(No Model.) 3 Sheets—Sheet 1.

F. H. RICHARDS.

DRILLING MACHINE.

No. 421,517. Patented Feb. 18, 1890.

Fig. 2

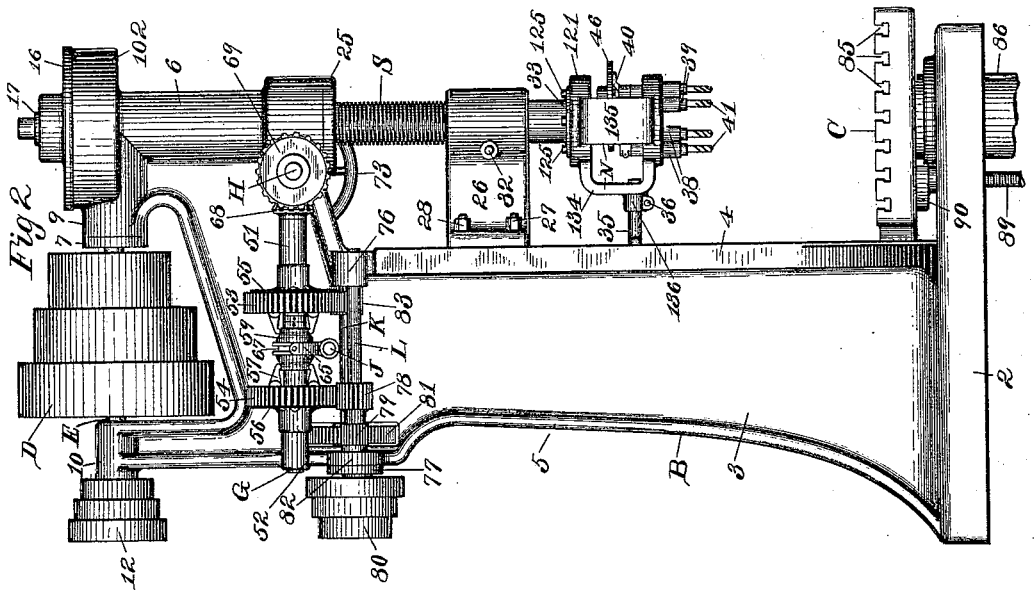
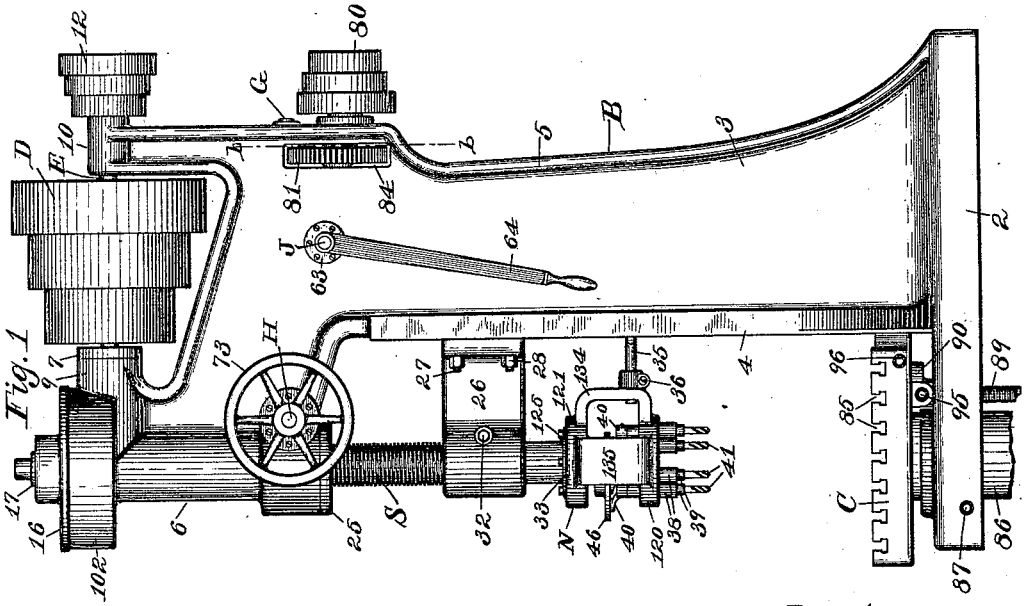


Fig. 1



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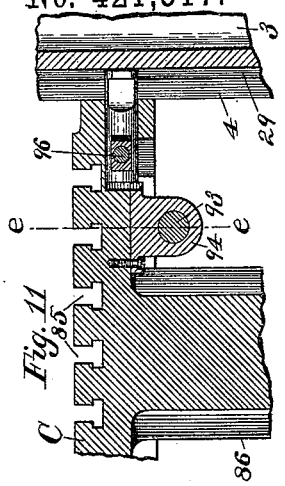
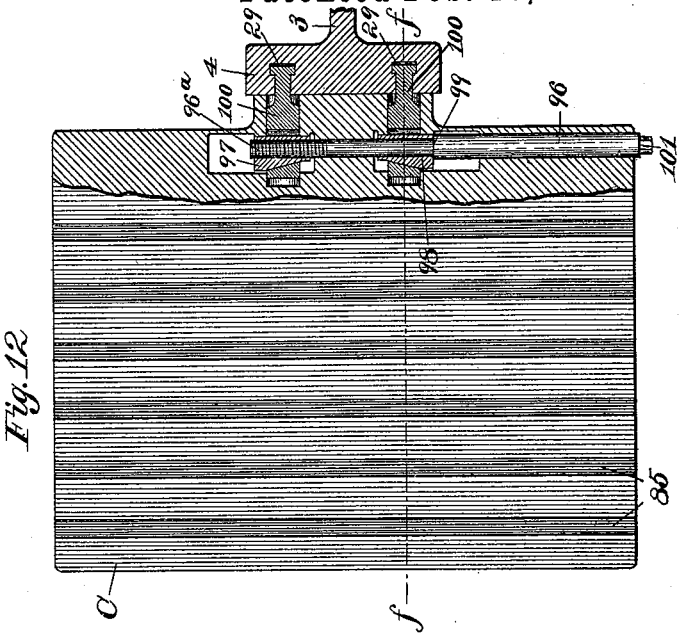
(No Model.) 3 Sheets—Sheet 2.

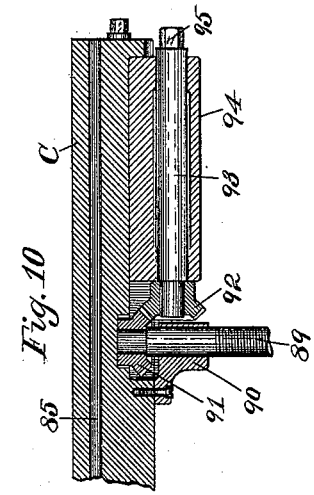
F. H. RICHARDS.

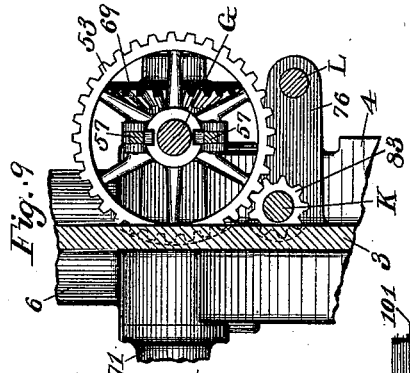
DRILLING MACHINE.

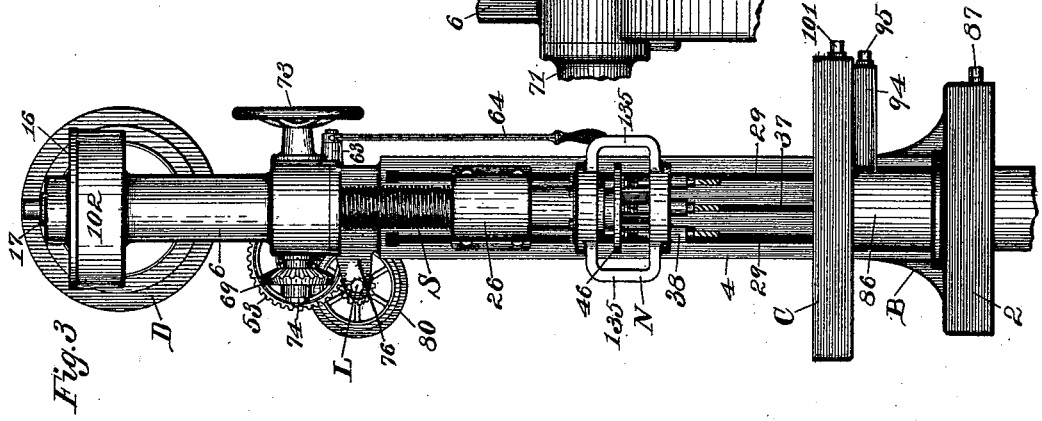
No. 421,517. Patented Feb. 18, 1890.











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(No Model.) 3 Sheets—Sheet 3.

F. H. RICHARDS.

DRILLING MACHINE.

No. 421,517. Patented Feb. 18, 1890.

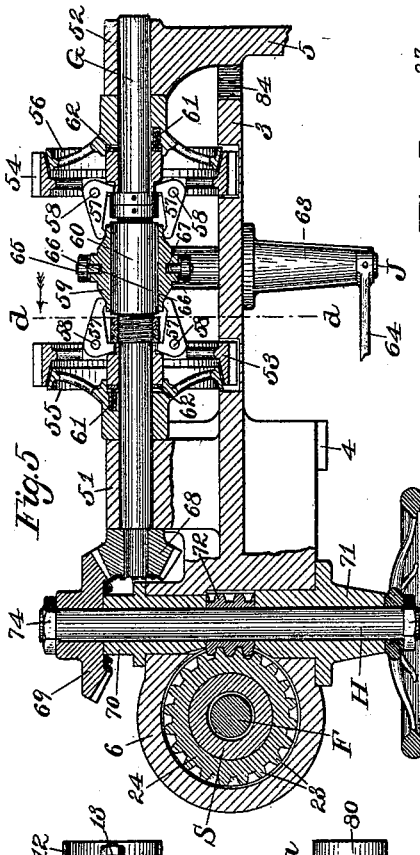

Fig. 5

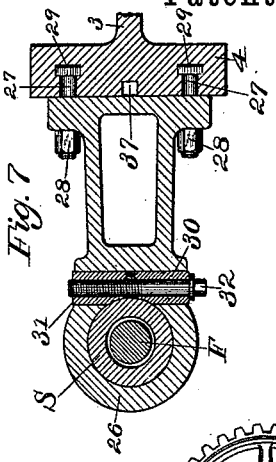

Fig. 7

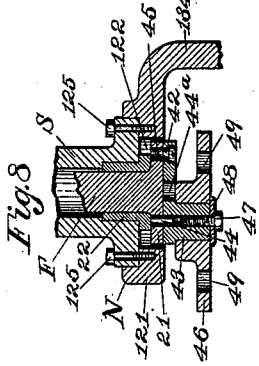

Fig. 8

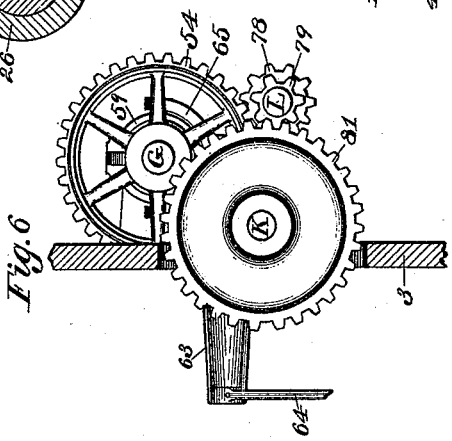

Fig. 6

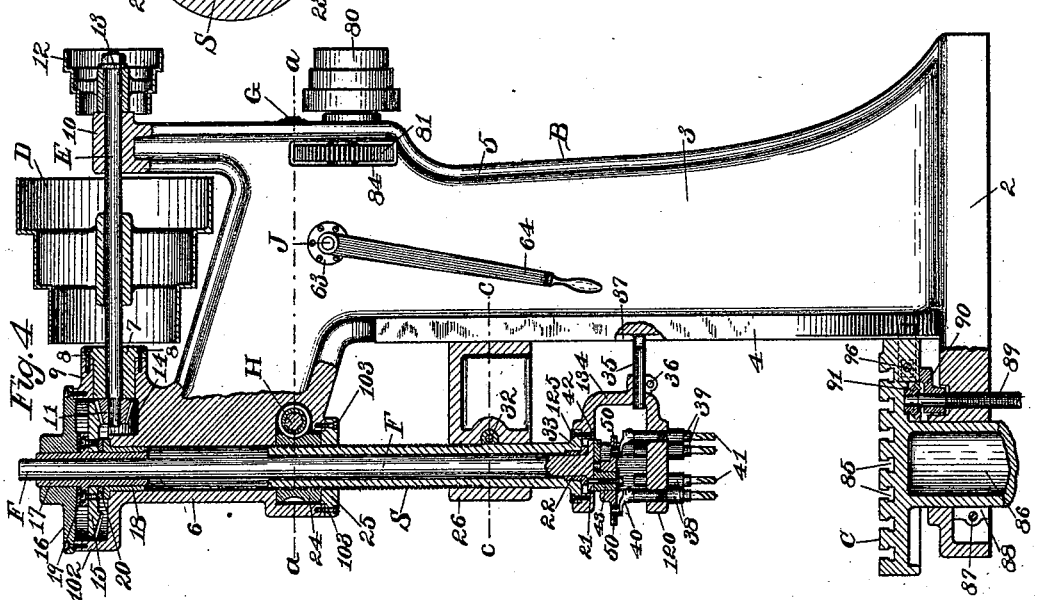

Fig. 4

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UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT, ASSIGNOR TO ECKLEY B. COXE, OF DRIFTON, PENNSYLVANIA.

DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 421,517, dated February 18, 1890.

Application filed November 23, 1889. Serial No. 331,390. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, 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 Drilling-Machines, of which the following is a specification.

This invention relates to drilling-machines for drilling metals, and more especially to that class thereof which are known as "multiple drilling-machines," and it is in the nature of an improvement on the machine which belongs to the same class and is described in Letters Patent of the United States, No. 404,364, granted to me May 28, 1889.

In the drawings accompanying and forming a part of this specification, Figure 1 is a right-hand side elevation of a drilling-machine embodying my present improvements. Fig. 2 is a left-hand side elevation, and Fig. 3 a front elevation, of the same. Fig. 4 is a view similar to Fig. 1, but drawn partly in section. Fig. 5 is a section taken on the line *a a*, Fig. 4, with many of the parts below that line removed. Fig. 6 is a fragmentary rear view taken on the line *b b*, Fig. 1, showing the arrangement of the feed-gearing. Fig. 7 is a section on the line *c c*, Fig. 4, showing certain features of the construction of the movable head. Fig. 8 is a vertical section of the crank-plate, the gyrating plate, and a portion of the crank-spindle, all drawn to a larger scale than in the principal views to better show the construction of said parts. Fig. 9 is a fragmentary sectional rear view taken on the line *d d*, Fig. 5, as seen in the direction of the arrow. Fig. 10 is a vertical section taken on the line *e e*, Fig. 11, showing the arrangement of the gearing for elevating the work-table. Fig. 11 is a vertical section taken on the line *f f*, Fig. 12, a portion of said table being broken away. Fig. 12 is a plan view of the table, together with a part of the column, drawn partly in section, showing the means for clamping the table to the column.

Similar characters designate like parts in all the figures.

The column B, which constitutes the frame-work of the machine, is composed of the base 2, the web 3 rising from said base and having the front rib 4 and the back rib 5 and the tubular casing 6 formed integral therewith. The upper and lower ends of said casing are enlarged to receive the gearing, as hereinafter set forth. The driving-shaft E, on which is fixed the driving-pulley D, has a front bearing consisting of the bushing 7, fitted into and secured by the screws 8 to the projection 9, that is formed on the column B, and a rear bearing 10, that is also formed on said column. On the forward end of said shaft E the driving-pinion 11 is fixed in any well-known manner. The feed cone-pulley 12 is usually secured to the rear end of said shaft E by the nut and washer 13, as shown in Fig. 4. Said gear or pinion 11 is contained in the wheel-pocket 14, that is formed in the upper and forward part of the frame-work, which pocket may be kept supplied with oil for the lubrication of the said gear 11 and the large bevel-gear 15, with which it meshes.

The gear 15 is contained in the enlarged upper portion 102 of the said casing 6, which casing is furnished with a cap or cover 16, secured thereto by holding-screws, as shown in Fig. 4. Said gear 15 is fitted on and secured to the sleeve 17 by screws, as shown, the said sleeve being splined to slide on the upper end of the crank-spindle F in a well-known manner, which, however, I have not deemed it necessary to show in the drawings. The said sleeve 17 is fitted to turn freely in the cap 16, which forms the upper bearing therefor, and in the bushing 18, that is fitted into the casing 6 and forms the lower bearing therefor. The washers 19 and 20 are provided to sustain the friction and wear.

The spindle F has a flange 21 formed on the lower end thereof, and has its lower bearing in the bushing 22, which is fitted to said spindle immediately above said flange, and is fixed in the lower end of the spindle-slide S, the upper bearing of the spindle being a sliding one in the aforesaid sleeve 17, that is splined thereto. Said slide S has its upper bearing in the revolving feed-nut 24, which is contained in a pocket formed in the lower end of the casing 6, and which is held in place in said pocket by the cap 25, that is fixed to the frame by the holding-screws 103, as shown in Fig. 4. The said feed-nut 24 has a screw-

thread cut therein to fit the similar thread cut on the tubular slide S, the upper end of which is fitted to move freely in the casing 6, forming a guide therefor. Said slide S is also fitted to move freely in the movable head 26, which head is adjustably secured to the column by means of the T-headed bolts 27 and the nuts 28, the said bolts fitting into the T-shaped slots 29, that are formed in the front wall or rib 4 of the column B. The movable head 26 is also furnished with suitable clamp for temporarily fixing it on the slide S. This clamp, as shown herein, consists of the wedges 30 and 31, and with the binding bolt or screw 32 as a means for clamping the said wedges together onto the said slide S. This is for the purpose of elevating and lowering said head 26 by power, as hereinafter set forth. (See Fig. 7.) A flange 33 is formed on the lower end of the slide S, which flange is fitted into the top of the jig-frame N, the said parts being held together by screws or bolts, as shown in Fig. 4. Said frame N is furnished with a guide-pin 35, secured therein by a clamp-screw 36, and whose rearward end is fitted to engage in the slot 37, that is formed in the said front rib 4. This device receives the torsional thrust due to the driving of the drills by the crank-spindle and holds the jig-frame against that tendency to revolve the same. The construction and arrangement of the drills and their spindles and sockets and the manner of carrying the same in the jig-frame N, is or may be substantially the same as that shown and described in United States Patent No. 404,364, for a drilling-machine, granted to me May 28, 1889, and to which reference may be had. The tubular drill-spindle sockets 38 are screwed into the bottom plate 120 of the jig-frame N. The drill-carrying spindles 39 are fitted into the said sockets and have the drill-spindle cranks 40 clamped to the upper ends thereof, the drills 41 being screwed or otherwise fixed firmly in the lower end of said spindles 39.

The crank-plate 42 has the crank-pin 43 formed thereon. The said plate is properly located on the lower end of the crank-spindle F by means of the dowel-pin 44 and the tenon 44^a, which tenon is formed on said spindle and fits the central hole in said plate. A number of holding-screws 45, one of which is shown in Fig. 8, serve to firmly hold the crank-plate to its spindle. The gyrating or driving plate 46 is bored to fit the crank-pin 43, and is or may be held in place thereon by means of the screw 47 and the washer 48. The said plate 46 has the holes 49 formed therein to secure the drill-crank rollers 50. The mode of operation of said driving-crank, driving-plate, and drills is the same as pointed out in my said prior Letters Patent.

The feed mechanism of this machine may be described as follows: The clutch-shaft G has a front bearing 51 and a rear bearing 52, both formed on the column B. The friction gears or wheels 53 and 54 are fitted to turn freely on said shaft. The rims of the said gears are beveled on the inner side to fit the friction-cones 55 and 56, respectively, and are furnished with the dogs or levers 57, that have their fulcrum on pins 58, that are fixed in said wheels. The sliding wedge or cam 59 is fitted to turn freely on the enlarged part 60 of the shaft G, between the said oppositely-disposed sets or pairs of levers 57. The friction-cones 55 and 56 are keyed or otherwise fixed to the said shaft, and have a series of springs 61 inserted in the hubs thereof and bearing against the collars or washers 62, for the purpose of holding the said gears and friction-cones normally apart in a well-known manner. As a means for actuating the wedge 59 to throw the said friction gears and cones into engagement, a shaft J is journaled in the long bearing 63, that is fixed in the frame and has securely fixed to its right-hand end the hand-lever 64 and to its left-hand end the fork 65, whose pins 66 fit the groove 67, that is formed in said wedge or cam 59. (See Fig. 5.) A small bevel-pinion 68 is keyed or otherwise fixed on the forward end of the shaft G, to mesh with and drive the larger bevel-gear 69, that is fixed on the left-hand end of the worm-shaft H. Said worm-shaft is journaled in the bearings 70 and 71, that are fitted into the column B, as shown in Fig. 5, and carries the worm 72, which meshes with and drives the feed-nut 24, hereinbefore mentioned, this nut having thereon the teeth 23 for that purpose. The hand-wheel 73 is fixed to the right-hand end of shaft H in a well-known manner. The nuts 74 and 75 hold the parts in place on said shaft. The feed-shaft L, Fig. 2, is journaled in the bearing 76, that is formed on the column B, and in the bearing 77, which is secured by screws or otherwise to a projection of the back rib 5 of said column. The gear 78 may be formed on or fixed to said shaft L. It meshes with and drives the friction-gear 54. The gear 79, also formed on or fixed to said shaft, meshes with and drives the large gear 81, that is fixed by a key or otherwise to the intermediate gear-shaft K. To the outer or rear end of the shaft L is fixed the feed pulley or cone 80, which is driven by a belt (not shown) from the corresponding cone-pulley 12. The said intermediate gear-shaft K is journaled in the forward bearing 76 and in a rear bearing 82, that is formed on the back rib 5 of the column. Said shaft has also keyed or otherwise fixed thereon the gear 83, that meshes with and drives the friction-gear 53. The numeral 84 designates the opening formed in the web 3 of the column to accommodate the gear 81. The system of gearing here described drives the wheel 54 directly and rapidly, thus constituting a "quick-return" movement for elevating the slide S. The wheel 53, being driven through the intermediate or "back-gear" shaft K and the gearing thereon, is re-

volved much more slowly and powerfully and constitutes the "feed motion" or mechanism proper for feeding the drills to their work.

The work-table C has numerous T-shaped slots 85 formed therein to receive the heads of bolts for holding thereon the article to be drilled. Th stem or spindle 86 of said table C is fitted to slide vertically in the base 2 of the column, and may be clamped therein in a well-known manner by means of the clamp-screw 87, the part 88 of said base being split, as shown, to permit of such clamping. The said table is raised or lowered by means of the elevating-screw 89, that works in a nut formed in the base 2 of the column and in a bearing 90, that is secured to the under side of the table. A miter-gear 91 is fixed to the upper end of said screw 89 and meshes with another and similar gear 92, that is fixed to the inner end of the shaft 93, as shown in Fig. 10. Said shaft 93 is journaled in the bearing 94, secured to the under side of the table C, and has a squared head 95 on its outer end to receive a crank or wrench by which said shaft 93 may be turned by hand to elevate said table. For clamping the table C to the column I have provided a shaft or screw 96, the inner end of which has a thread 96^a, fitting a similar thread cut in the wedge 97, Fig. 12. The opposite wedge 98 fits freely on the reduced part of said shaft and against the shoulder 99 thereof. On their rear sides both wedges lie against faces formed in the table. A pair of similarly-formed clamping-bolts 100 (having T-heads fitting the T-slots 29 formed in the front rib 4 of the column) have wedge-shaped holes formed therein to receive wedges 97 and 98, respectively. To clamp the table, a crank or wrench is applied to the squared head 101 of said shaft 96, by turning which the wedges are forced inwardly toward each other, thereby drawing the bolts 100 into the table, and thus clamping the same firmly to the column with a force proportional to the pitch of said screw and wedges.

The jig-frame N is a rigid frame comprising a bottom plate, a top plate, and connecting-columns, as 134 and 135, uniting the said plates. The bottom plate 120, as hereinbefore stated, carries the drill-spindle sockets, while the upper plate 121 furnishes a means for attaching the frame to the slide S and sustains the downward force thereof when the drills are forced down to the work being drilled. The slide-flange 33 is made of large size, so as to bear on the plate 121 outside of the bore 122 therein, which bore is larger than the flange 21 and crank-plate 42. Consequently when the screws 125 and the screw and washer 47 and 48 are removed the jig-frame may be lowered from said slide S, the crank 43 at the same time withdrawing from the driver-plate 46. By this means the whole apparatus is readily assembled and disassembled, an operation which in practice has frequently to be performed. The rear column 134 of frame N has a boss or hub 136 for carrying the guide-pin 35.

The mode of operation of the above-described machine is as follows: An ordinary belt from a line of shafting to the driving-pulley D imparts motion to the driving-shaft E, Fig. 4. Another belt from the pulley 12 to the pulley 80 drives the feed-gear shaft L, and through the gear 78 thereon the quick-return friction-wheel 54. The gear 79 on shaft L drives the large gear 81, and through it the intermediate shaft K, and through the small gear 83 on said shaft K drives the feed friction-wheel 53. It should be understood that the friction-gears 53 and 54 are thus normally kept always in motion, turning freely on the clutch-shaft G. The table C should first be adjusted to the proper height (according to the article to be drilled) by means of the elevating-screw 89, and the screw 87 should be tightened to clamp the stem 86 firmly in the base 2 of the column; also, the table should then be clamped to the front rib of the column by means of the screw 96 and the devices connected therewith. The article to be operated upon is now placed on the table and properly secured thereto in the usual manner. The movable guiding-head 26 should next be set to the proper height. This may be done by first clamping said head to the slide S and loosening the bolts 27 and 28, when, by means of the feed mechanism, the spindle S, together with said head thereon, may be raised or lowered to the desired position. The bolts 27 and nut 28 are now tightened and the clamp-screw 32 loosened, when the machine will be ready for use. The driving-shaft G, through the gear 11, the gear 15, and the sleeve 17, drives the crank-spindle F, and through said spindle and the crank-plate 42, the crank-pin 43, and the gyrating plate 46 drives the drills 41. By forcing the lever 64 back the operator may throw the friction-gear 53 into engagement with the friction-cone 55 to slowly feed the drills down to the work, the power therefor being transmitted through the pinion 68, the gear 69, the shaft H and worm 72, and the feed-nut 24 to the slide S. By forcing the said lever in the opposite direction, toward the front of the machine, the friction-gear 54 may be thrown into engagement with the friction-cone 56 to quickly return or raise the drills.

Having thus described my invention, I claim—

1. In a drilling-machine, the combination, with a frame-work having a fixed upper bearing receiving the upper end of the spindle-slide, of the movable head adjustable on said frame-work, and the spindle-slide fitted to slide in said head and extending into said upper bearing, said slide carrying a drill-actuating spindle, all substantially as described.

2. In a drilling-machine, the combination, with a frame-work having thereon the upper bearing for the spindle-slide and a way for

the movable head, of the movable head on said way, the spindle-slide extending through said head and into said upper bearing, and having on the upper end thereof a screw-thread, and a feed-nut carried by the frame-work at said upper bearing and engaging said screw-thread, said slide carrying a drill-actuating spindle, and said nut having means, substantially as described, whereby it may be revolved, all substantially as described.

3. In a drilling-machine, the combination, with a frame-work, substantially as described, having the slide-receiving casing and adapted to carry the feed-nut at the lower part of said casing, of the movable head below said casing and nut, the spindle-slide extending through said head and nut and carrying the drill-actuating spindle, the feed-nut supported and actuated substantially as described, and engaging a screw-thread on said slide, and gearing, substantially as described, carried by the frame-work at the upper end of said casing and engaging to drive said spindle, all substantially as described.

4. In a drilling-machine, the combination, with the frame-work having the casing 6, of the slide S, the spindle F, the feed-nut 24, engaging said slide, the sleeve 17, splined to said spindle and journaled at its lower end in the frame-work and at its upper end in the bearing 16, fixed on said frame-work, the wheel 15 on said sleeve, and means, substantially as described, actuating said wheel and feed-nut, all substantially as described.

5. In a drilling-machine, the combination, with the frame-work having the casing 6 enlarged, substantially as described, at its upper end to receive the gearing and having the bearing 9 of the sleeve 17, the cover and bearing 16, the wheel 15 on said sleeve, and the pinion 11 on shaft E and meshing with said wheel, said pinion and wheel being inclosed for lubrication, and said sleeve having a bearing on each side of said wheel, all substantially as described.

6. In a drilling-machine, the combination, with a frame-work having a way for a movable head, of the spindle-slide, means actuating said slide, the movable head on said way, means clamping said head to and unclamping it from the frame-work, and a clamp constructed and arranged to fix the head on the slide, all substantially as described.

7. In a drilling-machine, the combination of the movable head fitted to the way on the frame-work and adapted to be fixed thereto, the slide S, extending through said head and movable parallel to said way, and clamp-wedges 30 and 31, constructed and operated to temporarily fix the head on said slide, all substantially as described.

8. In a drilling-machine, the combination, with frame-work, substantially as described, of the threaded spindle-slide, the nut 24, having teeth meshing with worm 72, cap 25, supporting said nut, and shaft carrying said worm and carried in bearings in said frame-work, all substantially as described.

9. In a drilling-machine of the class specified, the combination, with the spindle F, having flange 21, and a tenon, substantially as described, of the crank-plate 42, having the crank 43 and being centrally perforated to fit the tenon on said spindle, and means, substantially as described, holding together said flange and crank-plate, substantially as described.

10. In a drilling-machine of the class specified, the combination, with the spindle F, having flange 21 and a tenon, substantially as described, of the crank-plate 42, having the perforated crank-pin 43 and being centrally perforated to fit the tenon on said spindle, the dowel-pin 44 in said flange and extending into the hole in said crank, and screws holding said plate to said flange, all substantially as shown and described.

11. In a drilling-machine, the combination, with the slide and with a feed-nut driving said slide and geared to be actuated from a clutch-shaft, of the reversely-actuated clutch-wheels on said shaft, the feed-shaft L, geared directly to one said clutch-wheel for the quick-return movement and geared indirectly through gearing, substantially as described, with the other said wheel for the feed-movement, and means, substantially as described, operating to engage and disengage said clutches, all substantially as described.

12. In a drilling-machine and in combination, substantially as described, the improved jig-frame N, it consisting in the upper plate fitted for attachment to the spindle-slide and bored for the passage through it of the spindle-crank, the lower plate carrying the drill-sockets, and the columns 135 and 134, rigidly uniting said plates.

13. In a drilling-machine, the combination, with the frame-work and with the table C, having the stem 86 sliding in the said frame-work and having one side fitting a way thereon, of the wedges 97 98, the bolts 100, and a screw actuating said wedges, said bolts having heads engaging T-slots in the frame-work, all substantially as described.

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