

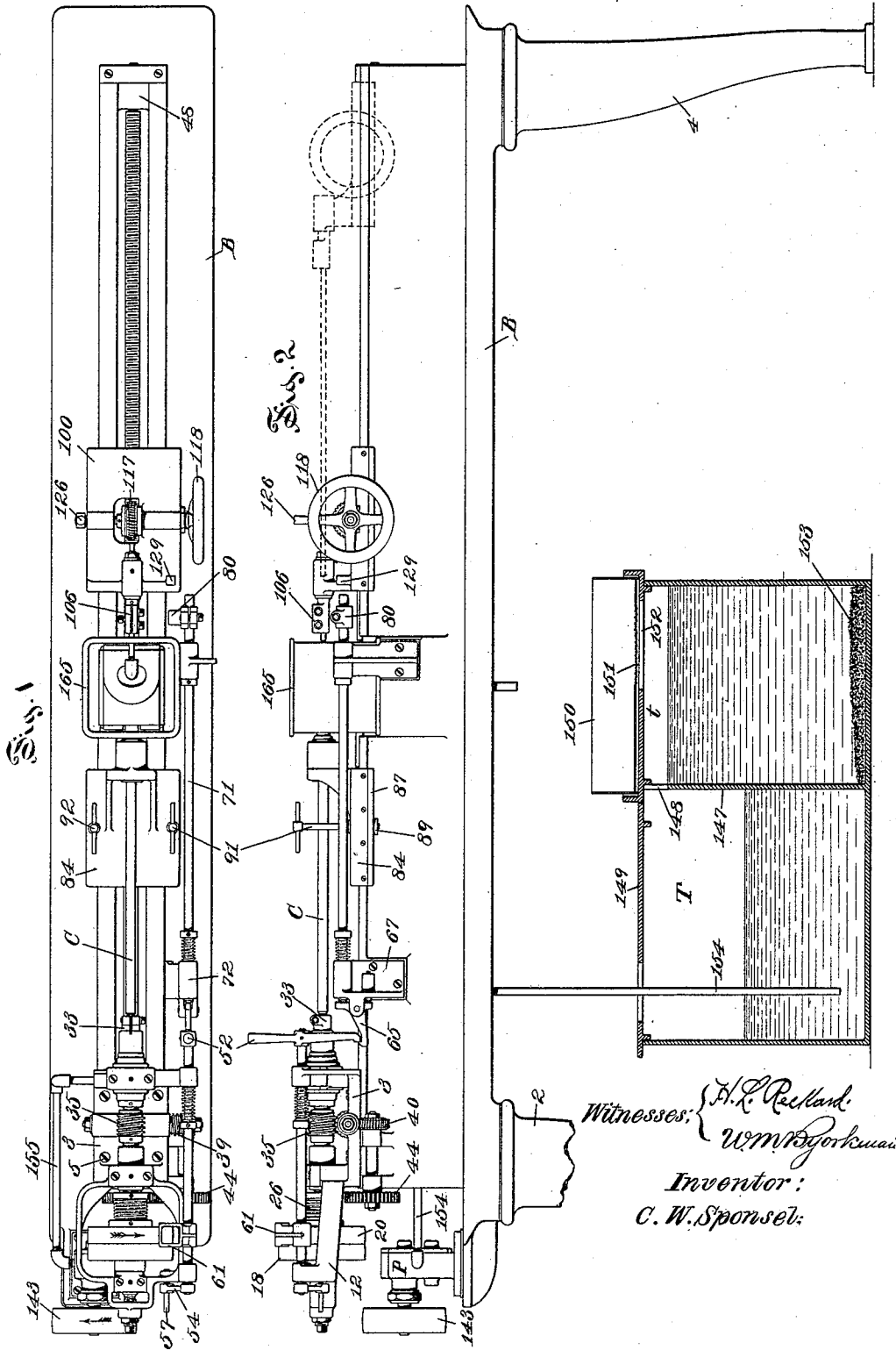
(No Model.)

6 Sheets—Sheet 1.

C. W. SPONSEL.
GUN BARREL DRILLING MACHINE.

No. 447,713.

Patented Mar. 3, 1891.



Witnesses: { H. L. Reckard.
W. M. Yorkman.
Inventor:
C. W. Sponsel.

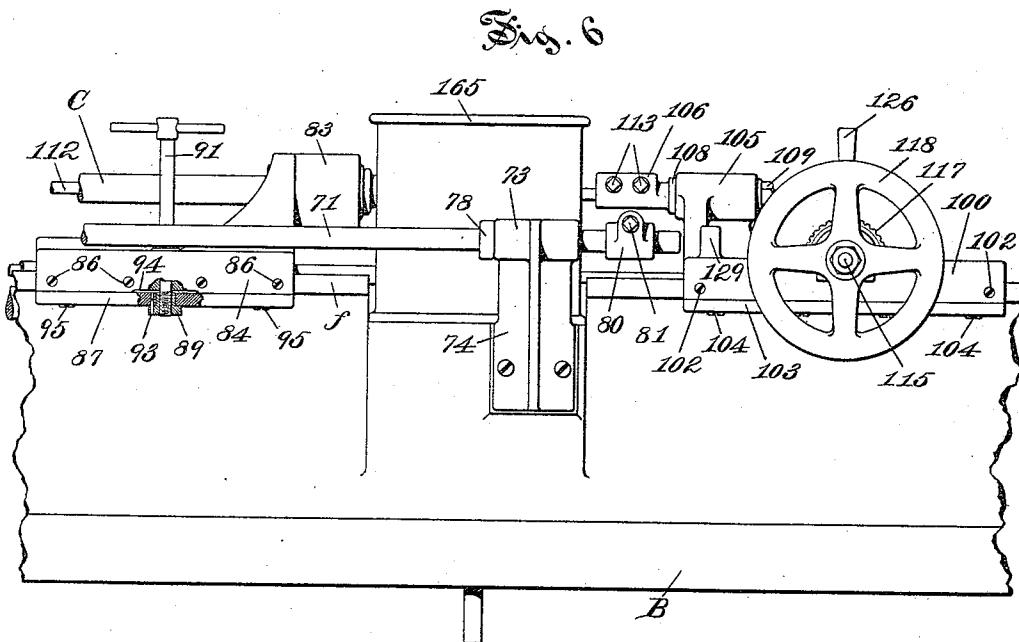
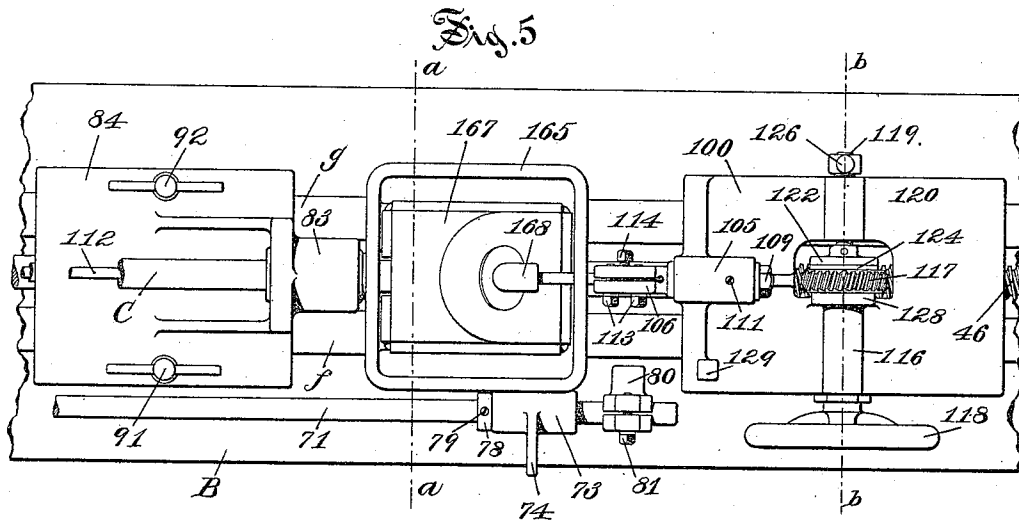
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6 Sheets—Sheet 3.

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Witnesses:

Henry L. Rickard.
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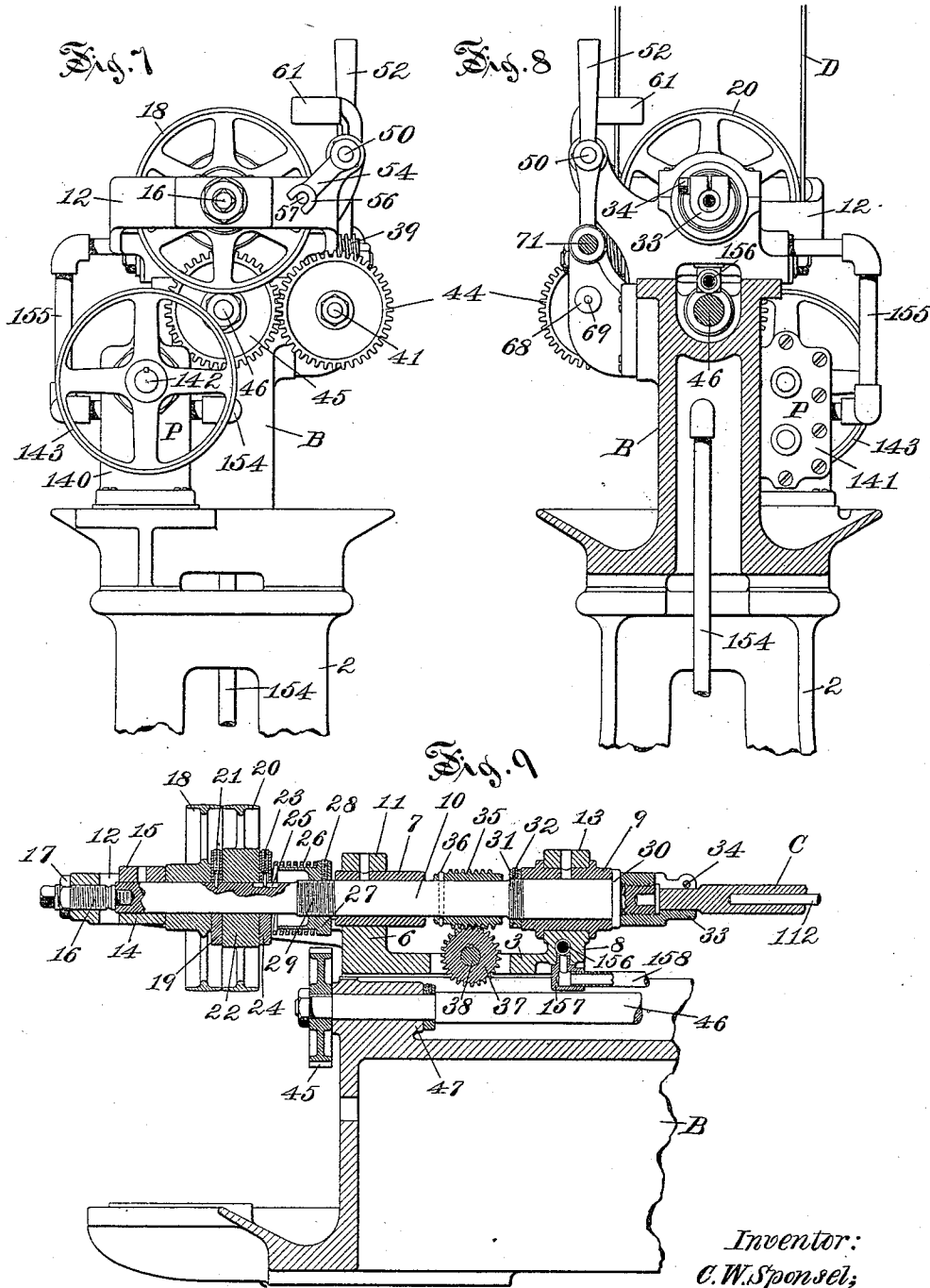
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Fig. 10

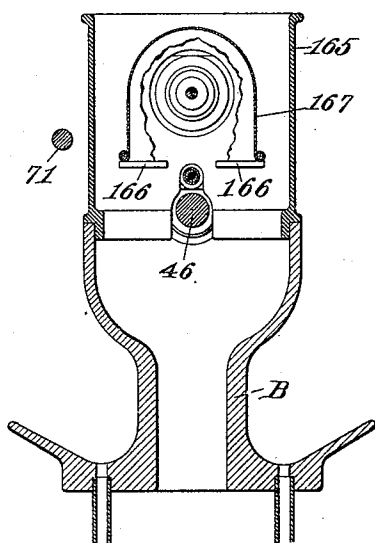


Fig. 11

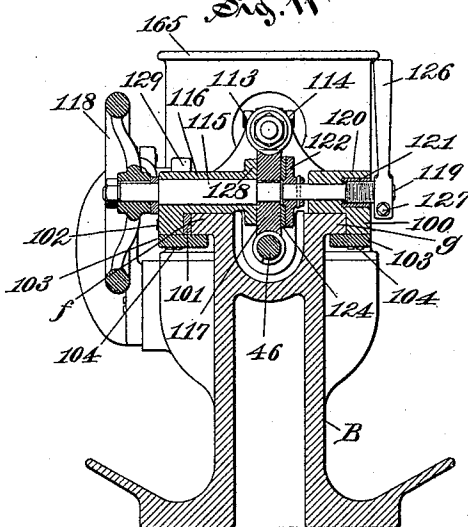


Fig. 12

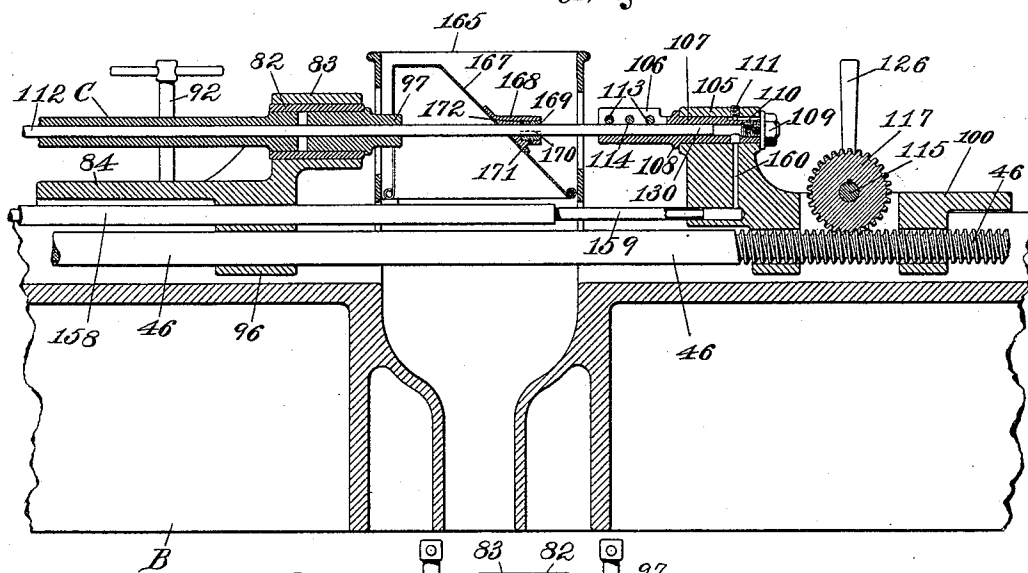
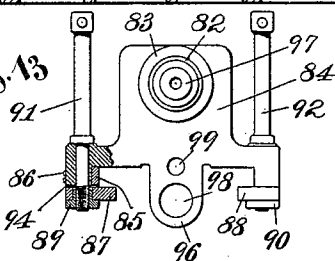


Fig. 13



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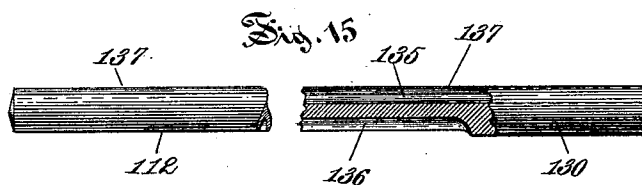
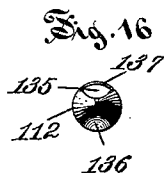
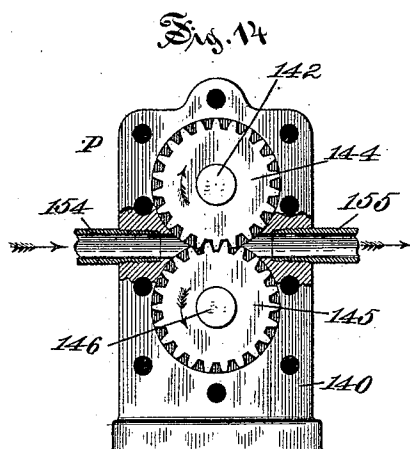
(No Model.)

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UNITED STATES PATENT OFFICE.

CHARLES W. SPONSEL, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE
PRATT & WHITNEY COMPANY, OF SAME PLACE.

GUN-BARREL-DRILLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 447,713, dated March 3, 1891.

Application filed October 28, 1890. Serial No. 369,605. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. SPONSEL, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Gun-Barrel-Drilling Machines, of which the following is a specification.

This invention relates to machines for drilling gun-barrels by means of a drill automatically fed to its work and having a forced supply of oil or other lubricating-fluid delivered through the drilling-tool to the face of the bore.

In the drawings accompanying and forming a part of this specification, Figure 1 is a plan view, and Fig. 2 a front elevation, of a barrel-drilling machine embodying my invention. Fig. 3 is a plan view, drawn on a larger scale, of that portion of the machine which is at the left hand in Figs. 1 and 2. Fig. 4 is a front or side elevation of that part of the machine shown in Fig. 3. Figs. 5 and 6 are a plan and a front elevation, respectively, of the middle portion of the machine, as will be seen by comparison with Figs. 1 and 2. Fig. 7 is an elevation of the end of the machine at the left hand in Figs. 1, 2, 3, and 4. Fig. 8 is a vertical transverse section in a line at the right hand of the parts shown in Fig. 4. This view shows the head of the machine and the parts carried thereby, as seen from the right hand in Fig. 4. Fig. 9 is a longitudinal vertical section through the head of the machine, this being the portion shown in Figs. 3 and 4. This view shows more in detail the construction of the driving-spindle. Figs. 10 and 11 are cross-sections in lines *a a* and *b b*, respectively, of Fig. 5. Fig. 12 is a vertical longitudinal section of the parts shown in Figs. 5 and 6. Fig. 13 is an end view, partially in section, of the barrel-rest. Fig. 14 is a side view, partly broken away, of the oil-pump, the cap or covering being removed. Figs. 15 and 16 illustrate the construction of the improved drill used in the machine.

Similar characters designate like parts in all the figures.

The main frame or bed of the machine, which is designated by B, is supported on legs, as 2 and 4, and is shaped and fitted to carry the

several mechanisms and operative details. The frame 3 of the drilling-machine head is fixed to said bed by screws 5, and is provided with the barrel-carrying spindle 10, which is furnished with suitable spindle-driving means, and is also connected to actuate the drill-feeding apparatus. The spindle 10 is journaled in the front bearing 9, which is carried by the upright 8 of said frame 3, in the middle bearing 7, which is carried by the upright 6 of said frame, and in the rear bearing 14, formed in the frame. The rear bearing 14 has the usual cap 15, and the bearings 7 and 9 are held in place by caps 11 and 13, respectively, secured by screws in a well-known manner. Said rear bearing is carried by the rearwardly-extending yoke-shaped part 12 of the frame 3, which also carries the thrust-screw 16, provided with a check-nut 17 for taking the end-thrust of the spindle 10. For actuating said spindle it is provided with the loose pulley 18 and the driving-pulley 20, the loose pulley being fitted to turn freely on the said spindle between the outer bearing 14 and a friction-collar 19, which is removably fixed to the spindle by means of the set-screw 21. The driving-pulley 20 is fitted to normally turn freely on the spindle contiguous to said collar 19, the hub 22 of said wheel being clamped between said fixed collar and a sliding friction-collar 24, that is furnished with a screw 23, whose point engages a slot 25, formed in the spindle. This construction (shown best in Fig. 9) permits of the free longitudinal movement of said collar while preventing rotation thereof on the spindle. A spring 26 is carried by the spindle between the collar 24 and the adjusting-nut 27, which nut is screwed onto the threaded part 29 of the spindle 10, and is provided with a set-screw 28 as a means for fixing the same in place on said spindle. In practice the spring 26 may be carried directly on the spindle; but it is preferably carried, as shown, by an extension of the nut itself, thereby providing for a larger and more even tensioned spring of a relatively short length.

The spindle 10 is revolved by means of an ordinary belt, as D, running on the pulley 20, Fig. 8, and through the pulley-clamping devices above described. By this means the

spindle is yieldingly driven, so that any unusual obstruction will cause the pulley to slip and thus avoid in a large degree the breakage of drills. A flange or collar 30, formed on the spindle 10, and a nut 31, screwed onto said spindle and fixed thereto by the set-screw 32, serve to hold the spindle in place longitudinally. A suitable chuck, as 33, for holding the small end or muzzle of the barrel to be drilled is firmly screwed or otherwise fixed to the forward end of spindle 10. Said chuck in the preferred form thereof herein shown is split on one side for a portion of its length and has a clamp-screw 34 for closing the same onto the small end of the barrel C, as will be understood from Fig. 9. A worm 35 (which may be fixed to the spindle 10 by a pin 36) meshes with and drives the worm-gear 37, which is fixed to the shaft or stud 38, that is journaled in bearings formed on the head 3. Said shaft 38 lies at right angles to the spindle 10 and carries fixed to its forward end a worm 39, which meshes with the worm-gear 40, that is fixed to one end of an intermediate shaft 41, journaled in suitable bearings, as 42 and 43, formed on the main bed B of the machine. Said shaft 41 has removably fixed to the rearward end thereof a gear 44, which meshes with another and similar gear 45, similarly fixed to the end of the feed-screw 46. One end of said feed-screw is journaled in a bearing 47, formed in the left-hand end of the bed B, the opposite end thereof being journaled in a similar bearing 48 at the right-hand end of said bed. By substituting differently-proportioned gears for the change-wheels 44 and 45 the relative speeds of the spindle 10 and the feed-screw 46 may be varied, as required.

For starting and stopping the machine, a shipper mechanism is provided for shipping the belt from the loose pulley 18 onto the driving-pulley 20 by hand, and from the pulley 20 back onto the pulley 18 automatically. The shipper-rod 50 is fitted to slide in bearings, as 49 and 51, formed on the yoke 12 and the upright 8, respectively, of the head 3. A shipper-handle 52 is fixed to the right-hand end of the said rod by means of a pin, as 53, or otherwise, and a guide-arm 54 is similarly fixed by a pin 55 to the left-hand end thereof. The forked end 56 of the arm 54 engages the guide-pin 57 that is fixed in the end of the yoke 12 to prevent rotation of the rod 50. A collar 58 is fixed to the rod 50 by a set-screw 59, and a retracting-spring 60 is carried on the said rod between the bearing 51 and said collar 58. The belt-shipper 61 is carried on the said rod 50, to which it is or may be fixed by a pin, as 62. The lower end or catch 63 of the shipper-handle 52 is designed to engage the hook end 64 of the knock-off pawl 65, which pawl is pivotally supported at 66 on the bracket 67, that is fixed to the main bed B by screws, as shown. Said bracket has a hub or boss 68 formed thereon, which is bored to receive the plunger 69 and the spring 70, that

are provided for the purpose of holding the pawl 65 normally in the position shown in Fig. 4 of the drawings. The knock-off rod 71 for disengaging the pawl 65 from the catch 63 is carried in a bearing 72, which is formed therefor on the bracket 67, and in another and similar bearing 73, which is formed on a bracket 74, that is fixed to the main bed by screws, as shown in Figs. 2 and 6. A spring 75 is carried on the rod 71 between the bearing 72 and the collar 76, which collar is adjustably fixed to the said rod by means of a set-screw, as 77, said spring being provided for the purpose of holding the said rod 71 normally in the position shown in Figs. 2, 4, and 6, with the adjustable stop-collar 78 against the bearing 73, the collar 78 being secured by a set-screw, as 79, in a well-known manner. A stop-arm 80, through which to actuate said rod, is adjustably secured to the rod 71 by means of a clamp-screw 81 in a well-known manner.

Referring to Figs. 5, 6, and 12, the breech of the barrel C to be drilled is first fitted to run closely within the sleeve or bushing 82, which is removably fixed in the hub 83 of the barrel-rest 84. This rest is fitted to slide on the ways of the main bed B, and is provided with a shoe or gib 85 and several set-screws, as 86, for adjusting said rest to its ways and for taking up any wear, as shown in Fig. 13. Said rest is also furnished with the usual straps, as 87 and 88, secured by screws 95, which are provided with the nuts 89 and 90, to receive the threaded ends of the binding-screws 91 and 92, respectively, the said nuts being provided with pins, as 93, Fig. 6, to prevent the same from turning. A portion of the rest is shown cut away on each side, as at 94, Figs. 6 and 13, to allow of the clamping of the said straps 87 and 88 to the ways *f* and *g*. A projection 96 is formed on the under side of the barrel-rest bed, and is bored to form a guide or rest for the feed-screw 46 and also for the large oil-pipe 158, hereinafter described. A drill-guide 97 is fitted tightly in the bore of the bushing 82 of the barrel-rest for guiding the point of the drill at the beginning of a bore. Referring to Figs. 5, 6, 11, and 12, it will be seen that the bed 100 of the drill-carriage is fitted to slide on the ways *f* and *g* of the main bed B, and is furnished with the usual shoe or gib 101, the set-screws 102 for said gib, and with the usual straps 103, secured thereto by the holding-screws 104. The said bed 100 has thereon a hub 105, suitably formed for receiving the drill-holder 106, the stem or shank 107 of which is inserted in the bore of said hub, with the flange 108 thereof bringing up against the forward end of the hub. The holder 106 is firmly held in place by the screw 109. To prevent the said drill-holder from turning in the hub 105 a slot or groove 110 is formed in the shank 107 thereof, and a screw 111 is provided whose point engages said slot and thus prevents said holder from turning. (See Fig. 12.) The holder 106

is bored to receive the shank 130 of the drill 112, and is split on one side for a portion of its length to provide for the clamping of the drill in the holder by means of suitable clampscrews, as 113. A push-screw 114 is provided to force open the sides of the drill-holder when the drill is to be removed.

The drill-carriage when disconnected from the feed-screw may be moved rapidly forward or backward by hand, as when setting the machinery ready for use, or may be fed slowly forward at the proper speed for drilling by means of the aforesaid feed-screw 46, and suitable means on said carriage for engaging said screw. As shown in its preferred form in the drawings, said means consist of the worm-gear 117, engaging said screw, and devices for clamping and releasing said gear and for turning the same by hand. The hand-wheel shaft 115 (see Fig. 11) is carried in a bearing 116, formed on the carriage 100, and the worm-gear 117 (preferably made of bronze) is keyed or otherwise removably fixed to the inner end of the said shaft, the hand-wheel 118 being similarly secured to the outer end thereof. Said worm-gear constitutes a revolving nut and also a feed-pinion, and is in constant engagement with the feed-screw 46, so that by turning the hand-wheel 118 the carriage may be moved forward or backward, as desired, the screw serving as a rack and the worm-gear as a pinion. For causing the said gear 117 to serve as a feed-nut, some suitable clamping devices are provided therefor, which may be as follows: A clampscrew 119 is fitted into a threaded bearing 120, formed on the bed 100, in alignment with the bearing 116. In practice the threaded part of said bearing may be a bushing or nut, as 121, that is firmly fixed in the said hub or bearing 120. A friction-plate 122 is carried on the inner end of the screw 119, and a friction-disk 124 (preferably made of leather) is fixed to the plate 122. A lever or handle 126 is firmly fixed to the outer end of the clampscrew 119 by means of a binding-screw 127. By means of these devices the operator may readily clamp and unclamp the worm-gear 117 between the said friction-washer 124 and the flange 128 of the bearing 116, thereby preventing said gear from turning, constituting it a feed-nut for operating the drill-carriage.

A lug or projection 129 is located on the bed 100 to strike the aforesaid stop-arm 80 on the completion of the drilling, and through the rod 71 to disengage the pawl 65 from the catch 63 of the shipper-handle 52, whereupon the spring 60 throws back the rod 50 and shifts the belt D from the driving-pulley 20 onto the loose pulley 18, thus stopping the machine.

The drill 112 is especially designed for use in my improved drilling-machine. The construction thereof will be best understood by referring to Figs. 15 and 16. The drill is truly formed and in a general way is similar to the ordinary two-fluted drill. One of its

two grooves or flutes 135 and 136 is continuous throughout the entire length thereof, as shown (partly in dotted lines) in Fig. 15. The groove 135, besides being continuous throughout the length of the drill, is covered or closed by a strip of sheet metal, as 137, which is dovetailed into the edges of said groove and then soldered to prevent leakage, thus forming a covered channel for the passage of oil throughout the entire length of said drill from the interior of the holder 106 to the face of the bore being made.

The means for supplying the cutting-edges 80 of the drill with oil consists of an ordinary pump, as P, Figs. 3, 4, and 14, suitably connected by piping, through which oil may be conveyed to the drill. The pump P consists of an ordinary pump case or box 140, which is shown secured by screws to the main bed B at the left-hand end thereof and furnished with a removable cover, as 141. A shaft, as 142, provided with a pulley 143, adapted to be driven by means of a suitable belt (not shown) carries the usual driving-gear 144, located within the case 140, and which, as shown in Fig. 14, meshes with and drives the driven gear 145, that is carried on a shaft or stud 146, also journaled in the frame or case of the pump.

A suitable oil-tank, as T, Fig. 2, is usually located about as shown in said figure, and has a partition-wall 147 dividing said tank into two divisions. An opening 148 in the said wall allows the oil to overflow from the part of the tank into the main division thereof. The tank-cover 149 has thereon a strainer, as 150, perforated at 151, for separating the coarser chips or cuttings from the oil drained from the machine. The said oil and the finer chips mixed therewith pass through the strainer at 151, and through the opening 152 in the cover 149 into the chamber of the tank. The fine chips settle to the bottom, as indicated at 153, and the oil gradually rises until it reaches the level of the overflow-opening 148, through which it passes into the main division T of the tank. A suction-pipe 154, reaching nearly to the bottom of the tank T, as shown in Fig. 2, is connected, as shown in Fig. 4, with the pump P. An outlet-pipe 155 connects the said pump with the opening or oil-passage 156, formed in the head 3, Figs. 3, 8, and 9, which passage is connected by a suitable pipe-joint, as 157, Fig. 9, with the large conveyer-pipe 158, that is supported at its outer end by the boss or guide-bearing 96 of the barrel-rest bed 84. The guide-bearing 96 (shown best in Figs. 12 and 13) is perforated, as therein indicated at 98, for the feed-screw shaft 46, and also at 99 for the aforesaid tube 158, thus maintaining the parallelism of said shaft and tube. As shown in this figure, a smaller conveyer-pipe, as 159, is fitted to slide closely within the pipe 158, thus connecting the pipe 158 with the oil-passage 160, formed in the carriage-bed 100, through which passage the oil passes into the hollow stem 107 of the

drill-holder 106, and thence through the covered channel 135 of the drill 112 to the cutting-point thereof.

An oil-guard 165, Figs. 10, 11, and 12, rests on the bed B, as shown in said figures, and has the projections 166 formed on the inside thereof for the partial support of the funnel 167. Said funnel is also furnished with the funnel-holder 168, which is provided with a bushing 169, fitting the drill 112, said bushing having a projection 170 fitting the groove 136 of said drill. Said funnel-holder is furnished with a pin, as 171, and the bushing 169 has a groove 172 cut in the periphery thereof, in which said pin engages for securing the said bushing in said holder and for allowing said bushing to turn with the drill, the projection 170 thereof acting as a driver therefor. By this means the funnel is securely held in place without materially wearing the drill. When the carriage is run fully back, the drill is withdrawn from the funnel and oil-guard and leaves the funnel free to be removed.

In the general views, Figs. 1 and 2, some details, owing to the intricacy of the mechanism, are not designated by reference-characters, reference being had in all such cases to the corresponding and enlarged views, Figs. 3 to 16, inclusive.

In preparing the machine for use, the operator secures a suitable-sized chuck 33 to the spindle 10, fixes in place a guide-bushing 82 corresponding to the barrel to be drilled, and provides the drill-guide 97, fitting in one end of said bushing, as hereinbefore described, and puts in place the drill and clamps it firmly into the drill-holder 106, setting the carriage at the extreme right hand of the bed, as indicated by dotted lines in Fig. 2, the barrel-rest being also moved toward the right hand sufficiently far to withdraw the bushing 82 some distance off from the barrel. Next, the gun-barrel to be drilled is fixed in the chuck 33 by means of a clamp-screw 34, and the barrel-rest is moved toward the left hand to carry the large end of the barrel, as indicated in Fig. 12. It will be understood of course that the arrangement of the barrel C may be reversed, the hole being drilled from the small end instead of the large end, provided the chuck and socket for supporting the same are suitably constructed therefor. The barrel being in place and the rest set for carrying the same, the clamp-screws 92 and 93 are tightened to firmly hold said rest. Next, the oil-funnel is put in place and the drill-carriage is moved forward by means of the hand-wheel and pinion thereof until the drill passes through the funnel and through the bushing 97 to the end of the barrel C. The machine now being started by hand by means of the handle 52, rod 50, and the shipper 61, whereby the belt D is shifted from the loose pulley 18 onto the driving-pulley 20, the clamp-screw 119 is turned by means of the handle 126 to

firmly clamp the revolving nut 117 in the carriage, thus causing the feed-screw to move forward the carriage at a speed determined by the described feed-gearing intermediate to the spindle 10 and said feed-screw. As the carriage moves forward the drill is forced against the barrel and cuts its way into the same, being lubricated by the current of oil forced by the pump P through the pipes 158 and 159, the channel 160, and through the drill itself to the face of the bore, as hereinbefore described. The pump P being a forcing-pump of positive action, the current of oil or other lubricating-fluid employed is driven to the face of the bore in a positive manner, thereby furnishing effective means for driving the chips through the open channel or groove 136 of the drill 112 until the chips mixed with the discharged oil or fluid are delivered into the funnel 167, from whence they drop through the opening in the bed B onto the screen 151 of the oil-tank. As the drill-carriage is driven forward as described, the conveyer-pipe 159 is forced forward within the larger conveyer-pipe 158, thus by a telescopic arrangement providing a constant communication between the fixed pump and the traveling drill-carriage. The conveyer-pipe 159 being parallel with the drill and with the ways of the frame, serves as a piston on which the forced current of fluid acts to normally drive the carriage backward toward the right hand. This action, in connection with the feed-screw acting on the clamped nut 117, holds the drill-carriage firmly between two opposing forces, thus rendering its forward movement very firm and steady, as required for drilling accurately-formed holes. On the drill-carriage reaching the forward end of its stroke and completing the drilling of the barrel, the stop 129 strikes the stop-arm 80, (this arm having been previously set on the rod 71 in a suitable position therefor,) and, as hereinbefore described, disengages the catch 65 from the shipper-rod arm 52, thereby permitting the spring 60 to shift the belt D from the driving-pulley 20 onto the loose pulley 18, and thus automatically stop the machine. The operator now loosens the clamp-screw 119, and, taking hold of the hand-wheel 118, runs back the carriage to the position shown by dotted lines in Fig. 2, thereby withdrawing the drill from the barrel. Next, the clamp-screws 91 and 92 are loosened and the barrel-rest moved toward the right hand, after which the clamp-screw 34 of the chuck 33 is loosened and the barrel taken out. The machine is then in position ready for a repetition of the above-described operations.

The drill-guide 97 is made of considerable length relative to the diameter of the drill, as will be seen from Fig. 12. It is also made to closely fit the drill and is set in accurate alignment with the axis of the barrel-carrying spindle, so as to afford a guide for the

long and slender drill and thus prevent any springing of the drill from affecting the direction of the drilling.

The frictional surface of the revolving nut 117 being in the plane of the carriage movement and the nut being set or fixed by friction only, any material increase of the resistance to the drill over the normal feeding-power will cause the slipping of said revolving nut between its clamping-faces, so as to reduce the feeding movement and thus allow the obstruction to be overcome. This provision accommodates the action of the machine to variability in the character of the metal of the barrel C, so that when meeting harder portions or spots of the metal the rate of drilling will be correspondingly reduced.

A practical effect of operating the main spindle 10 by means of the frictional driving apparatus and in connection with drill-feeding mechanism actuated from the spindle itself is to gradually reduce the velocity of the spindle (and of course the cutting-velocity) on the drill meeting with increased resistance—as, for instance, on reaching a harder portion of the barrel C. A slight increase in the resistance encountered by the drill causes the pulley to slip between the collars 21 and 23, the friction caused by the slipping increasing slightly the driving power of the pulley, so that the cutting-speed is slightly reduced and the cutting-pressure simultaneously slightly increased, thus automatically regulating the action of the machine to the particular character of the metal and thereby attaining the very highest degree of efficiency throughout the whole operation of drilling the barrel. This feature of the invention is further extended by the combination with the frictional driving mechanism of the frictional driving apparatus of the feed-carriage, thus providing two independent frictional apparatuses, one for the spindle and one for the drill-carriage, which apparatuses coact for the attainment of one result, it being understood that the machine herein described is peculiarly organized for the especial purpose of securing the utmost efficiency, precision, and economy.

One peculiar result of the organization shown and described is the automatic relieving of obstructions due to the clogging of the chips at the point of the drill. When, during the operation of the machine, the tough steel chips pack together at the point of the drilling-tool, the forced current of oil increases the pressure on the drill, so that both the drill and the tube 159 act as pistons for retracting the drill-carriage. This slightly withdraws the drill from the face of the bore, thereby dislodging the obstruction, which is immediately washed out by the high pressure current, leaving the drill free to be advanced again by the feed mechanism, the retreating movement of the carriage being due, as will be understood, to the pressure on the piston increasing to a point sufficient to overcome

the friction on the sides of the revolving nut 117. By this means a positive-acting pump coacts with the frictional feed mechanism to not only clear the bore of chips while the machine acts normally, but to also clear away obstructions arising from packing of the chips, experience showing that such obstructions will occasionally happen.

By means of this improved machine it is found practicable to drill a small-bore rifle-barrel by one continuous operation without stopping the machine or withdrawing the drill from the barrel to be cleared of chips, since the forced current of oil, conveyed as herein described, appears to forcibly dislodge and carry out the chips as fast as they are formed, thus keeping the bore free of obstruction, keeping the barrel cool, and lubricating the cutting-lips of the drilling-tool.

Having thus described my invention, I claim—

1. In a gun-barrel-drilling machine, the combination, with a frame having ways for a barrel-rest and a drill-carriage, of the barrel-carrying spindle and the feed-screw supported by bearings in substantial alignment with said ways, the barrel-rest constructed to support the outer end of the barrel and to be clamped to the frame and having a drill-guide, the drill-carriage fitted to slide on said ways and carrying the drill in alignment with said drill-guide and barrel-carrying spindle, and means for engaging and disengaging the carriage from the feed-screw.

2. In a gun-barrel-drilling machine, the combination, with the frame, the barrel-carrying spindle, and a feed-screw, of the barrel-rest movable on said frame and constructed to carry the outer end of the barrel, and provided with a drill-guide, of the drill-carriage connected and fitted to slide on said frame and adapted to be actuated by said screw, a drill carried by said carriage in alignment with said drill-guide and spindle, means for forcing lubricating-fluid in through the drill and out through the drilled bore and drill-guide, and a funnel, substantially as described, covering the drill adjacent to the guide for catching the discharged chips and lubricating-fluid.

3. In a gun-barrel-drilling machine, the combination, with means for rotating the barrel and with the movable barrel-rest adapted to engage the outer end of the barrel, of the drill-guide 97, closely fitting the drill and set in alignment with the axis of the barrel, the drill fitting said guide and having a covered channel to the point thereof, a carriage carrying and feeding the drill, and means supplying lubricating-fluid to the drill-channel, whereby the drill is accurately guided and the point thereof supplied with fluid, and the drill-guide kept free of obstruction.

4. In a gun-barrel-drilling machine, the combination, with a drill-carriage and a drill carried thereby, of a bushing fitted to slide on the drill in engagement with the groove

thereof, whereby the bushing is revolved with the drill, and a funnel, substantially as described, supported on the revolving bushing in longitudinal engagement therewith, whereby the bushing is slid on the drill.

5 5. In a gun-barrel-drilling machine, the combination, with the frame having ways for the drill-carriage and having a feed-screw parallel with said ways, of the drill-carriage
10 100, fitted to slide on said ways and carrying the drill, a revolving nut supported on said carriage in engagement with the feed-screw, means for revolving said nut by hand for traversing the carriage, and a clamp for friction-
15 ally setting the revolving nut to feed forward the carriage with a limited power, whereby the feeding movement is retarded by increased resistance to the drill.

6. In a gun-barrel-drilling machine, the
20 combination, with the head carrying the spindle, and having a channel supplied by a pump, and with the drill-carriage carrying the channeled drill in alignment with said spindle, of the two conveyer-tubes, one fixed to the head

and communicating with the channel therein 25 and the other fixed to said carriage and communicating with the drill-channel, said tubes being telescoped one within the other, and forming an extensible connection between the pump and the drill, and a frictional carriage-
30 feed, substantially as described, adapted to yield on the increase of pressure in the tubular connection beyond the normal working-point.

7. In a drilling-machine, the combination, 35 with means for supporting and rotating the piece to be drilled, of the drill-carriage carrying the channeled drill, a positive-acting pump communicating by connections, substantially as described, with the drill-channel, and frictional feed mechanism forwardly actuating
40 the drill-carriage, whereby an obstruction in the bore raises the pressure to retract the drill and dislodge the obstruction.

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Witnesses:

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