(No Model.) 3 Sheets—Sheet 1.

U. & H. E. EBERHARDT.

DRILLING MACHINE.

No. 407,339. Patented July 23, 1889.

Fig. 2.

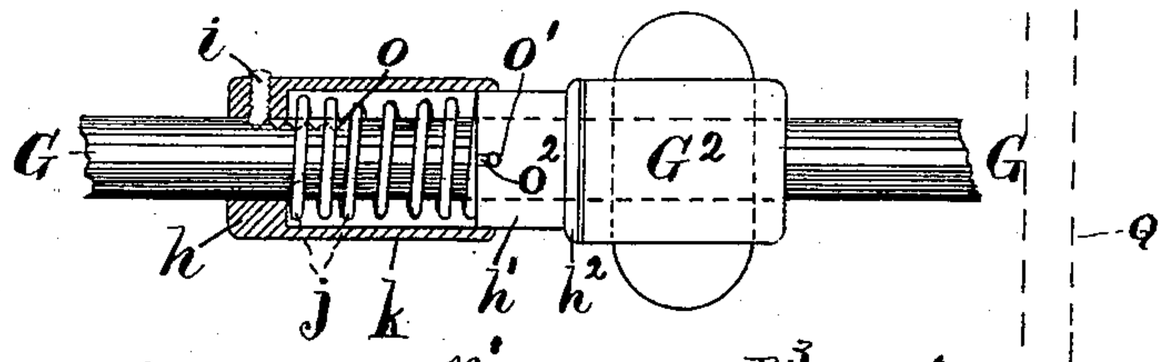

Fig. 3.

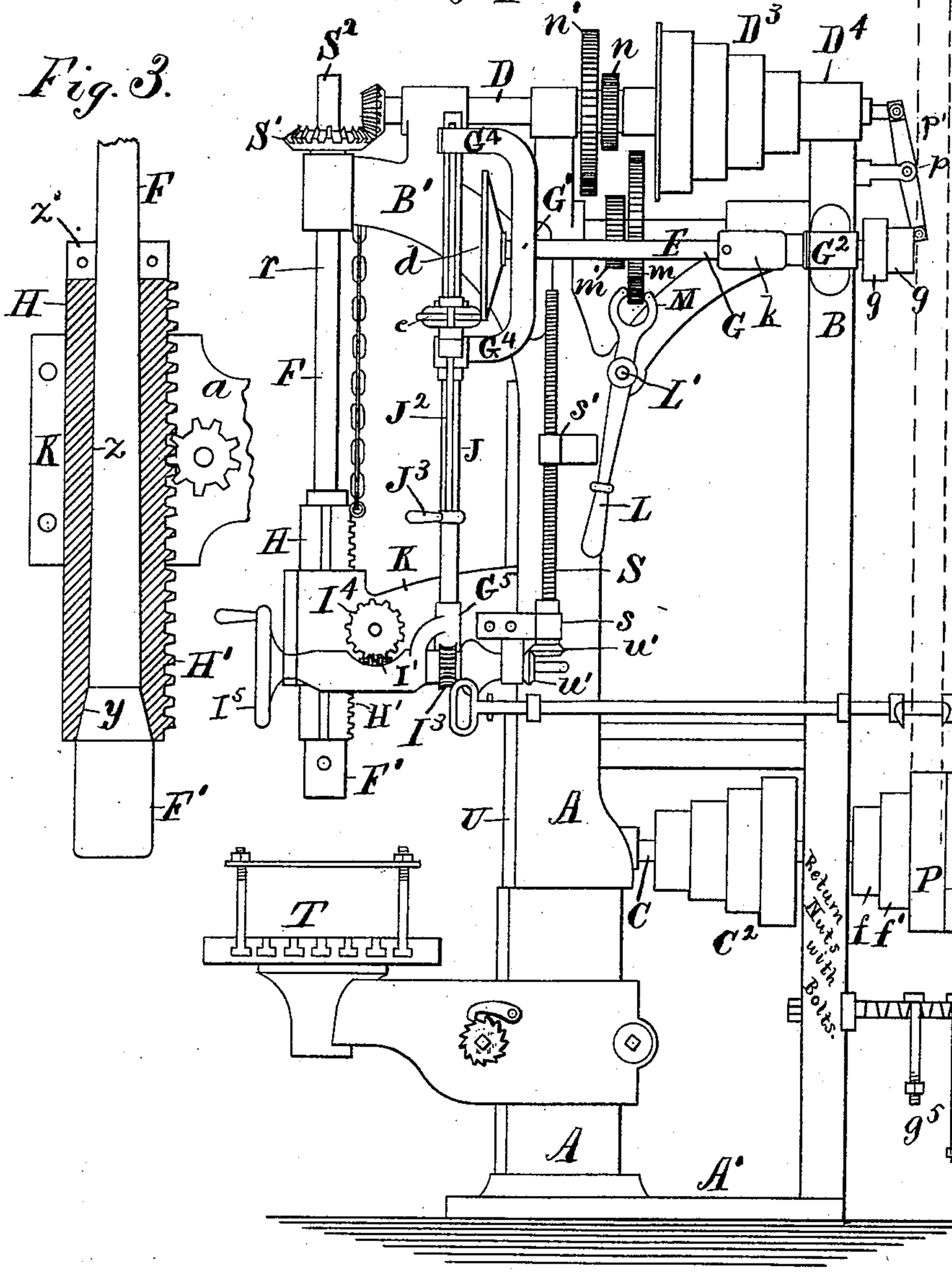

Fig. 1.

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DRILLING MACHINE.

No. 407,339. Patented July 23, 1889.

Fig. 1.

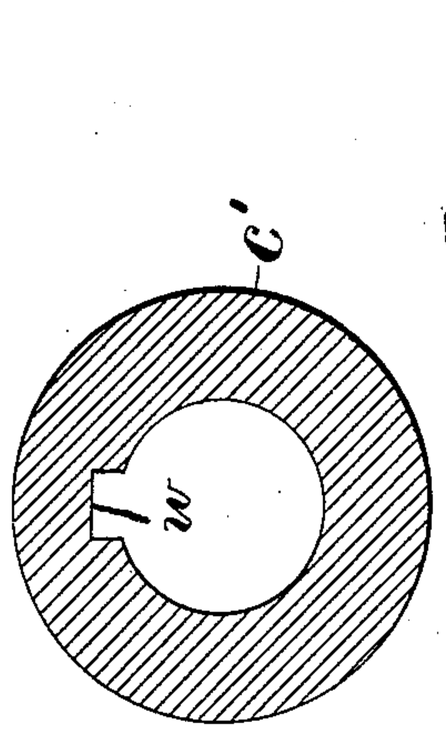

Fig. 2.

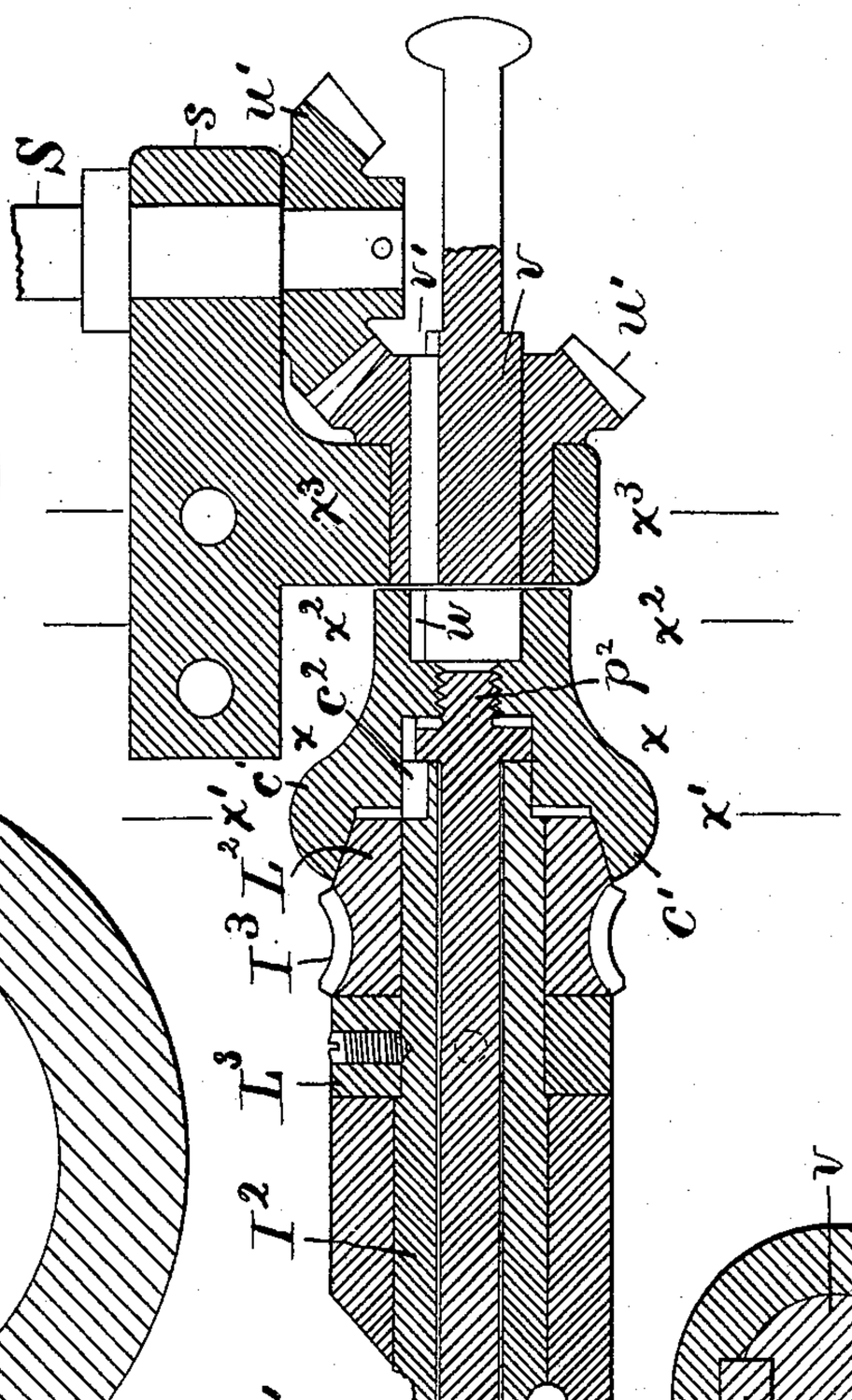

Fig. 6.

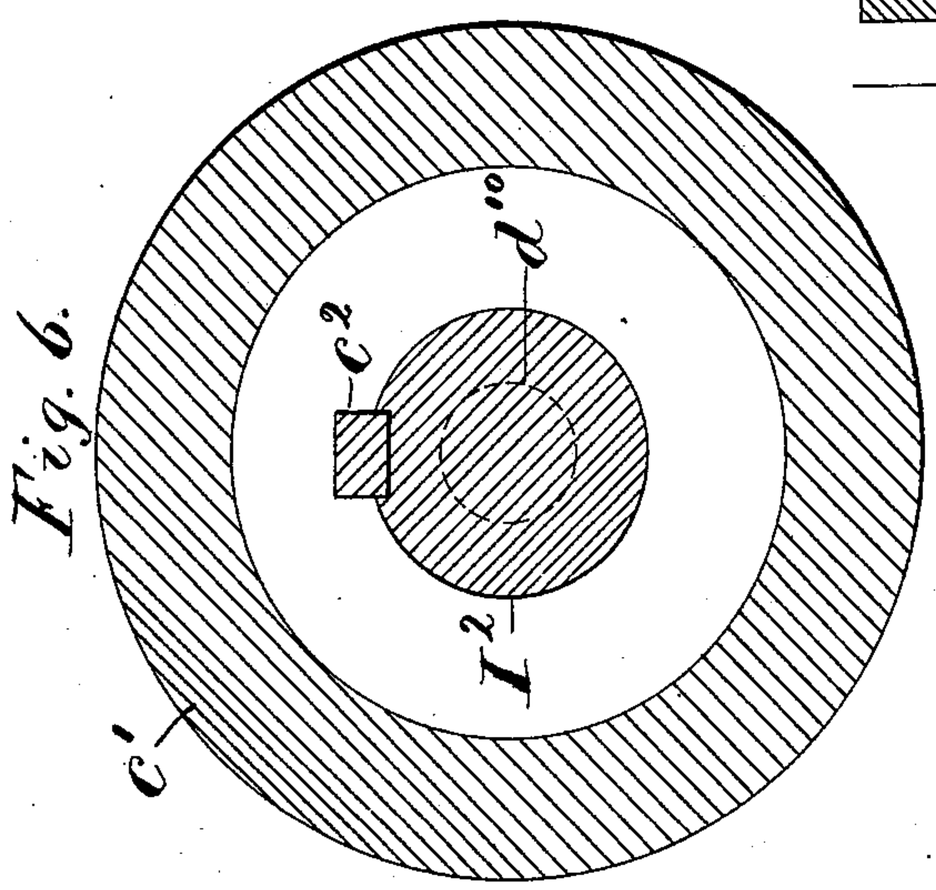

Fig. 5.

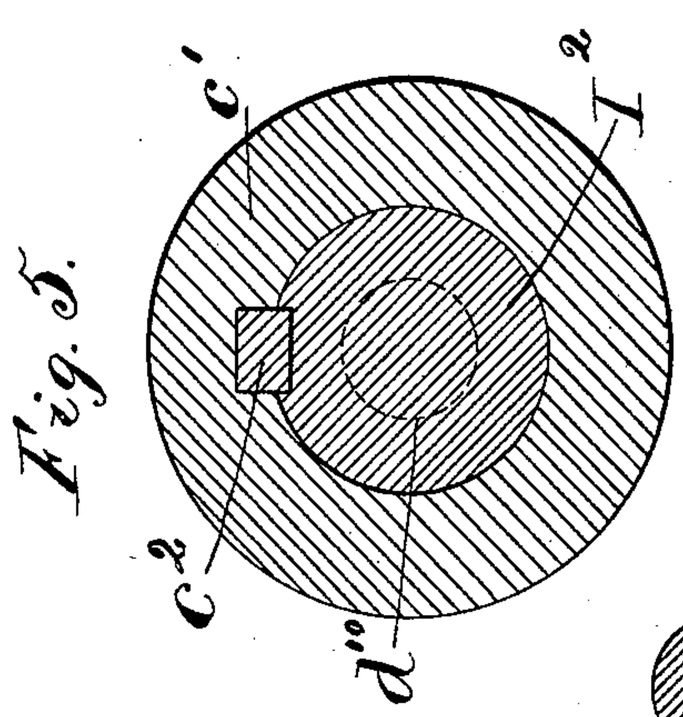

Fig. 4.

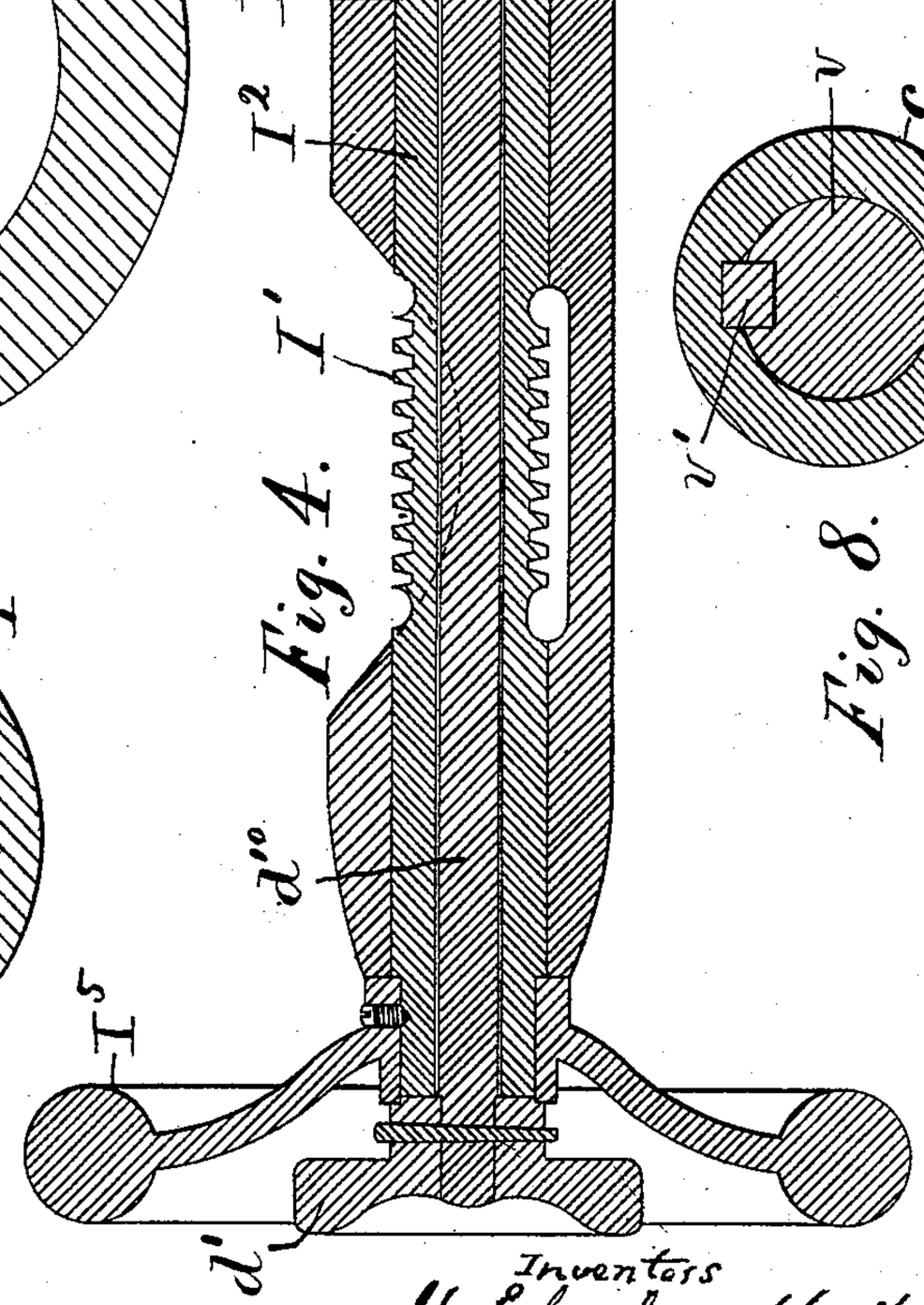

Fig. 8.

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DRILLING MACHINE.

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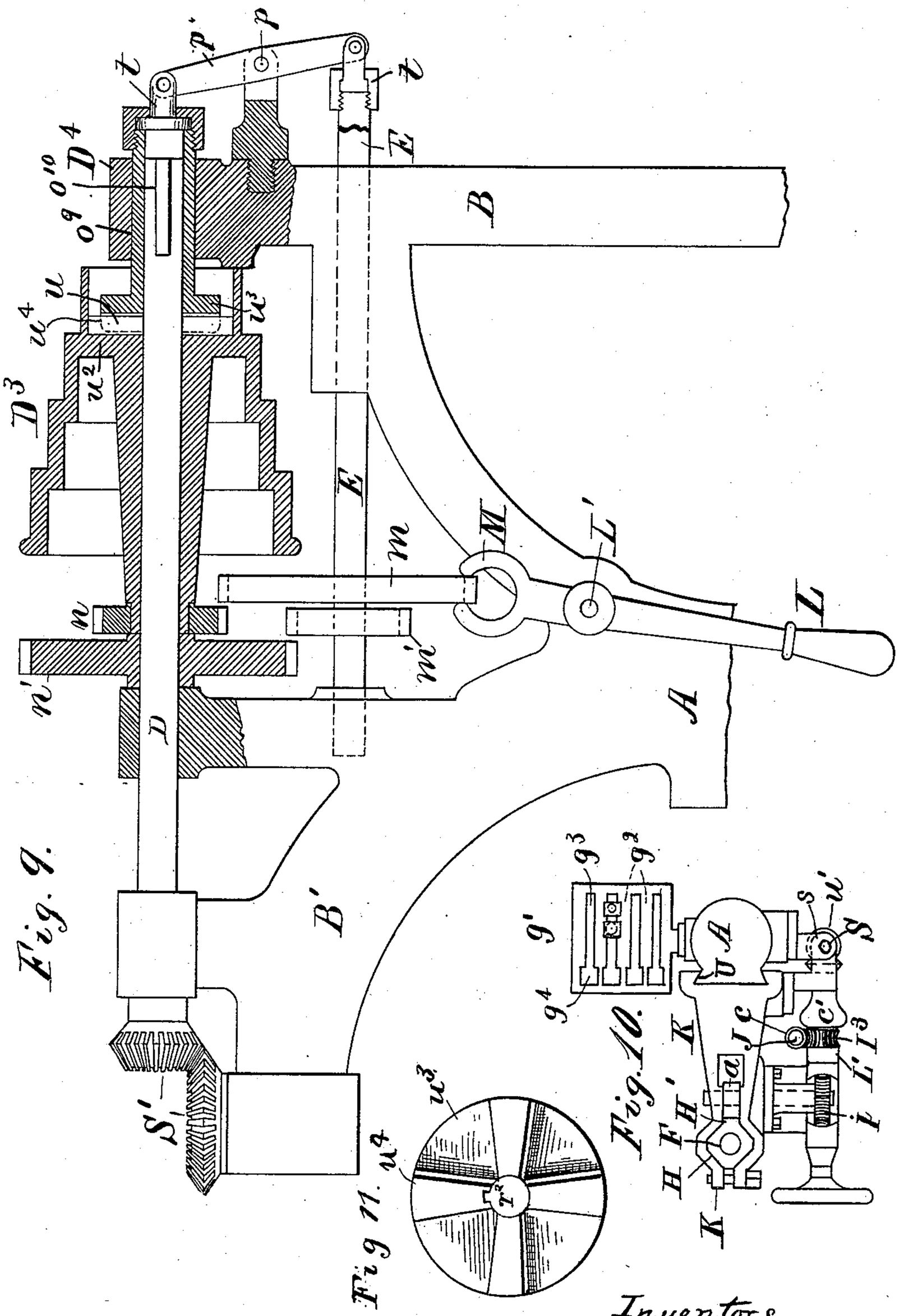

Fig. 9. Fig. 10. Fig. 11.

Attest:
L. Lee.
F. C. Fischer.

Inventors
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H. E. Eberhardt, per
Crane & Miller, Attys.

UNITED STATES PATENT OFFICE.

ULRICH EBERHARDT AND HENRY E. EBERHARDT, OF NEWARK, NEW JERSEY.

DRILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 407,339, dated July 23, 1889.

Application filed September 5, 1888. Serial No. 284,634. (No model.)

To all whom it may concern:

Be it known that we, ULRICH EBERHARDT and HENRY E. EBERHARDT, citizens of the United States, residing at Newark, Essex county, New Jersey, have invented certain new and useful Improvements in Drilling-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention consists in certain modifications in improvements upon the drilling-machine patented to us June 30, 1885, No. 321,196; and the object of the invention is to render the machine more convenient for operation and more effective and durable in practice.

The improvements relate to the means for simultaneously shifting the back gear and locking or unlocking the cone to the cone-spindle, to an improved means for pressing the friction driving-plate elastically toward the friction-wheel, to an improved bearing for the drill-spindle, and to an improved means for feeding the spindle vertically in boring long holes.

The invention will be understood by reference to the annexed drawings, in which—

Figure 1 is a side elevation of the entire machine. Fig. 2 is an elevation, upon a larger scale, of the device for pressing the friction-driver toward the friction-wheel, the guard for the spring being shown in section at its center line. Fig. 3 is a vertical longitudinal section, upon an enlarged scale, of the spindle-bearing, the carrier for the spindle-bearing and the spindle itself not being shown in section. Fig. 4 is a vertical longitudinal section, where hatched, upon a still larger scale, of the feeding worm-shaft and its connections to the vertical feed-screw. Fig. 5 is a section on line $x\ x$ in Fig. 4. Fig. 6 is a section on line $x'\ x'$ in the same figure. Fig. 7 is a section on line $x^2\ x^2$ in the same figure, and Fig. 8 a section on line $x^3\ x^3$ in the same figure. Figs. 5, 6, 7, and 8 are drawn twice the size of Fig. 4, corresponding to the full size of the parts. Fig. 9 is a side elevation, partly in section where hatched, of that part of the drilling-machine head which carries the cone D^3 and the back-gear spindle, the view being made twice the size of Fig. 1. Fig. 10 is a plan of bracket K, and Fig. 11 is a face view of the disk u^2 at the end of the sleeve o^9, showing clutch-teeth u' thereon.

In Fig. 1, A is the column of the machine, A′ the bed-plate, B a post to sustain the outer bearings of the belt-cones C^2 and D^3. The cone C^2 is fixed upon a shaft C, sustained near the lower part of the column and post, which is provided upon its outer end outside of the post with fast and loose pulleys P P′, for driving the said cone and operating all the other parts of the machine.

Q represents the path of the belt as it would be conveyed from an overhead counter-shaft to the pulley P when the machine was in operation. We have found in practice that the application of a lever outside of the post B brings it in the path of the belt Q and renders such lever inconvenient to reach in certain adjustments of the driving-belt. We have, therefore, in our present invention connected the cone-clutching devices and the back-gear spindle together by a lever P′, and have applied the hand-lever for shifting the back-gear spindle to the frame of the machine inside of the post B and entirely out of the way of the belt Q.

In the drawings, D is the cone-spindle, connected by bevel-wheels S′ with the drill-spindle F. As shown in Fig. 9, the spindle D has attached to it a gear n', and the cone D^3 is fitted to turn loosely upon the shaft and has a gear n attached to its hub adjacent to the gear n'.

E is the back-gear shaft upon the frame below the spindle D and having fixed upon it two gears $m\ m'$, adapted to mesh simultaneously with the wheels $n\ n'$ when the shaft E is moved longitudinally. In Figs. 1 and 9 the shaft is shown retracted, and the gears m m' therefore withdrawn from the gears $n\ n'$. When the back gear is thus thrown out of operation, the spindle-cone D^3 is locked to the shaft by a suitable clutch, and the drill-spindle can thus be propelled at a higher rate of speed than when the back gears are employed. A lever p' (shown in Figs. 1 and 9) is pivoted upon a stud p, intermediate to the spindle D and shaft E, and is coupled to the outer side of the latter by a swivel-union t.

The cone D^3 is provided with clutch-teeth u, formed upon the face of a disk u^2, cast in-

side of the smallest pulley, and a sleeve o^9 is fitted by a keyway o^{10} to a spline e' upon the rear end of the cone-shaft D and provided with a flange w^3, having clutch-teeth w^4 upon its inner end to engage the teeth w upon the cone.

The movement of the sleeve longitudinally toward the cone serves to clutch the cone to the shaft, while the movement of the sleeve and the clutch-teeth attached to it in the opposite direction serves to unclutch the cone from the shaft, leaving it at liberty to turn freely thereon, as is common when the back-gear wheels are disengaged. The smallest belt speed or pulley of the cone is shown fitted at its lower edge to the face of the bearing D^4, and the cone is thus held from longitudinal movement when the clutch is retracted, and the rear end of the sleeve is projected through the rear bearing D^4, where it is also coupled with one end of the lever p' by a swivel-union t. The connection of the lever p' with the clutch-sleeve and the back-gear shaft E thus operates to move them simultaneously, and the means shown herein for shifting the back-gear spindle by hand consists in the handle L, pivoted upon a stud L′ beneath the back gear m and provided with a fork M, adapted to embrace the opposite sides of the rim of the gear.

The handle is shown in Fig. 1 pushed toward the left, and the shaft E thus shifted toward the right to retract the back gears from the gears $n\,n'$, and it is obvious that the movement of the handle to the right would shift the shaft E toward the left and throw the back gears into connection with the gears $n\,n'$. Such movement would simultaneously throw the upper end of the lever p' to the right and detach the clutch from the cone D^3, as desired.

A vertical feed-shaft J, Fig. 1, is shown supported in a bracket G^4, attached to the goose-neck B′ of the drill, and in a bearing G^5 upon the bracket K, which holds the lower end of the drill-spindle movable upon the column A, and such feed-shaft is provided with a friction-wheel e, preferably made of leather, clamped between metallic disks. Such friction-wheel is movable upon a feather on the shaft J, and is driven by a friction-disk d, attached to the end of a shaft G, supported in bearings G′ and G^2, and provided upon its rear end with pulleys $g\,g'$, to be rotated by a belt from pulleys $f\,f'$ upon the lower cone-shaft C. The shaft J is held by collars in a bearing G^5 upon the bracket K, but slips freely through the bearings G^4 and wheel e when the bracket is moved upon the column A.

In order to compensate for any inequalities which are liable to be worn in the surfaces of the disk d and wheel e, we have devised a spring-pusher applied to the shaft G to press the disk d elastically toward the friction-wheel. Such spring j, Fig. 2, is shown applied to the shaft G, between a fixed collar h and a movable collar h', the latter pressing against the rear bearing G^2, with an intermediate washer h^2 to diminish the frictional resistance. The fixed collar h is shown combined with a sleeve or guard k merely for the purpose of protecting the spring from derangement, and is shown secured to the shaft by the set-screw i.

Several holes o are shown formed in the shaft G, adjacent to the collar h, to receive the point of the screw i, and the collar is thus susceptible of adjustment toward the bearing G^2 to increase the tension of the spring. The collar h' is rotated with the shaft G by a pin o', fixed in the shaft and fitted to a slot o^2 in the collar, and the ends of the spring are thus sustained between collars which rotate with the shaft, and are thus prevented from wearing upon the spring. The spring j operates against the collar h' and bearing G^2 as a fixed abutment, the shaft being pressed away from such bearing toward the wheel e by the pressure of the spring against the collar h, the shaft sliding through the bearing G^2 and the collar h' remaining pressed against the washer, and the collar h moving away from it as the surface of the disk and the wheel wears.

By the use of this device an elastic pressure is exerted upon the friction-wheel e, and the uniformity of the motion transmitted by the disk is not affected by any inequalities in the surface of the wheel or disk.

The means for feeding the spindle vertically in boring large holes consists in a feed-screw S, connecting the spindle-bracket K and the column A, and a clutch adapted to connect such feed-screw at pleasure with the feed-shaft J. The drill-spindle is connected to the cone-spindle D, as usual, by means of the bevel-wheels S′, so as to move vertically when feeding, and is fitted at its lower end to a bearing in a sleeve H, which is constructed to slide vertically in the bracket K.

H′ is a toothed rack formed upon the inner side of the sleeve, and a the pinion commonly used to actuate the same and connected by a shaft with a worm-wheel I^4 upon the outside of the bracket. A worm I′ is provided in contact with the worm-wheel I^4, as shown in Fig. 1, to rotate the same, and is connected by a friction-coupling with the feed-shaft J. The worm I′, as shown in Fig. 4, is formed upon a hollow spindle I^2, upon one end of which a worm-wheel I^3 is fitted to turn loosely when driven by a worm c upon the lower end of the feed-shaft J. (See Fig. 10.) The worm-wheel I^3 is formed with a friction-cone L^2 upon one side, and a hollow cone-clutch c' is fitted thereto and carried by the spindle I^2, being fitted to rotate therewith and to move longitudinally upon a feather or spline c^2 in the spindle. A collar L^3 is fixed upon the spindle at the opposite side of the worm-wheel I^3 to resist the thrust of the clutch c'.

Through the hollow spindle is inserted a stem d^{10}, having a handle d' affixed to its outer end, and a screw-thread p^2, formed

upon its inner end and fitted to a threaded hole in the clutch c'. The rotation of the stem d^{10} by the handle d' operates to jam the conical surfaces of the clutch together and secures the worm-wheel I^3 to the spindle I^2. The rotation of the feed-shaft will then be communicated to the worm I′, and through the worm-wheel I^4, its shaft and pinion a, to the rack H′. By this construction, which is common in various forms of self-feeding drill-presses, the feed-shaft may be allowed to rotate continuously, and the pinion a which operates on the rack H′ may be set in motion whenever desired. With the parts just described the greatest length of feed that can be imparted to the drill-spindle F in boring a hole is that limited by the movement of the sleeve H in the bracket K, and the object of applying the feed-screw S to the bracket and column is to provide a means of feeding the bracket itself and the spindle downward in boring long holes—as, for instance, cylinders clamped upon the table T or the floor below it. By rotating the screw the bracket is forced to slide upon the column, upon which it would be fitted to a dovetail guide U, as shown in Fig. 10, or other suitable fitting. To effect the driving of the screw S from the clutch c' is the object of the bevel-gears u', the lower one being sustained in a bearing adjacent to the clutch and provided with a movable stud v adapted to engage with a socket in the clutch when the stud is pushed inward. To receive the stud, the clutch is provided with a socket having a keyway w at one side, and the stud is provided with a feather v', fitted to a keyway in the lower gear u', and adapted to fit the keyway w. In Fig. 4 the stud is shown retracted from the socket, so that the rotation of the clutch would not affect the screw S; but when the clutch is rotating it is obviously easy to push the stud inward until its feather engages with the keyway w, thus locking the gears and clutch together. The motion of the clutch would then be transmitted through the gears u to the screw S, and the bracket would be fed along on the column A. It will be understood that the speed of the feed and the direction in which it is operated are regulated by means of a rod J^2 and handle J^3, which shifts the friction-wheel e across the face of the friction-disk d, and thus varies the speed and direction of rotation as desired, as in other machines heretofore used. The spindle is shown in Fig. 3 fitted in a peculiar bearing in its sleeve H to compensate for the difference in the wear at the upper and lower ends of such bearing.

The spindle above its nozzle F′ is fitted to a tapering socket y in the bearing, which socket forms only a small proportion of the whole length of the bearing in the sleeve H, and the remainder of the bearing portion Z of the spindle above such socket is tapered in the same direction, but in much less degree, toward the normal diameter of the spindle, which requires to be made parallel above the sleeve H to slide through the driving gear-wheel S′.

A clamp-collar z' is applied to the spindle above the sleeve H. It is obvious that the excessive wear at the lower end of the spindle is readily compensated for by the abrupt taper of the spindle in the socket y, while the less wear in the remainder of the bearing and at the upper part of the sleeve H would be fully compensated by the less taper of the portion Z, the taper in the bearing serving, as in lathe-spindles and other constructions, to bring the spindle into contact with the bearing by a longitudinal movement when it is worn loose by lateral pressure. The clamp-collar z' holds the spindle upward, with the taper portion in close contact with the taper socket y, and is adapted to be readjusted and clamped upon the spindle when the latter wears loose and requires to be lifted into fresh contact with its bearing. In the case of the drill-spindle the lateral pressure is almost nothing at the upper end, while it is often considerable at the lower end adjacent to the head F′, and the lateral wear at the point where the socket y is formed is much greater than anywhere else within the sleeve H.

It is obvious that a small amount of longitudinal adjustment would bring the parts in the socket y into contact when considerably worn, but that considerable movement would be required with the slight taper in the spindle at z serving to compensate for the wear upon the upper part of the spindle, with the same longitudinal movement that compensates for the excessive wear in the socket y.

If the spindle above the socket y were not tapered at all, it is obvious that the longitudinal movement of the spindle when crowded upward into the socket would not compensate at all for the wear above the socket, and the spindle would therefore be unsupported in the remainder of the bearing, and would be sustained wholly in the socket y, which would avoid the object sought in providing the spindle with a long bearing like that in the long sleeve H.

By our construction the excessive wear at the lower end of the spindle-bearing and the comparatively slight wear at the upper end of the spindle-bearing in the sleeve H are simultaneously compensated by a longitudinal movement of the spindle, the taper upon the upper and lower portions of the spindle within the bearing being proportioned to the relative wear at such points.

g is a grid for convenience in holding the bolts and nuts g^5, required for strapping work upon the table T. (Shown in Fig. 1 as applied to the post B and in Fig. 10 as applied to the column A.) Such device consists in a set of parallel bars g^2 and intermediate spaces g^3, fitted loosely to the bolts supported therein. g^4 are openings, Fig. 10, at the ends of the spaces g^3 to admit the bolt-heads.

Having thus set forth our invention, what we claim herein is—

1. In a drilling-machine provided with a cone-spindle having a back gear secured thereon and a cone and back gear turning loosely thereon, the combination, with the spindle and the cone, of a clutch for locking the cone and spindle together, a back-gear shaft movable longitudinally, with gears to mesh into those upon the cone and cone-spindle, a lever connected with the back-gear shaft to move it longitudinally and with the clutch to shift it in and out of gear, and a shifting-handle operating independently upon the back-gear shaft to shift it longitudinally and to indirectly actuate the cone-clutch, as and for the purpose set forth.

2. In a drilling-machine, the combination, with the feeding-shaft J, provided with the friction-wheel *e*, of the friction-disk *d*, the shaft G, movable longitudinally toward the wheel *e*, bearings for the shaft G, the spring *j*, applied to the shaft, and a collar adapted to press the shaft under the tension of the spring toward the wheel *e*, as and for the purpose set forth.

3. In a drilling-machine, the combination, with the feeding-shaft J, provided with the friction-wheel *e*, of the friction-disk *d*, the shaft G, movable longitudinally toward the wheel *e*, bearings for the shaft G, the spring *j*, applied to the shaft, and a collar adapted to press the shaft, under the tension of the spring, toward the wheel *e*, the collar *b'*, movable longitudinally upon the shaft G and fitted against the bearing G^2, the collar *h*, secured to the shaft by a screw *i*, the holes *o* in the shaft to adjust the collar, and the spring *j*, inserted between the collars *h* and *h'*, as and for the purpose set forth.

4. In a drilling-machine, the combination, with the main spindle, the bracket K, supporting the same movably upon the column A, and a feed-wheel rotated upon the bracket for actuating the feed, of a feed-screw coupled to the bracket, and a clutch for connecting such feed-screw to the rotary feed-wheel upon the bracket, as and for the purpose set forth.

5. In a drilling-machine, the combination, with the spindle F, provided with a long bearing adjacent to the head F', of the socket *y*, of abrupt taper, formed in the bearing adjacent to the spindle-head, and the less taper in the remainder of the bearing fitted to the spindle above the socket *y*, as and for the purpose set forth.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

ULRICH EBERHARDT.
HENRY E. EBERHARDT.

Witnesses:
JOS. B. PIERSON,
THOS. S. CRANE.