(No Model.) 3 Sheets—Sheet 1.

W. A. McCOOL.

DUPLEX DRILLING MACHINE.

No. 488,658. Patented Dec. 27, 1892.

Fig. 1.

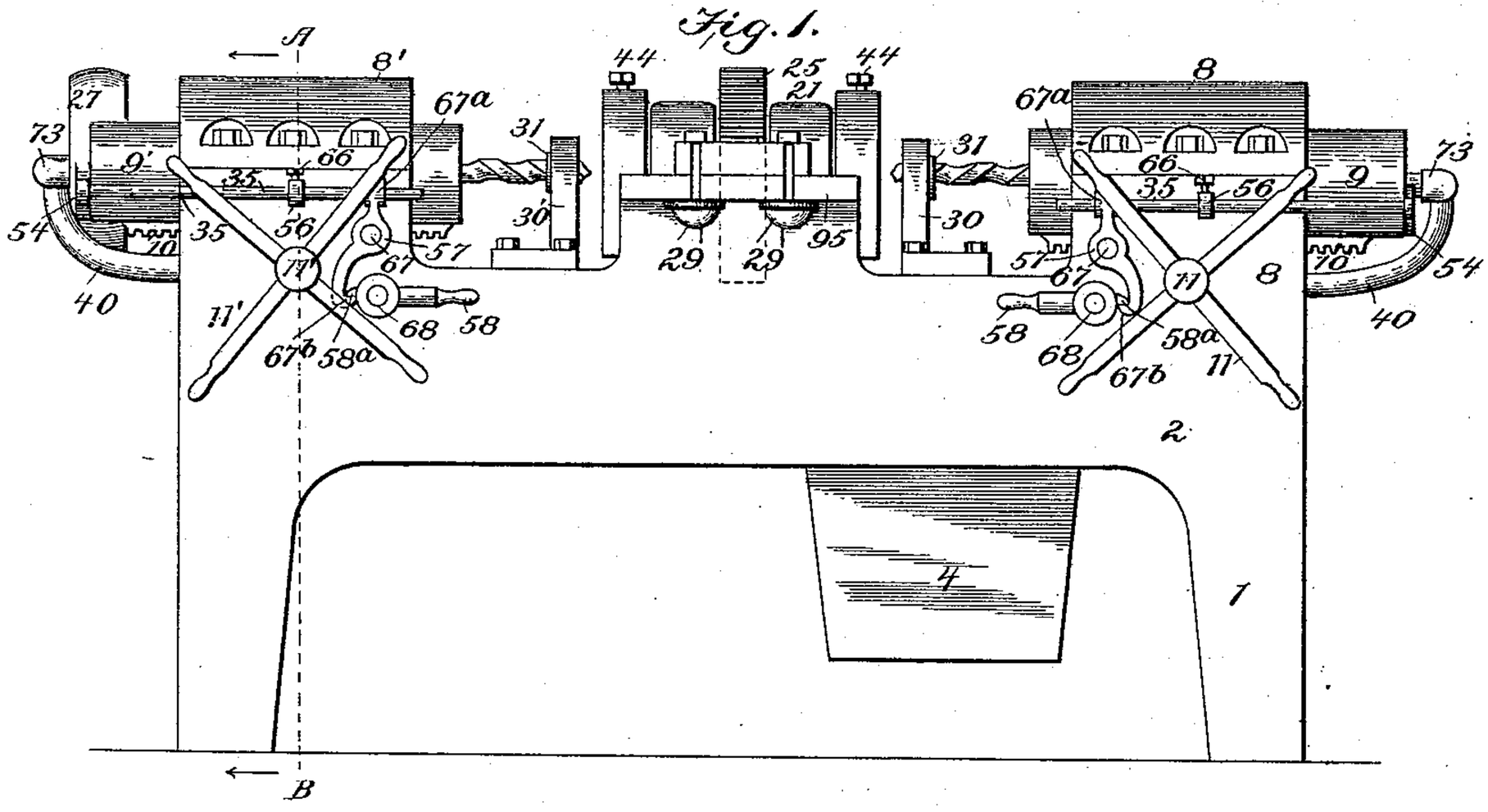
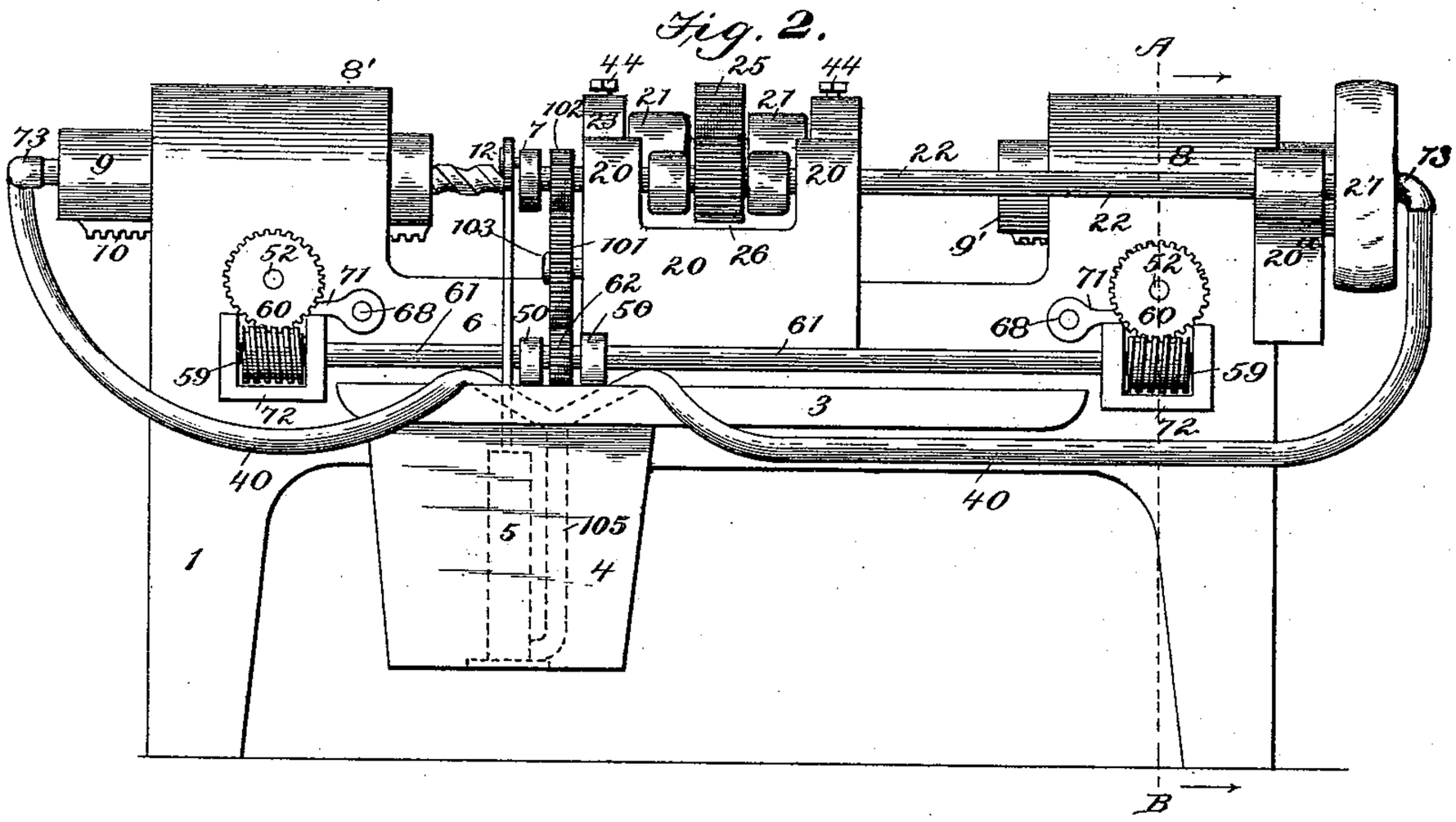


Fig. 2.



Witnesses
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J. M. Hopenhaver.

Inventor:
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His Attorneys

(No Model.) 3 Sheets—Sheet 2.

W. A. McCOOL.

DUPLEX DRILLING MACHINE.

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Fig. 3.

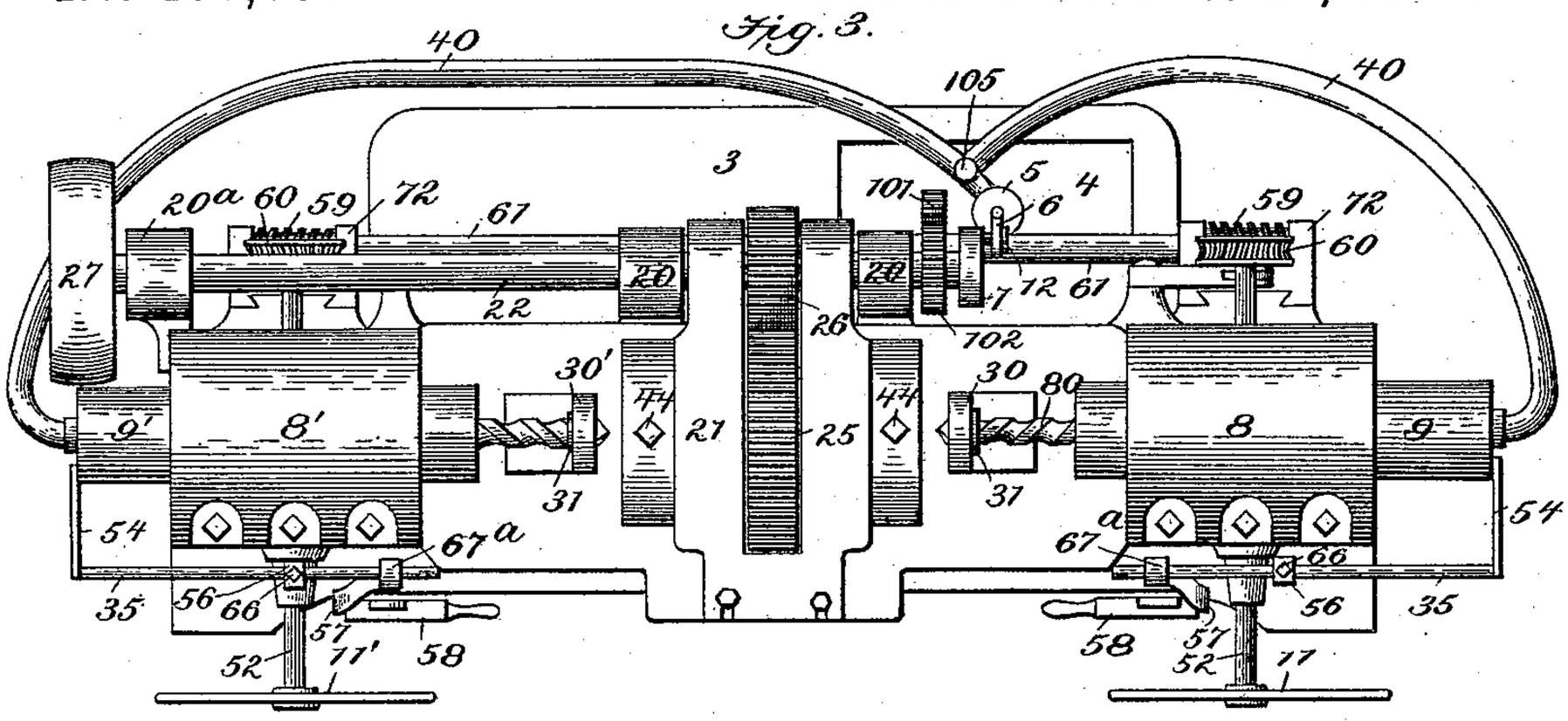


Fig. 4.

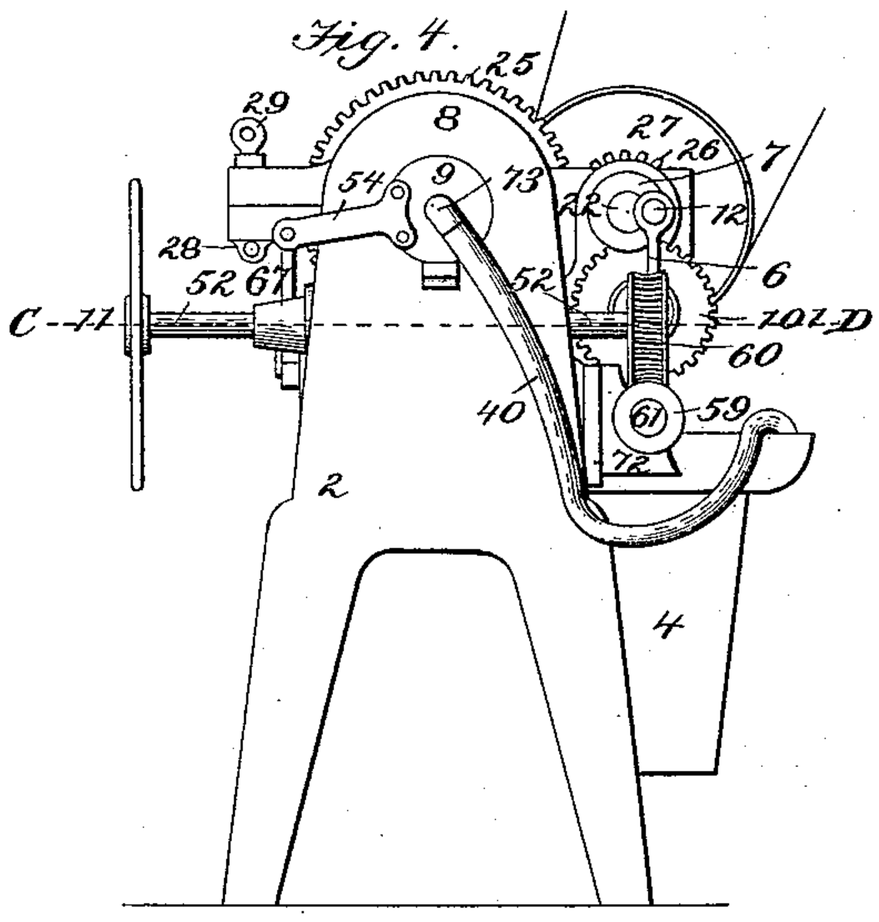


Fig. 5.

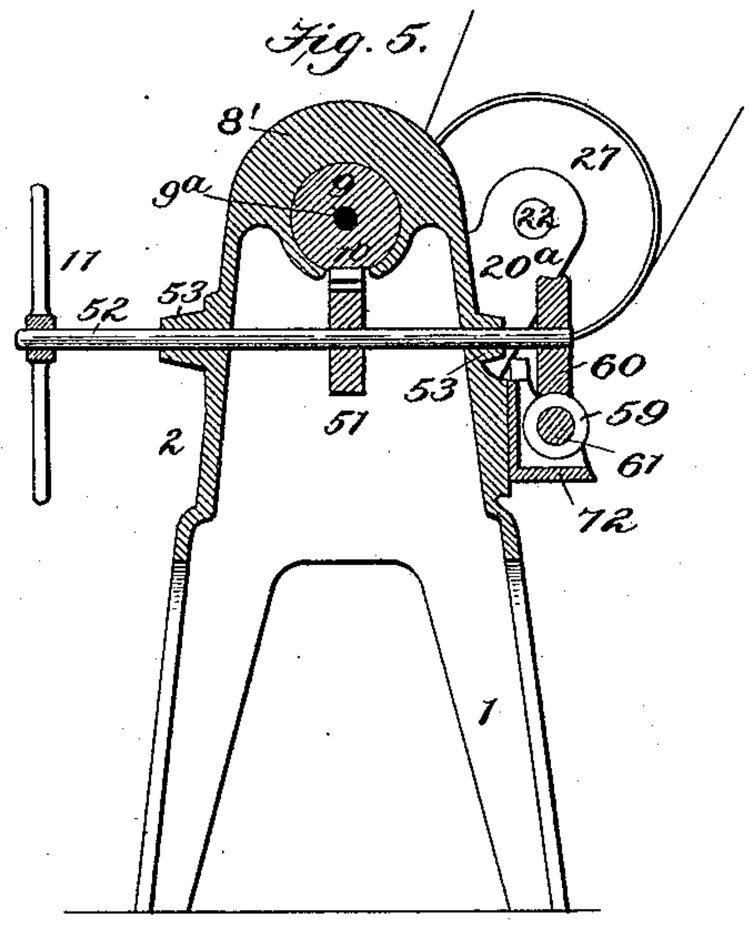
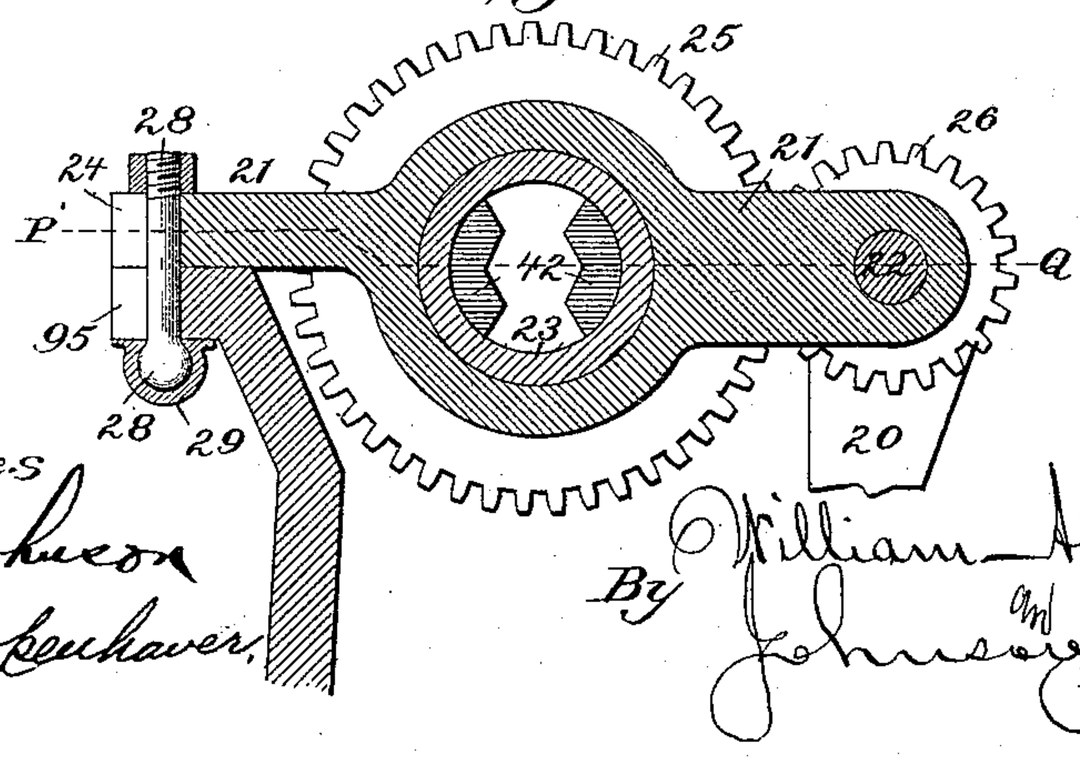


Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

W. A. McCOOL.

DUPLEX DRILLING MACHINE.

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Fig. 7.

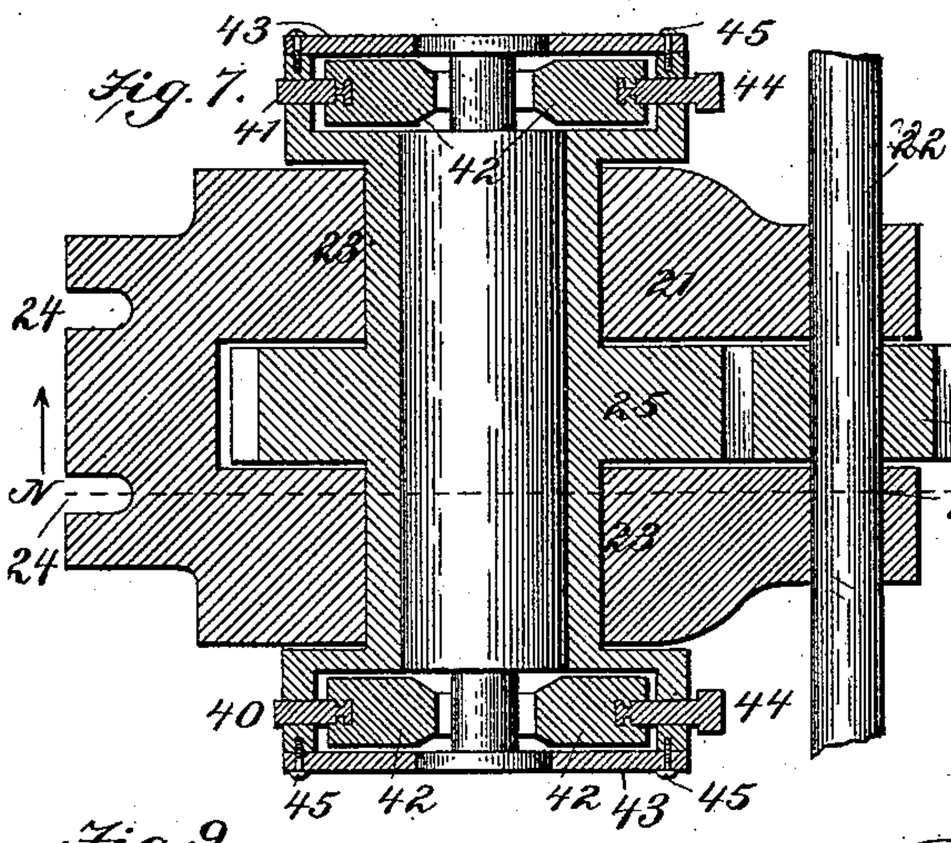


Fig. 8.

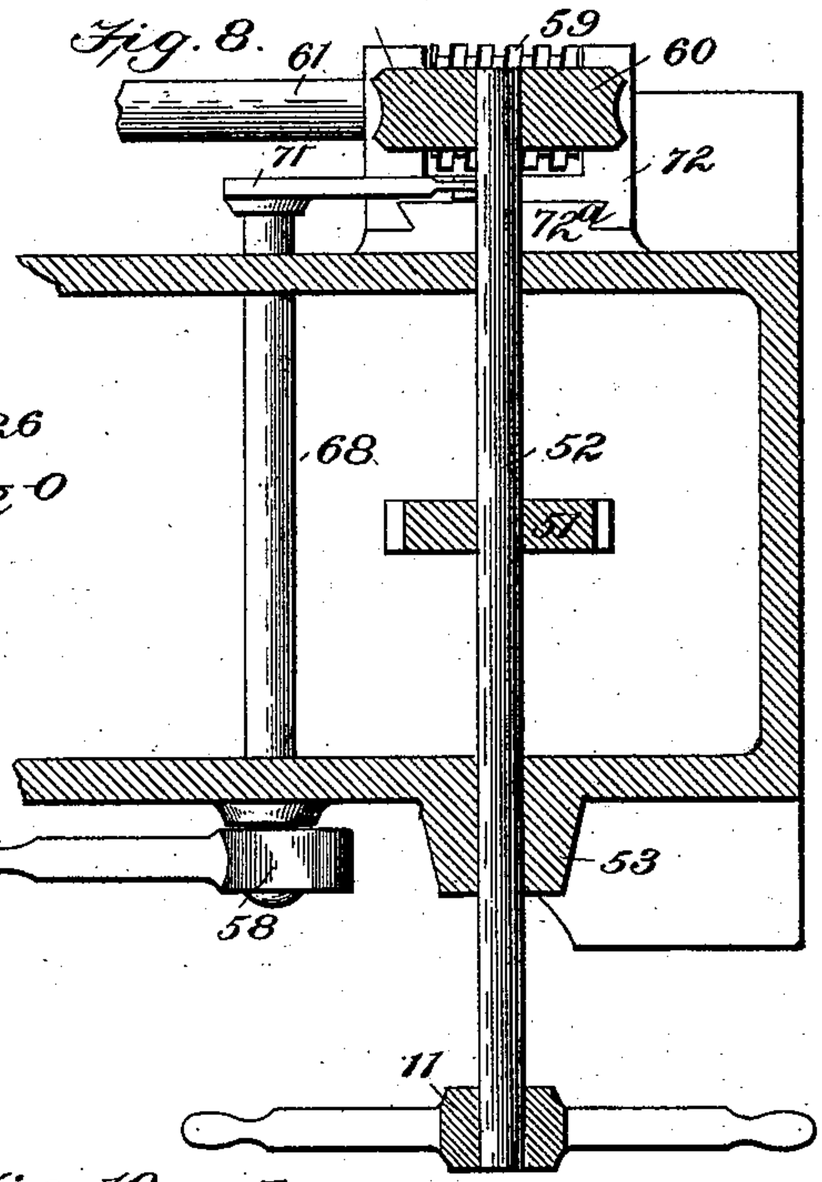


Fig. 9.

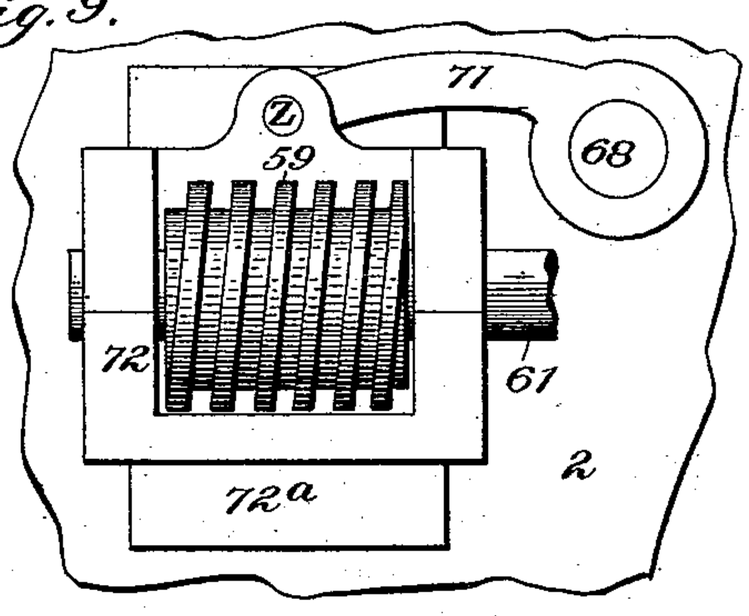


Fig. 10.

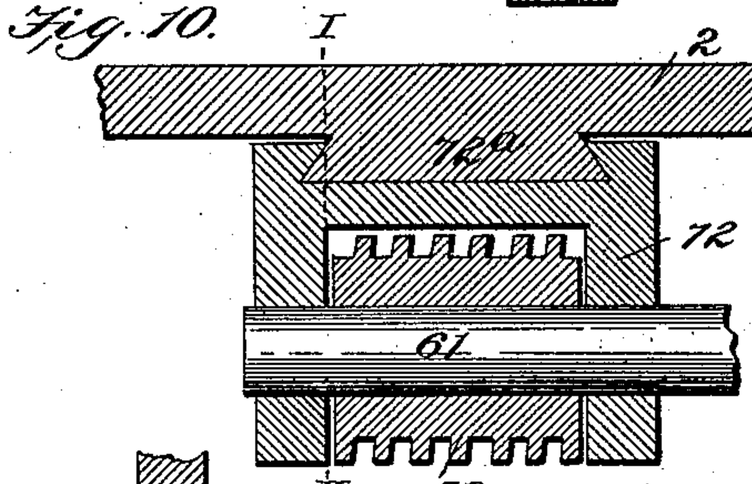


Fig. 11.

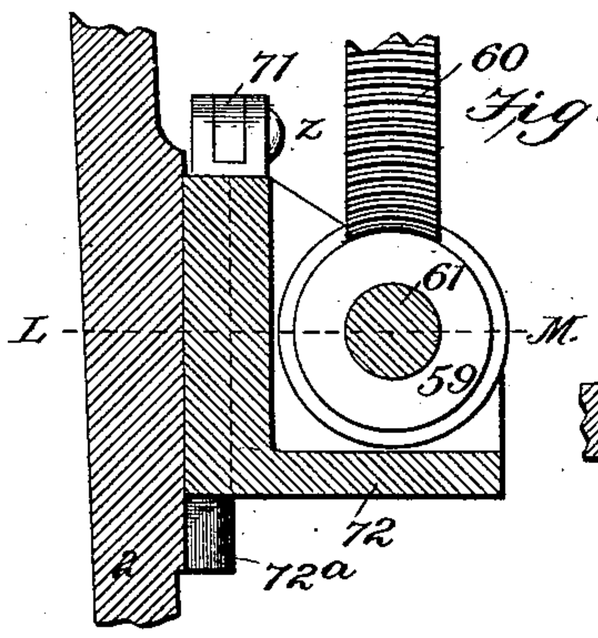


Fig. 12.

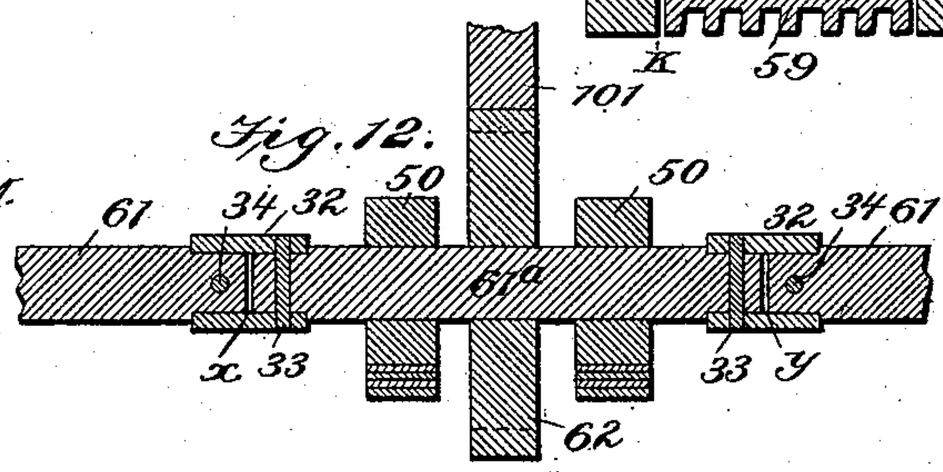
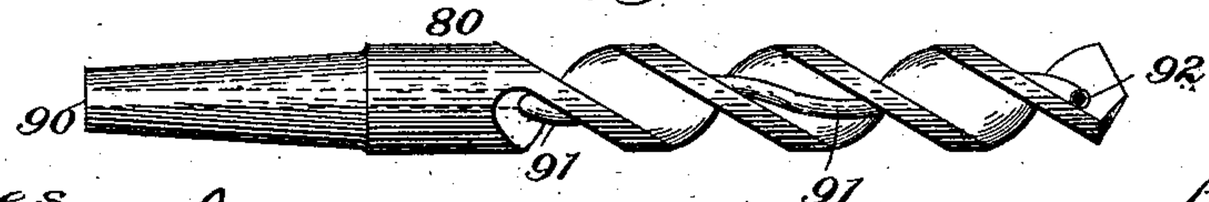


Fig. 13.



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UNITED STATES PATENT OFFICE.

WILLIAM ALLEN McCOOL, OF BEAVER FALLS, PENNSYLVANIA.

DUPLEX DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 488,658, dated December 27, 1892.

Application filed January 9, 1892. Serial No. 417,535. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM ALLEN McCOOL, a citizen of the United States, residing at Beaver Falls, in the county of Beaver and State of Pennsylvania, have invented a new and useful Improvement in Duplex Drilling-Machines, of which the following is a specification.

My invention herein is directed to improvements in machines for drilling billets and ingots preparatory to their manufacture into gun-barrels and other hollow articles; and the particular matters of novelty in said machine, consists of certain parts and combinations of parts, the several features of which will be separately and specifically pointed out in the claims concluding this specification.

An important feature of my said invention is the organization of duplex drilling appliances in co-operative relation with a rotating duplex-chuck, and provision whereby the duplex drills are adapted for both simultaneous and independent operation for the purpose of completing a bore made in the article from both ends thereof. In such organization a swinging head is provided for carrying the duplex chuck, whereby the work is held in alignment with the drills, and the chuck is adapted to be swung over out of the way of the drills to place and remove the work into and from said chuck, and to present the work at once properly to the drills.

Before specifying the claims of my invention I will describe the organized machine which is illustrated in the annexed drawings, showing a structure embodying the several features of my said invention in combination.

Referring to these drawings: Figure 1 represents in front elevation a drilling machine embracing my invention; Fig. 2 shows a rear elevation of the same; Fig. 3 a top view of the same; and Fig. 4 shows an end elevation of the same; Fig. 5 is a vertical transverse section of the same taken on the line A—B of Figs. 1 and 2; Fig. 6 is a vertical transverse section of the swinging chuck-head taken on the line N—O of Fig. 7; and Fig. 7 is a horizontal section of the same taken on the line P—Q of Fig. 6; Fig. 8 is a horizontal section taken on the line C—D of Fig. 4 showing the operating mechanism by which the drills are fed; Fig. 9 shows in elevation the device for raising and lowering the worm gear by which the drills are automatically operated; Fig. 10 is a horizontal section of the same taken on the line L—M of Fig. 11; and Fig. 11 is a vertical sectional view of the same taken on the line I—K of Fig. 10. Fig. 12 shows in detail the jointed shafts by which the drill slides are autimatically operated through the worm gear shown in Figs. 9, 10 and 11; and Fig. 13 shows the drill and its oil duct soldered in the fluke.

A suitable strong frame 1, 2, is provided for containing the operating parts of the drill.

At each end of the bed-plate or frame, a tool-head 8, 8′, is fixed which is bored out centrally in a horizontal, longitudinal line for the reception of cylindrical slides 9, 9′ within the inner ends of which the drills are secured. The bore of each tool-head has a longitudinal bottom slot, and each tool carrying slide has a bottom rack 10 which stands down within these slots for engagement with pinions 51 on shafts 52 which are mounted transversely in suitable bearings 53 in the body of the frame, and have hand wheels 11, 11′ on their front projecting ends for operating the drill slides, as seen in Fig. 5. It is important to notice that in this connection the drills 80 have only a sliding movement toward and from the work and that the racks of the drill-slides form locks in the slots of the tool-heads to prevent the tool slides from turning.

I prefer to secure the drills in the tapered socketed ends of the slides as in standard drills, and I provide for supporting the inner ends of the latter by standards 30, 30′ secured to the frame and fitted with bushings 31 for steadying and guiding the drills. The work to be drilled is supported in a line with and between the drills in a swinging head 21 formed of a single casting and adapted to contain in a revolving duplex chuck-head shown more clearly in Figs. 6 and 7. This swinging head is mounted on a horizontal shaft 22 which forms the driving shaft of the machine and is mounted at the rear and at the top thereof in bracket standards 20, 20ª and is driven by a pulley 27. The swinging head has a central bore which is co-incident with the axes of the drills, and is of a diameter

sufficient to receive and form the bearings of the duplex chuck, the cylindrical body 23 of which is fitted in the said central bore and has an enlarged head which forms a chuck at each end within which are fitted the chuck dogs or jaws 42, as I will presently state. The chuck has an axial opening which extends into each chuck-head and into this bore the ingot or billet to be drilled is placed and secured at each end by the chuck-jaws. The swinging frame is slotted transversely to receive a gear wheel 25 keyed or formed on the body of the duplex chuck, and a pinion 26 on the driving shaft 22, engages this chuck wheel to rotate the chuck and the article being drilled. The chuck-jaws seen in Figs. 6 and 7, are secured in suitable recesses in the chuck-head so that one of them in each head can be adjusted by means of the screws 40, 41, and leave them so adjusted, while the opposite jaws are clamped by square headed screws 44. Both sets of screws are connected to the respective jaws by collared ends. The jaws being fitted into place the end plates 43, 43 are screwed upon the chuck body by the screws 45 and the duplex chuck is complete. The swinging-frame is provided with slots 24 at its free end and when in its normal or horizontal position, rests upon a suitable projection 95, of the frame which is provided with socketed bearings 29 for swing bolts 28 which are co-incident with said slots, and within which they are secured by nuts for clamping the swinging frame in place when the machine is operating. This construction permits the duplex chuck and its support to be swung and turned over at the rear of the frame out of the way of the drills to remove the drilled article or to chuck the work in place. This construction also provides a solid support for the double chuck, by the bracket bearings 20—20 at its hinged ends and the bolts 28, at its other end, directly upon the frame so that the axial relation of the chuck to the drills is maintained and its resistance to the drills equalized.

The provision of the hand-wheels 11 allows the tool slides to be operated independently as described to bring up the drills so that they touch the work at both ends; while the provisions for automatically operating the machine for feeding both drills toward each other equally I will now describe. As stated each drill slide is operated by pinions 51 which are on each hand-wheel shaft 52, and referring to Figs. 2, 5, and 8, it will be seen that each shaft has a worm-gear 60 on its rear end which engages with a worm-gear 59 on a horizontal shaft 61 which, at such gear end, is mounted in a box 72 adapted for vertical adjustment on the rear wall of the frame, as I shall presently state. Each adjustable box has its horizontal shaft 61, one of which has a right and the other a left worm-gear, and these shafts at their other ends are jointed to a short shaft 61^a, mounted in bearings 50 as seen in Fig. 12. The jointing of these shafts is made by sleeves 32 and pins 33 and 34 placed at right angles to each other, whereby the outer ends of said shafts are permitted to be raised and lowered to engage or disengage their right and left worm-gear 59 with the worm gear 60 of the said hand wheel shafts. The short shaft 61^a has a gear wheel 62 which engages with a gear wheel 101 mounted on a stud 103 on the standard 20 and which last named gear engages with a pinion 102 on the driving shaft 22, as seen in Fig. 2 whereby the jointed shafts 61 61^a are caused to rotate together and thus give simultaneous motion to the drill-slides through the worm gear 59 and 60. The boxes 72 for the shaft 61, are shown in Figs. 9, 10 and 11, and as therein shown they are made with dove-tail recesses which engage vertical dove-tail projections 72^a on the back wall of the frame and thus allow of their vertical adjustment. At their upper ends these boxes have lugs to which are pivoted by pins z Fig. 9, a crank arm 71 which is fixed on the end of a shaft 68 mounted in the frame parallel to the hand-wheel shaft 52 and having on its front end a latch-lever 58 as seen in Figs. 1, 3, and 8. These levers are for raising and lowering the boxes 72, 72 of the shafts 61, for the purpose stated, and when so raised the worm-gears 59 of both shafts are held in engagement with the worm-gear 60, by means of a latch 58^a on the end of the lever 58 engaging a trip latch 57 on a stud 67 on the front side of the frame as seen in Fig. 1. It is in this relation of these parts that the feed of the drills is made automatic.

For stopping the feed of the drills I provide the following automatic device. Upon the outer ends of each drill slide I fix an arm 54 standing toward the front and to its end a rod 35 is fixed, it extends along the side of the head block and passes freely through an eye 67^a on the upper end of the latch-lever 67. A stop 56 is adjustably secured on this rod 35 by a screw 66 so that the said rod moving inward with the drill-slide, will bring its stop 56 against the eyed end 67^a of the latch-lever and moving said end inward will trip the latch 67^b from the latch 58^a of the hand lever 58, and thus releasing the crank arms 71 allow the boxes 72 with their gear to descend by gravity and stop the automatic feed of the drill slides. In this position the boxes are supported by suitable stops on the frame-wall, and in this action the shafts 68 will be partially rotated. When thus thrown out of gear with the driving shaft, the drill-slides can be drawn out by the hand wheels. In this automatic feed of the drill-slides it is important to notice that the stops 56 can be set in such relation to the trip-levers that one of them can be tripped before the other and its drill can be drawn back leaving the other drill to continue its feed so as to drill the bore completely through the work and thus avoid bringing the two drills together. This practically makes of the duplex drill two separate and distinct drills, both operating together but

either independently for the purpose of completing the bore.

Provision is made for automatically supplying oil to the drills to aid the work and lessen the heat of the drill as I will now describe. The shank of the drill is bored through to form a channel 90, and a tube 91 connects with the channels in the fluke, to the walls of which, it is soldered and terminates at the point 92 so as to deliver the oil under pressure at the point of drilling.

For supplying the oil I provide the following means: Each drill slide has a central bore 9^a seen in Fig. 5 which opens into the tapering socket for the drill shank, and at the outer end of said slide, into which end a coupling 73 is screwed. To these couplings are attached rubber tubes 40 which extend to and are connected to a pipe 105 connected with a pump-barrel 5 fixed in a tank 4 at the rear side of the machine. At that end of the driving shaft next the swinging frame, is a crank 7, to the pin 12 of which, is connected the plunger rod 6 of the pump, so that the oil is forced by the pump into both tubes during the operation of the drills—the supply tubes moving with the latter. The drills are necessarily one right and the other left, since the ingot revolves in one direction and is drilled from both ends in a duplex chuck. This chuck is rotated by direct gear connection with a power shaft mounted at the side of the machine, and which also operates by direct gear connection, the jointed shafts by which the duplex drills are operated either simultaneously or independently.

The machine is designed for drilling articles of cylindrical form and more especially for the production of ingots which are afterward drawn or rolled into seamless tubes, gun-barrels, hollow spindles, and similar articles. The cylindrical form of the bearings for the drill-slides and the manner of locking them from turning, renders them very firm and solid in their movements and preserves the perfect alignment of the drills; while the manner of mounting the duplex chuck, gives the advantage of placing the billet in alignment with the drills by a swinging movement of a head in which the duplex chuck has a bearing from one chuck jaw head to the other. When the swinging head is turned over out of the way of the drills, it hangs down at the rear side of the frame, and in this position the work is put into the bore of the chuck and secured by the dogs, two of which, as I have stated, are permanently set and the other two are clamped upon the work at each end and the work is thus properly aligned in the bore of the chuck before the latter is turned over in place between the drills. When so placed the swinging head presents the work in alignment with the drills without further adjustment, because the divided bearings of the swinging-head on the driving shaft, and the slots in the other end of said head, keeps it from the least lateral deflection and maintains a true alignment of the axis of the duplex chuck with the drills.

The jointing of the worm-gear carrying shafts may be effected in any suitable manner that will allow for the disengagement of the worm-gear for the purpose stated.

Referring to the hand-lever 58 seen in Fig. 1, it will be understood that its latch end 58^a is made beveled or convex on its upper side so as to act like a cam on the lower beveled end of the trip lever 67 to push it away when said lever latch end is raised and allow the latch end of the trip-lever to fall back by gravity under the latch end of said hand-lever and thus engage the hand-lever with the trip-lever.

Referring to the mechanism for operating the drill-slides by hand, it will be understood that when one of said slides is disconnected from its automatically operating mechanism, it is drawn out by its hand-wheel to withdraw its drill from the work while the other drill continues its work to complete the bore in the middle of the length of the article and while so completing the work, the machine acts with a single drill and the work is solidly supported against such action. After the bore is thus completed this drill is also disconnected from its automatically operating mechanism, the slide drawn out by the hand-wheel and the chuck swung over and supported at the back of the machine in convenient position to remove the work and put another billet in the chuck. When the billets are all of the same size the chuck jaws do not require to be specially adjusted for each billet, but the latter are clamped directly upon the fixed jaws which are set so that the bore will be made in the axis line of the billet. But for larger or smaller diameter billets the jaws are adjusted so as to bring the axis of the billet in co-incident line with the axes of the drills.

Referring to the oil conduit for the drill I make it of a small tube of pliable metal so that it can be twisted around in and following the fluke and soldered or brazed on the walls thereof, thereby carrying it away from the walls of the bore, and giving it the function of a screw thread within the fluke to facilitate the discharge of the filings.

Having thus described a drilling machine embodying in preferred form the several features of my invention in combination, what I separately claim and desire to secure by Letters Patent is:

1. In a drilling machine, the combination of a drill slide having a cog rack and a pinion engaging said rack, with a worm-gear on the transverse shaft of said pinion, and a device for operating said worm-gear consisting of a longitudinal shaft having a corresponding worm-gear, a vertically adjustable journal-box for said longitudinal shaft, a supplemental shaft having a crank-arm on one end pivotally connecting said journal-box, a latch-lever on the other end, a trip-lever for engag-

ing said latch-lever, and suitable means connected with the drill-slide for tripping said trip-lever, for the purpose stated.

2. In a drilling machine, the drill-slide having a parallel rod 35 provided with an adjustable stop 56, in combination with a trip-lever 67, loosely engaging said rod, a latch-lever engaging said trip-lever, a rack and pinion connection for said slide, a crank-arm 71 on the crank of said latch-lever, a vertically adjustable box, pivotally connected to said crank-arm, a longitudinal shaft, having a worm-gear, journaled in said box, suitable means for operating said shaft, and a corresponding worm-gear on the rack engaging pinion shaft, for operation in the way described.

3. In a drilling machine, the combination of the duplex drill-slides, each having an operating rack and pinion connection, a worm-gear 60 on each rack engaging pinion shaft, a longitudinal shaft of jointed sections having worm-gear 59, a vertically adjustable journal-box on the outer ends of said jointed shafts, and suitable means for operating said jointed shafts, with trip mechanism connecting said adjustable journal-boxes with the drill slides, whereby the movements of the latter toward each other will automatically operate to disengage the said jointed shaft worm-gear to stop the operation of the slides in the way and for the purpose stated.

4. In a drilling machine, a duplex chuck-head consisting of a tubular cylindrical body having radial chuck-dogs at each end, and a circumferential driving gear mediately of its ends, in combination with a bearing for supporting said chuck, duplex drill-slides, and mechanism for operating the chuck and the drill-slides, substantially as described.

5. In a drilling machine, the combination of the duplex drill-slides each having an operating rack and pinion connection, with a duplex work supporting chuck, a hinged supporting head forming journal bearing for said chuck and means for rotating the latter within said hinged head, substantially as described.

6. In a drilling machine, the combination of duplex drill-slides each having an operating rack and pinion connection, with a duplex work holding chuck having a gear wheel mediately of its chuck heads, a hinged supporting head forming a journal for said chuck and a shaft on which said chuck bearing head is hinged having a pinion engaging said chuck gear, substantially as described.

7. In a drilling machine, the combination of duplex drill-slides each having an operating rack and pinion connection, with a rotating duplex work holding chuck and a hinged bearing therefor adapted to be supported in alignment between said drill slides and to be turned over out of the way at the side of the machine, substantially as described for the purpose stated.

8. In a drilling machine, the combination of duplex drill-slides with a rotating duplex chuck having an axial bore, an enlarged annular head at each end provided with adjustable jaws or dogs, a swinging bearing head for said chuck, and a gear on the latter between its heads for rotating said chuck, substantially as described.

9. In a drilling machine, the combination of duplex drill-slides, mechanism for connecting them for automatic operation, and a rotating duplex work holding chuck, with a trip device for connecting and disconnecting the drill-slides with their operating mechanism consisting of the transverse shafts 68 each having a crank-arm 71 connecting and engaging and disengaging said operative mechanism, the rods 35 on the drill-slides each having an adjustable stop 56, a trip lever 67 pivoted on the frame for each slide-rod and a latch lever 58 on each shaft, and mechananism for operating said drill-slides by hand whereby both drill-slides may be operated together and one of them stopped and drawn out from the work while the other continues to operate for the purpose stated.

10. A duplex drilling machine, consisting essentially of two drill-slides, a shaft at the back of the machine formed of three jointed sections the two end sections whereof are mounted in vertically adjustable boxes at their outer ends and provided each with a worm-gear, a driving shaft above said jointed shafts and geared to the middle section thereof, a transverse shaft beneath each drill-slide having a worm-gear engaging the worm-gear of the jointed shafts and a pinion engaging a rack on the drill-slide, a supplemental shaft beneath each drill-slide having a crank arm pivotally connecting said boxes, and a latch-lever at its front end, a horizontal rod attached to the outer end of each drill-slide, and a trip-lever on the frame connecting said rod and latch-lever, a swinging head, mounted on the power-shaft between the drills, a duplex hollow chuck mounted in said head having a gear mediately of its ends, and a pinion on said power-shaft engaging said chuck gear for operation substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WILLIAM ALLEN McCOOL.

Witnesses:
F. N. BEEGLE,
E. C. REBESKE.