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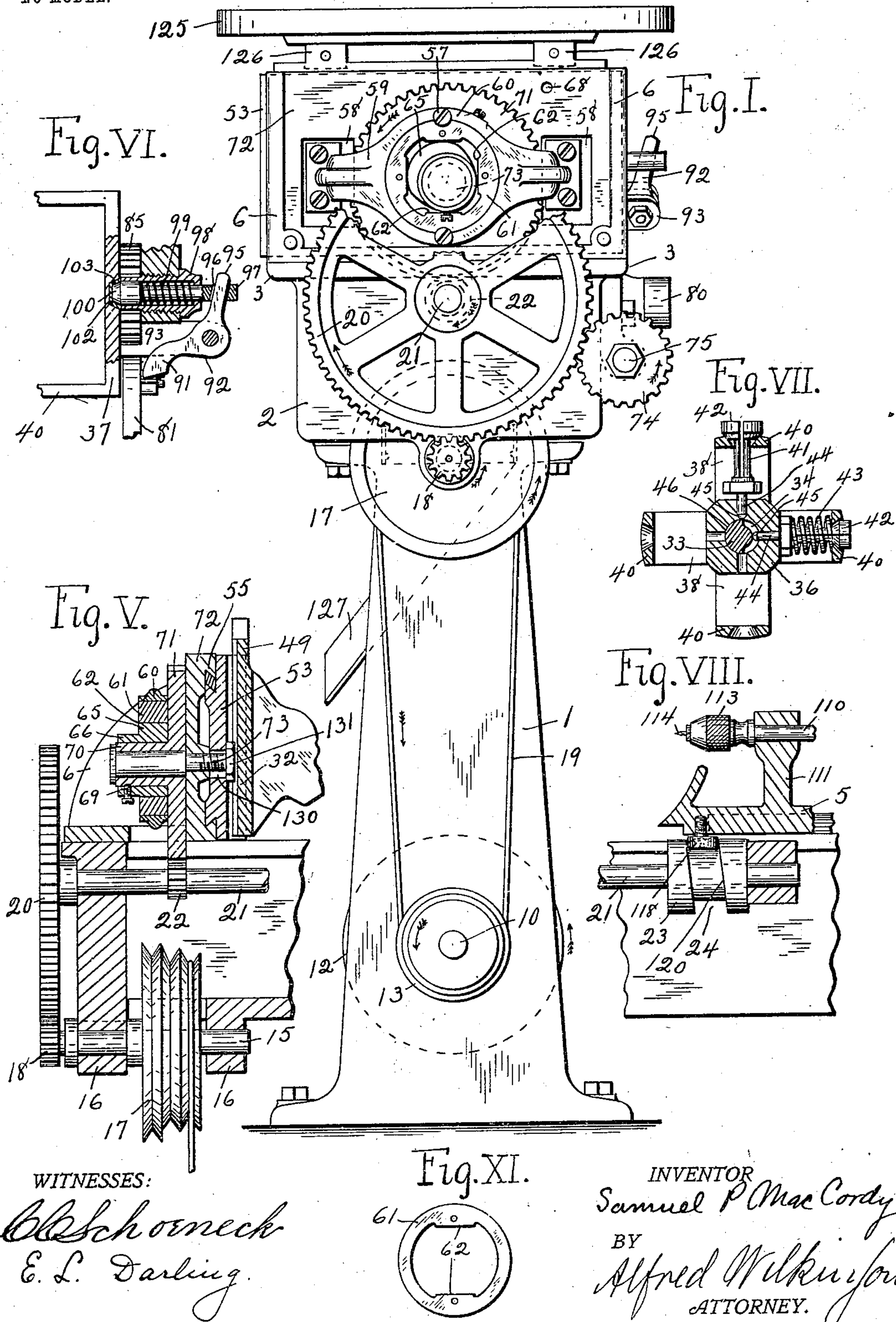
PATENTED APR. 21, 1903.

S. P. MACCORDY.  
BUTTON DRILLING MACHINE.

APPLICATION FILED AUG. 19, 1901.

NO MODEL.

3 SHEETS—SHEET 1.



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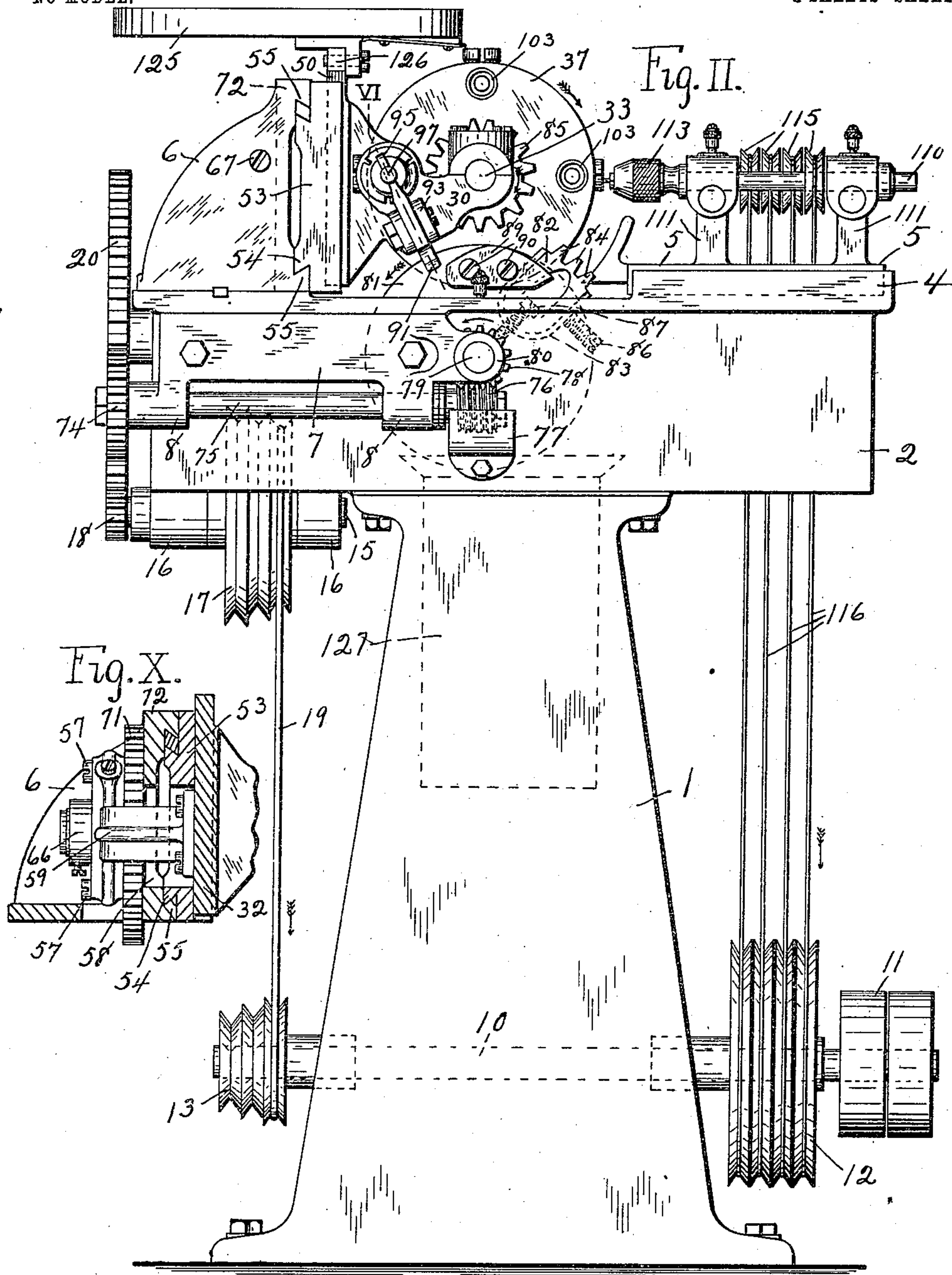
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3 SHEETS—SHEET 2.



WITNESSES:

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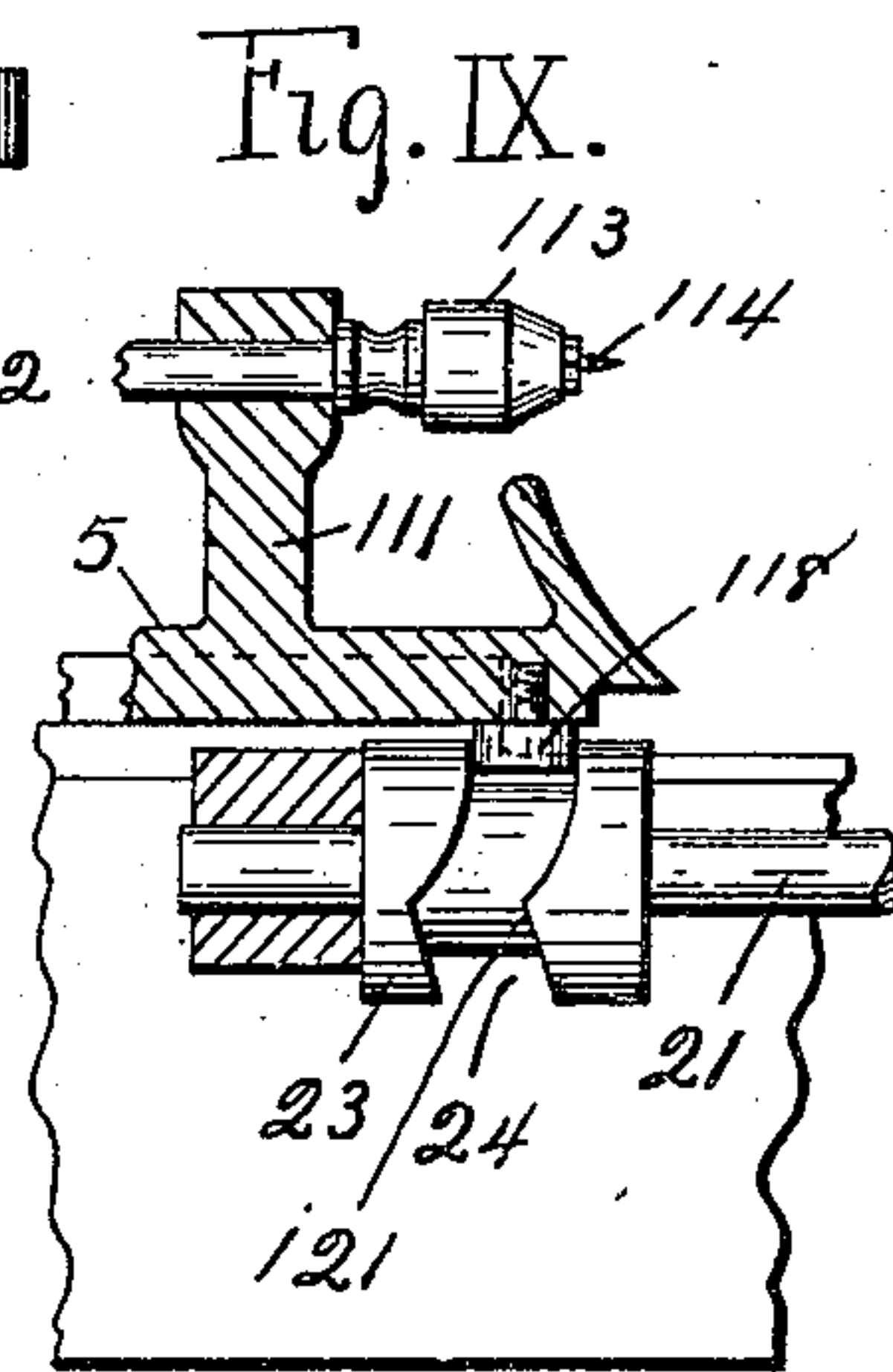
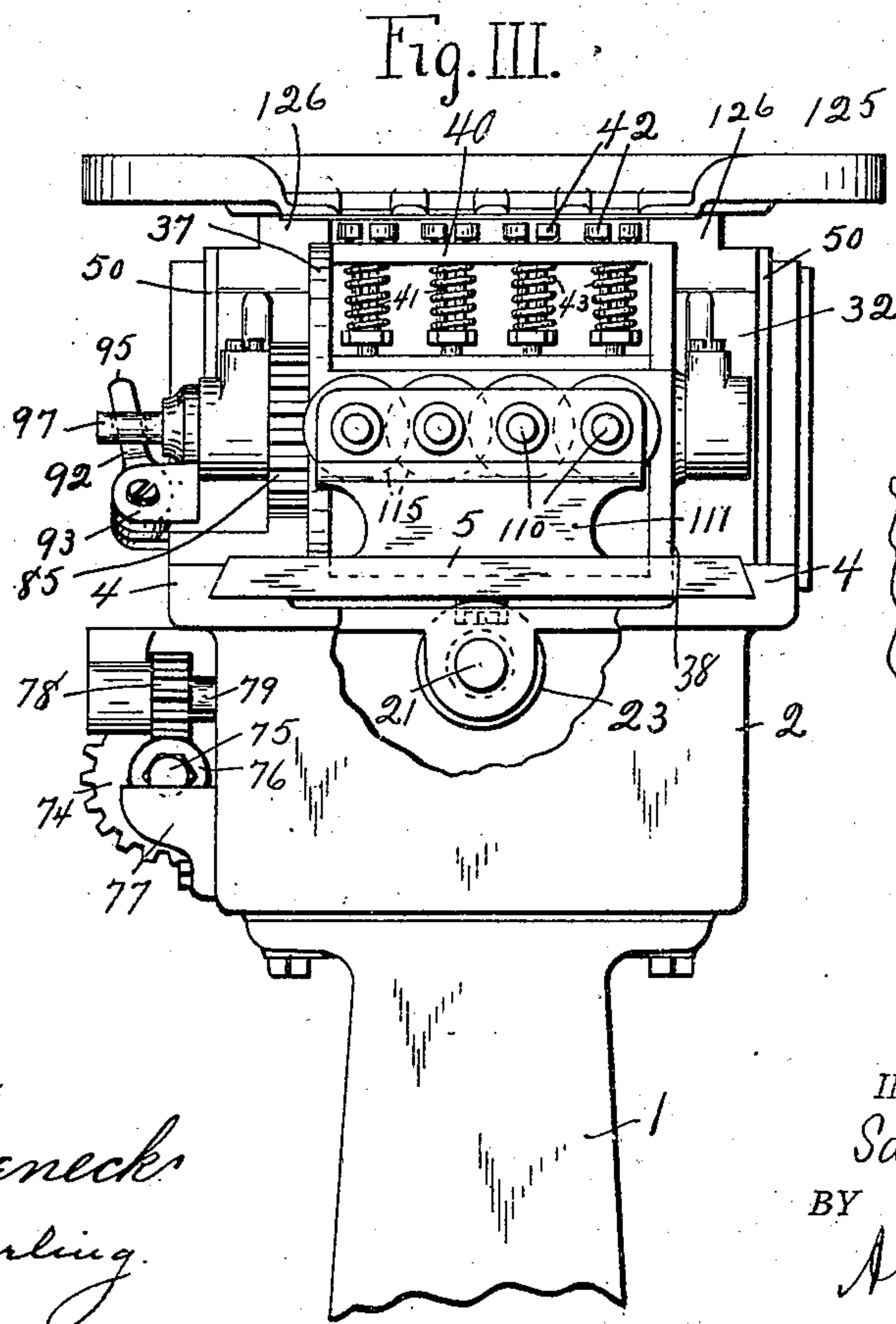
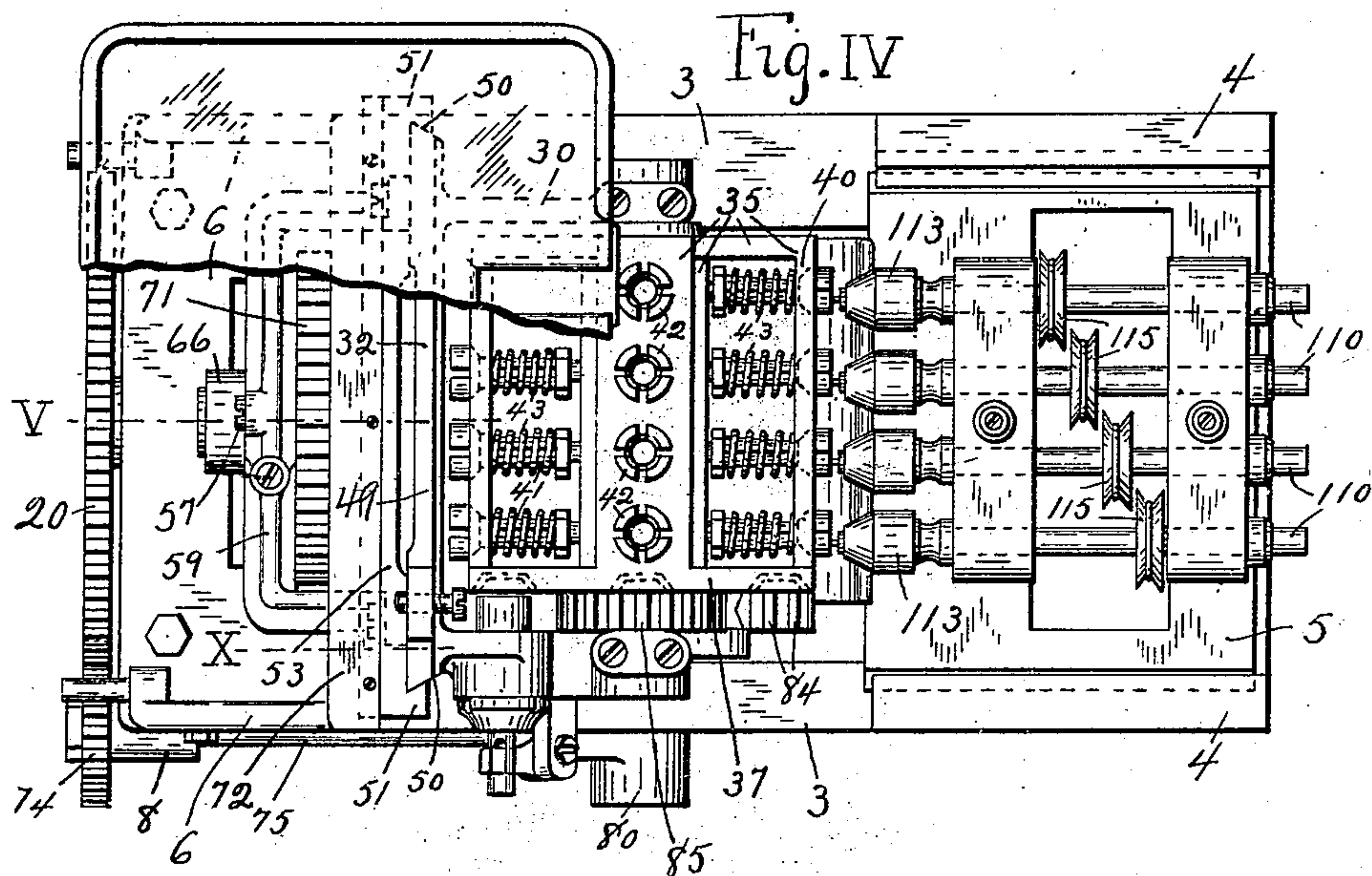
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3 SHEETS—SHEET 3.



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# UNITED STATES PATENT OFFICE.

SAMUEL P. MACCORDY, OF AMSTERDAM, NEW YORK.

## BUTTON-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 725,734, dated April 21, 1903.

Application filed August 19, 1901. Serial No. 72,488. (No model.)

*To all whom it may concern:*

Be it known that I, SAMUEL P. MACCORDY, of Amsterdam, in the county of Montgomery, in the State of New York, have invented new and useful Improvements in Button-Drilling Machines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to button-drilling machines of the type described in my reissued Letters Patent No. 11,879, dated January 1, 1901, in which the button-blanks are carried in expansible spring-chucks arranged in rows on the "drum" or carrier, rotated intermittently step by step. Rotating drills are arranged to reciprocate at right angles to the axis of the carrier to drill the blanks, and means are provided to shift the carrier both vertically and horizontally to shift the blanks into two or more positions to permit the drills to operate in two or more positions and drill the various holes. An automatic locking mechanism locks the carrier in each operative position.

My invention consists in improvements in the various parts of this machine by which its construction is simplified and its operation improved.

My invention will be understood by reference to the three sheets of drawings herewith, in which the reference-numerals of the specification indicate the same parts in all the figures.

Figure I is a front elevation, portions being broken away. Fig. II is a side elevation. Fig. III is a rear elevation with portions broken away. Fig. IV is a top plan with portions broken away. Fig. V is a vertical section on line V of Fig. IV. Fig. VI is a vertical section on line VI of Fig. II. Fig. VII is a cross-section of the carrier. Fig. VIII is a longitudinal section through the drill-bracket, showing the drill and grooved roller in side elevation. Fig. IX is a corresponding view from opposite side, showing form of groove. Fig. X is a cross-section on line X of Fig. IV. Fig. XI shows a contact-ring having two contact-surfaces.

In the figures, 1 indicates suitable legs or a standard on which is supported the base 2, having top flanges 3 and formed with the integral drill-slides 4 for the drill-standard 5.

On top of the base is secured the upper bracket 6, having vertical web 72 for the carrier-slides, and on one side the bracket 7, having suitable bearings 8 for the worm-shaft. In the standard is journaled the counter-shaft 10, carrying the power-pulley 11, the grooved spindle-driving pulley 12, and the cone-pulley 13, from which the chuck-carrier and other parts are operated.

15 is the upper driving-shaft, journaled in ears 16 on the bottom of the base and carrying the grooved cone-pulley 17, connected by belt 19 to pulley 13, and the small pinion 18 on its front end, meshing with the large main gear 20 on the main shaft 21, suitably journaled in the base parallel to the counter-shaft and upper driving-shaft and carrying the intermediate cam-pinion 22 and on its rear end the drill-roller 23, formed with a cam-groove 24 for reciprocating the drill-standard.

*Carrier and carrier-shifting mechanism.*— In the rear ends of arms 30 on the rear face of the rear slide 32 is fixed the carrier-spindle 33, recessed at 34, on which rotates the button chuck-carrier 35, fully described in my prior patent, having the hub 36, one solid head 37, the opposite head in the form of radial arms 38, and the chuck-bars 40, extending between the two heads, in which are arranged chucks 41, having resilient recessed split heads 42, adapted to grip the blanks when the chucks are forced inwardly by springs 43 into the recessed portion of the spindle, but spreading and releasing the blanks when the chucks are forced outwardly against the operation of the spring by the engagement of chuck-pin 44, having hardened-steel tip 45, with the unrecessed portion 46 of the spindle. The rear slide 49, as here shown adapted to move vertically, has beveled edges 50 fitting corresponding flanges 51 on the front slide 53, which is provided with beveled dovetailed flanges 54 on its front face fitting corresponding beveled flanges 55 on the rear face of the web 72 of bracket 6, whereby the rear slide, carrying the carrier, may be moved vertically, and the front slide, carrying the rear slide, horizontally. To the front face of the rear slide, extending forwardly through openings 58 in the front slide and in the web, is secured the yoke 59, carrying the integral ring 60, in which is secured by suitable screw 57 the removable



cam-ring 61, having the four cam contact-surfaces 62, with which engages the cam 65 as it is rotated to shift the carrier and the blanks into the four positions to permit the drilling of the four holes. As here shown in the various views, the cam has moved the carrier into the upper left-hand position and the lower right-hand hole in each blank is being drilled.

- 10 In Fig. X is shown a cam-ring formed with two contact-surfaces which may be substituted for the cam-ring with four contact-surfaces (shown in position in Fig. I) when it is desired to drill blanks with two holes only.
- 15 The cam-ring of Fig. X therefore engages with the cam only on two surfaces and shifts it into two positions—for instance, up and down—instead of into four, as where four holes are to be drilled. When drilling two
- 20 holes only, the front slide must be locked to its bracket by plug-screw 67, carried in a convenient position and adapted to fit plug-screw hole 68. By means of my arrangement of cam-ring provided with contact-surfaces engaging with the carrier-shifting cam I obtain
- 25 a universal movement by which the drum may be shifted into any even or uneven number of positions—such as three, five, or seven—in case it is desired to drill a blank with so
- 30 many holes or operated on any other article in so many positions by the use of the cam-ring with a corresponding number of contact-surfaces—three, five, or seven.

The cam 65 has the integral collar or hub 66, provided with set-screws 69 to secure it on the cam-gear hub 70 of the large cam-gear 71, suitably journaled on cam-shaft 73 in web 72 of the bracket 6 and meshing with the cam-pinion 22, by which it is operated. Cam-shaft may extend through slot 130 in front slide and is secured in position by nut 131 or in other suitable way. Also larger or smaller contact rings and cams may be substituted to give greater or less shift to slides and carrier

45 for the drilling of larger or smaller buttons.

*Carrier-rotating mechanism.*—To rotate in succession into operative position the successive rows of chucks carrying the blanks to be drilled each with two or more holes, the carrier is rotated step by step by the engagement of the large main gear 20 with the small worm-shaft or disk pinion 74 on the front end of the worm-shaft or disk shaft 75, journaled in bearings 8 on bracket 7, carrying the worm 76 on its rear end, dipping in oil-cup 77, bolted to the side of the base and meshing with disk gear 78 on disk-gear shaft 79, arranged at right angles to worm-shaft and suitably journaled in journal-bearing 80 on the side bracket

50 7 and base and carrying the disk or segmental gear 81, having slot 83, in which is arranged the toothed section 82, (having the teeth 84, meshing at each rotation with carrier-gear 85, secured to one of the carrier-heads,) secured in position in the disk by set-screws 86 and radially adjustable by screw 87.

*Carrier-locking mechanism.*—On the outer

face of the disk 81, just in advance of the toothed section 82, is secured the unlocking-cam 89 by screws 90. As the disk rotates this cam engages with the inner and lower arm 91 of the bell-crank lever 92, journaled in ear 93 on the arm 30, whose upper and outer end 95 fits in slot 96 in the outer end of the locking bolt or latch 97, fitted to the threaded bushing 98 and forced inwardly by spring 99, so that its inner end 100 bears on the outer face of carrier solid head 37 and engages with sockets 102 in said face, to which are fitted hardened-steel bushings 103, locking the carrier against accidental rotation from the positions in which the chucks are brought opposite the drills to offer the blanks to be drilled. Threaded bushing-carrying bolt may be withdrawn easily. By the arrangement of the cam 89 just in advance of the teeth on the section the bolt is drawn from engagement with the successive sockets, permitting the next row of chucks to be turned down and rearwardly into operative position.

*Drills.*—The drill-spindles 110 110 are journaled in arms 111 111, carrying the drill-chucks 113 and the drills 114 114, and are rotated by their pulleys 115 115, one on each drill-spindle, through belts 116 116 from pulleys 12 on counter-shaft 10.

The drill-standard 5 is reciprocated, carrying the drills by engagement of antifriction-roller 118 on pin or screw on the bottom of the standard near its front end, engaging with the cam-groove 24 in roller 23 on main shaft 21. This groove has a gradually-inclined portion 120 and an abruptly-inclined retracting portion 121, whereby the drills are moved up gradually and steadily while drilling, but moved back when the drilling has been completed, as best shown in Figs. VIII and IX.

125 is table for blanks supported on ears 126 on rear slide, and 127 chute for drilled blanks.

*Operation:* To explain the operation, I refer to the size and arrangement of parts as here shown, which may be varied as desired to suit different sizes and classes of work. By the arrangement of a small pinion on the upper driving-shaft engaging with the large main gear the high speed of the power-pulley and cone-pulley is reduced, giving slow steady work with power. The proportion of this large main gear to the disk gear is four to one, so that the toothed section comes into operation and the chuck-carrier is rotated one space—that is, one-quarter of the complete rotation at every four rotations of the main gear. There are the same relation and the same proportion between the main gear and the cam-pinion, so that while the main gear rotates four times the cam-pinion rotates once, rotating the cam one full revolution to engage with the four contact-surfaces in the cam-ring, and thus to shift the chuck-carrier horizontally and vertically into the



four positions to permit the drilling of the four holes by the drills. The grooved roller being on the main shaft rotates with the main gear, and therefore reciprocates the drill-standard four times while the cam is being rotated once. The parts being so proportioned are timed so that at each shift of the carrier the drills reciprocate to drill one of the holes, and after the cam has been shifted four times and the four holes have been drilled the toothed section comes into operation to rotate the chuck-carrier one-quarter turn, turning the next row of chucks and blanks to be operated upon. The unlocking-cam being arranged immediately in front of the toothed section, the bell-crank lever is locked, withdrawing the latch from engagement with the chuck-carrier head, permitting this rotation of one-quarter turn. Arrows indicate direction of rotation of parts.

The advantages of the machine here described are in its general construction, simplicity, and arrangement of shafts, gears, and other operative parts. In the shifting mechanism the contact ring is made removable to be renewed when worn or for the substitution of another ring of different size or with a different number of contact-surfaces for drilling more or less holes. By the arrangement of the cam and contact ring in front of the web on the upper bracket they may be removed and replaced conveniently without disturbing the carrier. The rotating and locking mechanism for the carrier is simple and positive in operation, practically indestructible, and the parts that may be worn—such as the toothed section 82, the unlocking-cam 89, the locking-bolt 97, and the steel bushings 103, arranged in the sockets 102—may be easily replaced, if worn.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles supported thereon, of a suitable bracket on the base, a slide fitted to flanges on the bracket, a rotating carrier carrying rows of expansible chucks supported on the rear face of the slide, a yoke extending forwardly from the slide, a contact-ring with interior contact-surfaces supported on said yoke, a suitably-journaled cam arranged to rotate within the contact-ring and to bear on the contact-surfaces in succession, means to rotate said cam, means to rotate the drum intermittingly, means automatically to lock the drum against rotation during the drilling operation, and means to unlock the drum permitting it to turn after the drilling operation has been completed.

2. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles supported thereon, of a bracket secured on the upper surface of the base having a vertical web extending across the base, a slide fitted to flanges on the web

and adapted to be reciprocated therein, rearwardly-extending arms on the slide, a rotating chuck-carrier carrying rows of expansible, blank-holding chucks, carried on the ends of said arms, a yoke forwardly extending from the slide through openings in the web, a detachable contact-ring with interior, opposite, contact-surfaces arranged on the forward end of the yoke, a cam journaled on the web and arranged to rotate within the contact-ring making contact in succession with the contact-surfaces to reciprocate the slide and shift the carrier, means to rotate the cam, means to rotate the drum intermittingly, means automatically to lock the drum during the drilling operation and to unlock it after the drilling operation has been completed.

3. In a button-drilling machine, the combination with a suitable base, of a main shaft journaled thereon, means for rotating the shaft, a reciprocating drill-standard suitably supported on the base, rotary drill-spindles carried on said standard, a roller formed with a cam-groove on the main shaft and engaging with an antifriction-roller on the drill-standard to reciprocate the standard, an intermediate cam-pinion on the main shaft, a suitable bracket on the base, a slide fitted to flanges on said bracket, a rotating carrier carrying rows of expansible chucks carried on the rear face of the slide, a yoke extending forwardly from the slide, a detachable contact-ring with interior contact-surfaces supported on the yoke, a suitably-journaled cam arranged to rotate within said ring and bear on the contact-surfaces in succession, a cam-gear connected to the cam and meshing with the cam-pinion, and means to rotate the drum intermittingly.

4. In a button-drilling machine, the combination with a suitable base, of a counter-shaft and upper driving-shaft suitably journaled thereon, connections between said shafts, a pinion on the upper driving-shaft, a main shaft, a main gear on the main shaft meshing with the pinion, a reciprocating drill-standard suitably supported on the base, rotary drill-spindles carried on the standard, a roller formed with a cam-groove on the main shaft and engaging with an antifriction-roller on the drill-standard to reciprocate the standard, an intermediate cam-pinion on the main shaft, a suitable bracket on the base having a vertical web, a slide fitted to flanges on said bracket, a rotating carrier carrying rows of expansible chucks, carried on the rear face of the slide, a yoke extending forwardly from the slide through openings in the vertical web of the bracket, a detachable contact-ring with interior contact-surfaces supported on said yoke, a suitably-journaled cam arranged to rotate within the ring and bear on the successive contact-surfaces, means to rotate the cam, means to rotate the drum intermittingly step by step, means automatically to lock the drum against rotation during the drilling operation, and means automatically to unlock



the drum permitting its rotation another step after each drilling operation has been completed.

5. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles thereon, of a bracket secured on the upper surface of the base having a vertical web extending across the base; a main shaft journaled on the base, means to rotate the shaft, an intermediate cam-pinion on the shaft, a roller formed with a cam-groove on the rear end of the shaft to reciprocate the drill-spindles; front and rear slides fitted to slide and be reciprocated, one on the vertical web and the other on the first at right angles thereto, rearwardly-extending arms on the rear slide, a fixed recessed spindle arranged in the ends of said arms, a rotating chuck-carrier carrying rows of expansible chucks arranged to rotate on said spindle, means to rotate said carrier intermittingly; means to lock said carrier against rotation and automatically to unlock it permitting said rotation; a yoke secured on the rear slide and extending forwardly therefrom through openings in the forward slide and in the vertical web, an integral ring on the yoke, a removable contact-ring fitting within said integral ring and having opposite cam contact-surfaces on its interior periphery, suitable screws to secure the contact-ring in position, a cam-stud extending forwardly from the web, a cam suitably journaled on the web and arranged to rotate within said contact-ring to bear in succession on the contact-surfaces thereby shifting the slides and the carrier, and a cam-gear on the cam meshing with the cam-pinion.

6. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles thereon, of a bracket secured on the upper surface of the base having a vertical web extending across the base; a counter-shaft on the base, an upper driving-shaft arranged parallel to the counter-shaft, operative connections between the drill-spindles and the upper driving-shaft, a pinion on the forward end of the upper driving-shaft; a main shaft arranged above the upper driving-shaft and parallel thereto, a gear on the forward end of the main shaft meshing with the pinion, an intermediate cam-pinion on the main shaft, a roller formed with a cam-groove on the rear end of the main shaft to reciprocate the drill-spindles; front and rear slides fitted to be reciprocated, one on the vertical web and the other on the first at right angles thereto; rearwardly-extending arms on the rear slide, a fixed recessed spindle arranged in the ends of said arms, a rotating chuck-carrier carrying rows of expansible chucks arranged to rotate on the recessed spindle, means to rotate the carrier intermittingly; means to lock the carrier against rotation and automatically to unlock it permitting rotation; of a yoke secured on the rear slide and extending forwardly therefrom through openings in the front slide and the

vertical web, of an integral ring on the yoke, of a removable contact-ring fitting within the integral ring and having opposite contact-surfaces on its interior periphery; a cam suitably journaled on the web and arranged to rotate within the contact-ring to bear in succession on the contact-surfaces thereby shifting the slides and the carrier, and a cam-gear connected to the cam and meshing with the cam-pinion.

7. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles thereon, of a bracket secured on the upper surface of the base at the opposite end of the drill-spindles and having a vertical web extending across the base, a counter-shaft on the base, an upper driving-shaft arranged parallel to the counter-shaft, connections between the drill-spindles and the counter-shaft, connections between the counter-shaft and the upper driving-shaft, a pinion on the forward end of the upper driving-shaft; a main shaft arranged above the upper driving-shaft and parallel thereto, a gear on the forward end of the main shaft meshing with the pinion, an intermediate cam-pinion on the main shaft, a roller formed with a cam-groove on the rear end of the main shaft to reciprocate the drill-spindles; two slides, the front slide having beveled edges fitting beveled flanges on the rear face of the vertical web and the rear slide having beveled edges fitting beveled flanges on the rear face of the front slide and arranged at right angles to the flanges on the web; rearwardly-extending arms on said rear slide, a fixed recessed spindle arranged in the ends of said arms, a rotating chuck-carrier carrying rows of expansible chucks arranged to rotate on said fixed spindle, means to rotate said carrier intermittingly; means to lock said carrier against rotation and automatically to unlock it permitting rotation; a yoke secured on the rear slide and extending forwardly therefrom through openings in the forward slide and in the vertical web, an integral ring on front of said yoke, a removable contact-ring fitting within said integral ring and having opposite contact-surfaces on its interior periphery; suitable screws to secure the contact-ring in position, a cam-stud extending forwardly from said web, of a cam having an integral hub journaled on the stud and arranged to rotate within the contact-ring to bear in succession on the contact-surfaces, thereby shifting the slides or sliding guides and the carrier, and a cam-gear on the cam-hub meshing with the cam-pinion.

8. In a button-drilling machine, the combination with a suitable base, of rotary, reciprocating drill-spindles thereon, an intermittingly-rotating chuck-carrier carrying rows of expansible blank-holding chucks; means to shift the carrier vertically and horizontally, to shift the blanks for the drilling of the various holes by the drills; a gear on the carrier, a mutilated gear suitably journaled and



engaging therewith, and means to rotate said mutilated gear to turn the carrier intermittently, moving one row of chucks out of position and the succeeding row into position opposed to the drills, said mutilated gear being arranged to rotate the carrier one step while the drills are out of operation and after the various holes have been drilled in the blanks carried in the preceding row of chucks.

9. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles arranged thereon, of a rotating carrier carrying parallel rows of expansible, blank-holding chucks, said rows being arranged parallel to the carrier-axis; means to shift the carrier vertically and horizontally; a carrier-gear on one end of the carrier, a disk suitably journaled and having a radial slot, an adjustable toothed section arranged in the slot and adapted to engage with the carrier-gear at each rotation, and means for rotating said disk to turn the carrier one space, turning one row of chucks out of operative position and the next row of chucks into operative position.

10. In a button-drilling machine, the combination with a suitable base, of rotary, reciprocating drill-spindles thereon, a main shaft suitably journaled in the base having a large main gear on its forward end, a rotating carrier carrying rows of expansible, blank-holding chucks, means to shift said carrier vertically and horizontally, a bracket secured on one side of the base near the top and on one of its side flanges; a worm-shaft or disk-shaft journaled in suitable bearings on the bracket, a small disk-shaft pinion on the disk-shaft meshing with the large main gear, a gear on the rear end of said disk-shaft; of a disk-gear shaft suitably journaled and having a disk-gear on its outer end engaging with the rear disk-shaft gear and a disk formed with a radial slot on its inner end; a carrier-gear arranged on the end of the carrier adjacent to said disk and in the same plane therewith, an adjustable toothed section arranged in said slot and arranged to mesh with the carrier-gear at each rotation; means for locking said carrier against rotation, and means for automatically unlocking it permitting it to rotate.

11. In a button-drilling machine, the combination with a flanged base, of rotary, reciprocating drill-spindles thereon, a main shaft suitably journaled in the base having a large main gear on its forward end, a rotating carrier carrying rows of blank-holding chucks, means to shift the carrier vertically and horizontally; a bracket secured on one side of the base near the top and under one of its side flanges, a worm-shaft journaled in suitable bearings on the bracket parallel to the main shaft, a small worm-shaft pinion on the front end of the worm-shaft meshing with the large main gear, a worm on the rear end of said worm-shaft, an oil-cup arranged beneath the worm, a worm-gear shaft journaled in the

bracket and the base, and having a worm-gear on its outer end engaging with the worm and a disk formed with a radial slot on its inner end; of a carrier-gear arranged on the end of the carrier adjacent to said disk and in the same plane therewith, of a radially-adjustable toothed section arranged in the slot, an adjusting-screw for the section, binding-screws fixing the section in position, the section being arranged to engage with the carrier-gear at each rotation; means for locking said carrier against rotation, and means for automatically unlocking the carrier permitting it to rotate.

12. In a button-drilling machine, the combination with a suitable supporting-base and rotary, reciprocating drill-spindles thereon, of a rotary carrier carrying rows of expansible chucks and arranged to rotate at right angles to the reciprocating movement of the drill-spindles; means to shift the carrier vertically and horizontally; means to rotate the carrier intermittently, the carrier being provided with one solid head formed with sockets, a disk rotating parallel to the carrier, an unlocking-cam on the disk, a latch, a spring forcing the latch against the carrier-head to engage in said sockets and prevent rotation of the carrier, and a bell-crank lever engaging with said latch and operated by the cam at each rotation of the disk to withdraw the latch and unlock the carrier.

13. In a button-drilling machine, the combination with a suitable supporting-base, and rotary, reciprocating drill-spindles carried thereon, of a rotary carrier carrying rows of expansible chucks and arranged to rotate at right angles to the reciprocating movement of the drill-spindles; means to shift the carrier vertically and horizontally; means to rotate the carrier intermittently; a solid head on the carrier having sockets formed on its outer face, a threaded bushing arranged in one of the carrier-supporting arms, a locking-bolt arranged in the bushing, a spring also arranged in the bushing forcing the latch or bolt inwardly against the solid face of the carrier to engage with the sockets as the carrier is turned; a bell-crank lever pivotedly supported in ears on the outer face of said arm and having an inner end, and an upper end engaging with a slot in the outer end of the bolt, of a rotating disk and a cam on the disk to engage with the inner end of the bell-crank lever to withdraw the bolt.

14. In a button-drilling machine, the combination with a suitable supporting-base, and rotary, reciprocating drill-spindles carried thereon, of a rotary carrier carrying rows of expansible chucks and arranged to rotate at right angles to the reciprocating movement of the drill-spindles; means to shift the carrier vertically and horizontally; a solid head on the carrier having sockets formed on its outer face, hardened-steel bushings fitted to the sockets, a threaded bushing arranged in one of the carrier-supporting arms, a bolt ar-



ranged in the threaded bushing, a spring also arranged in the threaded bushing forcing the bolt inwardly against the solid face of the carrier to engage with the sockets as the carrier is turned; a bell-crank lever pivotally supported in ears on the outer face of said arm, having an inner end, and an outer end engaging with a slot in the outer end of the bolt; a main shaft, a large main gear on the forward end of the main shaft; a bracket bolted on one side of the base, a worm-shaft journaled in the bracket parallel to the main shaft, a small worm-pinion on the forward end of the worm-shaft meshing with the main gear, a worm on the rear end of the worm-shaft, a disk-shaft journaled in the base and the bracket at right angles to the worm, a toothed disk by which the carrier is rotated on the disk-shaft, a disk-gear on the disk-shaft meshing with the worm, and a cam on the outer surface of said disk to engage with the inner and lower arm of the bell-crank lever to force outwardly the bolt, unlocking the rotating carrier.

15. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles thereon, of an upper bracket secured on the upper surface of the base having a vertical web extending across the base, a slide fitted to flanges on said web and adapted to be reciprocated therein, rearwardly-extending arms on said slide, a rotating chuck-carrier carrying rows of blank-holding chucks on the rearward ends of said arms, a yoke forwardly extending from said slide through openings in the web, a detachable contact-ring with interior contact-surfaces arranged on the forward end of said yoke, a cam journaled in the web and arranged to rotate within said contact-ring, bearing alternately on the alternate contact-surfaces to reciprocate the slide and shift the carrier, means to rotate the cam; a carrier-gear on one end of the carrier, a disk suitably journaled and having a radial slot, a toothed section arranged in said slot and adapted to engage with the carrier-gear at each rotation, means for rotating said disk to turn the carrier one space, turning one row of chucks out of operative position and the next row of chucks into operative position, and means automatically to lock the drum during the drilling operation and to unlock it after the drilling operation has been completed.

16. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles thereon, of a suitable bracket on the base having a vertical web, a slide fitted to flanges on said web, a rotating carrier carrying rows of expansible chucks supported on the rear face of said slide, a yoke extending forwardly from said slide through openings in the vertical web of the bracket, a detachable ring with interior contact-surfaces supported on said yoke, a suitably-journaled cam arranged to rotate within said ring and bear on the succes-

sive contact-surfaces, means to rotate said cam, a side bracket secured on one side of the base near the top; a worm-shaft journaled in suitable bearings in the side bracket, parallel to the main shaft, a small worm-shaft pinion on the front end of the worm-shaft, a worm on the rear end of said worm-shaft, means to rotate the worm-shaft, a worm-gear shaft journaled in the bracket and in the base and having a worm-gear on its outer end engaging with said worm and a disk formed with a radial slot on its inner end; a carrier-gear arranged on the end of the carrier adjacent to said disk and in the same plane therewith, a radially-adjustable toothed section arranged in the slot, an adjusting-screw, binding-screws holding the section in position, the section being arranged to engage with the carrier-gear at each rotation; means for locking said carrier against rotation, and means for automatically unlocking it permitting rotation.

17. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating drill-spindles thereon, of a suitable bracket on the base, a slide fitted to flanges on the bracket, a rotating carrier carrying rows of expansible chucks supported on the rear face of said slide, a yoke extending forwardly from said slide, a detachable ring with interior contact-surfaces supported on said yoke, a suitably-journaled cam arranged to rotate within said ring and bear on the successive contact-surfaces, means to rotate said cam, a carrier-gear on one end of the carrier, a disk suitably journaled and having a radial slot, a toothed section arranged in said slot and adapted to engage with the carrier-gear at each rotation, means for rotating said disk to turn the carrier one space, turning one row of chucks out of operative position and the next row of chucks into operative position, means automatically to lock the drum against rotation during the drilling operation, and means to unlock the drum permitting its rotation another step after each drilling operation has been completed.

18. In a button-drilling machine, the combination with a suitable base, of a counter-shaft and upper driving-shaft suitably journaled thereon, connections between said shafts, a pinion on the upper driving-shaft, a main shaft, a large main gear on the main shaft meshing with said pinion, a reciprocating drill-standard suitably supported on the base, rotary drill-spindles carried on said standard, a roller formed with a cam-groove on the main shaft and engaging with an anti-friction-roller on the drill-standard to reciprocate the standard, an intermediate cam-pinion on the main shaft, a suitable bracket having a vertical web on the base, a slide fitted to flanges on said web, a rotating carrier carrying rows of expansible chucks on the rear face of the slide, a yoke extending forwardly from the slide through openings in



the vertical web of the bracket, a detachable contact-ring with interior contact-surfaces supported on said yoke, a suitably-journale  
cam to rotate within said contact-ring and  
5 bear on the successive contact-surfaces, means to rotate the cam; a side bracket secured on one side of the base near the top, a worm-shaft journaled in suitable bearings in the side bracket, parallel to the main shaft, a small  
10 worm-shaft pinion on the front end of the main shaft meshing with the main gear, a worm on the rear end of the worm-shaft; a worm-gear shaft journaled in the side bracket and in the base and having a worm-gear on its  
15 outer end engaging with the worm and a disk formed with a radial slot on its inner end; of a carrier-gear arranged on the end of the carrier adjacent to the disk and in the same plane therewith, of a radially-adjustable toothed  
20 section arranged in said slot, an adjusting-screw for the section, binding-screws fixing the section in position, the section being arranged to engage with the carrier-gear at each rotation; a carrier-head formed with sockets,  
25 a bolt arranged adjacent thereto, a spring to force the bolt against the head, a bell-crank lever engaging with the bolt, and an unlocking-cam arranged on the disk in advance of the toothed section to engage and rock the  
30 bell-crank lever to withdraw the bolt.

19. In a button-drilling machine, the combination with a suitable base and rotary, reciprocating, drill-spindles supported thereon, of means to shift consisting of a suitable  
35 bracket on the base, a slide fitted to flanges on the bracket, a rotating carrier carrying rows of expansible chucks supported on the rear face of the slide, a yoke extending forwardly from the slide, a contact-ring with interior contact-surfaces supported on said  
40 yoke, a suitably-journale cam arranged to rotate within the contact-ring and to bear on the contact-surfaces in succession, and means to rotate said cam.

20. In a button-drilling machine, with a suitable base and rotary, reciprocating drill-spindles supported thereon, and means to shift the blanks to be drilled having in combination a bracket secured on the upper surface  
50 of the base having a vertical web extending across the base, a slide fitted to flanges on the web and adapted to be reciprocated therein, rearwardly-extending arms on the slide, a rotating chuck-carrier carrying rows of expansible blank-holding chucks carried in the ends  
55 of said arms, a yoke forwardly extending from the slide through openings in the web, a detachable contact-ring with interior opposite contact-surfaces arranged on the forward end of the yoke, a cam journaled on the web and arranged to rotate within the contact-ring making contact in succession with the contact-surfaces to reciprocate the slide and shift the carrier, and means to rotate the cam.

21. In a button-drilling machine, a suitable base, rotary, reciprocating drill-spindles thereon, an intermittingly-rotating chuck-car-

rier carrying rows of expansible blank-holding chucks, and means to rotate the carrier step by step having in combination a gear on  
70 the carrier, a mutilated gear suitably journaled and engaging therewith, and means to rotate said mutilated gear to turn the carrier intermittingly, moving one row of chucks out of position and the succeeding row into position  
75 opposed to the drills, said mutilated gear being arranged to rotate the carrier one step while the drills are out of operation and after the various holes have been drilled in the blanks carried in the preceding row of chucks.  
80

22. In a button-drilling machine, a flanged base, rotary, reciprocating drill-spindles thereon, a main shaft suitably journaled in the base having a large main gear on its forward end, a rotating carrier carrying rows of blank-holding  
85 chucks, and means to rotate the carrier step by step having in combination a bracket secured on one side of the base near the top and under one of its side flanges, a worm-shaft journaled in suitable bearings on the  
90 bracket parallel to the main shaft, a small worm-shaft pinion on the front end of the worm-shaft meshing with the large main gear, a worm on the rear end of said worm-shaft, an oil-cup arranged beneath the worm, a  
95 worm-gear shaft journaled in the bracket and the base, and having a worm-gear on its outer end engaging with the worm and a disk formed with a radial slot on its inner end; of a carrier-gear arranged on the end of the carrier adjacent to said disk and in the same plane therewith, a radially-adjustable toothed  
100 section arranged in the slot, an adjusting-screw for the section, and binding-screws fixing the section in position, the section being  
105 arranged to engage with the carrier-gear at each rotation.

23. In a button-drilling machine, the combination with a suitable base, a counter-shaft journaled thereon, an upper driving-shaft  
110 also journaled on the base, connections between said shafts, a drill-standard fitted to reciprocate longitudinally on the base, rotary drills carried on said standard, and connections to rotate said drills from the counter-shaft, of a main shaft journaled in the base  
115 parallel to the upper driving-shaft, a small pinion on the upper driving-shaft and a large gear on the main shaft engaging with the pinion, a small intermediate cam-gear on the  
120 main shaft whereby the cam is rotated to shift the carrier, a roller on the rear end of the main shaft having a cam-groove to engage with the drill-standard to reciprocate said standard, of two vertical slides carried  
125 on the base, a rotating carrier provided with rows of parallel blank-carrying chucks, arms extending rearwardly from the rear slide and supporting the rotating carrier, a yoke extending forward from slides, a contact-ring  
130 on the yoke having four interior contact-surfaces, a cam arranged within said contact cam-ring and rotated from said intermediate cam-gear to bear on each of said contact-



faces in succession, whereby the carrier is shifted; intermediate gears and shafts to rotate the carrier intermittingly from the main gear; means automatically to lock and unlock the carrier, said means being operated from the main gear through said intermediate gears and shafts, the gears being guarded and arranged to shift the carrier into four positions and to reciprocate the drills four times to operate in each of said positions to drill four holes in each blank while the carrier is locked, and then automatically to unlock the carrier and rotate it to bring the next row of blanks in position to be drilled before the next operation of the shifting and drilling mechanism.

24. In a button-drilling machine, the combination with a suitable base, a counter-shaft journaled therein, an upper driving-shaft also journaled on the base, connections between said shafts, a drill-standard fitted to reciprocate longitudinally on the base, rotary drills carried on the standard, and belts to rotate the drills from the counter-shaft, of a main shaft journaled in the base parallel to the upper driving-shaft, a small pinion on the upper driving-shaft and a large gear on the main shaft engaging with the pinion, a small intermediate cam-gear on the upper driving-shaft whereby the cam is rotated to shift the carrier, a roller on the rear end of the main shaft having a cam-groove to engage with an antifriction-roller on the bottom of the drill-standard to reciprocate said standard, said cam-groove being formed with one gradually-inclined portion to move the drill-standard

forward gradually, and with one abruptly-inclined portion to move the drill-standard back quickly; of two vertical slides carried on the base, a rotating carrier provided with four rows of parallel blank-carrying chucks, the rows being arranged parallel to the carrier-axis; arms extending rearwardly from the rearward slide and supporting the rotating carrier, a yoke extending forward from the rear one of said slides, a contact-ring supported on said yoke having four interior contact-faces, a cam arranged within said cam-ring and rotated from said intermediate cam-gear to bear on each of said contact-faces in succession whereby the carrier is shifted; intermediate gears, shafts and a worm to rotate the carrier intermittingly from the main gear; means automatically to lock and unlock said carrier, said means being operated from the main gear through said intermediate gears, shafts and worm, the gears being guarded and arranged to shift the carrier vertically and horizontally into four positions and to reciprocate the drills four times to operate once in each of said positions to complete the drilling of the blanks while the carrier is locked, and then automatically to unlock the carrier and rotate it a quarter-turn, before the next operation of the shifting and drilling mechanism.

In testimony whereof I have hereunto signed my name.

SAMUEL P. MACCORDY. [L. S.]

Witnesses:

C. C. SCHOENECK,  
E. L. DARLING.