(Model.) 2 Sheets—Sheet 1.

E. REYNOLDS.

MACHINE FOR CUTTING SPIRAL GROOVES IN GRINDING ROLLS.

No. 259,043. Patented June 6, 1882.

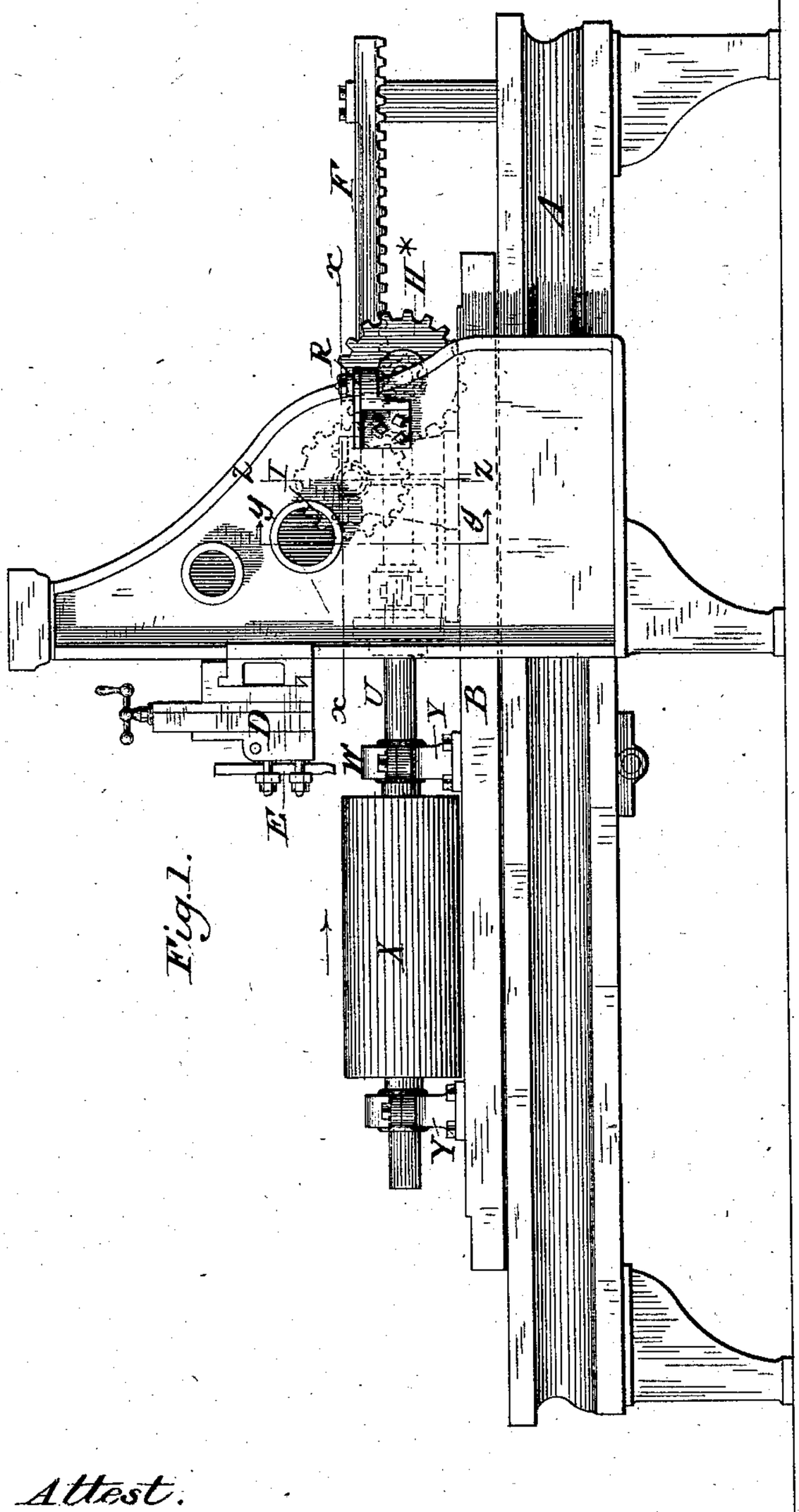

Fig. 1.

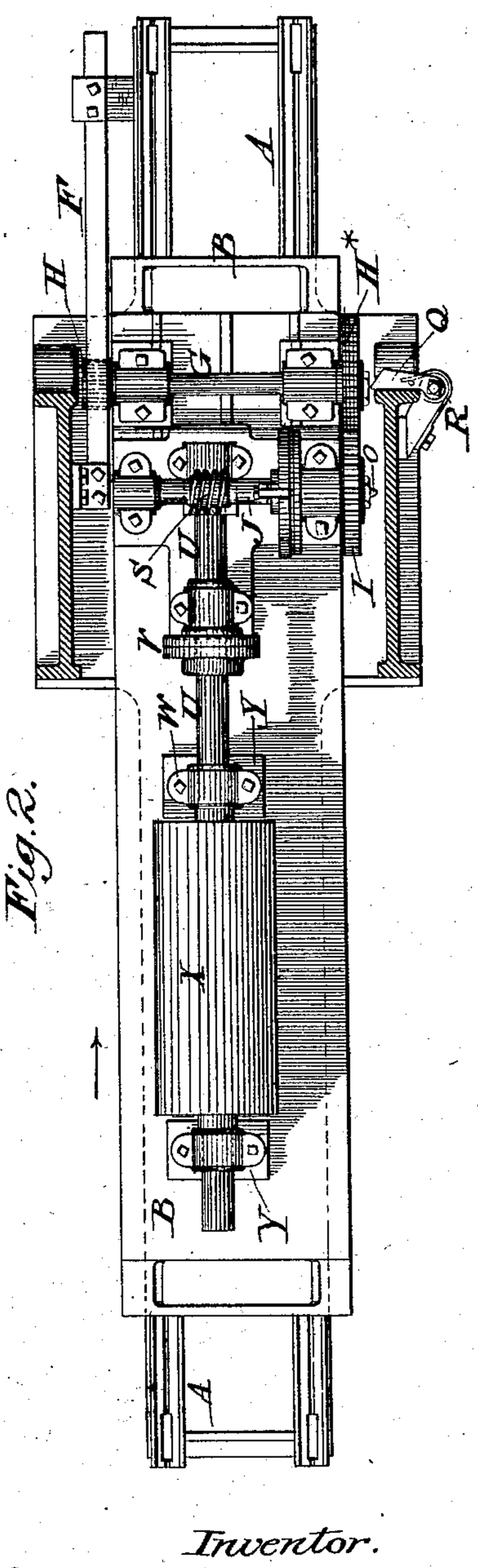

Fig. 2.

Attest.

Sidney P. Hollingsworth.

Walter S. Dodge

Inventor.

Edwin Reynolds.

By Dodge & Son

Attys.

(Model.) 2 Sheets—Sheet 2.

E. REYNOLDS.

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Fig. 3.

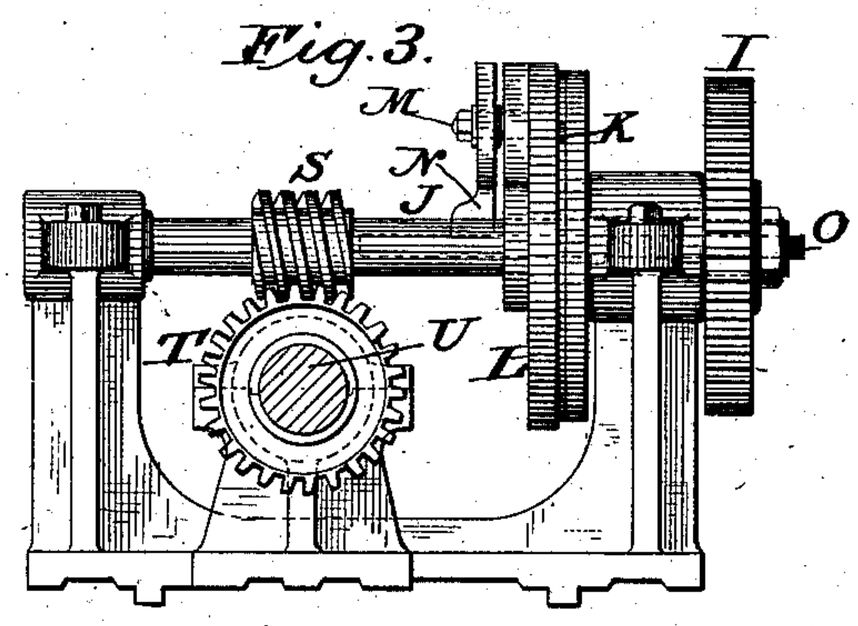


Fig. 4.

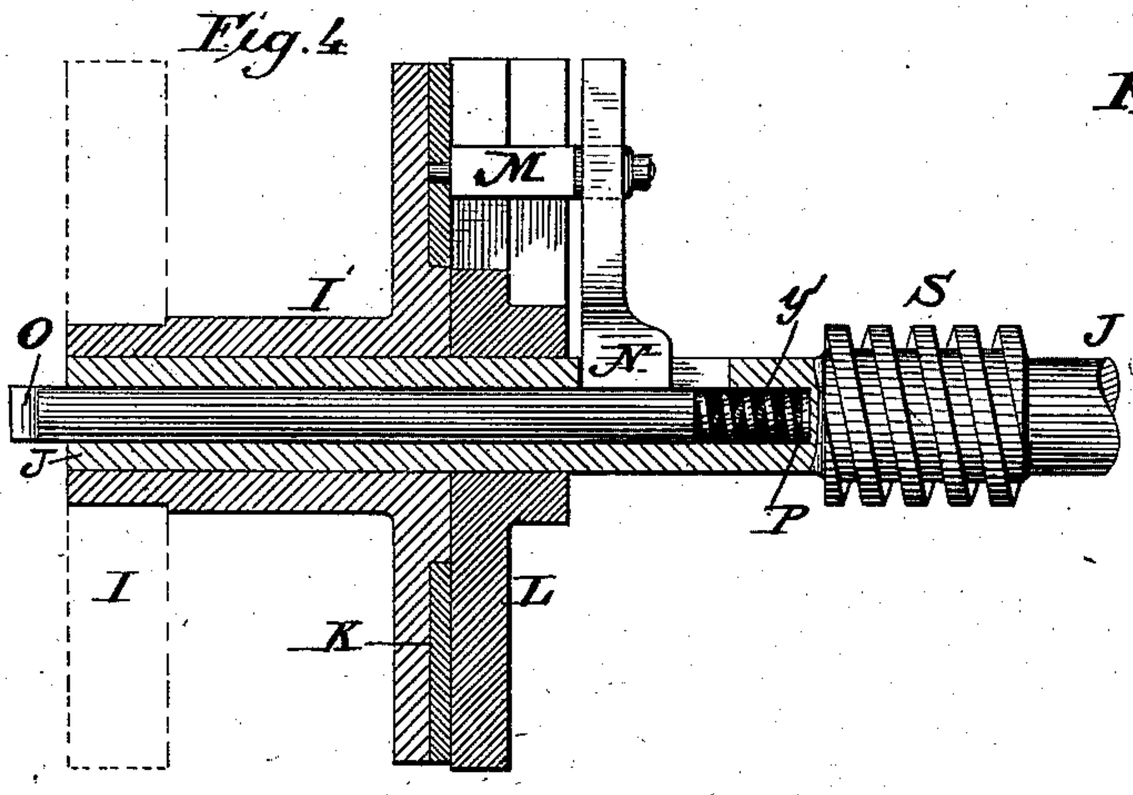


Fig. 6.

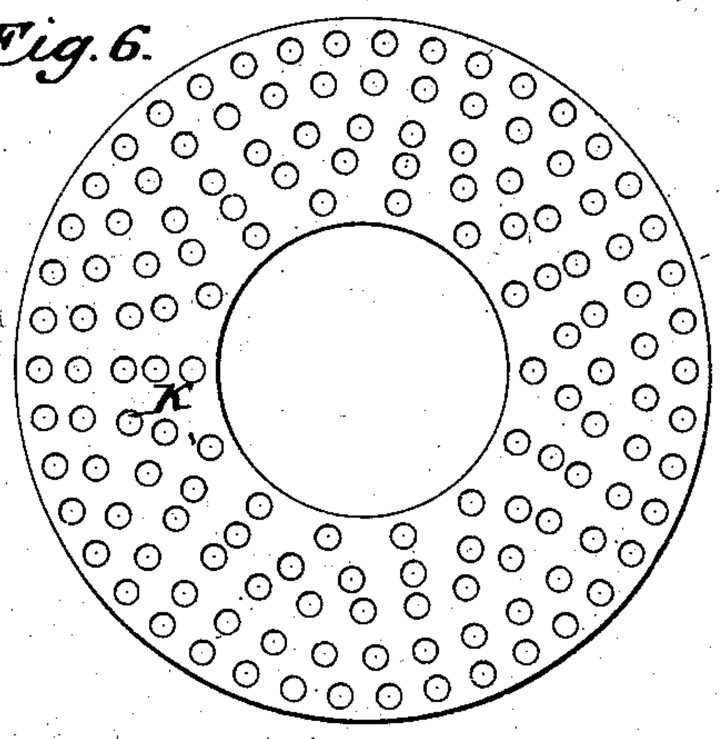


Fig. 5.

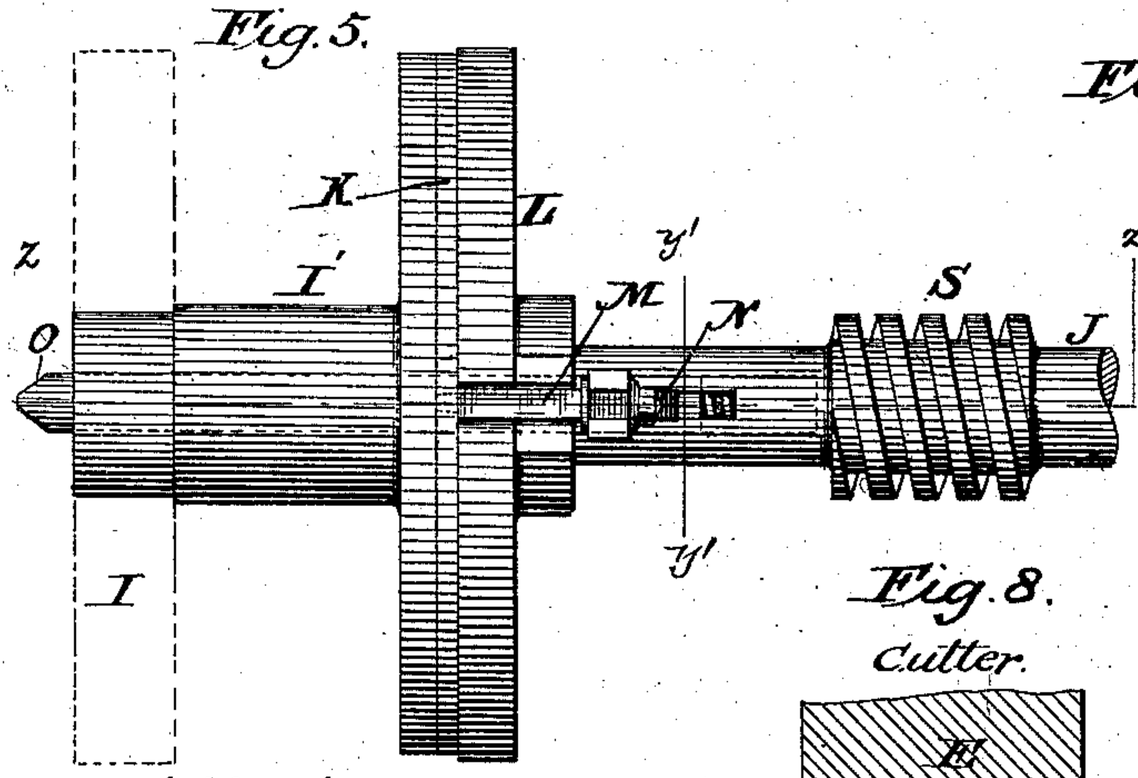


Fig. 7.

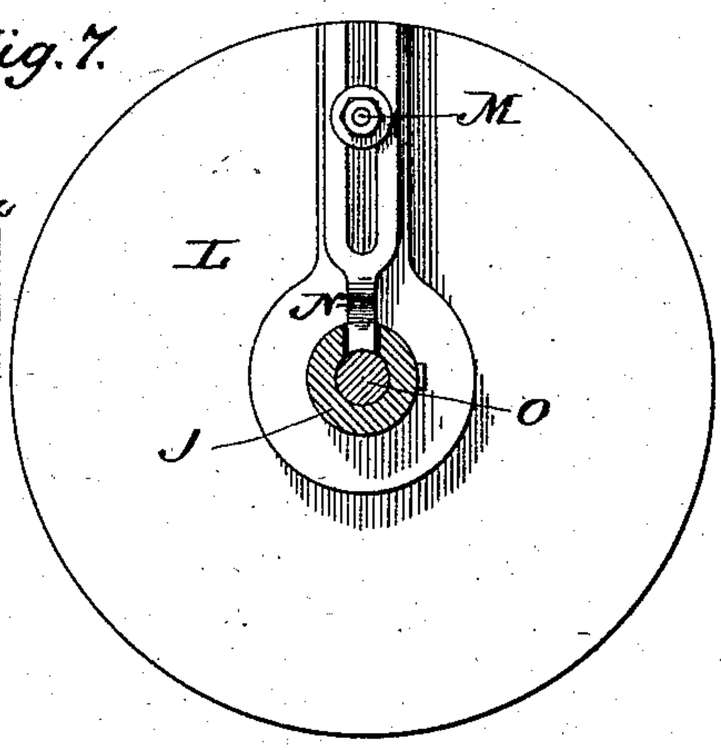
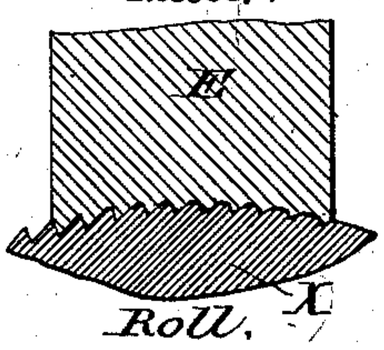


Fig. 8.

Cutter.



Attest.

Sidney P. Hollingsworth

Walter S. Dodge.

Inventor.

Edwin Reynolds.

By Dodger Lee

attys.

UNITED STATES PATENT OFFICE.

EDWIN REYNOLDS, OF MILWAUKEE, WISCONSIN.

MACHINE FOR CUTTING SPIRAL GROOVES IN GRINDING-ROLLS.

SPECIFICATION forming part of Letters Patent No. 259,043, dated June 6, 1882.

Application filed March 10, 1881. (Model.)

To all whom it may concern:

Be it known that I, EDWIN REYNOLDS, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain Improvements in Machines for Cutting Spiral Grooves in Grinding-Rolls, of which the following is a specification.

My invention relates to a machine designed for the purpose of cutting spiral ribs, teeth, or corrugations lengthwise upon the rolls for roller grinding-mills, the object of the invention being primarily to produce an automatic apparatus whereby the grooves or ribs may be cut with that exact uniformity in size and curvature which is in practice demanded, and which may be used to recut or sharpen rolls which have become dull or worn from use. In order to secure the best results in the reduction of middlings and the production of flour, &c., it is necessary that the ribs or teeth upon the rolls shall be of exactly uniform size and depth.

In practice it has been found necessary to make the rolls of chilled iron, hardened steel, or other extremely hard material, and for this reason it has been found exceedingly difficult to cut the ribs or teeth thereon with the required degree of accuracy and uniformity; and owing to the inaccuracy of the ribs formed by the machines hitherto in use it has been found practically impossible to sharpen or recut the teeth of old and finely-grooved rolls without in a measure destroying the teeth and thereby impairing the usefulness of the roll.

My invention consists in certain devices and combinations of devices whereby the roll to be cut is given a positive and uniform rotation as it is passed endwise beneath the cutter or grooving-tool, and whereby it is rotated after each cut a distance equal to the width of one or more teeth or ribs, the rotation being thus carried on step by step until the entire surface of the roll has been automatically cut or grooved.

The form of the frame-work and the arrangement of the cutting-tool and supporting devices constitute no material part of my invention, but may be modified as desired.

The construction and arrangement of various details may also be modified in many respects, which will suggest themselves to the skilled mechanic without departing from the limits of my invention.

In the accompanying drawings I have represented my appliances attached to an ordinary metal planer having a reciprocating bed or carriage and a stationary cutting-tool above the same.

Figure 1 represents a side elevation of the complete machine. Fig. 2 represents a top plan view of the same with the overhead tool-supporting frame cut away on the line *x x*, Fig. 1, in order to expose more clearly the parts below it. Fig. 3 is a vertical section on the line *y y*, Fig. 1, looking in the direction indicated by the arrows. Fig. 4 is a vertical section on the line *z z*, Fig. 1. Fig. 5 is a top plan view of the parts represented in Figs. 3 and 4. Figs. 6 is a face view of the index-plate used to control the distance between the teeth or ribs of the rolls. Fig. 7 is a cross-section on the line *y'*, Figs. 4 and 5. Fig. 8 is a cross-section of a roll partially grooved or cut and of the tool operating thereon.

In the drawings, A represents a rigid frame of an ordinary iron planer, provided with a horizontal reciprocating bed, B, and with a stationary overhead portion, having the usual tool-carrier, D, with the depending tool or cutter E therein.

The above parts may be of any ordinary or suitable construction, and may be provided with the usual driving-gear, as they constitute no part of my invention.

Above the bed, at one side of the machine, I secure a rigid longitudinal rack-bar, F, and in suitable supports secured upon the bed I mount a transverse shaft, G, one end of which is provided with a pinion, H, which gears into rack F, as shown in Figs. 1 and 2, so that as the reciprocation of the bed carries the shaft G to and fro therewith the shaft receives a rotary motion, first in one direction and then in the other, by means of the rack and pinion. On the opposite end of the shaft G, I secure a gear-wheel, H*, which gears into a second wheel, I, mounted on the end of a second transverse shaft, J, also sustained in bearings on the bed B, as hereinafter described. The wheel I is provided with a tubular shaft or journal mounted in a rigid support upon the bed loosely around a transverse shaft, J. The shaft J is sustained at one end by the tubular sleeve I', and at the opposite end by a support or bearing bolted upon the bed-plate.

The wheel I has its tubular shaft or sleeve I' provided on the inner end with a disk or

dial-plate, K, as clearly represented in Figs. 2, 3, 4, 5, and 6, this dial-plate being provided with numerous holes or teeth arranged in circular series, the holes in each series at uniform distances apart, as shown in Fig. 6.

Upon the shaft J, against the face of the dial-plate K, I secure a disk, L, through which there passes a stud or pin, M, for the purpose of locking the dial-plate and the disk together, in order that motion may be transmitted from the gear-wheel through the dial-plate K and disk L to the shaft J. The coupling-pin M is mounted upon arm N, which extends through a slot in the side of the shaft J, and is secured at its inner end to a rod or spindle, O, seated centrally within the shaft J, and extending at one end beyond the same, as shown in Figs. 2, 3, 4, and 5, so that by pushing the protruding end of said spindle inward the coupling-pin may be disengaged from the dial-plate in order to release the shaft J. A spiral spring, P, mounted within the shaft J, acts against the end of spindle O and causes and maintains an automatic engagement of the coupling-pin whenever the parts are released.

A dog, Q, beveled on its rear side, is pivoted to one side of the main frame, as shown in Fig. 2, in such manner that as the bed moves backward spindle O is forced back momentarily, thereby causing the coupling-pin M to disengage and permitting the dial-plate to turn independently of the shaft for a short interval of time, for reasons which will hereinafter appear. The dog Q is held in operative position by a spring, R, acting thereon; but as the bed moves forward the dog yields and moves away from the spindle O as the latter is carried past, the spindle being forced inward by the dog during the backward but not during the forward movement of the bed.

Upon the shaft J, I secure a worm, S, which engages with a worm-wheel, T, secured upon one end of a horizontal shaft, U, which is mounted in bearings bolted firmly to the bed-plate, and provided at one end with a coupling, V, by which to connect it with the journal of the roll to be cut.

For the purpose of holding and sustaining the roll which is to be operated on, the reciprocating bed B is provided with rigid bearings or journal-boxes Y, in which the journals of the roll are mounted, as clearly shown in Figs. 1 and 2, the roll extending lengthwise of the machine and being free to turn in its bearings, and having one of its journals secured firmly to the coupling on the end of shaft U, as plainly represented in Figs. 1 and 2. The roll mounted upon the bed, as shown, is in the proper position to be carried lengthwise beneath the cutting-tool, to be acted on thereby as the bed reciprocates.

It will of course be understood from the foregoing description that all the operating parts of my apparatus, except the rack-bar, the dog Q, and the cutting-tool E, are carried to and fro with the bed B.

A cutting-tool, E, is provided in its end with a series of lips or teeth corresponding in form and distance between them to the ribs and teeth which are to be formed upon the roll, as clearly shown in Fig. 8, the construction being such that the tool acts upon a number of teeth at one time. In order to secure the best results, I find it advisable to make the teeth of the cutter of progressively-increasing length from one side of the cutter to the other, the shorter teeth to commence and the longer teeth to finish the cut.

The operation of the parts is such that the roll is advanced after each cut of the tool a distance equal to the width of one or more teeth, whereby each rib or tooth of the roll is subjected successively to the action of the various teeth upon the cutter, commencing with the shortest and finishing with the longest. In this manner each rib or tooth of the roll is formed by a succession of cuts, each one deeper than the preceding one. This mode of operation is advantageous, in that it secures uniformity in the shape and size of the teeth, and in that it permits the cutting of the roll to progress very rapidly without making excessive deep cuts at any one time, thus enabling a smoother finish to be given and avoiding undue strain upon the parts.

The operation of the machine is as follows: As the bed of the machine, with the roll thereon, moves forward toward the cutter in the direction indicated by the arrow in Figs. 1 and 2, the stationary rack-bar F transmits motion, through the pinion H, shaft G, and wheel H*, to the wheel I, which in turn transmits motion through its tubular shaft I′ to the dial-plate K, and thence to the coupling-pin M, and thence through the disk L to the shaft J and its worm S, the latter in turn rotating the wheel T and shaft U, thereby imparting to the roller X, as it is carried beneath the cutter E, a positive and uniform rotation, causing the cutter to form the teeth or ribs in a true spiral path around the surface of the roll X. When the bed B moves backward the tool rises without cutting, as usual, and the entire system of gearing for turning the roll receives a positive backward motion until the end of spindle O encounters the beveled end of the dog Q, whereupon the dog causes the spindle to disengage the coupling-pin M, thereby releasing the disk L and shaft J momentarily from the actuating dial-plate K. During this momentary disengagement the sleeve I′ is permitted to turn backward independently of the shaft J, so as to bring the next one of the holes in the dial-plate K opposite the coupling-pin M, whereupon the coupling-pin, being previously released from the influence of dog Q, engages in the new hole in the dial-plate. This change of the dial-plate K in relation to the disk L and its shaft J causes the driving mechanism to advance the roll at the next movement of the bed a distance equal to the width of one tooth or rib, causing the cutting-tool to commence action upon an uncut portion of the roll and begin the formation of an addi-

tional tooth thereon. In this manner, through the changing relations between the dial-plate K and disk L, the roll is advanced or turned forward after each cut of the tool, and previous to the commencement of the next cut, a distance equal to the width of one tooth or rib.

By giving the face of the dog Q a greater or less length the period of time during which the coupling-pin M remains out of action may be lengthened or shortened, and in this manner the distance which the dial-plate K moves in relation to the disk L may be varied to any extent desired, and thereby the feed or distance to which the roll is advanced between each cut and the next may be increased or diminished, as desired.

By increasing the length of the dog Q to the proper extent the roll may be turned after each cut a distance equal to the width of two, three, four, or more teeth.

For the purpose of enabling the machine to cut rolls having teeth of different degrees of fineness, I make use of the several series of holes in the dial-plate, as before stated. The coupling-pin M is adjustable radially on its supporting-arm N, being secured by a nut, so that it may be set to operate in connection with one or another series of holes in the dial-plate. The distance between the holes in each series determines the extent of the rotary feed or advance of the roll X after each cut of the tool, thus determining the width of the ribs or teeth cut upon the roll.

The dial-plate may be removable or the holes formed, as shown, upon a removable portion of the plate, in order that it may be replaced by others having holes arranged at different distances apart, if desired.

By substituting in place of the pinion H others of a different diameter, or by changing the diameter of wheels H and I, the speed of the feed mechanism with relation to the speed of the reciprocating bed may be varied as desired to give the ribs of the roll a greater or a less obliquity or pitch with relation to the axis of the roll. In order to permit the substitution of driving-pinions of different diameters, the rack-bar is mounted upon supports in such manner as to be adjustable vertically by means of nuts or bolts.

When the parts are arranged as represented in the drawings the machine will cut teeth having a spiral curvature in one direction only around the roll.

In order to adapt the machine to cut teeth having a curvature in the opposite direction around the roll, it is only necessary to turn the rack F upside down and adjust it below instead of above the pinion H, the effect of which will be to reverse the motion of the parts.

While it is preferred to construct the disengaging devices in the train of gearing in the manner above described, their construction and arrangement may be modified in various ways which will readily suggest themselves to the skilled mechanic without departing from the limits of my invention.

I am aware that prior to the date of my invention a longitudinally-reciprocating carriage has been arranged to support and give to the roll to be grooved a corresponding longitudinally-reciprocating movement.

I am also aware that in a roll-grooving machine a stationary tool, consisting of a series of cutters arranged in a line substantially transverse to the axis of the roll and in such relation to the surface thereof as to cut successively, tapering from the first of the series to the last, the last of the series completing the groove begun by the first, is old.

I am also aware that in a roll-grooving machine a falling weight has been used to operate devices for turning the roll at the extremity of its reciprocating movement.

Having thus described my invention, what I claim is—

1. In combination with the stationary cutter E, the reciprocating bed B, with supports for the roller X, the gear-train located upon the bed for turning the roller upon its axis, the stationary rack F, an uncoupling or disconnecting device in the driving-train, and a dog, Q, arranged to operate the disconnecting device as the bed moves in one direction only.

2. In a machine for spirally grooving grinding-rolls, the combination of the positively-driven dial-plate K, disk L, coupling-pin M, spindle O, and dog Q.

3. In a machine for cutting spiral grooves in grinding-rolls, the combination, in a train for rotating the roll, of the dial-plate K, having several circular series of holes, the disk L, and the radially-adjustable coupling device.

4. In combination with the reciprocating bed and the devices thereon for sustaining and rotating a roll, a stationary rack, arranged substantially as shown, to operate the roll-turning devices as the bed is moved endwise.

5. The combination of the rotating dial-plate K, provided with two or more circular series of holes or teeth located at different distances from the center, a driven shaft, J, the device M, adjustable radially to engage with one or the other of the series of teeth, the spindle O, and the intermittingly-acting dog Q, substantially as described, whereby the dial-plate and shaft are momentarily disconnected in order that one may change its relation to the other, substantially as described and shown.

6. In a roller-grooving machine, the combination of the reciprocating bed and roller-turning devices with the stationary operating-rack, adapted to be reversed as described, whereby the machine is adapted to cut either right or left hand spirals at will.

7. The combination of the reciprocating bed, the stationary rack, pinion F, shaft G, wheels H* and I, dial-plate K, and disk L, coupling-pin M, spindle O, and dog Q.

EDWIN REYNOLDS.

Witnesses:
EDWD. P. ALLIS, Jr.,
HARRIE M. FUMADE.