(No Model.) 3 Sheets—Sheet 1.

# F. H. RICHARDS.

## MACHINE FOR MAKING TWIST DRILLS.

No. 286,150. Patented Oct. 2, 1883.

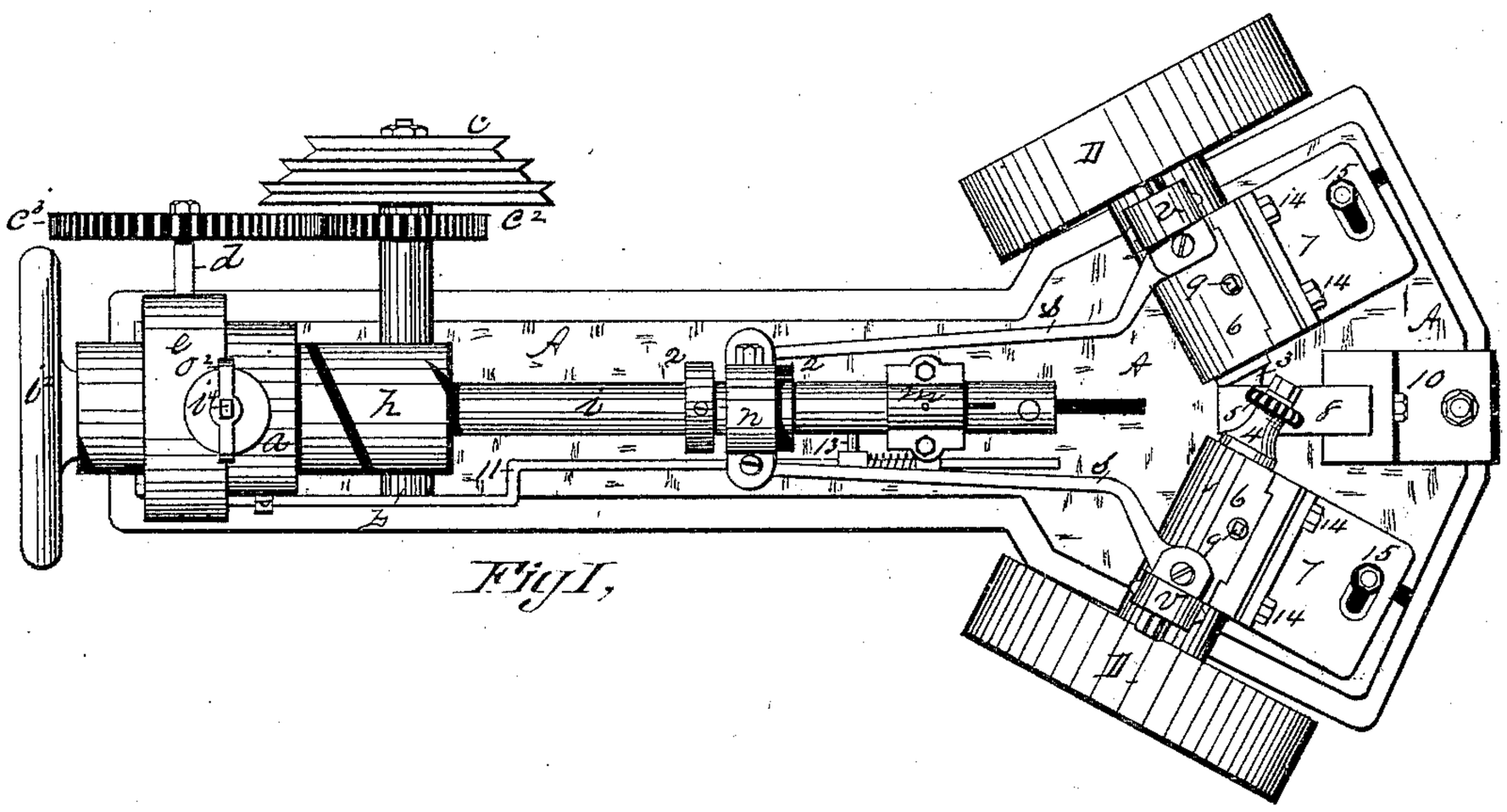

Fig I.

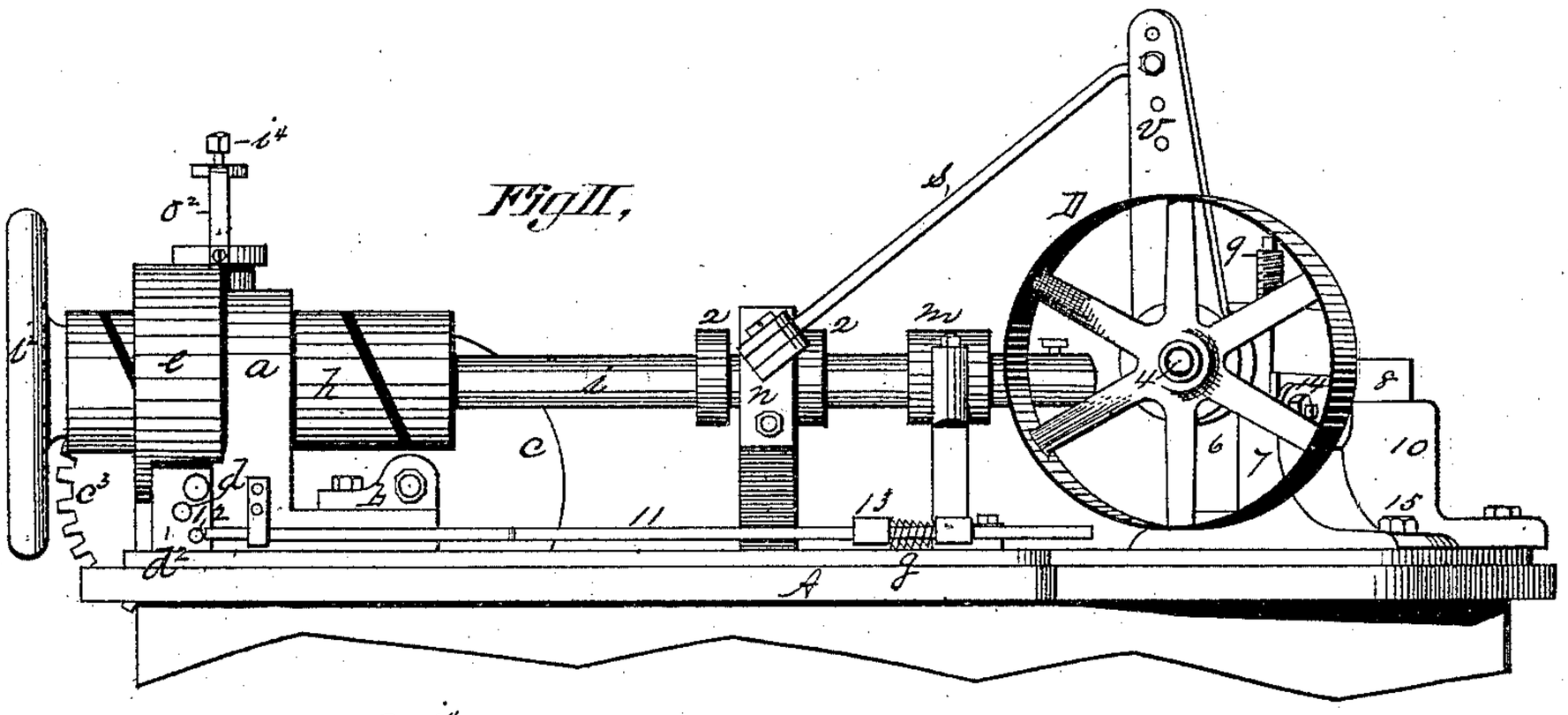

Fig II.

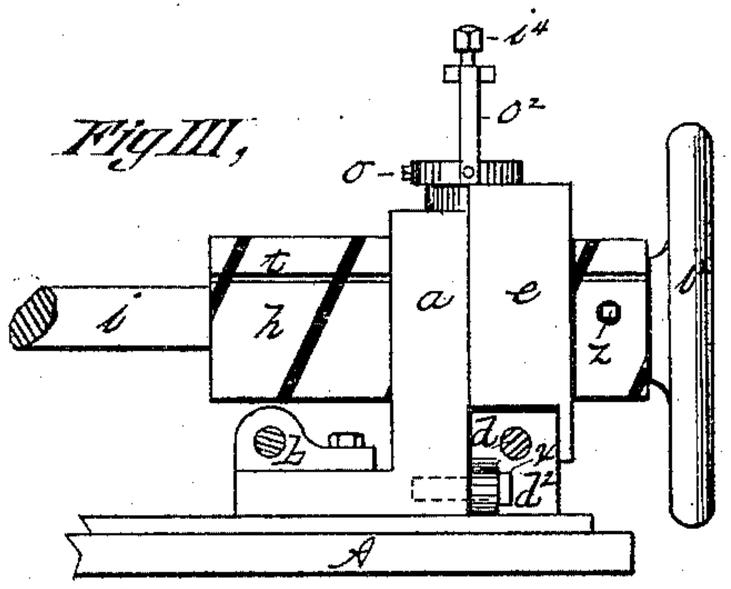

Fig III.

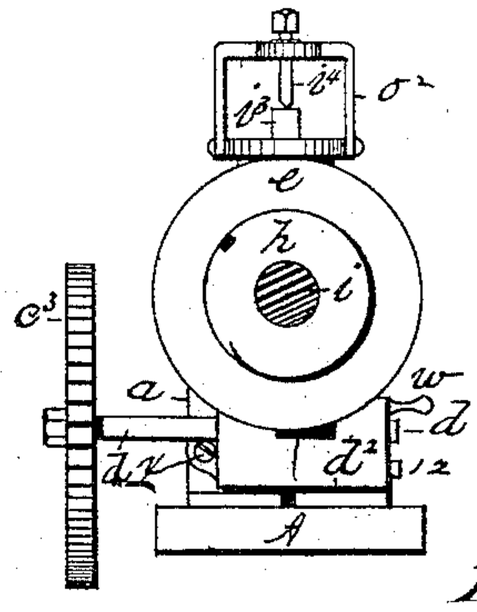

Fig IV.

Witnesses,
R. F. Hyde
Wm. H. Clapp

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Francis H. Richards
by Henry A. Clapp Atty

(No Model.) 3 Sheets—Sheet 2.

# F. H. RICHARDS.

## MACHINE FOR MAKING TWIST DRILLS.

No. 286,150. Patented Oct. 2, 1883.

Fig I,

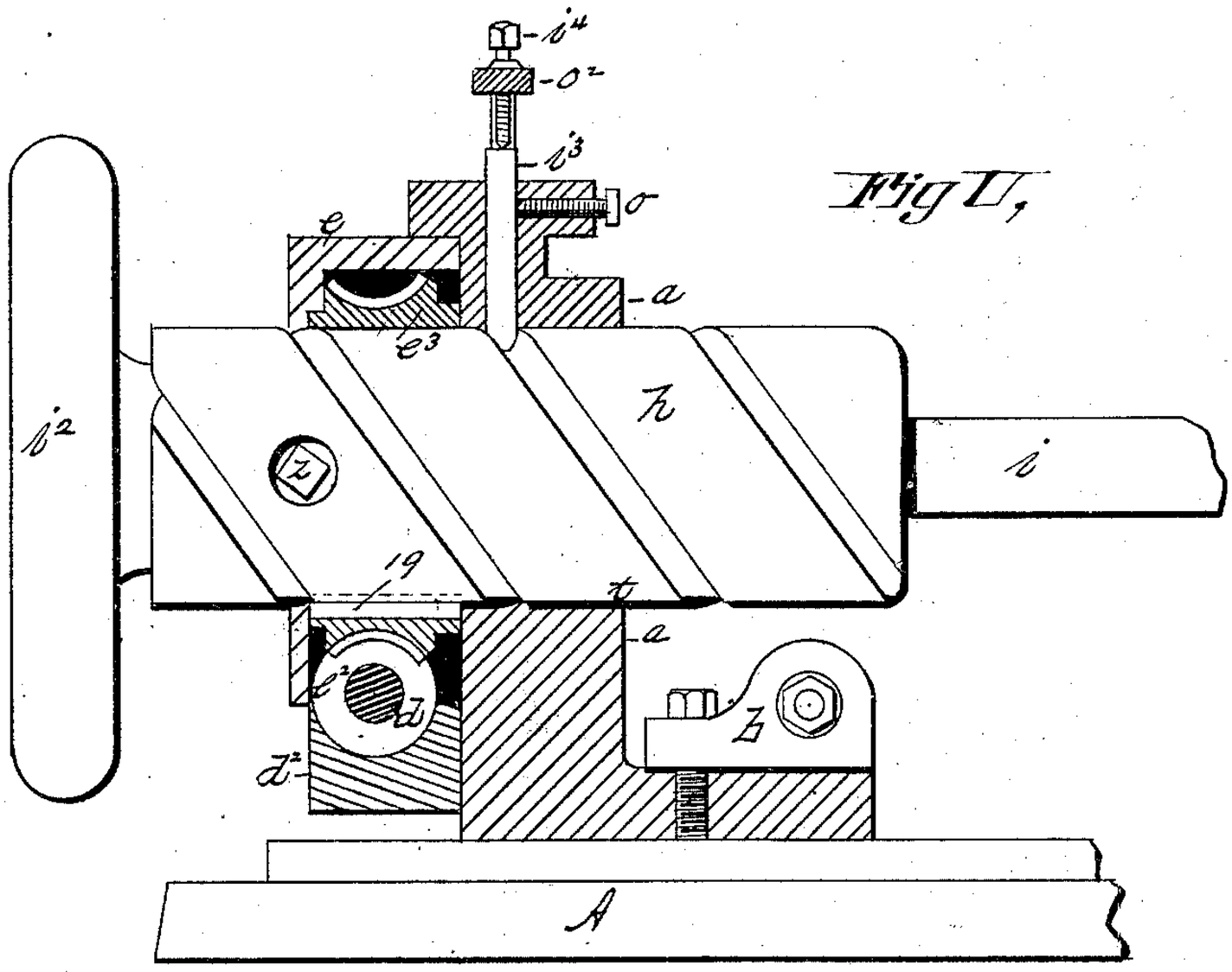
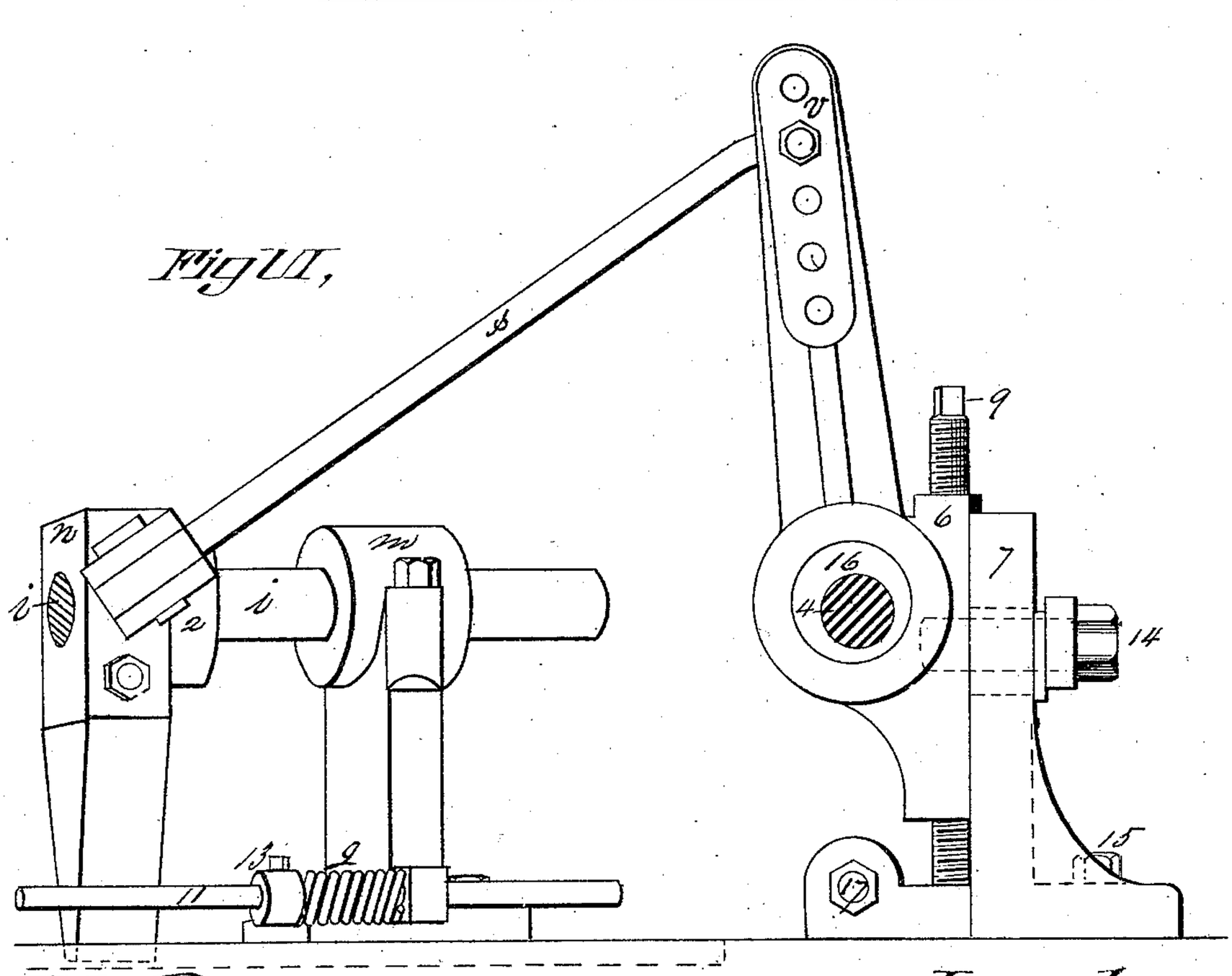



Fig II,




Witnesses,
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(No Model.) 3 Sheets—Sheet 3.

# F. H. RICHARDS.

## MACHINE FOR MAKING TWIST DRILLS.

No. 286,150. Patented Oct. 2, 1883.

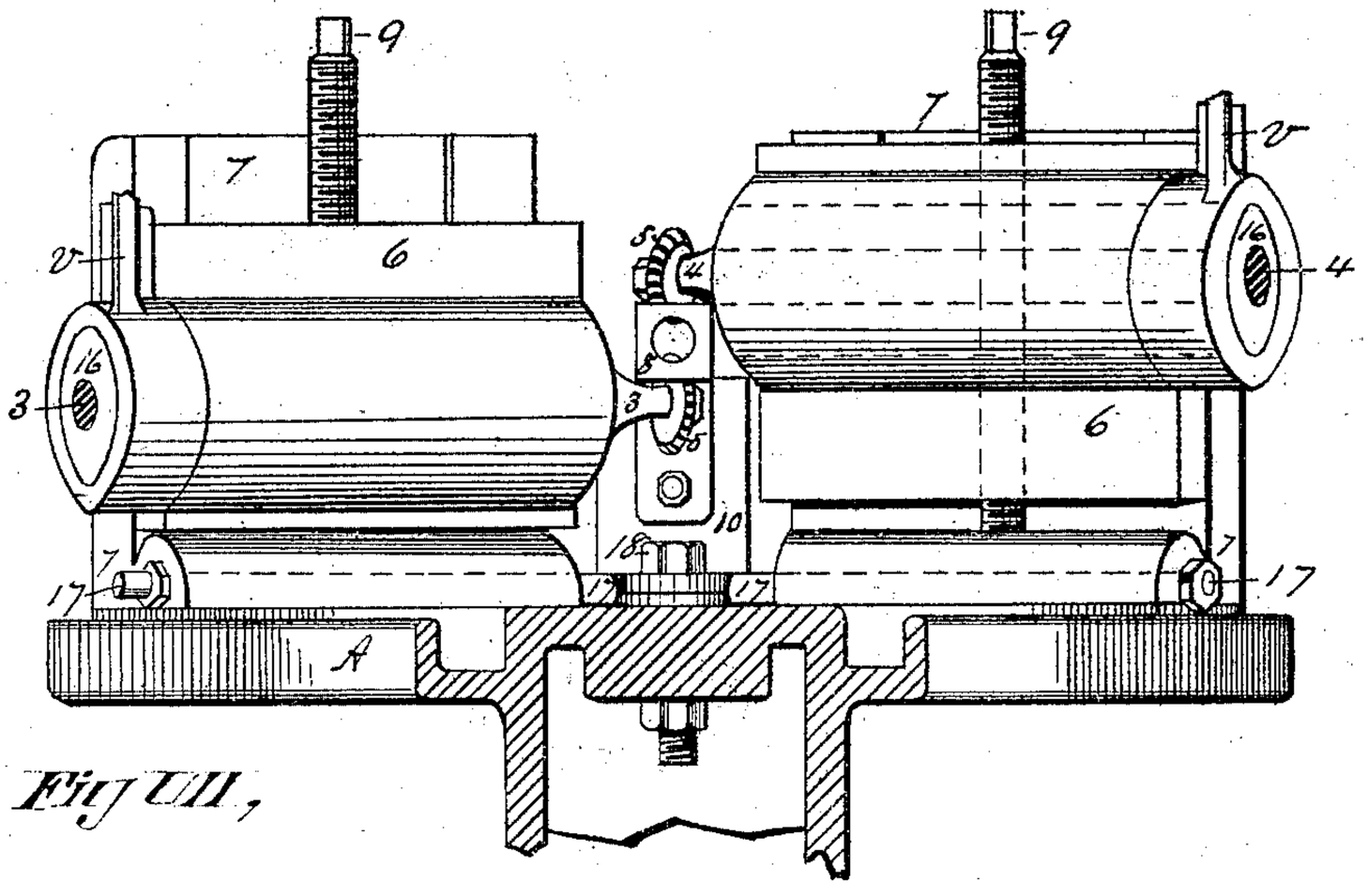


Fig III,

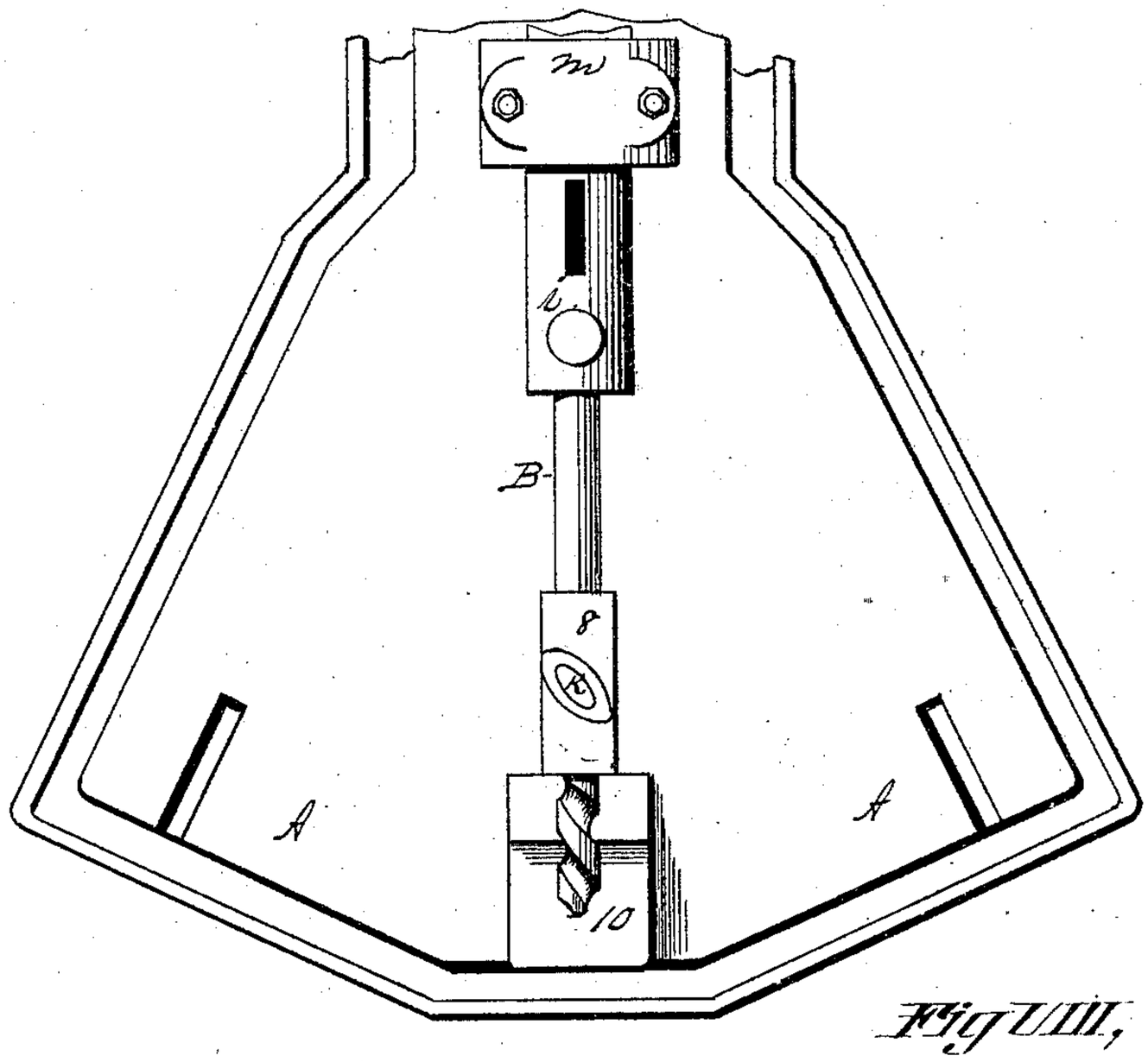


Fig IIII,

Witnesses,
F. F. Hyde
Wm H Chaplin

Inventor,
Francis H Richards
by Henry A Chaplin
Atty

# UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF SPRINGFIELD, MASSACHUSETTS, ASSIGNOR TO J. D. COX, JR., AND F. F. PRENTISS, OF CLEVELAND, OHIO.

## MACHINE FOR MAKING TWIST-DRILLS.

SPECIFICATION forming part of Letters Patent No. 286,150, dated October 2, 1883.

Application filed October 31, 1882. (No model.)

*To all whom it may concern:*

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Twist-Drill-Milling Machines, of which the following is a specification.

This invention relates to an improved mechanism for cutting the spiral grooves in twist-drills, and to the combination and arrangement of apparatus to be employed therein, the object being to provide improved means for supporting a drill-blank between groove-cutters, for imparting thereto a longitudinal and a rotary motion, according to the desired spirality of the grooves to be formed therein, for adjusting the machine to cut grooves of different degrees of twist, for cutting spiral grooves of a gradually increasing or decreasing depth, for supporting the cutter-shafts so as to maintain their point of axial intersection directly over the axial line of the drill, be the degree of groove twist what it may which the cutters are adjusted to cut, and for automatically stopping the machine when the grooving of the drill is completed.

In the drawings forming part of this specification, Figure I is a plan view of a machine for milling twist-drills, constructed according to my invention. Fig. II is a side elevation. Fig. III is a side elevation of the rear portion of the machine, partly in section. Fig. IV is a view of the rear end of the machine, partly in section, in which the driving-pulley is not shown. Fig. V is a side elevation, partly in section, of the rear portion of the machine shown in Fig. III, but showing the side thereof opposite to that in the last-named figure. Fig. VI is a detail view. Fig. VII is a view of a portion of the bed of the machine, and a view from the rear of the drill cutting and supporting devices. Fig. VIII is a plan view of the front end of the bed, from which the cutting mechanism is removed, and showing a section of the drill-carrying spindle and the drill-supporting block.

In the drawings, A is the bed of the machine, having its surface suitably formed to serve as a proper receptacle for oil which may drip from the working parts thereof, and suitably constructed to adapt it for the support of the operative parts of the machine, as hereinafter set forth.

The main spindle *i* is adapted to rotate in a horizontal position, supported in the front and rear bearings, *m* and *a*, which are bolted to the bed A. The said rear bearing, *a*, is provided with an opening through it of sufficient diameter to receive the spirally-grooved former *h*, which is secured on the rear end of said spindle *i* by the set-screw *z*, said former being adapted to have a rotary and a horizontal motion in said rear bearing. The spindle *i* has its front end perforated centrally, to receive within it the shank of a twist-drill blank, and is provided with a transversely-operating set-screw or other suitable fastening device, for rigidly securing said blank therein while the grooves of the bearing are being cut. The rear end of said spindle projects beyond the end of said former *h*, and is provided with the hand-wheel $i^2$.

The former *h* is, as aforesaid, grooved spirally, and in practice the machine is provided with several formers, each being differently grooved, to provide means for cutting grooves of varying degrees of spirality, as required in drills of different diameters and for various uses. Said formers are conveniently changed by removing the wheel $i^2$ and unscrewing the screw *z*, when the former may be slipped off from the rear end of the spindle *i* and be replaced by another one, which will be secured on the spindle, as before. The former *h* is provided with a key-slot, *t*, formed in its surface from end to end, and a worm-gear, $e^3$, is fitted onto the former and carries a key, 19, which fits in said slot *t*. A gear-case, *e*, supported on the rear side of the bearing *a*, covers the worm-gear $e^3$. A worm-shaft bearing, $d^2$, is pivoted to the rear side of said bearing *a* by the bolt *x*, and lies across the bed A under said worm-gear $e^3$. The free end of said bearing is provided with a pin, 12, and with a handle, *w*, for the purposes hereinafter set forth. A worm-shaft, *d*, bearing upon it a worm, $e^2$, and having secured on one end a gear, $c^3$, is fitted to rotate in said bearing $d^2$, and the latter is adapted to swing on said bolt *x*, for the purpose of

carrying said worm $e^2$ into engagement with said worm-gear, and for disengaging it therefrom. A driving-pulley, *c*, and a gear, $c^2$, are secured to a shaft supported in a bearing, *b*, located just forward of said spindle-bearing *a*, and said gear engages with the gear $c^3$ on the worm-shaft *d*.

A boss is formed, as shown, on the top of the bearing *a*, directly over the former *h*, and is perforated to permit of passing a swiveling key, $i^3$, down through it, and is provided with a screw-yoke, $o^2$, to support a set-screw, $i^4$, and has a set-screw, *o*, set in its side at right angles to said key-perforation. Said key $i^3$ has its lower end fitted to enter the spiral groove in the former *h*, and is free to turn in its bearing in said boss to adapt itself to the pitch of said groove, when it is secured by the screw *o*, having been previously forced downward suitably by the screw $i^4$.

Two collars, 2 2, are adjustably fitted onto the spindle *i*, and between said collars a cutter-feed yoke, *n*, is loosely secured on said spindle, whose lower end enters a groove in bed A on a line with the spindle.

Near the front end of the bed A is located a block, 10, to the rear side of which is bolted a bracket (see Fig. VII) supporting a drill-rest, 8. Said drill-rest is provided with a cylindrical perforation through it from end to end on a line with the drill B, carried by the spindle *i*, and with oval-shaped openings *k* through its upper and lower sides, opposite each other, to permit the cutters 5 to pass therethrough into said cylindrical perforation.

Two angle-blocks, 7 7, are located on bed A, and are adapted to swing thereon on a common center to bring their vertical faces to different degrees of incline relative to the axial line of spindle *i*, and consequently of that of a drill or drill-blank carried by said spindle. The said common center upon which said angle-blocks swing consists of the bolt 18, which passes through the jointed ends of two bolts, 17 17, and is secured in bed A, directly under said axial line of spindle *i*. Said bolts 17 pass through the lower portions of said angle-blocks 7, the latter being adjustable thereon to and from bolt 18, and, having been set to the desired angular positions relative to spindle *i*, they are secured firmly to the bed by the bolts 15. Two spindle-bearing blocks, 6 6, are secured adjustably to the vertical faces of said angle-blocks 7 by the bolts 14, and a screw, 9, passing through each of blocks 6, serves to aid in the vertical adjustment of the latter. Said blocks 6 6 are each adapted to receive in a horizontal position an eccentric cutter-spindle sleeve, 16, Fig. VI. Said sleeves have the cutter spindles or shafts 3 4 fitted into them, and they in turn are fitted to have a rotating motion in the said blocks 6. The outer surface of said sleeves 16 is turned eccentric to the axial line of the said spindles, which pass through them, and their outer ends project beyond the ends of blocks 6 6, and have secured thereto the levers *v*, and the latter are connected to the aforesaid yoke *n* by the connecting-rods *s*, the latter being secured to said yoke and to said levers by joint-bolts, as shown. The said cutter-spindles 3 4 have the driving-pulleys D D secured to their outer ends. The inner ends of said spindles extend one over and one under the aforesaid drill-rest 8, and the point of intersection of the axes of said spindles is directly over the axial line of spindle *i* and the pivot-bolt 18. The cutters 5 are fixed on said spindles 3 4, to have their cutting-edges operate directly opposite each other, and each side of the axial line of a drill held in the rest 8. The edges of said cutters extend through the sides of the latter, as shown in Fig. VII.

A shipper-rod, 11, is supported in a horizontal position on bed A, and has an arm, 13, thereon, which extends over said bed and in the track of the yoke *n* as it is moved along by spindle *i*. A coiled spring, *g*, serves to slide said rod to the left.

A pin, 12, projects from the end of the worm-shaft bearing $d^2$, and when the latter is lifted by handle *w* rod 11 slides under said pin and holds said bearing up until yoke *n* moves against arm 13 and draws rod 11 to the right, when said bearing drops down again and causes the machine to stop, as hereinafter described.

The operation of my improvements is as follows: Pulley *c*, and consequently the worm-shaft *d*, with worm $e^2$, are set in motion by a belt applied to said pulley, or by other suitable means, and the cutter-spindle pulleys D are run by suitable belts. The cutter-spindles 3 4 are set to such angles by adjusting the angle-blocks 7 7, as described, as the pitch of the twist in the drill to be cut requires, and a suitable former, *h*, is fixed on the spindle *i*, and a drill-rest, 8, adapted to the diameter of the drill-blank, is secured on block 10. The operator now seizes the hand-wheel $i^2$ and turns spindle *i* and the former to draw the spindle backward, and then he places the drill-blank in the end of said spindle and secures it therein, as above described. When spindle *i* is drawn back, as aforesaid, the yoke *n* moves with it and causes the ends of levers *v*, which are connected thereto by the rods *s*, to swing and to roll the eccentric sleeves 16. Said sleeves are so set relative to said levers and to the spindles 3 4, which pass through them, that when said levers are swung back, as aforesaid, each of said spindles and their cutters are moved to cause the cutting-edges of the latter to approach each other and stand in the desired position to begin cutting at the end of the drill-blank. The spindle *i* is now turned to carry the end of the drill-blank forward into the drill-rest 8, to meet the edges of the revolving cutters 5. The free end of the worm-shaft bearing $d^2$ is now lifted up, bringing worm $e^2$ into engagement with the worm-gear

$e^3$, whereby the former $h$ and spindle $i$ are made to revolve and move forward, and thereby the drill-blank is rotated and moved forward through the rest 8 and between the cutters, and as it passes the latter the spiral grooves are cut therein, as shown in Fig. VIII. When the end of said shaft-bearing $d^2$ is lifted, as aforesaid, the rod 11, actuated by spring $g$, moves back under pin 12, thereby retaining said bearing and worm $e^2$ in an upward position; but when spindle $i$ has moved forward the requisite distance to complete the length of the grooves desired in the drill, the yoke $n$ is carried against the arm 13 on rod 11, drawing the latter from under said pin 12 and letting the end of the bearing $d^2$ drop, thereby separating worm $e^2$ and gear $e^3$, and causing spindle $i$ and the former $h$ to stop. The aforesaid forward movement of yoke $n$ caused the eccentric sleeves 16 to turn and gradually separate the cutters 5 as the drill-blank passed between them, thereby causing the grooves in the drill to be cut of a decreasing depth from the point thereof toward its shank. The spindle $i$ and the former are now turned back by using the wheel $i^3$ to draw the milled blank out from the rest 8, and said blank is removed, and the aforesaid operations are repeated.

For the purpose of giving the spindle $i$ and the milled blank a slight backward start after the grooves are cut, and without at first starting yoke $n$ and the parts connected with it, the collars 2 each side of yoke $n$ are so set as to allow of some play, as shown.

By the employment of the above-described rigidly-moving spindle $i$ to carry the drill-blank and the drill-rest 8, to inclose and support the latter while the cutters operate upon it, the grooves are cut therein under the most advantageous conditions, whereby dispatch and perfection of work are secured, the grooves being cut rapidly and smooth, and the metal is guarded against undue strain or fracture.

It will be observed that the point of connection of the rods $s$ with levers $v$ may be varied by connecting said rods in the different holes in said levers, whereby the degree of decrease in the depth of the grooves of the drill from the point back may be varied.

I am aware that machines have heretofore been constructed for milling twist-drills, as shown in the patent to Arnold, of August 30, 1864, whereby while the blank is given a rotary and a longitudinal movement cutters operate upon each side thereof to cut grooves of varying depth, and I not claim, broadly, mechanism for so operating upon drill-blanks; but

What I claim as my invention is—

1. In a machine for milling twist-drills, a drill-rest having a cylindrical chamber to admit within it that part of the drill against which the cutters operate, and having cutter-openings through its opposite sides, a pair of cutters adapted to operate through said openings, and mechanism, substantially as described, for rotating said cutters, the spindle $i$, to carry the blank, the removable grooved former $h$, the fixed key $i^3$, and means, substantially as described, for rotating said spindle and former, combined and operating substantially as set forth.

2. The spindle $i$, adapted to carry a drill-blank, and capable, by means substantially as described, of a combined longitudinal and rotary motion, two cutter-spindles standing at an incline to the axial line of said spindle $i$, and carrying cutters to operate on opposite sides of said axial line, the eccentric sleeves 16, levers $v$, rods $s$, and yoke $n$, combined and operating substantially as set forth.

3. In combination, the cutter-spindles 3 and 4 and their cutters, and the angle-blocks 7, supporting said spindles, and provided with the bolts 17, pivoted to each other and to the bed of the machine, substantially as set forth.

4. In combination, the spindle $i$, the cutter-spindle 4, the eccentric sleeve 16, lever $v$, rod $s$, and yoke $n$, substantially as set forth.

5. In combination, the spindle $i$, the spirally and longitudinally grooved former $h$, removably secured on said spindle, the key $i^3$, the gear $e^3$, provided with the key 19, shaft $d$, provided with the worm $e^2$, and the pivoted bearing $d^2$, substantially as set forth.

FRANCIS H. RICHARDS.

Witnesses:
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R. F. HYDE.