Sheet 1, 3 Sheets.

A. R. Arnold.

Milling Machine.

No. 44,037. Patented Aug. 30, 1864.

Witnesses!

J. W. Burbank

A. De Lacy

Inventor!

Andrew R. Arnold.

Sheet 2, 3 Sheets.

A. R. Arnold.

Milling Machine.

No. 44,037. Patented Aug. 30, 1864.

Fig 4. y. y.

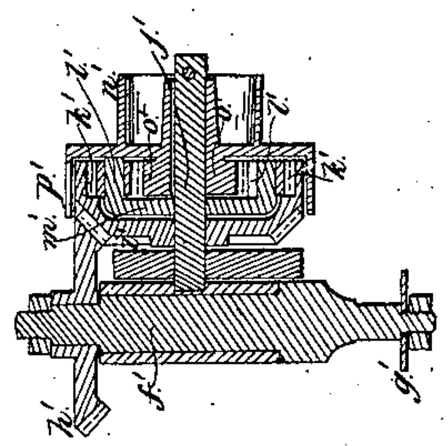

Fig 3. x. x.

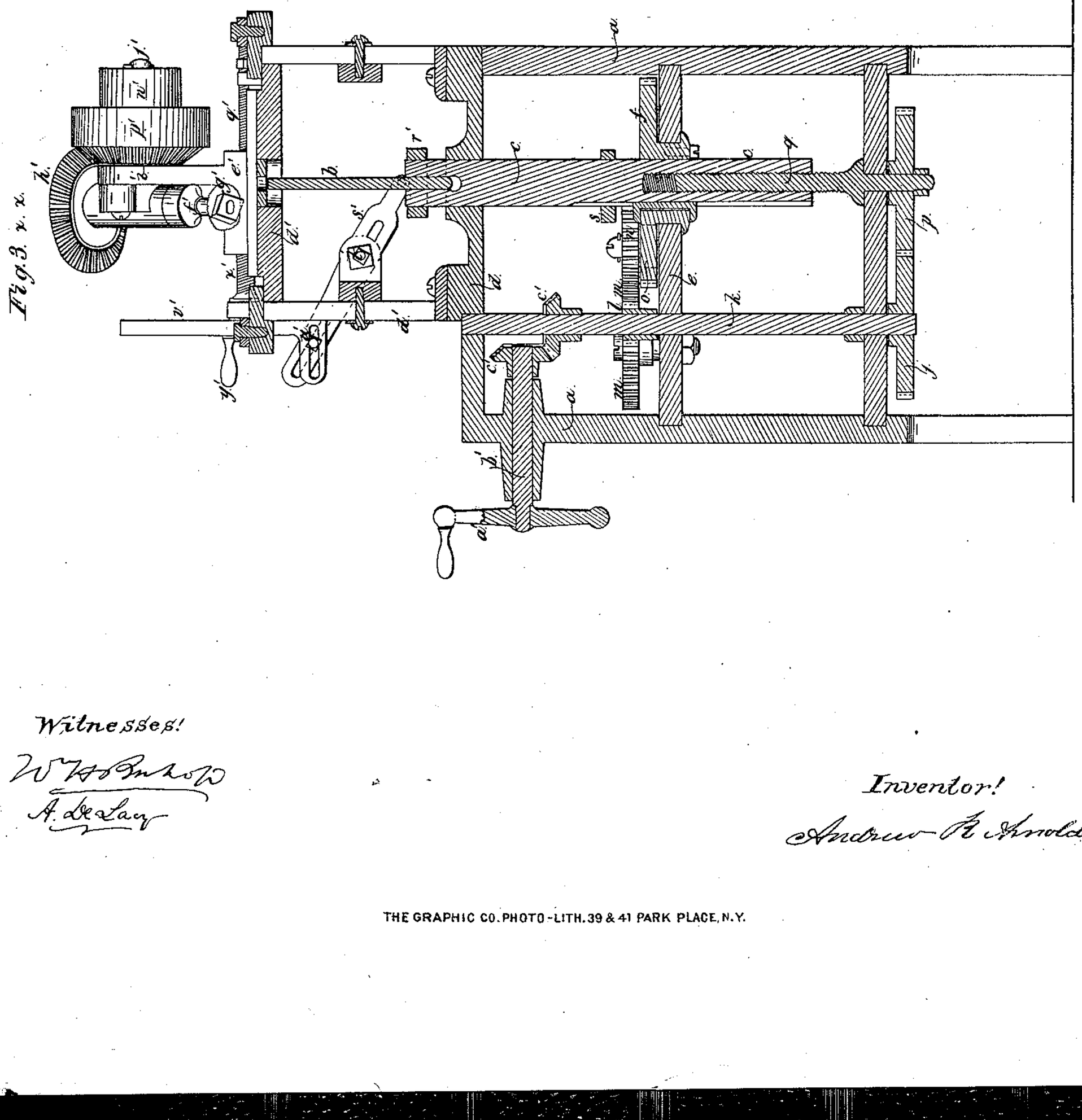

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Fig. 7.

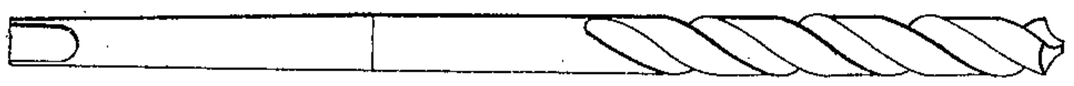

Fig. 8.

Fig. 9.

Fig. 6.

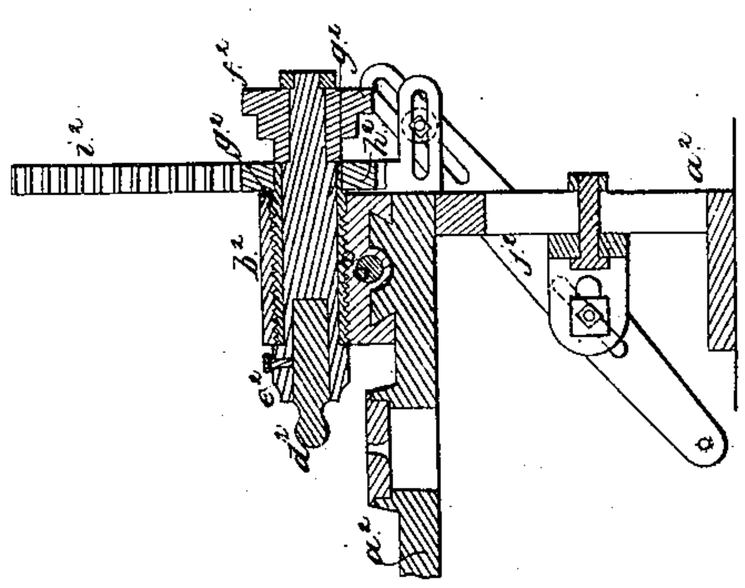

Fig. 10.

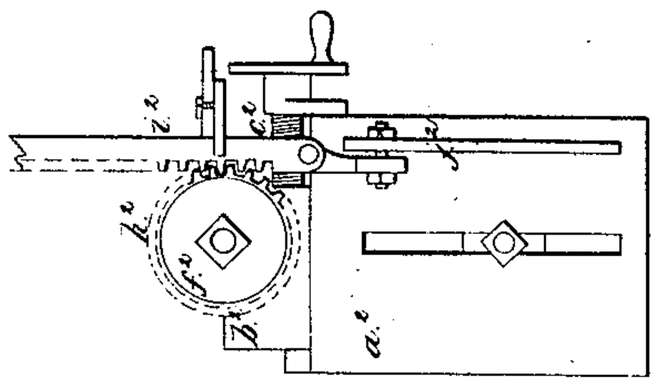

Fig. 5.

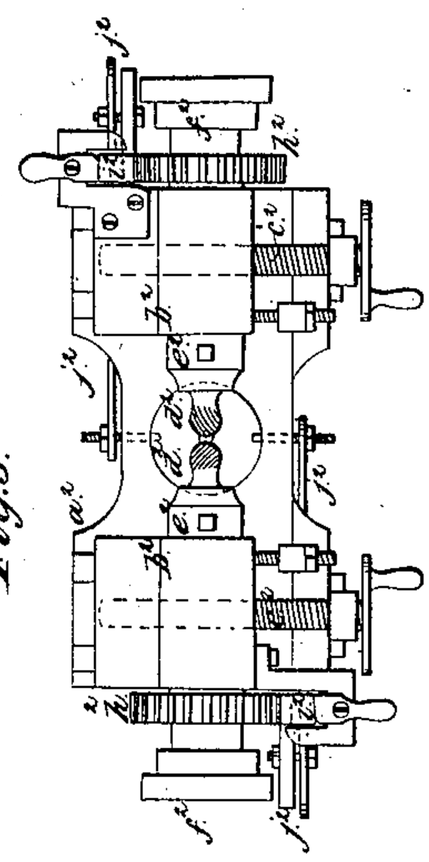

Fig. 11.

Witnesses!

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UNITED STATES PATENT OFFICE.

ANDREW R. ARNOLD, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE MANHATTAN FIRE ARMS COMPANY, OF SAME PLACE.

IMPROVED MACHINE FOR MAKING TWIST-DRILLS.

Specification forming part of Letters Patent No. **44,037**, dated August 30, 1864.

To all whom it may concern:

Be it known that I, ANDREW R. ARNOLD, of Newark, in the State of New Jersey, have invented certain new and useful Improvements in Machinery for Making Twist-Drills; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation; Fig. 2, a side elevation; Fig. 3, a vertical section at *x x*, Fig. 2, in the plane of the axis of the mandrel; Fig. 4, a section at *y y* of Fig. 2, in the plane of the axis of one of the burr-cutters, to exhibit the arrangement of the gearing for driving the burr-cutters; Fig. 5, a top view of the modification for finishing the grooves of twist-drills; Fig. 6, a vertical section in the plane of one of the cutters; Figs. 7 and 8, side elevation and end view of a twist-drill as grooved by burr-cutters, and Fig. 9 an end view of such a cutter when finished; Fig. 10, an end view of Fig. 5.

The object of my invention is to cut or finish the two grooves which form what is termed a "twist-drill" at one and the same operation by two cutters acting simultaneously on opposite sides of the blank, that the two may counteract each other, and thereby avoid all tendency to spring the blank.

In the accompanying drawings, *a* represents a suitable frame, and *b* the blank or cylindrical rod of steel which is being formed or cut. The lower end of this blank is inserted in a central socket at the upper end of a cylindrical mandrel, *c*, which is fitted to turn and slide longitudinally in suitable boxes in the two cross-bars *d* and *e* of the frame, and it also slides longitudinally in the eye of a cog-wheel, *f*, to which it is feathered so as to be turned by it. A slow rotary motion is imparted to the mandrel *c* by a worm, *g*, on the horizontal driving-shaft *h*, which carries a cone-pulley, *i*, to receive a band from some motor. The worm *g* drives a worm-wheel, *j*, at the lower end of a vertical shaft, *k*, which carries a pinion, *l*, and this pinion, by the train of wheels and pinion *m n o*, drives the wheel *f* on the mandrel *c*. In this way a slow rotary motion is given to the mandrel and the blank *b* which it carries, which rotary motion can be increased or diminished at pleasure by the cone-pulley.

While the mandrel is rotated, as above described, it is gradually lifted by a regular motion derived from the same source as the rotary motion.

The worm-wheel *j* at the lower end of the vertical shaft *k* drives a cog-wheel, *p*, on the lower end of a shaft, *q*, and the upper end of this shaft is threaded and fitted to the lower end of the mandrel *c*, which is made hollow and threaded for that purpose.

The cog-wheel and pinion *n o*, before described, are mounted and turn on a stud projecting from a bracket, *r*, attached to the frame by a screw-bolt passing through an elongated slot, or otherwise connected to admit of adjustment, so that they can be taken off and others of different size substituted to vary the relative speed of the rotary and longitudinal motions of the mandrel *c*, and thereby admit of making the twist to be cut of any desired pitch.

The operation of cutting the twist on the blank is performed while the mandrel is rising, and at the end of this upward motion the worm *g* on the driving-shaft is thrown out of gear with the worm-wheel *j* by a cam, *s*, on the mandrel, which then pushes a slide, *t*, on the under side of the cross-bar *d* of the frame. One end of the driving or worm shaft *h* is mounted in the lower arm of a lever, *u*, which turns on a fulcrum-pin, *v*. The upper arm of this lever has sufficient spring to be held in place by a shoulder or catch on the frame while the worm *g* is in gear; but when the slide *t* is pushed out by the cam *s* it disengages the upper arm of the lever *u*, and the lower arm is then forced outward by a spring, *w*, to throw the worm out of gear. After this disengagement of the worm the mandrel can be run down rapidly by a crank-handle, *a'*, on a short horizontal shaft, *b'*, which communicates motion by the bevel cog-wheels *c' c'* to the vertical shaft *k*. To the top of the cross-bar *d* or cap of the main frame is secured by screws or other suitable means an auxiliary frame, *d'*, on the top of which are mounted two puppets, *e' e'*, which slide horizontally in parallel ways. In each puppet is mounted an inclined arbor or spindle, *f'*, which carries at its lower end a burr-cutter, *g'*, the cutting-edge of which

is rounded to suit the form of groove to be cut in the blank. The inclination of these two arbors is to be such that the inclination of the planes of the two burr-cutters shall correspond with the pitch of the twist to be cut in the blank, and the two arbors are inclined in opposite directions. As it is desirable to set the machine for cutting twist-augers of different twist, the boxes in which the arbors or spindles f' are mounted are attached to the puppets by screw-bolts passing through elongated slots. In this way the arbors can be set at any desired inclination. Each arbor f' carries a bevel cog-wheel, h', at its upper end, which meshes into the cogs of another bevel cog-wheel, i', that turns on a stud-pin, j'. The opposite face of the bevel-wheel i' is a rim, k', with cogs on its inner periphery, which engage the cogs of two pinions, l' l', that turn on stud pins arranged on opposite sides of the axis of the bevel-wheel, and which are attached to a plate, m', on the stud-pin j', on which the bevel-wheel i, turns. The pulley n', by which the arbors are driven by a belt from some motor, is mounted to turn on the stud-pin j', and on its inner face it carries a pinion, o', which drives the two pinions l' l', and these in turn drive the bevel cog-wheel i', which is cogged on its inner periphery, as at k', and this bevel-wheel drives the arbor. The inner face of the pulley n', which carries the pinion o', may be made of enlarged diameter, with a rim, p', extending over the rim of the beveled wheel, and the outside of this rim is in the form of and can be used as a pulley when desired.

The burr-cutters are arranged and operate on opposite sides of the blank, each cutting one groove, and in this way I am enabled not only to cut the twist in one-half the time heretofore required, but to avoid all tendency to spring the blank—a difficulty heretofore experienced, and which cannot take place in this arrangement, as the cutters in their action counteract each other. The puppets which carry the two burr-cutters, as before stated, slide in parallel ways, and each is set to the depth of cut to be made by an adjustable gage, q'. Before starting the machine each puppet is pushed against its gage.

The grooves forming the twist-drill are of the greatest depth at the cutting end of the drill, and of gradually less depth toward the shank, as represented by dotted lines in the separate Fig. 11, representing a section of such a drill.

On account of the gradually-reduced depth of the grooves of the drill, the burr-cutters are gradually moved from the axis of the blank as it rises during the operation. To effect this motion of the cutters, there is a collar, r', on the upper end of the mandrel c, and which, for adjustment, can be shifted and fastened by a temper-screw at any desired distance from the upper end of the mandrel. A lever, s', that turns on a fulcrum pin at t', bears by a roller or pin on the surface of the collar r', and therefore that end of the said lever will be elevated as the mandrel rises. The opposite end of the lever is slotted and embraces an adjustable pin, u', on the lower end of a sliding cogged rack, v', which engages the cogs of a pinion, w', on the end of a screw-shaft, x', mounted on the top of the auxiliary frame d', and the thread on this shaft engages and slides the puppet, so that as the mandrel with its collar r' rises the lever depresses the cogged rack, which turns the screw-shaft, and this in turn slides the puppet with the burr-cutter gradually from the axis of the blank. When the operation is completed, the rack is disengaged from the pinion on the screw-shaft, to admit of moving back the puppet to its place of starting against the gage q', by a crank-handle, y'. This disengagement of the rack is effected by turning a button, z', situated behind the rack.

To adjust the parts to increase or decrease the range of motion, the fulcrum-pin on which the lever s' vibrates is adjustable in a slot of the bracket from which it projects, so that it can be set near to or farther from that end of the lever which bears on the collar; and in like manner the pin which is acted upon by the other arm of the lever is fitted and secured in a slot in the lower end of the cogged rack. The other puppet is provided with a like arrangement.

The parts being adjusted, the mandrel let down, a blank inserted, and the puppets of the burr-cutters set up against their gages and the machine started, the mandrel will rise gradually to present the point of the blank to the burr-cutters, which gradually cut the two grooves as the mandrel continues to raise and turn the blank, both motions being so timed and proportioned as to give the desired twist to the two grooves, and as these motions proceed the two burr-cutters are gradually moved from the axis of the blank to reduce the depth of cut, and in this way and at one operation the two grooves, to form a twist-drill, are cut simultaneously and without strain on the rod of steel.

The cutting-edges formed on the end of the twist-drill, by reason of the form of the grooves made by the burr-cutters, will be curved, and as it is desirable to have such cutting-edges straight, I subject the formed drill to a second operation in the same machine, substituting what are known as "cherry-cutters" for the burr-cutters above described.

The mode of applying the cherry-cutters is represented in Figs. 5 and 6. For convenience I take off the auxiliary frame above described from the main frame and substitute therefor the auxiliary frame a^2, which is in all essential respects like it. The puppets b^2 b^2 slide in parallel ways on the top, and these are adjusted by screw-shafts c^2 c^2 with crank-handles. The cherry-cutters d^2 d^2 are semi-spherical at their front ends and conical at their rear ends. They are secured in the front ends of two arbors e^2 e^2, each carrying a cone of pulleys, f^2, to receive the driving-belt.

Each mandrel is fitted to turn in a sleeve, g^2, the outer periphery of which is threaded and tapped in the puppet, and the outer end of the sleeve is provided with a cog-wheel, h^2, which engages and is turned by a cogged rack, i^2, connected with the lever j^2, operated by the collar r' on the mandrel c, as already described, for cutting the grooves of gradually less depth with the burr-cutters.

By the arrangement last described the two grooves cut by the burr-cutters are enlarged, the semi-spherical end of the cherry-cutters finishing the bottom of the two grooves which form the twist-drill, and the conical part of the cutters forming the sides of the grooves, so that when the end of the drill is ground off to a bevel the cutting-edges thereby formed will be straight.

I have thus described and represented the mode of construction which I have tried with success, and which I prefer; but I do not wish to be understood as limiting my claim of invention to such mode of application, as it may be varied by the substitution of mechanical equivalents having the same mode of operation.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The arrangement of the two rotating cutters, whether for cutting or finishing the two grooves, and acting simultaneously on opposite sides of the blank, substantially as described, in combination with the mandrel for carrying the blank, and having a simultaneous longitudinal and rotary motion, substantially as described, whereby I am enabled to cut or finish both grooves at the same time and of the required pitch, without tendency to spring the blank, as set forth.

2. Moving the cutter or cutters gradually from the axis of the blank, to make the groove or grooves of gradually less depth, by means of the sliding puppet (or puppets) in which the cutter (or cutters) is mounted, the sliding mandrel with a collar, or the equivalent thereof, and the mechanism, or the equivalent thereof, by which the rising of the mandrel communicates the required motion to the puppet for cutting the grooves of gradually less depth, as set forth.

3. The arrangement of gearing for communicating rotary motion from the shaft k to the wheel o, in which the mandrel c slides, and to which it is feathered so as to be turned thereby, in combination with the rotating screw-shaft q, which receives motion from the shaft k, and which imparts the required longitudinal motion to the mandrel c, substantially as and for the purpose specified.

4. The combination and arrangement of gearing herein described for transmitting motion from the driving-pulleys n' to the burr-cutters g.

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Witnesses:
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