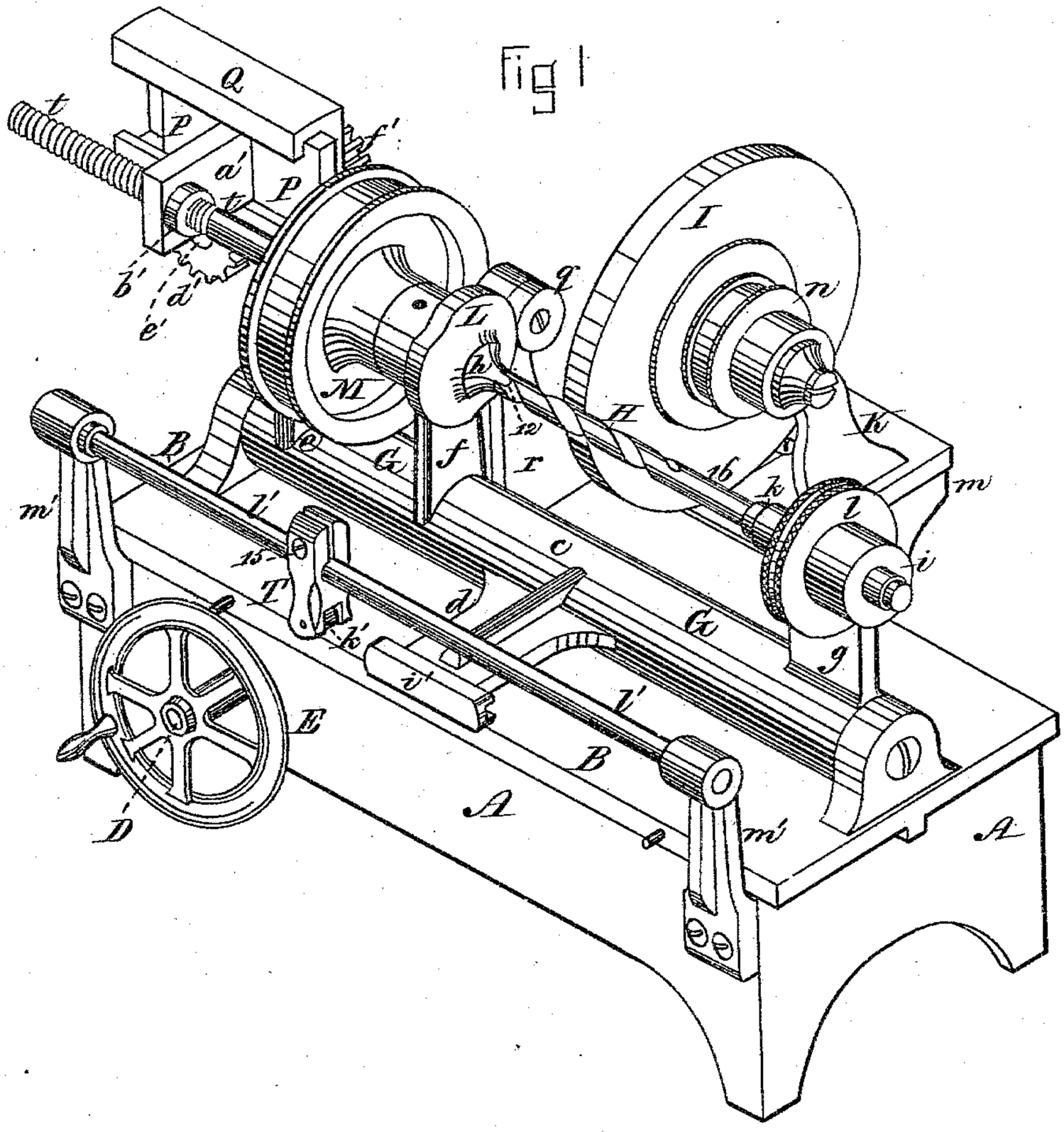
(No Model.) 3 Sheets—Sheet 1.

H. F. WHEELER.

GRINDING MACHINE FOR PRODUCING THE RELIEF ON TWIST AND FLUTED DRILLS.

No. 286,663. Patented Oct. 16, 1883.

Fig 1



WITNESSES

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(No Model.) 3 Sheets—Sheet 2.

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Fig 2

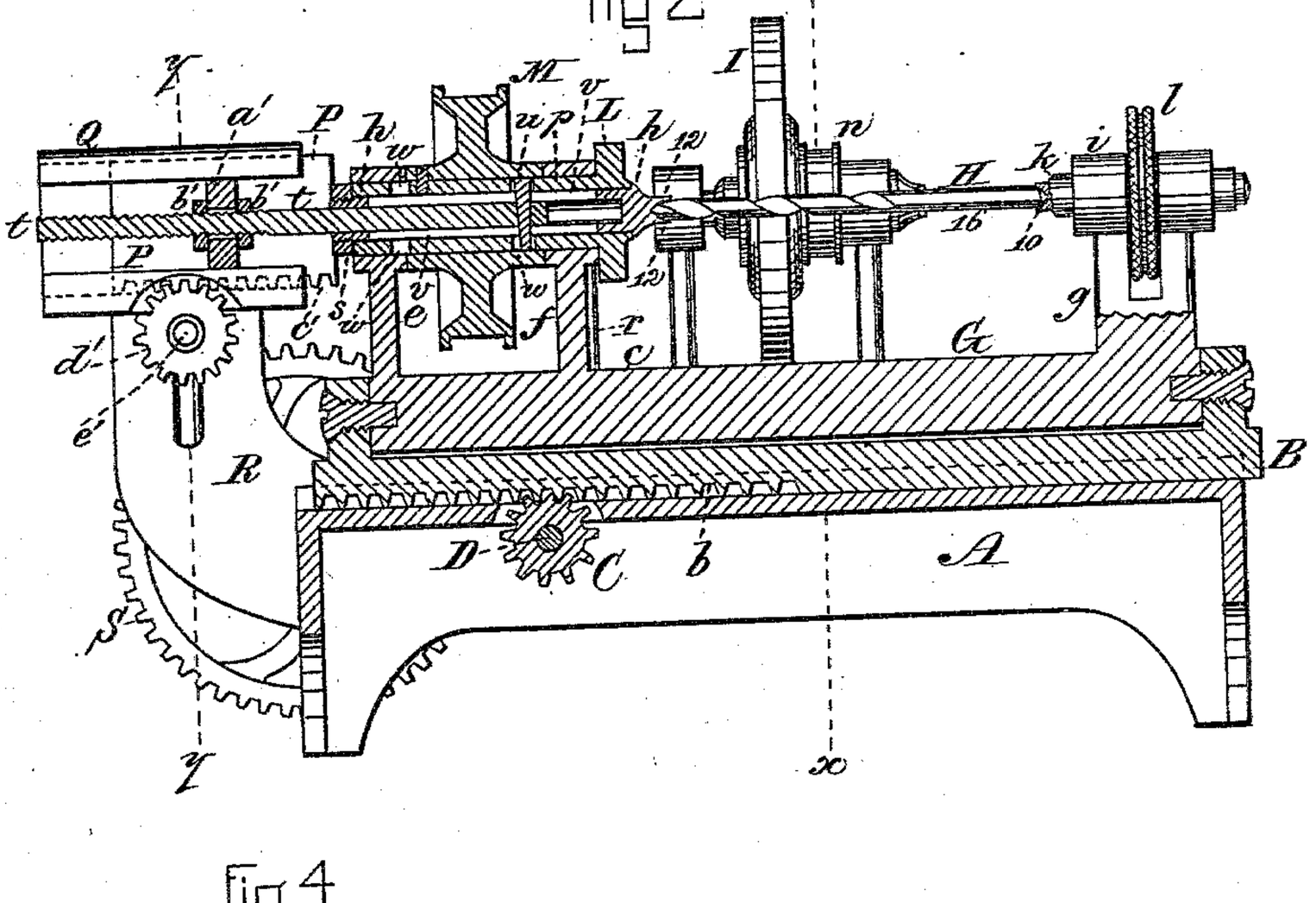


Fig 4

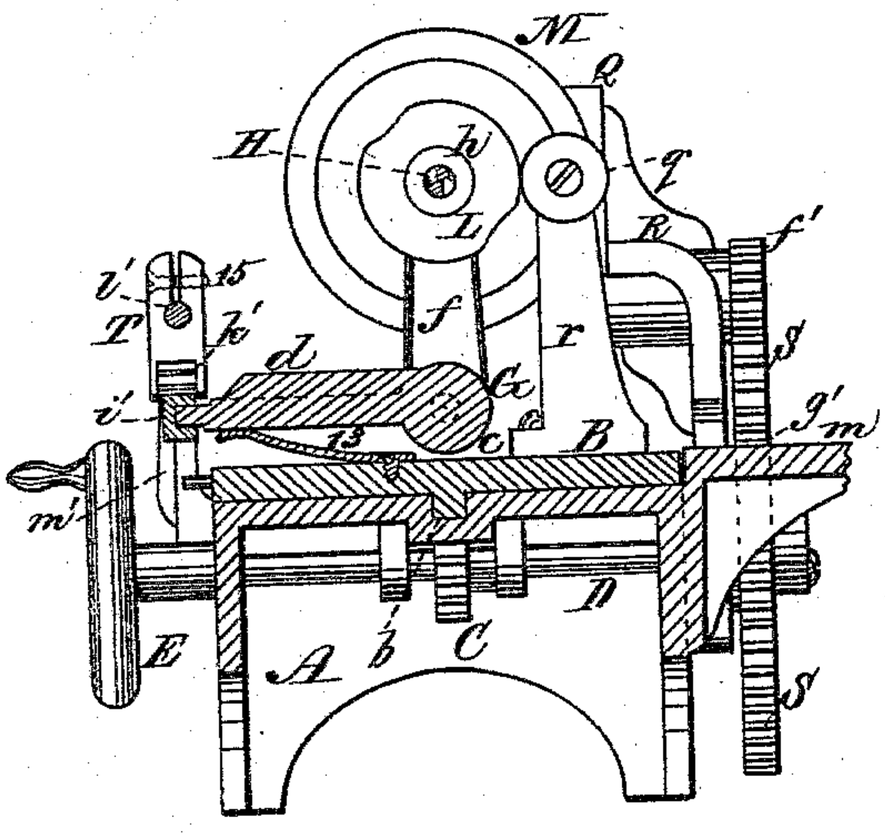
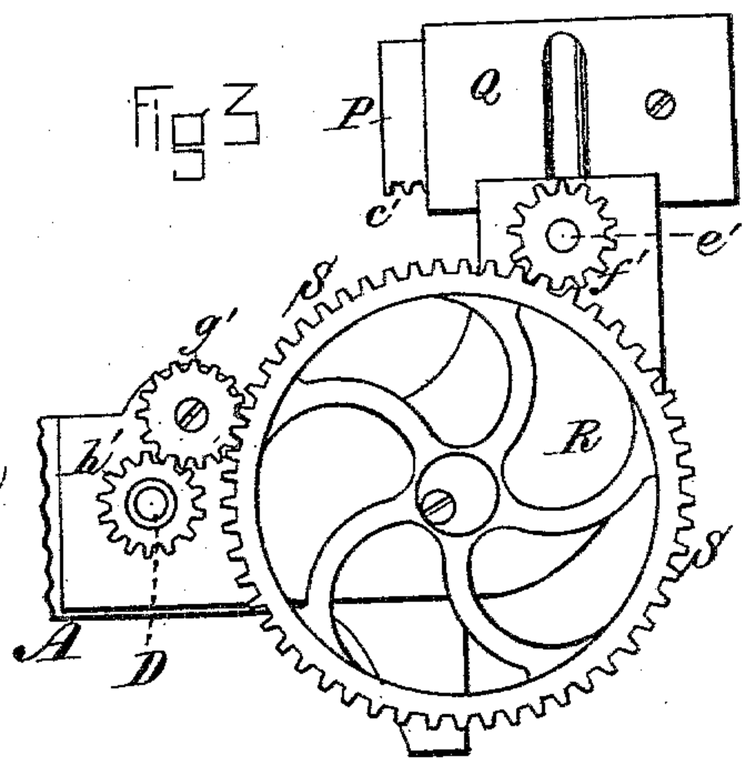


Fig 3



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(No Model.) 3 Sheets—Sheet 3.

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GRINDING MACHINE FOR PRODUCING THE RELIEF ON TWIST AND FLUTED DRILLS.

No. 286,663. Patented Oct. 16, 1883.

Fig 5

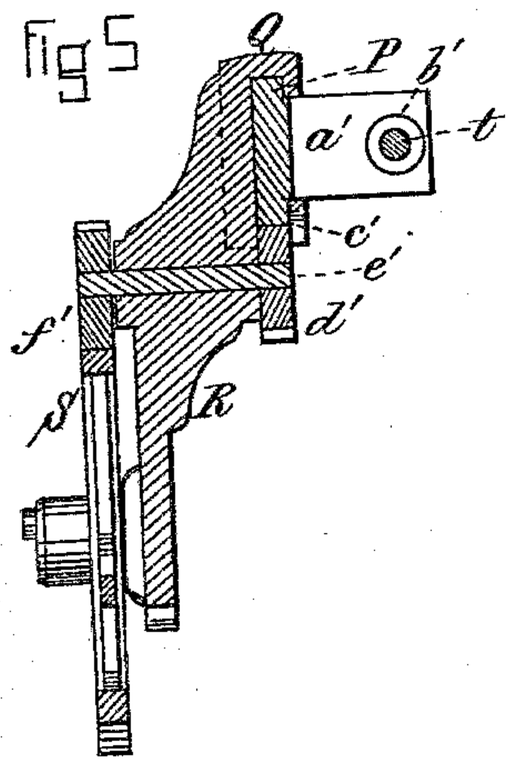


Fig 6

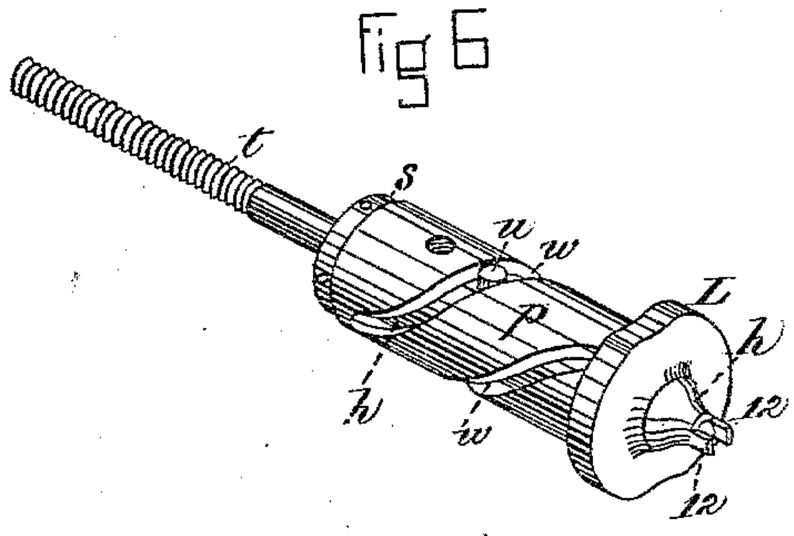


Fig 7

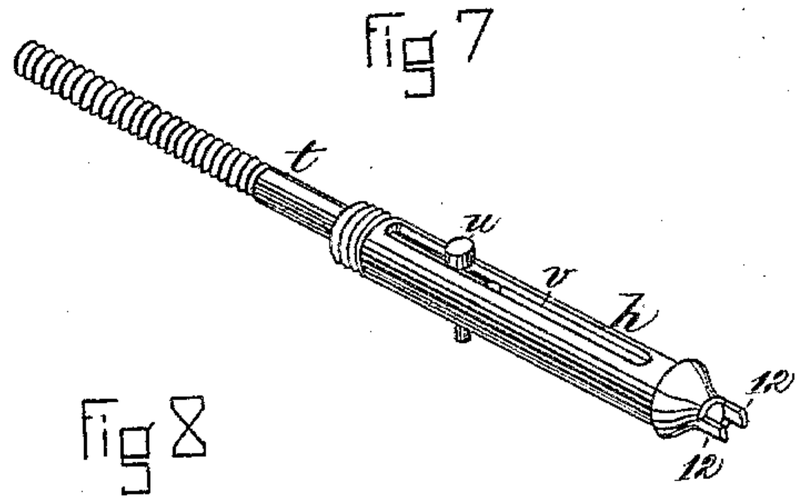


Fig 8

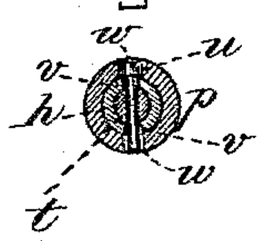
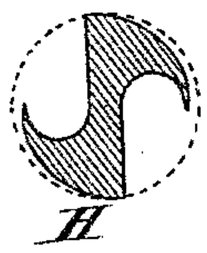


Fig 2



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UNITED STATES PATENT OFFICE.

HENRY F. WHEELER, OF LEOMINSTER, MASSACHUSETTS, ASSIGNOR TO THE UNION TWIST DRILL COMPANY, OF SAME PLACE.

GRINDING-MACHINE FOR PRODUCING THE RELIEF ON TWIST AND FLUTED DRILLS.

SPECIFICATION forming part of Letters Patent No. 286,663, dated October 16, 1883.

Application filed August 4, 1883. (No model.)

To all whom it may concern:

Be it known that I, HENRY F. WHEELER, a citizen of the United States, residing at Leominster, in the county of Worcester and State of Massachusetts, have invented a Grinding-Machine for Producing the Relief on Twist and Fluted Drills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a perspective view of a drill-grinding machine constructed in accordance with my invention. Fig. 2 is a longitudinal vertical section through the center of the same. Fig. 3 is an elevation of a portion of one side of the same. Fig. 4 is a transverse vertical section on the line *x x* of Fig. 2, the grinding-wheel being removed. Fig. 5 is a section on the line *y y* of Fig. 2; Figs. 6 and 7, details in perspective. Fig. 8 is a transverse vertical section through the live-spindle and its rotating sleeve. Fig. 9 is a transverse section through a drill, drawn to an enlarged scale to illustrate the decrease in diameter from the cutting-edge of one groove backward to the edge of the other groove which forms the "relief."

Twist and fluted drills are usually finished and given the exact diameter required by rotating them in a suitable lathe in contact with an emery-wheel, after which they are removed and the necessary relief or decrease in diameter from the cutting-edge of one groove backward to the edge of the other groove produced either by filing or by hand-grinding on an emery-wheel, which is a tedious and expensive operation, requiring the exercise of much skill on the part of the mechanic.

To avoid the necessity of two separate and distinct operations, as described, and to enable the drill to be accurately ground to the desired diameter and the relief simultaneously produced all at a single operation without removing the drill from the machine is the object of my invention, which consists in the combination, with a reciprocating carriage and an adjustable grinding-wheel, of a rocking or movable frame secured to the carriage and provided with centers for supporting the drill and means for rotating the same, a pattern-plate applied to the drill-rotating mechanism, a fixed roll or bearing secured to the carriage, and a spring applied to the movable frame and adapted to press the drill against the grinding-wheel and keep the pattern-plate in contact with the fixed roll or bearing, as hereinafter set forth.

My invention also consists in providing the live-spindle of the machine with a mechanism by means of which the drill as it is traversed by the carriage is turned independently of the sleeve which rotates the live-spindle, whereby the machine is adapted for grinding the relief on twist-drills where it is necessary that the spiral cutting-edges should be at a uniform distance from the center or axis of the drill.

My invention also consists in a device whereby the pattern plate or cam is thrown out of action when the drill has been traversed to bring its shank portion opposite the grinding-wheel, thus causing the shank to be ground perfectly circular in cross-section, as required.

My invention also consists in certain details of construction, as hereinafter set forth and specifically claimed.

In the said drawings, A represents the bed or frame-work of the machine, on which slides, in a suitable guideway, a traversing carriage, B, which is reciprocated by means of a gear, C, on the driving-shaft D, which engages with a rack-bar, *b*, on the under side of the carriage.

To the front end of the shaft D is secured a hand-wheel, E; but in practice it would be preferable to substitute therefor fast and loose pulleys, with belts and automatic mechanism, adapted to produce a rotation of the driving-shaft in opposite directions at the proper times.

Between lugs at the opposite ends of the carriage B is pivoted a rocking frame, G, composed of a longitudinal base-piece, *c*, provided with a horizontal arm, *d*, and three vertical posts, *e f g*, the posts *e f* being provided at their upper ends with bearings for the rotating device of the live-spindle *h*, and the post *g* having at its upper end the tail-stock *i* of the dead-spindle *k*, which is provided with a recess or female center, 10, as seen in Fig. 2,

and is operated by a hand-wheel, *l*. The live-spindle *h* is provided at its outer end with two prongs or projections, 12, which are adapted to enter the grooves of the drill H at the point thereof, the opposite or shank end of the drill being supported in the female center 10 of the dead-spindle, within which it is free to turn when rotated by the live-spindle *h*.

I is the grinding or emery wheel, the arbor of which is supported in suitable bearings in a frame, K, the base of which is made adjustable upon a bracket, *m*, projecting from the frame-work A by means of a slot and screw. The emery-wheel I is rotated by a belt passing over a pulley, *n*, on its arbor, and as the carriage is traversed on the bed A all portions of the surface of the drill are brought into contact with and ground by the emery-wheel as desired. If, however, the drill were held continuously at the same distance from the center of the grinding-wheel, it would be rendered perfectly circular in cross-section. In order, therefore, to produce the relief, or decrease in diameter from the cutting-edge of one groove back to the edge of the other groove, as shown in Fig. 9, it becomes necessary to hold the drill during each revolution at different distances from a vertical plane passing longitudinally through the center of the arbor of the emery-wheel, which is effected by means of a pattern plate or cam, L, at one end of the sleeve *p*, which rotates the live-spindle, the sleeve *p* carrying a pulley, M, over which passes a belt, (not shown,) by means of which the sleeve *p* is rotated. The pattern-plate L is caused, by a spring, 13, Fig. 4, between the arm *d* and the carriage B, to bear against a fixed friction-roll, *q*, which revolves on a stud at the upper end of a post, *r*, secured to the bed A, and thus, as the pattern-plate revolves, the frame G is rocked on its pivots, which causes the drill to advance toward and recede from the center of the grinding-wheel at each revolution, and thus be ground off more or less at different portions of its circumference to produce the relief, while the drill is at the same operation ground to the exact diameter required, thus avoiding two separate and distinct operations, as heretofore necessary, the contour of the periphery of the pattern-plate being such as to give the drill the exact shape in cross-section required.

In grinding twist-drills it will be apparent that the drill, as it is being traversed by the carriage, must be turned independently of the sleeve *p*, which rotates it, in order that the cutting-edges of the spiral grooves of the drill may be always properly presented to the emery-wheel to cause the relief to be ground backward therefrom accurately and prevent the cutting-edges from being ground down more at one point than another. This independent rotation of the drill is effected in the following manner: The live-spindle *h*, which is made hollow, as seen Figs. 2 and 7, fits snugly within the sleeve *p*, and is secured in place therein by means of a nut, *s*, turned over its inner end and bearing against the end of the sleeve *p*. Within the live-spindle *h* slides a rod, *t*, provided with a pin, *u*, which projects from opposite sides thereof through straight longitudinal slots *v* in the live-spindle *h*, the opposite ends of the pin extending outward into two spiral slots, *w*, cut in the sleeve *p*, by which construction, as the rod *t* slides backward and forward within the live-spindle, the pin *u* is caused to travel within and follow the spiral slots *w* of the sleeve *p*, which thus produces a partial rotation of the live-spindle and drill independently of the rotation of the sleeve itself. The rod *t* is moved backward and forward within the live-spindle *h*, to increase or diminish the speed of rotation of the latter with relation to that of the sleeve *p* at each traverse of the carriage B in the following manner: The rod *t* passes through a lug or projection, *a'*, on a sliding carrier, P, which fits within a guide, Q, at the upper end of a heavy arm, R, secured to one corner of the bed A, the rod *t* being secured to the lug *a'* by means of screw-nuts *b'* on each side thereof.

On the under side of the slide P is formed a rack, *c'*, which engages with a gear, *d'*, on a shaft, *e'*, having its bearing in the arm R, the opposite end of the shaft *e'* carrying a gear, *f'*, which engages with a large gear, S, revolving on a stud projecting from the arm R. This gear S meshes with an intermediate gear, *g'*, which is driven by a gear, *h'*, Fig. 3, on the driving-shaft D, and thus as the latter is rotated the slide P and rod *t* are caused to move backward and forward as desired. By changing the size of either of the gears *f'* or *h'*, the amount of rotation given to the drill independently of its rotation by the sleeve *p* at each traverse of the carriage can be varied as required, the amount of rotation depending on the pitch of the grooves of the drill, which vary in drills of different diameters, and by adjusting the relative position of the rod *t* with respect to the lug *a'* by means of the nuts *b'* the position of the drill with respect to the pattern-plate or former can be regulated to cause the cutting-edges of the grooves to be always in line with the proper portions of the pattern-plate. By this construction the speed of rotation of the spindle *h* can be increased or diminished with relation to that of the sleeve *p*, and consequently the speed of rotation of the drill relative to that of the cam L, so as to produce the proper relative position between the part of the drill in contact with the grinding-wheel I and the part of the cam in contact with the friction-roll *q*. As soon as the carriage has been traversed into a position to bring the shank portion of the drill opposite to the grinding-wheel, a bar or projection, *i'*, secured to the outer end of the arm *d*, is brought into contact with and passes beneath a friction-roll, *k'*, at the bottom of an adjustable stop-piece, T, which is clamped by means of a screw, 15, upon a horizontal rod, *l'*, sup-

ported at its opposite ends in uprights m', rising from the ends of the frame A. As the bar i' strikes the roll k' the arm d is depressed, which rocks the frame G on its pivots against the resistance of the spring 13 and causes the pattern-plate L to be drawn away from and entirely out of contact with the fixed roll q, when the drill will rotate at a fixed and uniform distance from the center of the emery-wheel, causing its shank-portion 16 to be ground of perfectly circular form in cross-section, as required, the position of the piece T on the rod l' being adjusted to correspond to the point in the length of the drill at which the grooves terminate and the shank commences. By making the upper surface of the bar i' inclined, it is evident that a proper movement may be imparted to the frame G to cause the shank of the drill to be ground of taper form, if desired.

When it is desired to grind straight-grooved or fluted drills, the mechanism for imparting the independent rotation to the drill must be disconnected, which can be effected either by removing the intermediate gear, g', or uncoupling the rod t from the sliding carrier P.

By the employment of the above-described machine, the time required to grind and finish a drill is reduced to a minimum, as it is accurately ground to the required diameter and the relief produced at one and the same operation, thus effecting a material saving in time and labor.

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

1. In a drill-grinding machine, the combination, with the reciprocating carriage B and an adjustable grinding-wheel, I, of the rocking or movable frame G, secured to the carriage B, and provided with centers for supporting the drill and means for rotating the same, a pattern-plate, L, applied to the drill-rotating mechanism, a fixed roll or bearing, q, secured to the carriage, and a spring, 13, applied to the movable frame and adapted to press the drill against the grinding-wheel and keep the pattern-plate in contact with the roll q, all constructed to operate substantially as and for the purpose set forth.

2. In a drill-grinding machine, the combination, with a grinding-wheel and a reciprocating carriage having a movable frame provided with centers for supporting the drill and a pattern-plate for governing the movements of said frame, of a sleeve for carrying and rotating the live-spindle of the drill-supporting device, and means, substantially as described, for producing an independent rotation of the live-spindle within its carrying-sleeve, as and for the purpose described.

3. In a drill-grinding machine, the combination, with the live-spindle h, with its longitudinal slots v, of the driving-sleeve p, provided with spiral slots w, the rod t, having a pin, u, adapted to slide in the slots v w, and means for reciprocating the rod t during the traverse of the carriage B, substantially as and for the purpose set forth.

4. In a drill-grinding machine, the combination, with the grinding-wheel I and reciprocating carriage B, having a movable frame for supporting the drill and a pattern-plate for governing the movements of said frame, of the slotted live-spindle h, the driving-sleeve p, with its spiral slots w, the rod t, with its pin u, adapted to slide in the slots v w, and the sliding carrier P, with its rack-teeth c', secured to the rod t by the adjusting-nuts b', and adapted to be reciprocated by the gear d', driven by gearing connected with the driving-shaft D, all constructed to operate substantially in the manner and for the purpose set forth.

5. In a drill-grinding machine, the combination, with the grinding-wheel and the reciprocating carriage B, having a movable frame, G, provided with mechanism for supporting and rotating the drill and the pattern-plate L and spring 13, of the bar or projection i', secured to the frame G and adapted to be brought into contact with the adjustable stop-piece T, whereby the pattern-plate L is withdrawn from the fixed roll q and thrown out of action while the shank of the drill is being ground, substantially as described.

6. In a drill-grinding machine, the combination, with the reciprocating carriage B and the movable frame G, having a bar or projection, i', of the stop-piece T, with its friction-roll k', made adjustable longitudinally upon the rod l', all operating substantially in the manner and for the purpose set forth.

Witness my hand this 26th day of May, A. D. 1883.

HENRY F. WHEELER.

In presence of—
P. E. TESCHEMACHER,
W. J. CAMBRIDGE.