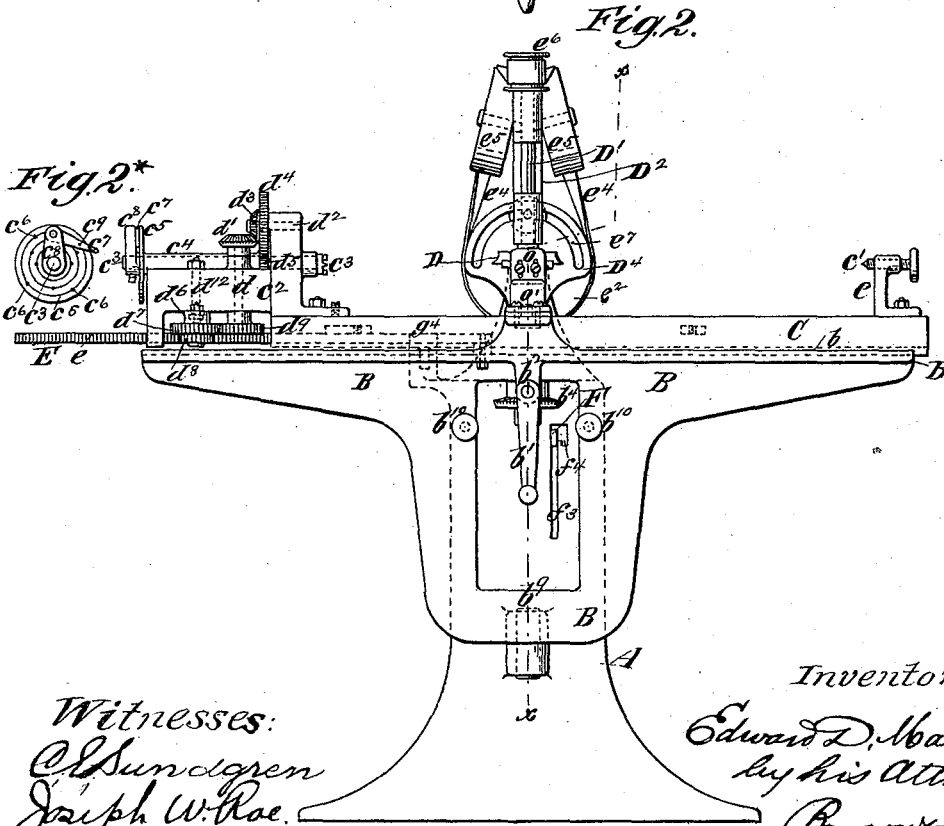
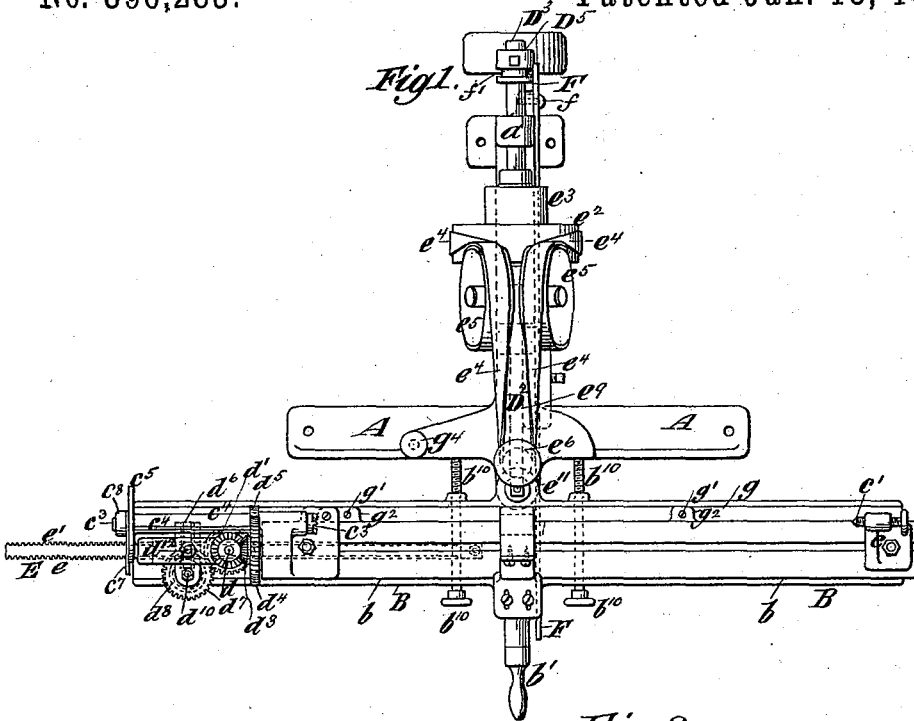


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LATHE FOR TURNING SPIRAL FORMS.

No. 396,283.

Patented Jan. 15, 1889.



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LATHE FOR TURNING SPIRAL FORMS.

SPECIFICATION forming part of Letters Patent No. 396,283, dated January 15, 1889.

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To all whom it may concern:

Be it known that I, EDWARD D. MACKINTOSH, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Lathes for Turning Spiral Forms, of which the following is a specification.

My invention relates to lathes or machines for turning spiral forms or producing what is commonly known as "twist-work," which is now used to a great extent in furniture and the inside finish of buildings. Such machines as commonly made comprise a work table or bed provided with centers for carrying a piece of work, a frame or guideway for the work table or bed, gearing for traversing the table or bed along the frame or guideway, and a spindle provided with a cutter-head and supported so as to admit of its adjustment to cause the cutter-head to cut in a plane of greater or less obliquity to the axial center of the work, so as to provide for cutting spirals of any desired degree of pitch.

In the accompanying drawings, Figure 1 is a plan of a machine embodying my invention. Fig. 2 is a front elevation thereof. Fig. 2* is an end view of the head-spindle and the means employed to hold it in fixed but adjustable position relatively to a tube in which it is journaled and to which rotary motion is imparted for rotating the head-spindle. Fig. 3 is a plan view similar to Fig. 1, but showing the cutter-spindle and frame as swung to the extreme right-hand position. Fig. 4 is a vertical section of the work-table and the frame or guideway whereby it is supported upon about the plane indicated by the dotted line *x x*, Fig. 2, including also a side elevation of the main frame of the machine and the swinging cutter-spindle frame. Fig. 5 is a front view of an arc-shaped connection which is employed for holding the spindle-frame in position, as hereinafter described. Fig. 6 is a plan view, upon a larger scale, of change-gears and an adjustable support for them, such change-gears constituting a part of the gearing whereby the work table or bed is traversed along its guideway. Fig. 7 is a transverse section upon the plane of the dotted lines *y y*, Fig. 6; and Fig. 8 is a sectional view of one of the change-wheels which may

be employed for varying the speed of rotary motion transmitted to the head-spindle and to the work when the work table or bed is traversed along its supporting-frame or guideway.

Similar letters of reference designate corresponding parts in all the figures.

A designates the main stationary framing of the machine, and B designates a movable frame, which comprises a guideway, *b*, wherein is fitted to slide lengthwise a work-table, C. This work-table C is intended to be traversed or moved lengthwise in its guideway *b* in the frame B by gearing operated by hand, and *b'* designates a hand-crank fast upon a shaft, *b²*, which has at its inner end a bevel-wheel, *b³*. This bevel-wheel *b³* engages a corresponding wheel, *b⁴*, upon an upright shaft, *b⁵*, journaled in the frame B, and upon the upper end of the shaft *b⁵* is a pinion, *b⁶*, which engages a rack, *b⁷*, fast upon or formed upon the work-table C. This gearing for moving the work-table C is best shown in Fig. 4, and it will be readily understood that as the hand-crank *b'* is turned in one or other direction the work table or bed C will be traversed along its guideway *b* in the frame B.

For a purpose hereinafter described the frame B is mounted upon vertical pivots or a circular bearing, so that it may swing in a horizontal plane. As here represented, the fixed frame A carries an upper pivot, *b⁸*, upon which fits a socket in the upper part of the frame B, and a lower pivot, *b⁹*, upon which fits a socket in the lower part of said frame. I have also represented set-screws *b¹⁰* as inserted in the frame B and bearing with their inner ends against the fixed frame A, and by loosening one of these screws and by tightening or setting up the other of them the frame B may be swung upon its pivots or circular bearing *b⁸ b⁹*, as will be more fully hereinafter described.

Upon the work table or bed C is secured a tail-stock, *c*, in which is adjustable a tail-spindle, *c'*, and upon the opposite end of the table or bed C is a head-stock, *c²*, in which is mounted a head-spindle, *c³*. These two spindles *c³ c'* center the work between them, and by turning the head-spindle *c³* the work also may be turned.

c^4 designates a tube within which the spindle c^3 is journaled, and with which the spindle is connected, so as to provide for the turning of the spindle relatively to said tube, and so that when the tube is turned the spindle will turn with the tube. As here represented, the tube c^4 has upon its end a disk, c^5 , in which are drilled holes c^6 ; and c^7 designates a spring-tongue, which is fast to an arm, c^8 , extending from the spindle c^3 , and has in it a pin, c^9 , adapted to engage in one of the holes c^6 . Through this connection the tube c^4 , when rotated, also rotates the spindle c^3 , and the spindle c^3 may be turned within the tube c^4 and locked in any desired position relatively thereto. This connection between the spindle c^3 and the tube c^4 is desirable—as, for example, in forming a thread or spiral on the work intermediate between a thread or spiral of open or long pitch already formed.

D designates a cutter-head mounted upon a spindle, D' , and which is presented opposite the work on a line drawn between the spindles c^3 c' , as is shown in Figs. 3 and 4. In order to present the work properly to the action of this cutter-head D , the head-spindle c^3 must be rotated as the bed or table C is traversed lengthwise in order to turn the work. The gearing whereby this is accomplished is best shown in Figs. 1, 2, and 3. The head-stock c^2 , which in reality forms a part of the work table or bed C , has journaled in it an upright shaft, d . This shaft has upon its upper end a bevel-pinion, d' , and upon the stud d^2 in the head-stock are mounted a bevel-pinion, d^3 , and a spur-wheel, d^4 , connected to turn as one. The bevel-pinion d^3 is in gear with the bevel-pinion d' and the spur-wheel d^4 is in gear with the pinion d^5 upon the tube c^4 .

Fixed in position relatively to the frame B , and extending beyond the end of said frame, is a bar, E , upon the opposite sides or edges of which are cut teeth, thereby forming two stationary racks, e e' , facing in opposite directions. To the head-stock c^2 is secured a support, d^6 , upon which are mounted to rotate wheels d^7 d^8 . One of these wheels, as d^8 , engages the rack-bar E , and the other wheel, as d^7 , gears into a wheel, d^9 , upon the lower end of the shaft d . The wheels d^7 d^8 are connected so as to rotate as one, as I shall hereinafter describe, and it will be obvious that as the table or bed C is traversed along the frame B the wheel d^8 will receive rotary motion by its arrangement with the stationary rack-bar E , and will impart such rotary motion through the gearing described to the tube c^4 , and through it to the spindle c^3 . Consequently as the table or bed C is traversed lengthwise the spindle c^3 will be turned to present the work properly to the cutter-head D .

The table or bed C is moved lengthwise of the frame B always at a uniform speed, and the variation in the pitch or twist of the work is produced by changing the gear through which rotary motion is imparted to the tube c^4 , and through it to the spindle c^3 . The wheels d^7 d^8

of this gearing I term "change-wheels," and the construction of them and their support d^6 will be best understood from Figs. 6, 7, and 8. The support d^6 carries a stud, d^{10} , upon which the wheels d^7 d^8 turn freely, and said wheels d^7 d^8 are connected to turn as one by pins s . Two pins are employed to connect the wheels d^7 and d^8 , and one of these pins is fast in the wheel d^7 and enters a socket, s' , in the wheel d^8 , while the other pin s is fast in the wheel d^8 and enters a socket, s' , in the wheel d^7 . Several of these change-wheels d^7 d^8 are usually provided, of different sizes, and all provided each with a pin and a hole, whereby they may be interchangeably connected in different relations, as is shown in Fig. 9. Where three wheels d^7 d^8 are thus provided six changes of speed in the rotary motion imparted to the tube c^4 may be produced. Where four change-wheels are provided twelve changes of speed in the rotary motion imparted to said tube may be produced, and where five change-wheels are provided twenty variations in speed imparted to the tube c^4 may be produced. The support d^6 for the change-wheels has an undercut or dovetailed channel, d^{11} , formed in it, with which engages the head of a bolt, d^{12} , in the head-stock c^2 . This channel d^{11} provides for sliding the support d^6 lengthwise, so that whatever be the sizes of the wheels d^7 d^8 the former may always be set into gear with the wheel d^9 and the latter into gear with the rack-bar E . This support d^6 may also be adjusted so as to project on either side of the rack-bar E , and the wheel d^8 is brought into gear with one or the other rack e e' , according to whether right or left hand work is to be produced. In Fig. 1 I have shown the support d^6 adjusted to hold the change-wheel d^8 in gear with the rack e for producing right-hand work, and in Fig. 5 the support d^6 is adjusted to hold the wheel d^8 in engagement with the rack e' for producing left-hand work.

The cutter-spindle D' should be mounted so as to provide for its adjustment toward and from the work. As here shown, the spindle D' is mounted in a spindle-frame, D^2 , which is supported by a fulcrum-bar, D^3 . This fulcrum-bar D^3 is free to slide in bearings a , formed upon the main frame A , and also to turn in said bearings. Upon the fulcrum-bar D^3 are two loose pulleys, e^2 e^3 , connected to rotate as one. The pulley e^2 receives a driving-belt from an outside source, and from the pulley e^2 motion is transmitted by a belt, e^4 , which passes over guide-pulleys e^5 to a pulley, e^6 , upon the cutter-spindle D' .

It will be observed that the fulcrum-bar D^3 is substantially radial to the line of the centers c^3 c' and is in a horizontal position, and the cutter-spindle D' is substantially transverse to the fulcrum-bar D^3 . In order to prevent the cutter-spindle frame D^2 from swinging idly upon the fulcrum-bar D^3 as a center, I provide a holding-frame, D^4 . (Best shown in Figs. 4 and 5, but also in Fig. 2.) This holding-frame is fitted upon the fulcrum-bar D^3 and

has in it an arc-shaped connection with the spindle-frame D². As here shown, the holding-frame D⁴ has an arc-shaped slot, *e*⁷, and a clamping-screw, *e*⁸, passes through this slot and taps into the spindle-frame D². The holding-frame D⁴ receives through its lower portion a guide-bar, *e*⁹, which also slides in a bearing, *a*⁷, in the main frame A. The holding-frame D⁴ and the guide-bar *e*⁹ may be rigidly connected by a set-screw, *e*¹⁰.

It will be observed that by the guide-bar *e*⁹, which passes through both the holding-frame D⁴ and the bearing *a*⁷ in the fixed frame A, the said holding-frame D⁴ is prevented from turning, and by loosening the clamping-screw *e*⁸ the spindle-frame D² may be swung upon its fulcrum-bar D³ as a center from the extreme right-hand position shown in Fig. 3 upward into a vertical position, as shown in Figs. 1, 2, and 3, and to the same distance beyond such vertical position and into a left-hand position. After the spindle-frame D² is swung to desired position, so that the cutter-head D will rotate in an oblique plane corresponding to the pitch of the spiral to be formed, said spindle-frame D² is locked against turning by the clamping-screw *e*⁸. The spindle-frame D² is balanced by a weighted arm, D⁵, applied to the end of the fulcrum-bar D³, and the fulcrum-bar D³ and also the guide-bar *e*⁹ may slide freely along their bearings *a* *a*⁷ in the main frame A, so as to present the cutter-head D to the work and to withdraw it from the work.

F designates a bell-crank lever fulcrumed at *f*, and having its one end engaging a circumferential groove, *f*¹, in the fulcrum-bar D³ or a piece attached thereto, and having upon its other arm an adjustable weight, *f*². This bell-crank lever F slides in a vertical slot, *f*³, in the frame A, as best shown in Fig. 2, and at the upper part of the slot *f*³ is a notch, *f*⁴, with which the bell-crank lever F may be engaged for holding the spindle-frame D², with the cutter-head D, most distant from the work. When the lever F is not engaged with its locking notch or recess *f*⁴, the weight *f*² always depresses the lever and moves the fulcrum-bar D³ and the spindle-frame D² in a direction toward the work.

To control the depth to which the cutters of the cutter-head enter the work, I provide upon the guide-bar *e*⁹ a roll, *e*¹¹, and this roll bears and runs against a former, *g*, attached to the work table or bed C, and governs the distance to which the cutters of the cutter-head D may enter the work. The former *g* may be of wood and secured to the work table or bed C by screws *g*¹, passing through lugs or ears *g*² upon the work table or bed C. When the work to be operated on is cylindrical, the former *g* is dispensed with and the roll *e*¹¹ is allowed to bear directly against the straight edge of the bed or table C. When the general outline of the work is conical or tapering with the same degree of taper from

end to end of the piece, the former *g* is made with the same amount of taper as the work is to have, and the frame B and the traveling bed or table C are swung upon the pivots *b*⁸ *b*⁹ and secured by the set-screws *b*¹⁰ in such position that the cutters will cut equally deep at both their-edges, as will be hereinafter described.

When the work is large in the middle and small at both ends, as the example of work shown in Fig. 3, the work outline being curved or the amount of taper different at different parts of the work, a second former, *g*³, is placed below the first and secured to the traveling bed or table C in the same manner. This second former, *g*³, bears against a roll, *g*⁴, upon an arm projecting from the main frame A, and the former *g*³ is of a shape corresponding to the shape of the work, so that if the set-screws *b*¹⁰ be removed and said former be kept against the roll *g*⁴ it will cause the bed and the swinging frame B to swing around upon the pivots *b*⁸ *b*⁹ more or less as the taper of the part being cut varies, and will thus cause the cutters to cut equally deep at both of their edges upon the parts of the work. The frame B and the work table or bed C may be easily held by the left hand of the operator, so that the former *g*³ continues to bear upon the roll *g*⁴ as the work table or bed C is fed along.

When operating with the cutter-head D on slender and thin sticks, which are liable to spring, I may steady the stick by a block, *o*, of wood, through which the stick passes, and which is supported by a bracket, *o*¹, from the frame B. The cutter-head D when first started cuts its way into the block *o*, and as the stick slides along through the block it is steadied opposite the point of cutting.

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

1. The combination, with a work-frame mounted on a vertical pivot which occupies a fixed position, of a work-table carrying work-spindles and movable lengthwise in guides in said frame and a rotary spindle carrying a cutter-head and cutters for operating on the work between said spindles, substantially as herein described.

2. The combination, with a work table or bed provided with centers for carrying a piece of work, a frame or guideway therefor, and gearing for traversing the table or bed along the said frame or guideway, of a swinging spindle-frame having the axial line on which it swings in the same plane with said centers, and a spindle journaled in said spindle-frame in a position transverse to the fulcrum and carrying a cutter-head, substantially as herein described.

3. The combination, with a work-frame having a rectilineal guideway and a work table or bed carrying work-spindles and movable lengthwise in said guideway, of a cutter-spindle carrying a cutter-head and movable toward and from the work and a former on

the table or bed which governs the approach of the cutter-spindle toward the work, substantially as herein described.

4. The combination, with a longitudinally-movable work table or bed provided with work-centers, of a spindle-frame, a fulcrum-bar therefor extending transversely to the table or bed and loaded to carry it and the frame toward the work, a rotary cutter-head and a spindle therefor journaled in said frame, and a former for governing the approach of the cutter and spindle-frame toward the work, substantially as herein described.

5. The combination, with a work-frame mounted on a vertical pivot to swing horizontally, of a work table or bed movable lengthwise in said frame and carrying work-spindles, a cutter-spindle and a cutter-head thereon, and a steady-block mounted upon the work-frame and receiving the work through it, the cutter-head cutting its way to the work through the block, and the block serving to steady the work opposite the cutter-head, substantially as herein described.

6. The combination, with a longitudinally-movable work table or bed having centers for work, of the spindle-frame D^2 and its fulcrum-bar D^3 , the guide-bar e^9 , and the holding-frame D^4 , receiving the guide-bar through it and having an arc-shaped adjustable connection with the spindle-frame, bearings for the fulcrum-bar, and a guide in the main frame for the guide-bar, and a spindle, D' , journaled in the spindle-frame and carrying a rotary cutter-head, substantially as herein described.

7. The combination, with a work table or bed provided with centers for holding work and a frame whereon the table or bed is movable lengthwise, and which is supported by vertical pivots, of a swinging spindle-frame and a fulcrum-bar therefor in substantially the same vertical plane as said vertical pivots and transverse to the line of said work-centers, and a cutter-spindle journaled in said spindle-frame and arranged at substantially right angles to said fulcrum-bar, substantially as herein described.

8. The combination, with the main stationary frame A and the work-frame B, supported thereon by circular bearings which provide for swinging it in a horizontal plane, of adjustable stops, as screws b^{10} , to lock said work-frame against swinging, the work table or bed provided with centers for work and gearing for traversing it along said work-frame, the spindle-frame D^2 and its fulcrum-bar D^3 , and the cutter-spindle D' , journaled in said spindle-frame, substantially as herein described.

9. The combination, with work-spindles, of a cutter-head and a cutter-spindle, D' , and the spindle-frame D^2 , wherein it is journaled, and the fulcrum-bar D^3 , on which said frame is mounted, and which is movable lengthwise in its bearings to carry the cutter-head toward and from the work, substantially as herein described.

10. The combination, with a swinging spindle-frame and a cutter-spindle journaled therein, of a work-frame and a work table or bed movable on said work-frame, a rack on the table or bed, and gearing on said work-frame for driving into said rack and traversing said table or bed, a head-spindle and a tail-spindle or center on the table or bed, a fixed rack on the work-frame, and gearing whereby the head-spindle is geared with a wheel engaging said rack and the head-spindle and work driven as the table or bed is moved lengthwise, substantially as herein described.

11. The combination, with the rack-bar E and change-wheels for engaging therewith, of the support d^6 , having a stud for supporting the change-wheels and adapted to be slid lengthwise and turned on its securing-bolt d^{12} , substantially as herein described.

12. The combination, with a spindle-frame and a cutter-spindle journaled therein, of a work-frame and a sliding work table or bed thereon and supporting head and tail spindles, gearing for traversing the table or bed along the work-frame, two racks on said work-frame facing in opposite directions, gearing for imparting motion to the head-spindle, and which includes a change-wheel and a bearing or support for the change-wheel secured to the work table or bed and adjustable to hold said wheel in engagement with either of said two racks, substantially as herein described.

13. The combination, with a spindle-frame and a cutter-spindle journaled therein, of a work-frame and a sliding table or bed thereon and head and tail spindles on the table or bed, gearing for traversing the table or bed, a rack on said work-frame, a transmitting gear-wheel in permanent geared engagement with the head-spindle, change-wheels gearing one into the rack and the other into said transmitting-wheel and connected together to rotate as one by pins secured one in each wheel and entering a hole in the other wheel, and a bearing or support for the change-wheels on said table or bed, substantially as herein described.

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