(No Model.)

6 Sheets—Sheet 1.

F. H. RICHARDS.

HORIZONTAL DRILLING MACHINE.

No. 515,129. Patented Feb. 20, 1894.

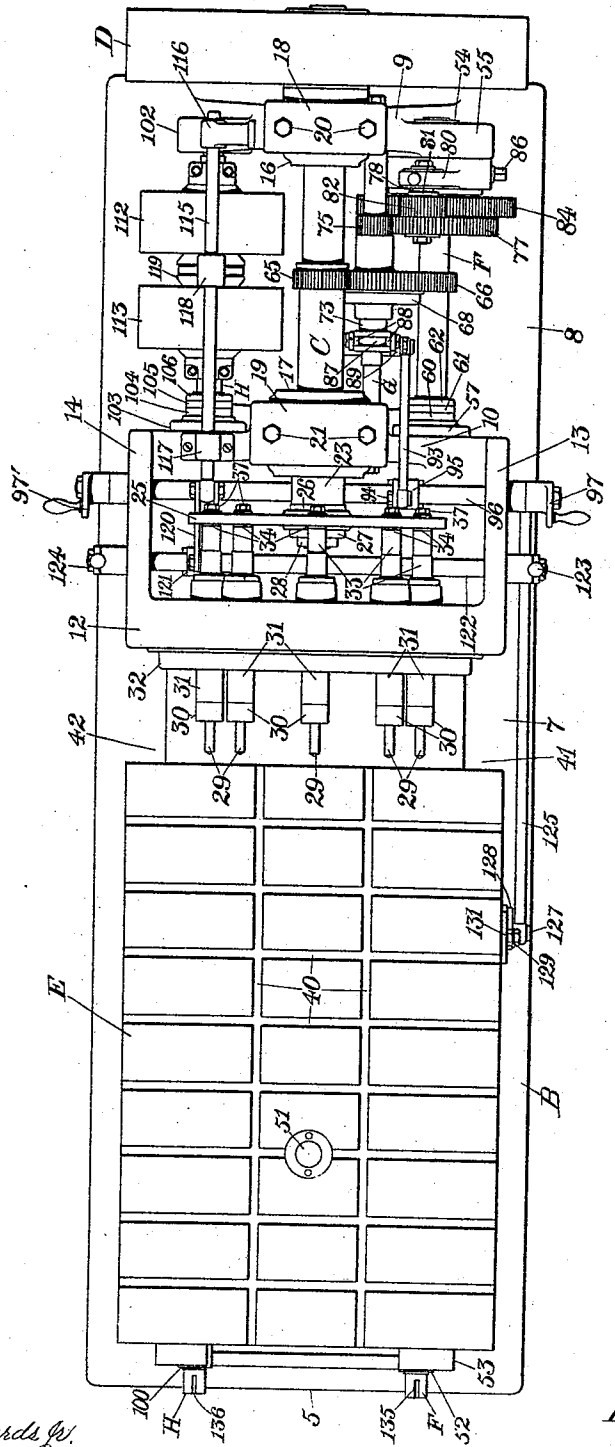

Fig. 1

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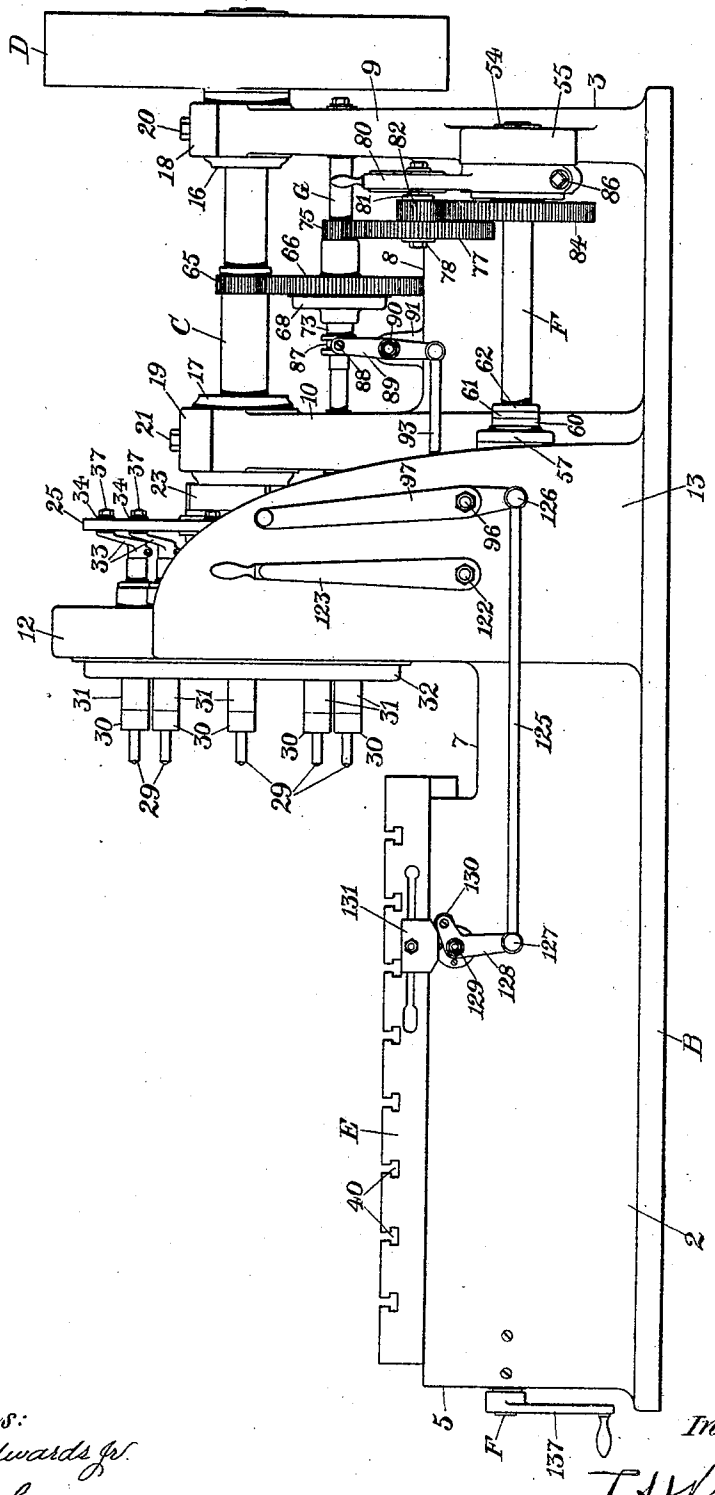

Fig. 2.

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Fig. 4

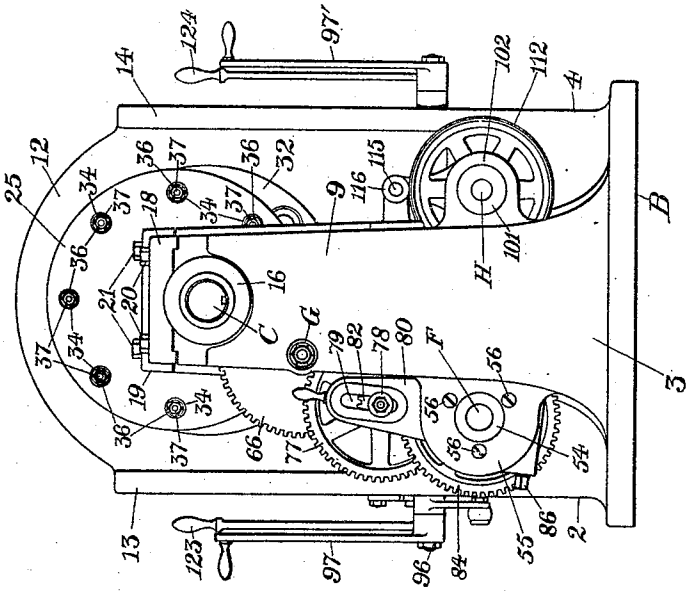
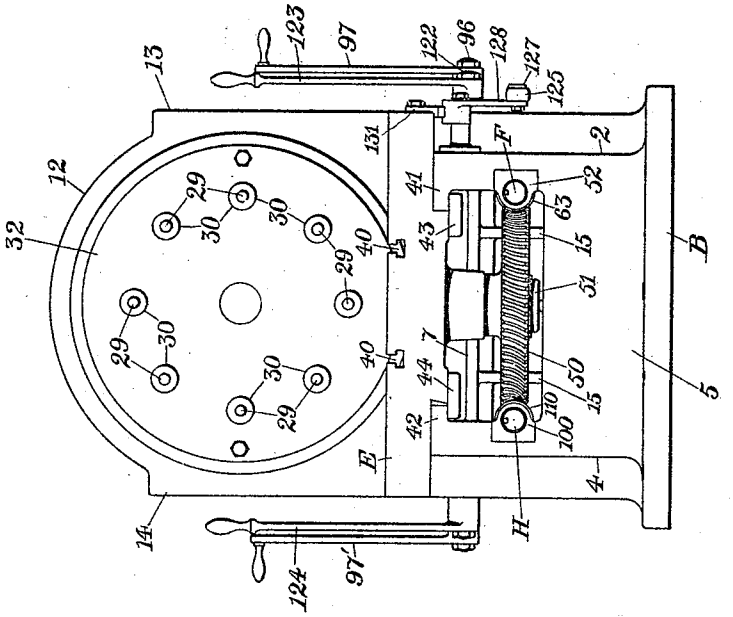


Fig. 3



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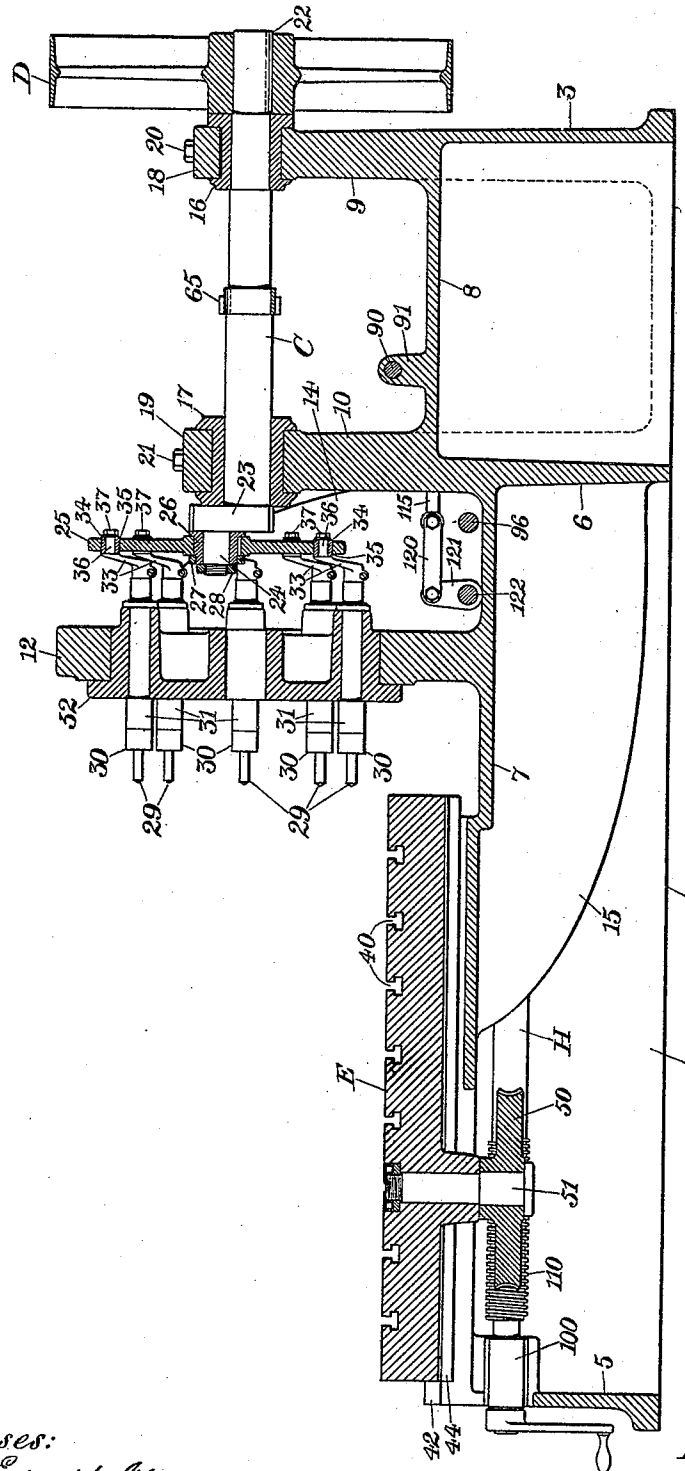

Fig. 5

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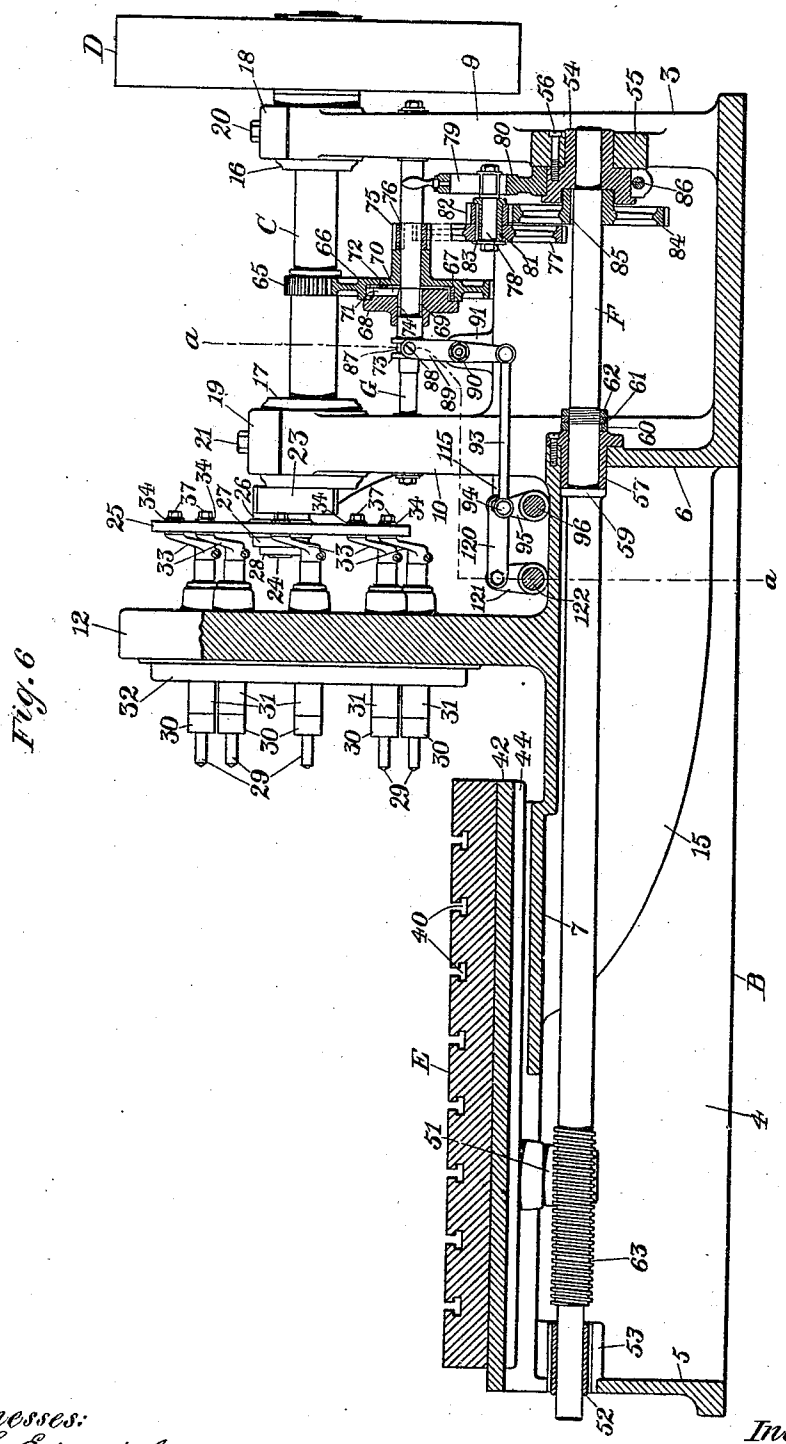

Fig. 6

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HORIZONTAL DRILLING MACHINE.

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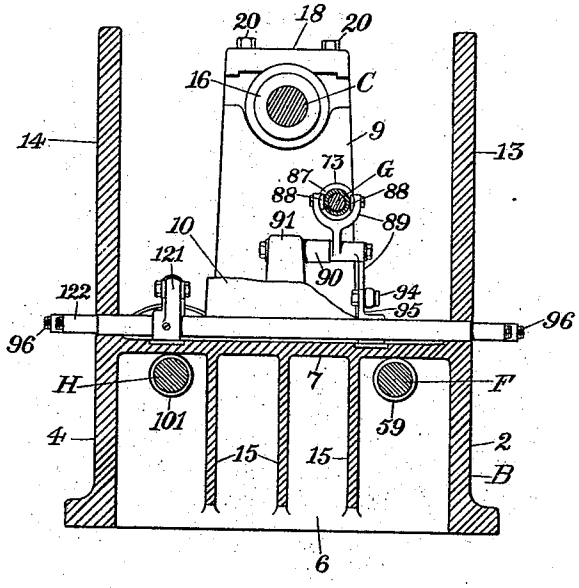
Fig. 7



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UNITED STATES PATENT OFFICE.

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HORIZONTAL DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 515,129, dated February 20, 1894.

Application filed June 26, 1893. Serial No. 479,103. (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 Horizontal Drilling-Machines, of which the following is a specification.

This invention relates to horizontal multiple drilling-machines, the object of the invention being to furnish a drilling-machine of the class specified especially adapted for simultaneously drilling a series of holes in work carried upon the table or platen of the machine, and to provide the same with a "duplex" feeding-mechanism capable of independent operations for imparting to the sliding table either a slow or a fast movement alternately;—that is—a slow forward movement, and a fast return movement, or a continuously fast or a continuously slow movement in either direction, as may be desired.

In the drawings accompanying and forming a part of this specification, Figure 1 is a plan view of a horizontal multiple drilling-machine embodying my present invention. Fig. 2 is a side elevation of the drilling-machine. Fig. 3 is an end elevation of the machine as seen from the left hand of Fig. 2. Fig. 4 is a similar view as seen from the right hand in Fig. 2, the driving pulley being removed for more clearly showing the arrangement of other parts. Fig. 5 is a vertical longitudinal section taken through the center of the machine. Fig. 6 is a side elevation, partially in central vertical longitudinal section. Fig. 7 is a vertical cross-sectional view of the machine on line *a a* of Fig. 6, as seen from the left hand of said figure, some of the parts being removed, and others being broken away to more clearly show the arrangement of certain details.

Similar characters designate like parts in all of the figures.

The framework of my improved drilling-machine, which may be of any suitable construction, is herein shown as a one-piece casting designated by the letter B, comprising two side-walls 2 and 4, the end-walls 3 and 5, and the intermediate wall or web 6; the top-plate or web 7 Fig. 5 connects the two side-walls, it extending toward the front end of the machine a considerable distance from the transverse wall or web 6; a similar plate 8 joins the said side-walls and the walls 3 and 6, which plates 7 and 8 form the top-plate of the frame of the machine. An upright or pillar 9 rises above the transverse end-plate 3 at the right hand end of the machine, and forms the rearward support for the driving-shaft C; a similar upright or pillar, extends upward from the web 6, and forms the forward support for said shaft and will be hereinafter more fully described. A web 12 of suitable thickness rises from the top-plate 7, and extends from side to side of the machine in advance of the pillar 10, said web carrying the jig-plate 32 which supports and receives the thrust of the drills, said web being braced at its sides by the ribs 13 and 14 which increases its strength and rigidity. The top-plate 7 is braced from below by a series of vertical longitudinal ribs 15 connecting said top-plate 7 and transverse web 6, as clearly shown in Figs. 5 and 7. By this construction of frame I secure the maximum of strength and rigidity with the minimum amount of material thus securing a comparatively light structure which will withstand great strain, for a relatively small expense.

The driving-shaft C is journaled in bearings 16 and 17 in the uprights or pillars 9 and 10, respectively, said shaft being held in place in the bearings by suitable caps 18 and 19 secured in the usual manner by cap-screws 20 and 21, respectively. The driving-pulley D is secured to the rear end of the shaft C outside of the upright 9, and adjacent to the bearing 16, by means of a key 22, or in other well-known manner.

Secured, or formed upon the shaft C, is a crank 23, having a crank-pin 24 which carries the drill-driving plate 25 which is centrally-bored to receive a bushing 26 which is closely yet freely fitted upon the said crank-pin, a ring-nut 27 serving to hold the bushing in place in the driving-plate, and a nut 28 holding said parts in place on the crank-pin.

The construction of the drill-spindles, their sockets and cranks, is substantially identical with the construction shown and described in United States Patent No. 404,364, granted

to me May 28, 1889, to which reference may be had.

The drills 29 are removably-secured in spindles 30, journaled in sockets 31 which are removably-secured in the jig-plate 32 with their rear ends projecting beyond the jig-plate as shown in the drawings. Clamped, or otherwise secured to the rear end of the spindles 30, are cranks 33, having crank-pins 36 at their ends upon which are mounted friction-rollers 34 which bear in corresponding holes formed in the driving-plate 25. The crank-pins 36 of the drill-cranks turn within the rollers 34 as a journal within a properly-fitted bearing, the rollers being held in place on said crank-pins by means of nuts, or other suitable devices 37.

By constructing the machine to impart a positive gyratory movement to the driving-plate in about the same radius as the movement of the drill-crank, and by making the holes 35 a fraction greater in diameter than the diameter of the rollers 34 on the crank-pins, said rollers (or the crank-pins if no rollers are employed) will, during the operation of the machine, rotate within the bearing-holes, thus driving the crank without any cramping thereof, and comparatively little friction.

Inasmuch as the operation and relative movement of the driving-shaft, driving-plate, crank-spindles and drills just referred to, were fully described in the Letters Patent referred to, and inasmuch as the operation will be clearly apparent to those skilled in the art, by comparison of this description with the drawings, it is deemed unnecessary to minutely describe their operation in the present application.

The work-holding table E is herein shown as of usual general construction as having the usual T-slots or grooves 40 formed in its upper face to receive the clamp-blocks that secure the work to the table. Said table is fitted to slide longitudinally upon ways 41 and 42 at the sides of the frame and being held in place by suitable straps 43 and 44, see Fig. 3, in the usual manner.

The piece of work to be drilled and which is secured to the table E, is moved toward or from the drills by means of the feed-mechanism hereinafter described, which feed mechanism will preferably be similar in construction and operation, to the duplex feed-mechanism described and claimed in Letters Patent No. 487,775, granted to me December 13, 1892, and to which reference may be had. This feed-mechanism, in the preferred form thereof shown in the drawings, comprises a worm-wheel 50 fitted to rotate freely on a stud, 51, which is shown fixed in the table E from the under side; a slow-feed shaft F and a quick-feed shaft H located one on each side of, and having a screw or worm in mesh with the teeth of the worm-wheel; and mechanism to impart motion to each of said shafts, as will be hereinafter more fully described. The slow-feed shaft F, herein shown as located at the right-hand side of the machine, (looking from the front end,) is journaled at its forward end in a bearing 52 formed in a projection 53 at the front end of the frame, and at its rear end in a bearing 54 formed in a projection 55 in the upright 9 at the rear end of the machine, said bearing being held in place in said projection by means of screws, as at 56, Fig. 4. An intermediate bearing 57 is also provided for the shaft F, said bearing being formed in, or carried by, the web 6 of the framework. A collar 59 is formed on the shaft F to bear against the bearing 57, and a wear-washer 60 carried on the said shaft bears against the opposite end of said bearing against which it is held by reason of the nut 61 and a set-nut 62, which bearing takes the thrust of the shaft; any end-wise play due to wear may be readily taken up by means of said nut and set-nut.

The shaft F is rotated from the driving-shaft C through a train of gears as will be hereinafter described. Formed upon the forward end of the shaft F is a feed-worm 63 which meshes with the teeth of the worm-wheel 50, and rotates said wheel on the turning of said shaft. As a means for rotating the shaft F, the driving-shaft C is provided with a pinion 65, keyed or otherwise secured thereto, and which meshes with the gear 66 that is loosely mounted upon an intermediate or clutch-shaft G; said gear 66 has an enlarged hub which is capped or recessed as clearly shown in Fig. 6, to receive a split friction-ring 67. A disk, 68, is fixed to the shaft G by means of the key 69, and has a radial groove 70 formed therein for receiving a ring-expanding wedge 71, that is held in place in said groove by means of a strap 72 and screws, not shown. A sleeve 73 is fitted to slide longitudinally on the shaft G and has formed thereon or fixed thereto a wedge 74 which fits in a key-way or groove formed in the disk 68, the inclined forward end of said wedge 74 engaging the inner end of the ring-expanding wedge 71 and forcing it outward to expand the friction-ring 67 within the hub of the gear 66, thus frictionally connecting said gear with the shaft G. A pinion 75 is fixed to the shaft G, preferably by a key 76, and meshes with a gear 77, mounted upon a stud 78, and adjustably secured in a slot 79 formed in a swinging-arm 80 carried on the bearing 54 of the shaft F, the lower end of said arm being preferably split and clamped to said bearing by means of the binding-screw 86. The stud 78 is provided with a sleeve 81 which is fitted to turn freely upon said stud, and the gear 77 is fitted to said sleeve and secured thereto by a key 83. Secured upon the said sleeve intermediate between the gear 77 and arm 80, is a pinion 82 which, if desired, may be formed integral with the gear 77, which pinion 82 meshes with a gear-wheel 84 secured to the shaft F by means of a key 85. By means of the gearing above described, the

shaft F may be rotated from the driving-shaft C. The gears 77 and 82 are preferably change-gears and may be removed and replaced by gears of different sizes as may be desired.

As a means for advancing or retracting the wedge 74 to throw the clutch-parts into engagement, the sleeve 75 has formed therein a groove 87, a pair of pins 88 carried by the forked ends of an operating lever 89 being seated in said groove to force the sleeve 75 and its wedge 74 inward or outward as the case may be when said lever is actuated for that purpose. The lever 89 is pivoted at 90 to a projection 91 on the framework, and is pivotally-connected at its opposite end to one end of a connecting-rod 93; the opposite end of which rod is pivoted at 94 to an arm 95 formed upon, or secured to, a rock-shaft 96 that extends transversely through, and is mounted in bearings in, the ribs 13 and 14 of the framework; said rock-shaft has fixed to its outer end, an arm or lever 97, Fig. 3, by means of which the shaft is rocked to throw the clutch into, or out of engagement.

The above described feeding-mechanism constitutes the slow feed used in feeding the work to the drills. I have also provided a quick-feed mechanism by means of which the work-table may be fed a quick movement in either direction if desired. Said quick-feeding mechanism will preferably be constructed as follows:—The quick-feed shaft H is similar in construction to the shaft F, and is likewise mounted at its forward end in a bearing, 100, carried by the framework, and at its rear end in a bearing, 101, (Figs. 3 and 4) carried in a projection, 102, formed upon the upright 9. An intermediate bearing 103 is also provided for said shaft H, which bearing is similar to the bearing 57 for the shaft F; and for the purpose of adjustment, it is likewise provided with a wear-washer 104, a nut 105 and a check-nut 106, which are arranged similarly to the corresponding parts of the shaft F, hereinbefore described. This shaft H has also formed thereon, or secured thereto, a feed-worm or screw 110, which is similar to the worm 63, and like that, meshes with the worm-wheel 50. For rotating the shaft H in either direction, I provide a frictional driving-mechanism located upon said shaft and intermediate to the bearings 101 and 102, which driving-mechanism may be of any suitable form. In the present instance, I have shown simply a pair of pulleys 112 and 113, which are loosely mounted upon the shaft H; these pulleys should, in practice, be capable of frictional-engagement with said shaft independently, whereby motion may be imparted thereby to said shaft in either direction, for moving the table backward or forward as may be required. Said pulleys 112 and 113 are designed to be rotated in opposite directions from pulleys upon the line-shaft or counter-shaft, by means of ordinary belts, not herein shown, one of which belts will usually be a half-turn or cross-belt.

In the drawings I have shown a shipper-device for bringing the pulleys 112 and 113, one at a time, into frictional-engagement with the shaft H, said shipper-device consisting of a shipper-rod 115 fitted for free longitudinal movement in the bearings 116 and 117 on the framework; said shipper-rod has fixed thereto midway of its length a bifurcated arm 118 which engages, as shown in Fig. 1, the part 119, constituting a cam or wedge for the clutch-mechanism, that is located upon the shaft H intermediate between the pulleys 112 and 113, with which pulleys said clutch-apparatus may be engaged with one or the other of the pulleys, for revolving the shaft to reciprocate the table. The rod 115 is connected by means of connecting-rods or links, as 120, to an arm, 121, formed upon or fixed to a rock-shaft, 122, similar to the shaft 96 and and like that journaled in bearings formed therefor in the ribs 13 and 14 of the framework; the ends of said rock-shaft being provided with levers or arms, as 123 and 124, by means of which the operator may actuate the friction-clutch device. The connection between the pulleys 112 and 113 being direct, the shaft H may be rapidly rotated in either direction, and, through the medium of the worm and worm-wheel, the work-table will receive a quick feed movement in one or the other direction as the case may be.

When the worm-wheel 50 is rotated through the worm 110 of the shaft H, said worm-wheel runs at its opposite side on the worm 63 of the shaft F as upon a rack, and "vice versa" when the wheel 50 is rotated by means of the worm 63 of the shaft F, in which case the worm-wheel 50 runs on the worm 110 of the shaft H as above described with reference to shaft F which in this instance gives a slow-feed movement to the table.

I have provided a device for automatically disengaging the clutch-mechanism in the shaft G to thereby stop the shaft F, said device consisting, preferably, of a connecting rod 125, Fig. 2, one end of which is pivotally-connected at 126 to the lower end of lever 97, and at its opposite end as at 127 to a bell-crank lever 128 which is pivotally-supported at 129 on the framework. The opposite end of said lever is furnished with a roller 130, which in the movement of the table, rides over the cam-face of the block 131, and is adjustably-secured to the side of the table E, said block being fixed to the table at a point where it will contact with the roller 130 of the bell-crank lever 128 when the drills have completed their work, thus acting to tip the lever, throwing the connecting-rod 125 forward, which rocks the rock-shaft 96 and throws the clutch-mechanism out of engagement, thus arresting the further forward movement of the table E carrying the work.

In practice, the feed-shafts F and H will preferably be provided with means for turning them in either direction by hand, which is desirable in setting the work preparatory

to drilling. In the drawings I have shown said shafts as having key-ways 135 and 136, respectively, formed therein, see Fig. 1, adapted to be engaged by a key upon a crank, as 137, or suitable hand-wheel. This construction and arrangement permitting either of said shafts to be turned as desired.

Having thus described my invention, I claim—

1. In a multiple drilling-machine, the combination with the frame having a transverse jig-supporting web or upright rising from the upper face thereof, of a horizontally-sliding table, driving mechanism therefor, the jig-plate supported in the said web or upright, and having a series of drill-spindles revolubly supported therein, a cranked driving-plate actuating-shaft horizontally supported at its ends in bearings upon the frame and concentrically disposed with relation to the series of spindles, a driving-plate directly connected to the cranked end of the said shaft and connected to the spindles by means of cranks, mechanism for imparting motion to said shaft to actuate the driving-plate and rotate the spindles, and mechanism substantially as described connecting the plate-actuating shaft with the table feeding mechanism to secure a longitudinal movement of the table and a rotary movement of the spindles simultaneously or independently, substantially as and for the purpose set forth.

2. A multiple drilling machine comprising, in combination, a horizontally traveling table having a revolving feed-wheel thereon, and two horizontal feed-shafts having feed-screws thereon in engagement with said feed-wheel, one at either side thereof, a jig supported by a web or upright upon the frame, a series of radially disposed drill-spindles revolubly supported in said jig, a driving shaft therefor substantially concentric therewith, a train of gearing in direct connection with the drill-driving shaft and one of the table feed-shafts, substantially as described, whereby motion is imparted to the table and drill-spindles simultaneously, and driving mechanism in direct connection with the other feed-shaft of the table, whereby the two feed-shafts may be actuated independently, substantially as described and for the purpose set forth.

3. In a drilling-machine, the combination with the sliding-table having a worm-wheel revolubly-secured thereto, of two horizontal shafts supported, one at each side thereof, in bearings at each end of the frame and having screws or worms in mesh with the teeth of the ratchet-wheel; drill-spindles having horizontal bearings in a jig secured to the frame, a driving-shaft therefor having a driving-pulley at its ends and a driving-plate interposed between and pivotally secured to the driving-shaft and spindles, mechanism for driving the spindle driving-shaft and one of the table-feed-shafts simultaneously, which consists of a gear-wheel secured to each of said shafts, a clutch-mechanism mounted upon a counter-shaft interposed between and in communication with the gear-wheels upon the spindle-driving shaft and table-feed shaft, shifting-mechanism for said clutch, and mechanism connected with the other table feed-shaft whereby said feed-shaft may be rotated independently, substantially as described.

4. In a horizontal multiple drilling-machine, the combination with the horizontally-reciprocating table, a horizontal shaft having a screw or worm to reciprocate said table and having a gear-wheel fixed at one end, a jig secured in an upright on the frame and having a series of horizontally-supported drill-spindles therein, a driving-shaft for said drill-spindles supported in horizontal bearings in uprights at the rear end of the frame and having a pinion secured thereto, intermediate gear-wheels adjustably-secured to an arm adjustably-held upon a bearing which supports one end of the table feed-shaft, one of said gear-wheels meshing with the gear-wheel upon the said shaft, a clutch-gear interposed between and meshing with the said intermediate change-gears and the pinion upon the spindle-driving-shaft, and mechanism, substantially as described, to throw said clutch-mechanism into and out of operative engagement, substantially as described.

5. In a drilling-machine, the combination with the frame and horizontally-sliding bed, the worm-wheel mounted upon said table and the two horizontal shafts journaled in the frame at each side of, and having screws to mesh with the teeth of the worm-wheel, of a driving-shaft located above and central with relation to the two feed-shafts, gear-wheels connected to the driving-shaft and one of the feed-shafts, a clutch-shaft interposed between and having a pinion fixed thereon to mesh with the feed-shaft gearing, a clutch-member loose upon said shaft and in mesh with the pinion upon the driving-shaft, a clutch-member fixed to the clutch-shaft adapted to be thrown into engagement with the other clutch-member to rotate the feed-shaft, and a shifting device for said clutch comprising a lever pivoted to the frame having a bifurcated end to engage and shift the clutch-member, a rock-shaft journaled in bearings upon the frame and having a projecting arm, a connecting-rod connecting said arm and shifting lever, and mechanism to oscillate said rock-shaft, substantially as described.

6. In a multiple drilling-machine, the combination with the frame having the horizontal bed supporting the sliding table with a revoluble worm-wheel mounted thereon, of two feed-shafts mounted in bearings at each end of the frame and having screws or worms in mesh with opposite sides of the worm-wheel, as described, a jig-plate having a series of radially-arranged horizontally-supported drill-spindles mounted therein, said jig being supported in an upright upon the frame in the rear of the table, a driving-shaft supported in uprights upon the frame and located above

the feed-shafts and axially-aligned with the center of the jig and having a crank at its forward end, a driving pulley at its rear end and a centrally-arranged pinion, a driving-plate movably secured to the crank of the driving-shafts and pivotally-secured to the drill-spindles by cranks, as set forth, a driving-mechanism comprising a train of gearing, in which a clutch is a component part, interposed between and connecting the driving-shaft with one of the feed-shafts, and a shifting-mechanism to throw the gearing of the said shafts into and out of operative engagement, whereby the drills and table may be operated simultaneously or independently, and driving-mechanism secured directly to the opposite feed-shaft having a friction device, and mechanism to operate said friction-device, whereby this shaft may be actuated independently, all substantially as and for the purpose described.

7. In a drilling-machine, the combination with the frame, the sliding table supported thereon and the two shafts located at each side of the center and parallel with the table, of the horizontal driving-shaft located in a line centrally with relation to the center of the machine, a clutch and driving-mechanism interposed between and in engagement with said driving-shaft and one of the feed-shafts, and a shifting-mechanism to automatically operate the clutch comprising a rock-shaft journaled transversely in the frame, arms upon said rock-shaft with a connecting-rod and lever connecting the clutch and rock-shaft, a connecting-rod pivoted at one end to one arm of the rock-shaft and at its other end to a bell-crank lever pivoted to the frame, and a cam-faced block secured to the table to act against said lever to operate the clutch, substantially as described.

8. In a multiple drilling-machine, the combination with the frame, of a sliding table, two worm feed-shafts mounted in bearings at each end of the frame, a worm-wheel in mesh with said feed-shafts, a vertical jig-supporting web rising from the top-plate of the frame of the machine, a jig supported by said web and having a series of radially disposed drill-spindles supported therein with their axes substantially in alignment with the plane of movement of the table, a horizontal drill-driving shaft concentric to the series of spindles, a drill-actuating plate in engagement with said drill-spindles and driving-shaft, and mechanism substantially as described for rotating the table-feed shaft and drill-driving shaft simultaneously or independently, substantially as described.

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