provide a semi-automatic lathe with a greater range and accuracy of operation than has hitherto been possible.

Secondarily, the object of the invention is to provide for the more accurate feeding and stopping of the tool-holding carriage whereby a greater accuracy in the production of work is secured, to provide for controlling the retrograde movement of the carriage and arresting it at any predetermined point, to provide improved mechanism for operating the cutting-off tool and such other devices as may be supported upon the bed of the lathe, to provide an improved cross-slide mechanism mounted upon the turret with provisions whereby the slide may be actuated by power, and to provide certain other improvements for simplifying the construction and enhancing the efficiency of lathes of the character indicated.

On the drawings, Figure 1 represents in front elevation the improved lathe. Fig. 2 represents a plan view of the same. Fig. 3 represents an end elevation of the lathe. Fig. 4 represents a front elevation of the carriage and the forward part of the bed. Fig. 5 represents a section on the line 5 5 of Fig. 4. Fig. 6 represents the carriage and turret in plan view with the turret broken away to illustrate the wedges. Fig. 7 represents the same enlarged. Figs. 8 and 9 are detailed views representing the different positions of the rock-shaft which controls the dogs. Figs. 10, 11, 12, 13, and 14 are similar sections, showing the operation of the wedges, the dogs, and the stop-bars. Fig. 15 represents in detail a portion of the mechanism for feeding the carriage. Fig. 16 represents an enlarged section on the line 16 16 of Fig. 4. Fig. 17 represents the carriage-feeding mechanism and the stops which control the disengagement of the worm from the worm-wheel. Fig. 18 represents a plan view of the same. Fig. 19 represents a section through the worm or feed-shaft. Fig. 20 represents the formation of the teeth on the worm-wheel. Figs. 21 and 22 illustrate different positions of the stops which control the engagement of the worm-wheel with the worms. Fig. 23 (see the preceding sheet) represents a section on the line 23 23 of Fig. 15. Fig. 24 represents a section on the line 24 24 of Fig. 15. Fig. 25 represents a plan view of the machine with the cross-slide on the turret. Fig. 26 represents a front elevation of the same. Fig. 27 illustrates the arrangement of gearing for actuating the cross-slide. Fig. 28 represents a section on the line 28 28 of Fig. 27. Fig. 29 represents a section on the line 29 29 of Fig. 26. Figs. 30 and 31 represent the gear connections between the cross-slide and the controller thereof. Figs. 32, 33, 34, and 35 represent the cutting-off and other tools which are supported upon the bed.

Referring to the drawings, 50 indicates the bed, which is supported upon a base having two standards 51 52, as shown in Fig. 1 and 3. The base is formed with a large tray 53, which is greater in length and breadth than the bed and which is adapted for the reception of oil and cuttings. The bed rests in the tray, being secured therein in any suitable way. At the rear there is a guard 54 for preventing the spattering of oil and the discharge of chips or cuttings on the floor, there being a smaller guard 55 at the front of the machine for the same purpose. These guards are removably supported upon the upwardly-projecting rods 56 57, respectively. The bed is formed with a hollow head-stock separated by partitions from the remainder of the bed, on which the carriage is adapted to slide. In the head-stock 58 are journaled the hollow work-holding and rotating spindle 66 and the mechanism for rotating the same and for transmitting power to the longitudinally-arranged feed-shaft for the carriage. At one end of the spindle 66 there is a chuck, (indicated as a whole at 67,) and at the other end there is an automatic

roller-feed, (indicated at 68.) The other end of the bed is provided with parallel ways or shears 59 59 for the reception of the tool slide, holder, or carriage 60, upon which is rotatably mounted the turret 61.

Carriage, turret, and carriage-actuating mechanism.—In some respects the mechanism now to be described is somewhat similar to the mechanism set forth in my Letters Patent No. 457,967 hereinbefore referred to; but there are several important differences, which will be pointed out in the course of the following description.

It has been generally customary in feeding lathe-carriages to have a positive-feeding apparatus that is disengaged by a positive stop. According to the present invention the carriage is fed forward until it meets a resistance exceeding a fixed or arbitrary amount necessary for the cutting operations—that is to say, when the carriage is positively arrested by a stop the feeding device continues to press against that stop until the work has rotated a predetermined number of turns. Then the latch will yield and cause the cessation of pressure. The amount of pressure always reaches but never exceeds a predetermined amount. Thus it will be seen that the carriage is not only fed up to its positive stop, but the pressure brought to bear against that stop is always the same, which insures an accuracy not previously obtained.

The feed-shaft 164 is jointed, its portion at the head end being journaled in fixed bearings and the other end being adapted to move or swing relatively thereto to a certain extent. By reference to Fig. 1, Figs. 15 to 24, and Figs. 27 and 28 it will be seen that the shaft 164 is provided with a longitudinal groove to receive a key on a two-part or double worm. The threads on the two ends of the worm are reversed, so that for the sake of convenience they will be referred to as the two "worms" 206 207. The worms are arranged in a box 208, in the end of which the feed-shaft 164 is journaled. The box is normally located in the rear of the apron 209 of the carriage 60. Said box is supported by an angle-bar 210, so as to bring either one or the other of the worms into operative relation with a worm-wheel 211 on an eccentric journal-shaft 212. It will be seen from Fig. 20 that the teeth of the worm-wheel are so cut that the teeth of either worm may operatively engage them. The box is maintained in its raised position so long as it is desired to feed the carriage, mechanism being provided whereby the box is permitted to drop to disengage the worm from the worm-wheel when the cutter has finished its operation. The upper end of the bar 210 is supported upon an arm 213, projecting from a shaft 214, journaled in the apron 209. On the front end of the shaft there is secured an arm 215, having a handle 216, by means of which it may be oscillated. This arm carries a stud or stop 217, which when the worm-box is lifted bears against a rocking latch 218, journaled in the upper part of the apron. The stop and latch 217 218 are substantially semicylindrical, as best shown in Figs. 21 and 22, whereby they form, as it were, contacting knife-edges, so that the arm 215 may be held in the position shown in Fig. 21 until the stud or stop 218 is rocked sufficiently to permit the stud 217 to swing past it to the position shown in Fig. 22. The stud 217 has a slight rocking motion, it being passed through the end of the lever 215 and having the handle 216 secured thereto. The stud or stop 217 carries a pin 219, adapted to play between two lugs 220, as shown in Fig. 21. The rocking latch 218 is adapted to be held with yielding pressure in the position shown in Fig. 17. For this purpose the inner end of said latch is provided with a disk 221, having projecting rearwardly therefrom two pins 222 223. A pin 224 bears against the pin 222, being held downwardly by a spring 225, the tension of which may be varied by the adjusting-screw 226. An upright rod 227 has in its upper end a cross-bar 228, which lies beneath the pin 222 and above the pin 223, so that a vertical movement of said bar either upward or downward will effect a rocking of the latch 218 against pressure of the spring 225. The lower end of the rod 227 has a pivoted connection with the bell-crank lever 229, fulcrumed on a stud 230, extending inwardly from the apron 209. The depending arm of the said lever 229 has a pin-and-slot connection with the worm-box 208. While this is the preferred form of construction, it is evident that any spring bearing against the end of the worm and any latch mechanism operated by the longitudinal movement of the worm relatively to the carriage would accomplish the purpose and would be mechanical equivalents of those herein described. Now it will be seen that assuming that the parts are in the position shown in Fig. 17 and that the worm is locked against longitudinal movement relatively to the box the worm-wheel 211 will be rotated until the resistance against its rotation is sufficient to overcome the tension of the spring 225 and permit the rocking of the latch 218. When the said latch is rocked, the arm 215 is permitted to swing to the position shown in Fig. 22, so as to lower the worm-box and permit the disengagement of the worm from the worm-wheel. Either of said worms may be engaged with the worm-wheel, and it will be seen from Fig. 20 that the teeth on the worm-wheel are cut so that it will intermesh with either of the worms. Said worms may be held in position for either of them to engage the worm-wheel, and for the purpose of shifting them and locking them after they have been shifted there is a rock-shaft 231, having a forwardly-projecting handle 232 and journaled in bearings afforded

by the worm-box. The shaft may be moved longitudinally of the worm-box, and it is provided with a plate 233, which extends into a groove formed between the worms. The rear edge of the worm-box is provided with two notches 235 235, into either of which the plate may be dropped, so as to hold either one of the worms in position to be engaged by the worm-wheel and lock it against movement longitudinally of the worm-box.

Secured to the worm-wheel 211 there is a pinion 236, from which power is transmitted to rotate the pinion 237 by a train of gears on a shaft journaled in the apron 209. The pinion 237 intermeshes with a rack 238, formed on or secured to the bed, as shown in Figs. 16 and 27. By this construction it will be observed that the worm-wheel may be driven in either direction, according to the worm that is engaged therewith, and that its rotation will effect through the rack and pinion and gearing between the worm-wheel and the pinion a longitudinal movement of the carriage. It is apparent that whether the machine is feeding the carriage forward or backward the spring 225 holds the worm-box in correct position until something arrests the travel of the carriage with sufficient force to compress the spring. The advantage of this is that it insures the feeding of the carriage the correct distance every time. In ordinary practice with the present system of feed trips and stops it is customary for the operator to press the carriage forcibly against the stop after the feed has disconnected the worm. This is done in order to make sure that the carriage has fully reached a positive stop, on which point there is always more or less uncertainty, resulting in the product of the lathe being unreliable as to length between shoulders. The apparatus herein described not only insures the carriage reaching its stop, as will be explained, but also presses it with a fixed pressure against said stop, insuring a uniform springing of all the parts that will effect the location of the shoulder on the work.

Stop mechanism on the carriage.—In conjunction with the carriage-feeding mechanism there is employed a stop mechanism for stopping the carriage, and thus effecting compression of the spring 225 and the separation of the worm and the worm-wheel 211.

Referring to Figs. 5 to 14, it will be seen that the flat top 240 of the bed 50 is provided with a recess for the reception of a plurality of stop-bars, which are indicated at 241. The turret 61 is usually provided for the reception of six turret-tools, and as the carriage recedes from the work a longitudinally-arranged bar 242 engages a stationary stop 243 on the bed. The continued movement of the carriage causes the unlocking of the turret and a partial rotation thereof to bring another tool into operative relation to the work. The mechanism for accomplishing this rotation of the turret is not illustrated, as it forms no part of the present invention, being fully illustrated and described in said Letters Patent No. 457,967, hereinbefore referred to. Heretofore no automatic provision has been made for stopping the carriage in its recession from the chuck at different points in its travel, and in the present case there is an arrangement whereby the carriage may be stopped at any point in its receding movement by means of one of the stop-bars 241. These last-mentioned stop-bars may be secured in any suitable way in the top 240 of the bed and are independently adjustable. There are at least two stop-bars 241 for each tool on the turret, so that one bar may be utilized for limiting the forward movement of the turret and the other for limiting the receding movement thereof. Each of the stop-bars is provided on its end underneath the carriage with a beveled portion 245 and a socket 246, having a beveled end wall 247. The carriage 60 is provided with a plurality of vertically-arranged dogs 248, each one of which is arranged directly above one of the stop-bars 241. Said dogs are normally held in a raised or inoperative position by a plurality of wedges 249, there being one wedge for each two dogs. These wedges have beveled ends 1250 resting against inclined ways on the carriage and with points 1251, which extend into notches 1252 in two adjacent dogs 248. Said wedges are all arranged as shown in Fig. 6, and their ends 253 bear against the edge of the turret 61. The said turret is provided with a plurality of notches, one for each turret-tool, and the said notches are so arranged that for each position of the turret one of the notches 254 will register with one of the wedges 249 and permit it to enter therein, whereupon the dogs 248, supported thereby, will drop, so as to rest upon the top of one of the stop-bars 241, as shown in Fig. 14. As the carriage travels in the direction shown by the arrow in the last-mentioned figure the dog slides along the top of the stop-bar until it enters the notch 246 therein, as shown in Fig. 13, whereupon the carriage is held from further movement, and the continued rotation of the feed-shaft effects the compression of the spring, as previously described, and the feed-shaft is moved into inoperative position with relation to the carriage-feeding worm. When the carriage moves rearward, the lower end of the dog rides up on the beveled end wall 247 of the notch 246 in the stop-bar. To prevent the dropping of the two dogs at the same time, a rock-shaft 250 is journaled in the carriage and is provided with six pins 251, so spaced as to engage the alternate dogs 248. The said dogs are provided with sockets or notches to receive the pin, as shown in Figs. 10 and 11. By rocking the shaft 250 by means of the handle 252 on the end thereof every other dog may be maintained in a raised

position, even though the wedge which cooperates therewith should register with a notch in the turret. The rock-shaft is adapted to be held in raised position by a spring-pressed conical pin 255, as shown in Figs. 8 and 9, the end of which is adapted to enter a recess in the periphery of the shaft. Said shaft may be moved longitudinally to cause the pins 251 to engage the first, third, fifth, seventh, ninth, and eleventh dogs or may be moved to engage the second, fourth, eighth, tenth, and twelfth dogs, so as to hold them in an inoperative position. The rock-shaft, however, may be brought to intermediate position, whereby each pin 251 will engage and lift two adjacent dogs, so as to move them all to inoperative position. In order to permit the dogs 248 to be engaged by the stop-bars 241 on a receding movement of the carriage, said stop-bars may be turned upside down, as shown in Figs. 12, 13, and 14, in which event the said dogs would not enter the sockets or notches in the stop-bar, but would engage the ends thereof. If desired, the stop-bars may be so arranged that one dog of each pair will engage one stop-bar in the forward feed of the carriage and the other dog of the pair (after the rock-shaft has been shifted) can engage the adjacent stop-bar in the receding movement of the carriage. This provision is made so that the turret-carriage can be moved toward and from the work a series of times to cause the same tool to operate more than once upon the work without allowing the carriage to complete its full rearward traverse, so as to effect the partial rotation of the turret. The mechanism in addition presents a fixed stop for the carriage, so that the work can be accurately shouldered. As soon as one of the dogs engages a stop-bar the carriage of course is held against movement and the worm is disconnected from the worm-wheel by the continued rotation of the feed-shaft and the longitudinal movement of the worm-box against the compression of the spring. It will be seen, therefore, that the stop mechanism thus described is a positive stop against which the carriage is held by a pressure that is always the same and during a desired period of time, which allows the cutting-tool to smooth the shoulder instead of leaving it abruptly while fed at its regular travel. By the provision of a plurality of stop-bars for one of the tools the carriage can be fed forward to one shoulder on the work, the tool adjusted and another dog thrown into action, so that the tool will be fed still farther along the work to a second shoulder and, if desired, the tool a third time adjusted, both dogs rendered inactive, and the tool fed forward to the limit of movement of the carriage. The dogs are then selectively rendered active or inactive, as the case may be, at the will of the operator.

Cutting-off tool.—Referring to Figs. 1, 3, 32, 33, 34, and 35, it will be observed that fulcrumed on a stud 260, projecting forwardly from a bracket 261, attached to the top of the head-stock, there is a two-armed lever 262. The stud 260 is directly above the chuck, so that the lever may be swung to bring either end toward the chuck. The said lever may be normally held in a neutral or substantially horizontal position by a spring-pressed pin 263 (see Fig. 33) entering a socket in the bracket 261. The pin projects only so far in the socket as is necessary to hold the lever in neutral position; but upon force being applied to the lever the pin will be forced back to permit the said lever to swing. Each of the arms of the lever is bent downwardly and is provided with a handle 264, by which it may be selectively actuated to bring it toward the chuck. Each of the arms is provided with a detachable cutting-off tool 265, held in place by set-screws 266. The two cutting-off tools may vary in character according to the stock that is being turned, or they may be replaced by other tools for performing any desired function on the work. Either tool may be brought selectively by hand to closed position and then engaged by a suitable power-transmitting device for forcing it toward the axis of the work. A large worm 267 is formed on or secured to a shaft 268, which is journaled in bearings 269 in the front wall 62 of the head-stock, the front end of said shaft being provided with a spoked wheel or handle 270. On the end of each of the arms of the two-armed lever 262 there is a roll 271, which may be engaged with the worm 267, as indicated in dotted lines in Fig. 32. The operator swings the lever 262 about its fulcrum until one of the rolls 271 is selectively engaged with the worm, after which he rotates the shaft 268 in one direction or the other to wedge the tool toward the axis of the work to effect the severing of the finished product. Each of the arms is provided with an adjustable screw 273, adapted to strike against a stop 274 on one of the bearings 269 to limit the inward movement of the arm to which it is attached. The advantage of the described construction is that the two-armed lever 262 normally occupies a neutral or inactive position and yet either end thereof may at will be selectively engaged with the worm to effect the actuation of the tool on said end. The worm is rotatable by hand in either direction to move the tool toward the axis of the work.

Cross-slide on the turret.—In conjunction with the mechanism thus far described there may be employed cross-slides on the turret, with provisions whereby the said slides may be operated by power from the feed-shaft. Upon the top of the turret 61 may be secured a base-plate 280, having a plurality of guides for the cross-slides or provisions for the employment of other tools. In Fig. 25 only one of the guides is provided with a cross-slide.

The slide in this instance consists of three members 281, 282, and 283, all connected together by a bar 284. Each of the members 281 and 283 is provided with a plurality of sockets for the reception of tools 285 286, so that the tool may be located at various points with relation to the axis of the work. The member 282 of the slide is located substantially midway between two members 281 283 and is provided with a tool 287. The slide is adapted to be operated either by hand or by power. The member 283 is formed with a threaded aperture 288 (see Fig. 30) to receive a screw-bar 289, which is journaled in the base-plate 280. The screw-bar is provided on its end with a pinion 290, intermeshing with an idler 291, located below it, as shown in Figs. 30 and 31. These two gears revolve with the turret and are adapted to be brought into potential relation to a sliding pinion 292, secured to a shaft 293, loosely journaled in a bracket 294, attached to the carriage. The shaft 293 is provided with a hand-wheel 295, by means of which it may be moved longitudinally or rotated, as occasion may require. The pinion 292 is located in a socket or chamber in the bracket and may be adjusted to the position shown in Figs. 30 and 31, where it is out of engagement with the pinion 291 to permit the free rotation of the turret without interference. By drawing the said pinion forward, as indicated in Fig. 30, it may be engaged with the pinion 291. Said pinion 292 intermeshes at all times with a gear 296, which is driven by a train of gearing from a pinion 297, whose shaft 298 is journaled in the apron 209 of the carriage in proximity to the shaft 212, which carries the worm-wheel 211. It has been already stated that the said shaft 212 is eccentrically mounted, the purpose of which is to permit the moving of the pinion 236 laterally either into engagement with the gear 299 of the train for feeding the carriage or into engagement with the pinion 297 for feeding the cross-slide. In Fig. 27 the pinion 236 is in engagement with the gear 299; but it will be readily understood that by rocking the eccentric shaft the said pinion 236 may be disengaged from the said gear 299 and caused to intermesh with the pinion 297. When it is in the last-mentioned position, the pinion 236 will not cause the movement of the carriage, but will effect a movement of the cross-slide through the train of gearing including the pinions 292, 291, and 290.

For rocking the eccentric shaft 212 it is provided on its forwardly-projecting end with an arm or handle 300, having a spring-pressed pin 301, adapted to be inserted in either of two apertures in the apron to hold it in either of the two positions to which it may be moved for effecting the intermeshing of the gear 236 with either the pinion 297 or the gear 299. The pin 301 has a knob or head 302, which may serve as a handle for rocking the arm 300.

Referring now to Fig. 25 in connection with Fig. 29, it will be seen that the cross-slide has a lug 310, through which a shaft 311 loosely passes. This shaft is journaled in a bearing on the base-plate 280 and is provided with a handle 312, by means of which it may be rotated when the shaft is held against longitudinal movement, and it is provided with two collars 314 315, rigidly and adjustably secured thereto, as shown. In each collar there is a plurality of set-screws 316, the ends of which serve as stops to limit the travel of the cross-slide. By rotating the shaft 311 the stops 316 may be brought into proper relation to the lug 310 to engage it and hold it against further movement when it has reached the limit of its travel. The stops on the two collars are arranged in alinement, so that they are in pairs, and each pair may be brought by the rotation of the shaft 311 into position to engage the stud or lug 310. The same action takes place with regard to the disengagement of the worm-wheels from the worm on the feed-shaft when the cross-slide is held against movement as takes place when the carriage itself is stopped.

It is unnecessary to describe in detail more than has been done the operation of the lathe, which is semi-automatic in character. The operator may rotate the work at any one of a large number of speeds and may secure a great variation in the speed at which the carriage is moved toward and from the chuck. All of the parts are under control of levers, handles, or other controllers which are located in front of the machine where they may be conveniently manipulated.

A lathe of this character possesses many features of advantage over those heretofore used, which are apparent to those skilled in the art to which the invention relates.

It should be borne in mind that the phraseology employed in this specification and in the claims hereto appended is for the purpose of description and not of limitation, that various mechanical equivalents may be employed in lieu of the parts which have been illustrated and described, and that various changes may be made in the lathe without departing from the spirit and scope of the invention.

Having thus explained the nature of the said invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, I declare that what I claim is—

1. A lathe having a work-rotating spindle, a bed, a worm rotatively mounted on the bed, and a tool-carrier pivoted on said bed and having a member adapted to be disengaged from and engaged with said worm.

2. A lathe having a work-rotating spindle,

a bed, a worm rotatively mounted on the bed, and a two-armed carrier having a tool on each arm, and having a member on each arm adapted to be selectively engaged with and disengaged from said worm.

3. A lathe having a work-rotating spindle, a bed, a worm journaled on said bed and rotatable in either direction, said worm being arranged transversely of the said spindle, means by which said worm may be rotated in either direction, a two-armed carrier pivoted upon an axis substantially parallel to the axis of the spindle and being normally in an inoperative position with respect to the worm, a tool on each arm of said carrier, and a member on each arm of the carrier adapted to be engaged with the said worm upon a movement of said carrier about its pivot.

4. A lathe having a work-rotating spindle, a bed, a worm rotatively mounted on said bed and having a hand-wheel by which it may be rotated in either direction, a pivot parallel to and above said spindle, and a two-armed carrier fulcrumed on said pivot and having a tool on each arm, said carrier having on its arms members which may be selectively engaged with said worm.

5. In a turret-lathe, a bed, a carriage movable thereon, a turret on the carriage, coacting stops, of which one is turret-controlled, for arresting the carriage, and carriage-moving gearing comprising a driving member and driven member adapted to be connected and disconnected, one of said members being yieldingly mounted, and mechanism controlled by said yielding member for automatically disconnecting said members upon the yielding of the yielding member.

6. In a turret-lathe, a bed, a carriage movable thereon and adapted to be arrested, a turret on the carriage, coacting stops, of which one is turret-controlled, for arresting the carriage, feed mechanism for moving said carriage but adapted to be disconnected from said carriage, and mechanism rendered active by the arrest of the carriage for automatically effecting the disconnection of the feed mechanism from the carriage.

7. In a turret-lathe, a bed, a carriage movable thereon and adapted to be arrested, a turret on the carriage, coacting stops, of which one is turret-controlled, for arresting the carriage, feed-gearing for advancing said carriage, said gearing comprising two separable complemental members, means for holding said members in operative relation, and mechanism rendered active by the arrest of said carriage at any point in its travel for causing said holding means to permit the separation of said members.

8. In a turret-lathe, a bed; a carriage movable thereon and adapted to be arrested at any point in its travel; a turret on said carriage; coacting stops, of which one is turret-controlled, to arrest the carriage; and feed mechanism for advancing said carriage comprising two bodily-separable elements, one driving and the other driven, tension mechanism acting upon said elements to cause the carriage to be fed thereby with a predetermined yielding pressure until arrested by a resistance greater than said pressure, means for holding said elements in operative position, and connections between said holding means and said tension mechanism in consequence of which the arrest of the carriage at any point in its travel and the yielding of the tension mechanism automatically cause said holding means to separate said elements.

9. A turret-lathe having a bed, a carriage movable thereon and carrying a turret, a work-rotating spindle; coacting stops, of which one is turret-controlled, to arrest the carriage; and carriage-feeding mechanism comprising separable members in engagement, a tension device exerting a predetermined yielding pressure upon one of said members, to cause the feeding of the carriage with a predetermined pressure, and means controlled by the yielding movement of one of said members for separating said members.

10. In a turret-lathe, a bed, a turret, a carriage movable on the bed and adapted to be arrested at any point in its travel, coacting stops on the carriage and bed respectively for arresting the carriage; and carriage-moving mechanism comprising a driving member, a driven member, means for holding said members in engagement, and a tension device placed under increased tension by the arrest of the carriage at any point in its travel to cause said holding means to disconnect said members.

11. In a turret-lathe, a bed, a carriage, a turret on said carriage, coacting stops on said bed and carriage respectively, means by which one of the stops is controlled by the turret, and carriage-feeding mechanism comprising a worm-wheel, and worm adapted to be separated, a tension device exerting a yielding pressure against the worm to hold it against longitudinal movement, and means rendered active by the longitudinal movement of said worm to separate the worm and worm-wheel.

12. In a turret-lathe, a bed, a carriage movable on said bed, a turret on the carriage, coacting stops of which one is turret-controlled, for arresting the carriage, and carriage-feeding mechanism comprising a feed-shaft, a worm thereon, a worm-wheel on the carriage, said feed-shaft and said worm being bodily movable to separate said worm from said worm-wheel, means for exerting a yielding pressure against said worm to hold it against longitudinal movement, means for holding said worm and worm-wheel in engagement, and means rendered active by the arrest of the carriage and a longitudinal movement of said worm to cause said holding means to separate said worm from said worm-wheel.

13. In a turret-lathe, the combination of a bed, a turret, a carriage, a feed-shaft having a worm slidingly keyed thereon, a worm-wheel journaled on said carriage, coacting stops of which one is turret-controlled, for arresting the carriage, a yielding worm-box for holding the worm in detachable engagement with the worm-wheel, means for holding the worm-box and worm in an operative position, and provisions whereby the arrest of the carriage and worm-wheel by the engagement of said dog with said fixed stop, and the continued rotation of the worm, will cause said holding means to move said worm-box to detach the worm from the worm-wheel.

14. In a metal-working lathe, the combination of a bed, a tool-carriage, a feed-shaft having a worm slidingly keyed thereon, a worm-wheel journaled on said carriage, coacting stops mounted on the bed and the carriage, respectively, for arresting the carriage, a device for holding the worm in detachable engagement with the worm-wheel, and a yielding latch for said device operatively connected to said worm.

15. In a turret-lathe, the combination of a bed, a carriage, a turret on the carriage, coacting stops, of which one is turret-controlled, for arresting the carriage, a feed-shaft having a worm slidingly keyed thereon, a worm-wheel journaled on said carriage, a support on the carriage for said worm, a latch on said carriage for the support, and a spring connection between said worm and said latch.

16. In a turret-lathe, the combination of a bed, a carriage, a turret on the carriage, coacting stops, of which one is turret-controlled, for arresting the carriage, a worm-box on said carriage, a worm in said box, means for yieldingly resisting the axial movement of the worm, a worm-wheel on the carriage a worm in said-box, means for yieldingly resisting the axial movement of the worm, a worm-wheel on the carriage, a support for the worm-box in consequence of which said worm is held in operative engagement with the worm-wheel, a movable latch connected to said support, and means rendered active by the axial movement of said worm for tripping said latch.

17. In a metal-working machine, the combination of a bed, a stop thereon, a carriage adapted to be arrested by said stop, a transversely-movable feed-shaft, a worm slidingly keyed on said shaft, a worm-box on the carriage in which the shaft is slidingly journaled and which is movable transversely with said shaft, a carriage-feeding worm-wheel, a lever having a crank-arm connected with said box to support it in position to hold the worm in intermeshing relation to the worm-wheel, a spring-tensioned latch for said lever, and a connection between the worm-box and the latch, the longitudinal movement of the worm and worm-box effecting the actuation of the latch to permit the lever to rock with a subsequent transverse movement of the worm-box and the shaft to disconnect the worm from the worm-wheel, substantially as described.

18. In a turret-lathe, the combination of a bed, a carriage, a turret on the carriage, coacting stops, of which one is turret-controlled, for arresting the carriage, carriage-feeding gearing comprising separable toothed intermeshing elements, a spring for holding said elements in operative relation until the carriage meets a predetermined resistance and is arrested thereby, and means in consequence of which the continued rotation of one of said elements effects their separation into unmeshed relation.

19. In a turret-lathe, the combination of a bed, a carriage, a turret on the carriage, coacting stops, of which one is turret-controlled, for arresting the carriage, carriage-feeding gearing comprising separable elements, a support for holding said elements in operative relation, a latch for said support connected to one of said elements, and a spring for holding said latch against release except when the resistance to the feed of the carriage exceeds the tension of said spring.

20. In a turret-lathe, the combination of a bed having one or more fixed stops, a turret, a carriage having one or more unyielding turret-controlled dogs for coaction with said stops to arrest the travel of the carriage, feed mechanism comprising a worm and worm-wheel, latching devices for holding said worm and worm-wheel in intermeshed relation, a spring to resist the end thrust of the worm, and means whereby the yielding of the worm operates the latch.

21. In a turret-lathe, a bed, a movable carriage, a turret on the carriage, coacting stops on the bed and carriage respectively arresting the movement of the carriage at any predetermined points in its travel, a yielding feed mechanism arranged to exert a predetermined feeding pressure against the carriage and including coacting separable elements, and means rendered active by the arrest of said carriage for separating said elements.

22. In a metal-working machine, the combination of a bed, a carriage, and mechanism for reciprocating the carriage comprising oppositely-threaded worms movable in the direction of their axis, a tension device for resisting the axial movement of said worms, a single worm-wheel having its teeth cut to mesh with the threads of each of said worms separately, and mechanism rendered active by the movement of the worms in either direction for disconnecting the intermeshing worm and the worm-wheel.

23. In a metal-working machine, the combination of a bed, a carriage, and mechanism for reciprocating the carriage comprising a shaft rotating in but one direction, oppositely-threaded worms axially movable thereon,

yielding means for resisting the axial movement of the worms in either direction, a worm-wheel adapted to be rotated in either direction by said worms according to the relative position of said worms and worm-wheel, and means rendered active by an axial movement of said worms in either direction to disconnect the intermeshing worm and the worm-wheel, said means including a member connected to said worms and a worm-holding device connected to said member.

24. In a metal-working machine, the combination of a bed, a reciprocatory carriage, fixed stops for arresting the movement of the carriage in either direction, and feed mechanism for moving the carriage in either direction comprising a worm-wheel, a right and left threaded worm, and provisions rendered active by the arrest of the carriage in either direction for effecting the disconnection of said double worm from said worm-wheel.

25. In a metal-working machine, the combination of a bed, a carriage movable thereon, coacting stops on the bed and carriage and arranged to arrest the travel of the carriage in either direction, and carriage-moving mechanism for advancing and withdrawing the carriage until it is arrested by a stop, said carriage-moving mechanism being adapted to be disconnected from the carriage, and having a tension device by which the power is transmitted to the carriage with a yielding pressure, and means rendered active by the arrest of the carriage in either direction and a consequent increase in tension on said tension device to disconnect the feeding mechanism from said carriage.

26. In a metal-working machine, the combination of a bed, a carriage movable thereon, coacting stops on the bed and carriage and arranged to arrest the travel of the carriage in either direction, and carriage-moving mechanism for advancing and withdrawing the carriage until it is arrested by a stop, said carriage-moving mechanism comprising separable rotatable elements, one driving and the other driven, means for holding said elements in engagement to cause the driving element to rotate the driven element, and a tension device placed under increased tension by an arrest of the carriage in either direction to effect a separation of said elements and the rotation of one of said driving elements without a consequent rotation of the driven element.

27. In a metal-working machine, the combination of a bed, a carriage thereon, a carriage-feeding right and left worm, a worm-wheel, a feed-shaft on which said worm is mounted, fixed stops for arresting the travel of the carriage in either direction, and provisions whereby when the carriage is arrested in its movement in either direction by a stop, the continued rotation of the worm effects its separation from the worm-wheel.

28. In a metal-working machine, the combination of a bed, a carriage, a unidirectionally-rotatable feed-shaft having a right and left worm slidingly keyed thereon, a worm-wheel journaled on said carriage and adapted to intermesh with said right and left worm to move the carriage in either direction, fixed stops for limiting the travel of the carriage in both directions, and mechanism comprising a spring and a latch for holding said right and left worm in intermeshed relation to said worm-wheel.

29. In a metal-working machine, the combination of a bed, a carriage, a worm-wheel, a double worm having right and left threads, means for holding the worm and worm-wheel in engagement, a spring for resisting the end thrust of the worm when either of the threads thereon are intermeshed with the worm-wheel, and means rendered active by the yielding of the spring to effect the disengagement of said worms and worm-wheel.

30. In a metal-working machine, the combination of a bed, a carriage, a double worm having right and left threads, a worm-wheel adapted to be rotated in either direction thereby, a movable support for the worm to hold it in engagement with the worm-wheel, a spring for resisting the end thrust of the worm, a rotatory latch for engaging said support and thereby holding the worm and worm-wheel in intermeshed relation, and connections between the worm and the said latch.

31. In a metal-working machine, the combination of a bed, a carriage, a double worm having right and left threads, a worm-wheel adapted to be rotated in either direction thereby, a rotatory latch for holding the worm and worm-wheel in intermeshed relation, connections between the worm and the said latch whereby said latch is rotated in the same direction by the longitudinal movement in either direction of said worm, and a spring for resisting the rotation of said latch.

32. In a metal-working machine, the combination of a bed, a carriage, a movable dog on said carriage, and a reversible stop-bar on said bed adapted to be engaged by said dog whereby said stop-bar may be engaged during either a forward or else a rearward movement of the carriage.

33. In a metal-working machine, the combination of a bed, a carriage, provisions for the reception of a predetermined number of tools, a plurality of stop-bars on said bed for each of one or more of said tools, and an equal number of movable dogs for coacting with said stop-bars, for the purpose described.

34. In a metal-working machine, the combination of a bed, a tool-carriage, a series of stop-bars on the bed, a series of movable dogs on the carriage, and provisions for throwing all or a part of said dogs out of action.

35. In a metal-working machine, the combination of a bed, a carriage, a plurality of stop-

bars on the bed for each of one or more of the tools, a series of movable dogs on the carriage, and provisions by means of which the dogs may be selectively rendered active.

36. In a metal-working machine, the combination of a bed, a carriage, provisions for the reception of a predetermined number of tools, and a plurality of stop-bars for said carriage on said bed double in number to said tools, and movable dogs for coacting with the stop-bars for the purpose described.

37. In a metal-working machine, the combination of a bed, a carriage, a turret, a pair of stop-bars on the bed, a pair of turret-controlled dogs on the carriage for coaction with said stop-bars, and means for rendering either of said dogs inoperative.

38. In a metal-working machine, the combination of a bed, a carriage, a turret, a pair of stop-bars for a single tool on the turret, a pair of dogs for coaction with said stop-bars, and a turret-controlled member for governing the action of both of said dogs.

39. In a metal-working machine, the combination of a bed, a carriage, a turret, a pair of stop-bars for a single tool on the turret, a pair of dogs for coaction with said stop-bars, a turret-controlled member for governing the action of both of said stop-bars, and means for rendering either of said dogs inoperative.

40. In a metal-working machine, the combination of a bed, a carriage, a turret, a pair of stop-bars, a pair of dogs for coaction with said stop-bars, a turret-controlled member for governing the action of both of said stop-bars, and a rock-shaft having means for rendering either of said dogs inoperative.

41. In a metal-working machine, the combination of a bed, a carriage, a turret, a pair of stop-bars, a pair of dogs for coaction with said stop-bars, a turret-controlled member for governing the action of both of said stop-bars, and a sliding rock-shaft having a pin for rendering either of said dogs inoperative.

42. In a metal-working machine, the combination of a bed, a carriage, a turret, a stop-bar, a dog for engaging said stop-bar, and a longitudinally-movable turret-controlled wedge for governing said dog.

43. A turret-lathe comprising a turret having tools, a carriage, a bed, a plurality of stop-bars on the bed for one or more of the tools, an equal number of turret-controlled dogs for said stop-bars, and means for selectively rendering one or all of the dogs inactive with respect to their corresponding stop-bars.

44. In a metal-working machine, the combination of a bed, a carriage, a turret, a cross-slide on said turret, carriage-feeding mechanism, feeding mechanism for said cross-slide, a yielding power-transmitting device, and means for connecting said device with either of said feeding mechanisms.

45. In a metal-working machine, the combination of a bed, a carriage, a turret, a cross-slide on said turret, and feeding mechanism for said cross-slide including gearing journaled on the carriage, gearing journaled on said turret, and a sliding gear for connecting said gearing when the turret is rotated to proper position.

46. In a metal-working machine, the combination of a bed, a carriage, a turret, a cross-slide on said turret, carriage-feeding mechanism, feeding mechanism for said cross-slide, feeding-gearing journaled on the carriage, and provisions including a sliding gear for connecting said gearing with the cross-slide when the turret is rotated to proper position.

47. A lathe comprising a carriage, a feed-shaft, carriage-moving gearing comprising a right and left worm axially movable on said shaft, a worm-wheel journaled on said carriage, a worm-box supported by the carriage, means for moving said worm axially in said box, and a lock adapted to engage the said box and lock said worm in either the right or left position in engagement with the worm-wheel.

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

JAMES HARTNESS.

Witnesses:
J. W. BENNETT,
J. W. WALKER.