(No Model.) 3 Sheets—Sheet 1.

P. FOSS.

TURNING AND BORING MACHINE.

No. 583,010. Patented May 18, 1897.

Fig. 1.

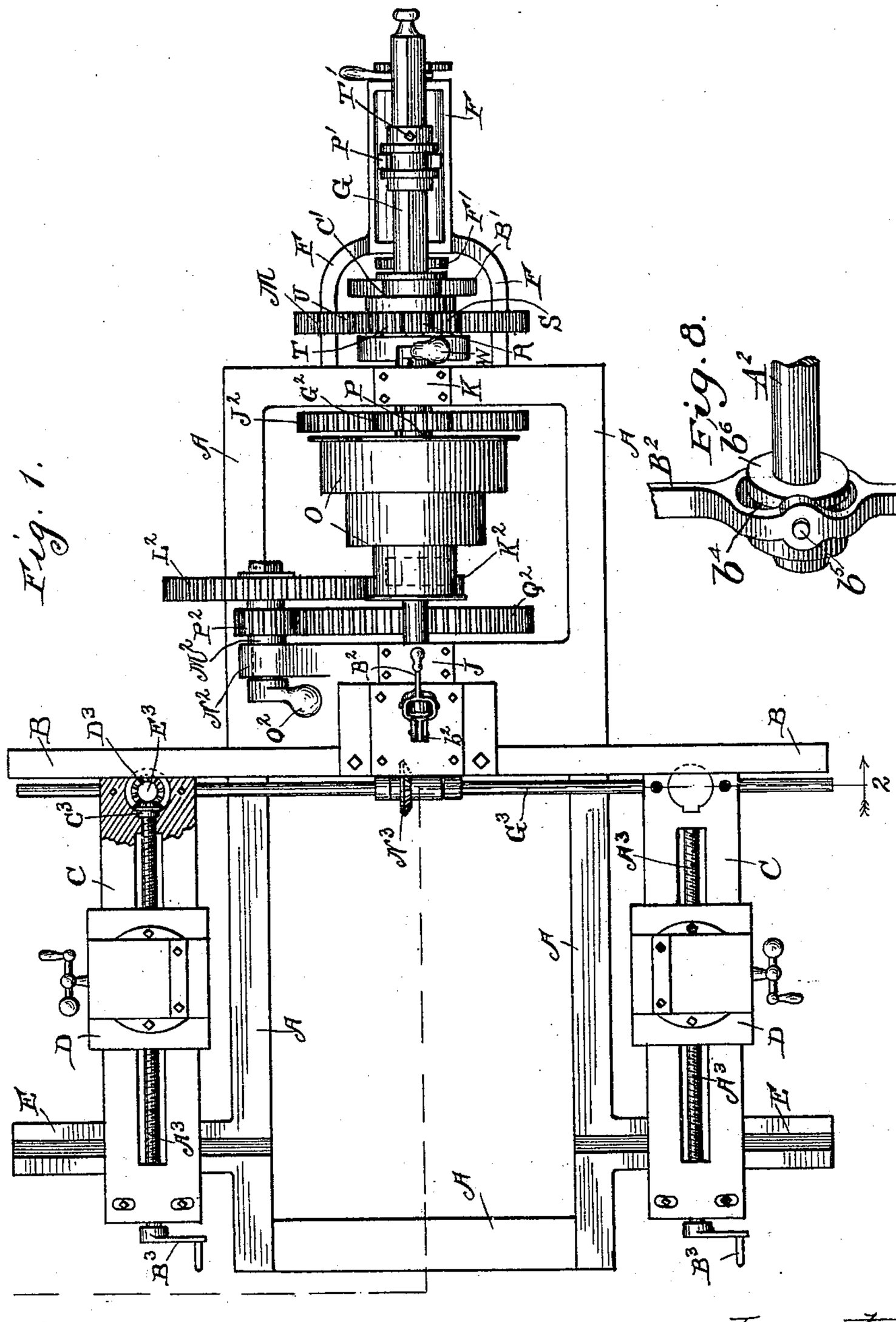


Fig. 8.

Witnesses:
R. J. Jacker.
J. A. Harrison.

Inventor
Paul Foss;
By Brown & Brown,
Attys.

(No Model.) 3 Sheets—Sheet 2.

P. FOSS.

TURNING AND BORING MACHINE.

No. 583,010. Patented May 18, 1897.

Fig. 3.

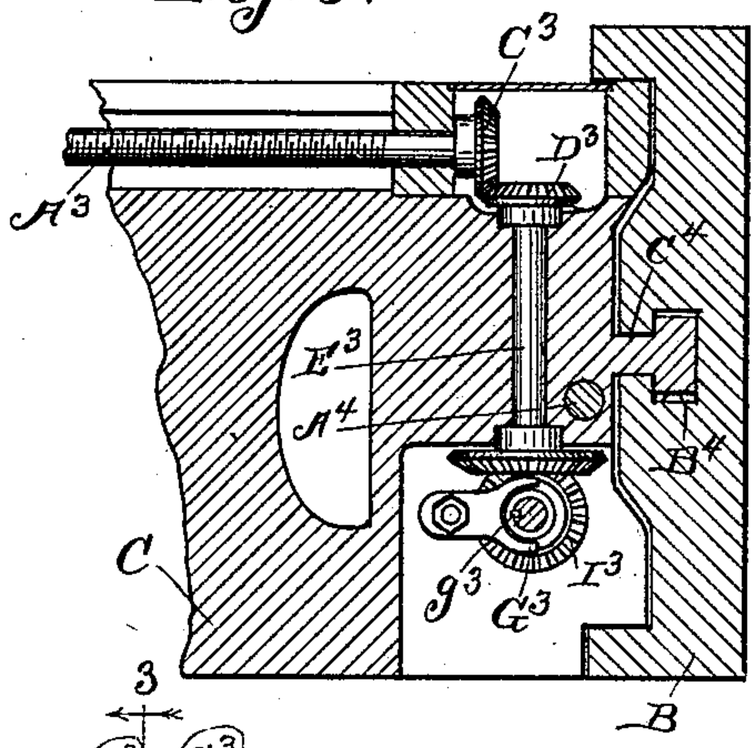
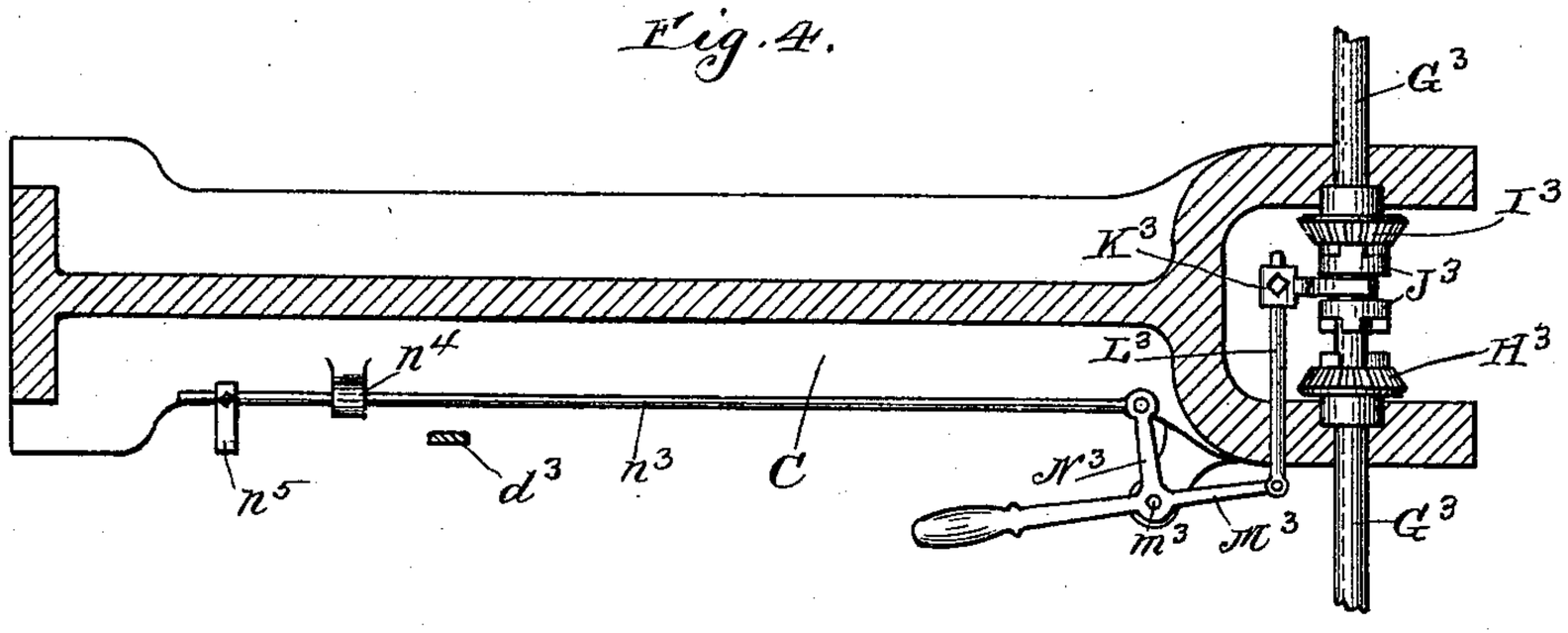


Fig. 2.

Fig. 4.



Witnesses:
R. J. Jacker,
J. H. Harrison.

Inventor:
Paul Foss;
By Brown & Brown,
Atty's.

(No Model.) 3 Sheets—Sheet 3.

P. FOSS.

TURNING AND BORING MACHINE.

No. 583,010. Patented May 18, 1897.

Fig. 5.

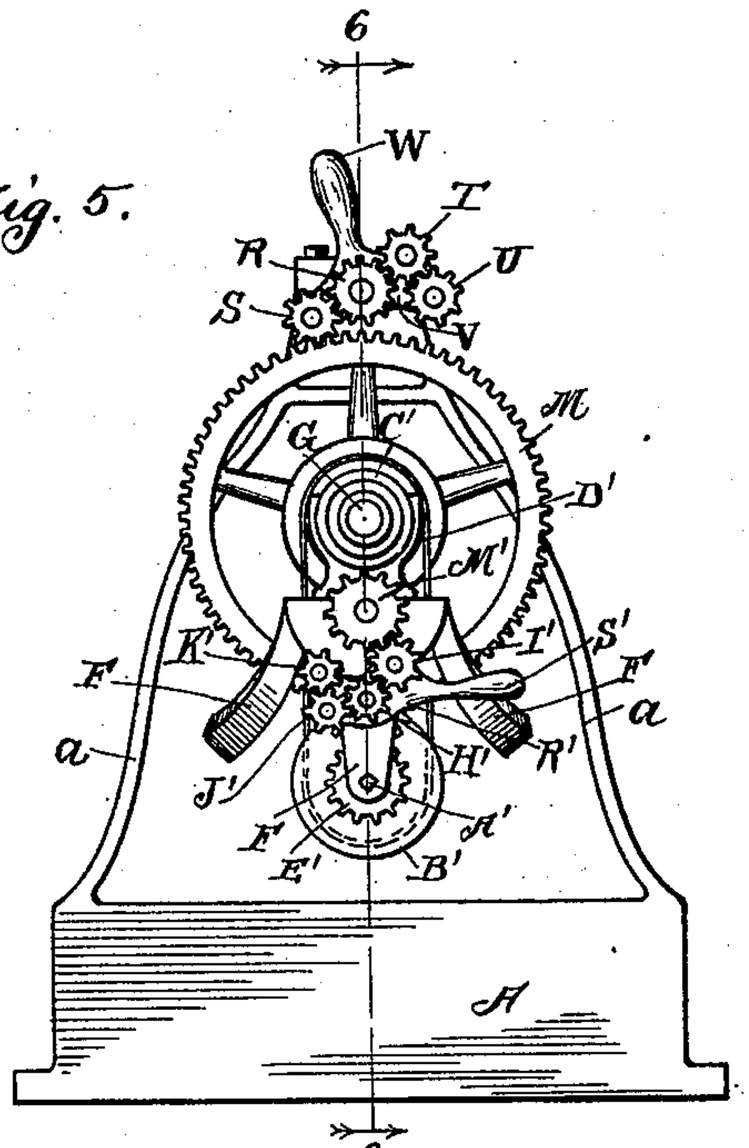


Fig. 7.

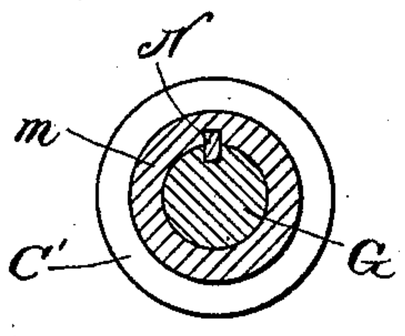
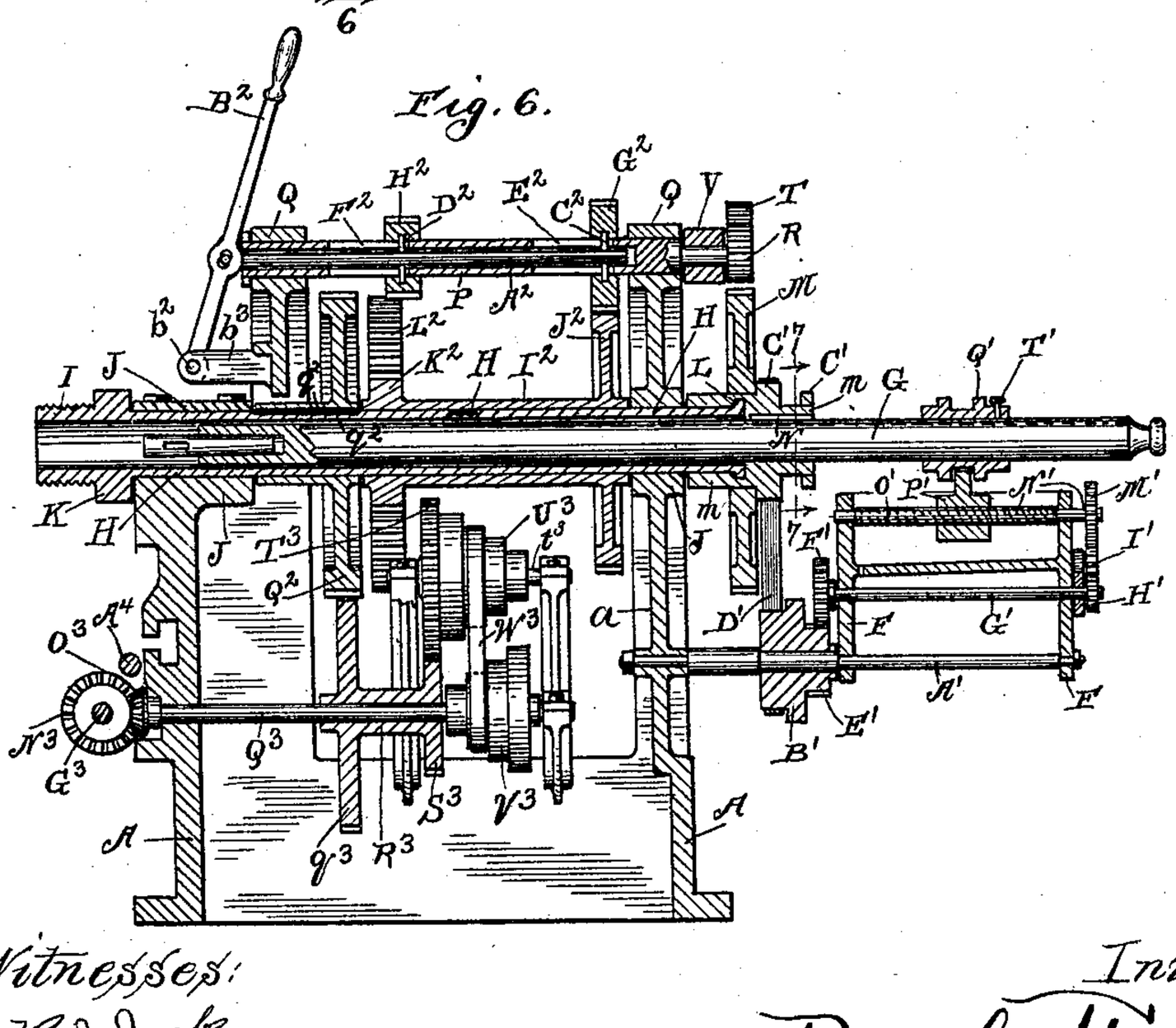


Fig. 6.



Witnesses:
R. J. Jacker,
J. A. Harrison.

Inventor:
Paul Foss;
By Brown & Brown,
Attys.

UNITED STATES PATENT OFFICE.

PAUL FOSS, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO HERMAN FLORENTZ.

TURNING AND BORING MACHINE.

SPECIFICATION forming part of Letters Patent No. 583,010, dated May 18, 1897.

Application filed June 24, 1896. Serial No. 596,699. (No model.)

To all whom it may concern:

Be it known that I, PAUL FOSS, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Turning and Boring Machines, of which, when taken in connection with the drawings accompanying and forming a part hereof, the following is a full and complete description, sufficient to enable those skilled in the art to which it pertains to understand, make, and use the same.

One of the objects sought by me in this invention is to obtain a machine whereby pulleys or other wheels can be bored and the face thereof turned concentrically therewith at the same time when desired.

A further object of my invention is to obtain a machine of the character described wherein the pulley-face turned on the machine will be convex when desired, although such turning is done simultaneously with the boring of the pulley.

A further object of the invention is to obtain a machine of the character described wherein the relative movement of the cutting-tool and the part of the pulley cut thereby or the relative movement of the part of the pulley being cut to the tool producing the cutting may be suitably adjusted both for the boring and the turning of the pulley or other wheel—that is to say, I desire to obtain a turning and boring machine wherein the proper relative speed of the boring-tool and the pulley or the proper relative speed of the boring-tool to the pulley may be obtained, while at the same time the proper relative speed of the face of the pulley to the cutting-tool thereof is obtained, such boring and turning being simultaneously done by the machine.

A further object of the invention is to obtain a machine of the character described wherein either boring or turning may be effected when desired.

A further object is to obtain a machine of the character described wherein the movement of the face of the pulley relative to the cutting-tool thereof may be in either direction—that is, so as to require the setting of such tool above or below the center of the pulley, as preferred.

A further object of the invention is to obtain means whereby the relative movement of the pulley and the cutting-tool effecting the boring thereof may be either in the right or left direction, and that independently of the relative movement of the face of the pulley to the cutting-tool thereof.

The manner in which I effect the several purposes sought by me is illustrated and described herein, and may be stated briefly to be the construction of mechanism whereby the pulley or other wheel is held and rotated, thereby presenting the face or rim thereof to properly mounted and adjusted cutting-tools, while boring or drilling mechanism adjusted to turn at a suitable rate of speed for the size of the hole being made is presented to the hub of the pulley or wheel, the mechanism holding and turning the pulley being rotatable at variable rates of speed and the boring or drilling mechanism being arranged so as to be held non-rotatable as the hub is presented thereto or to be turned in either direction and at variable rates of speed and to be adjusted to project beyond the chuck or face-plate of the machine.

In the drawings referred to and forming a part of this specification, Figure 1 is a top plan view of a combined boring and turning machine embodying my invention with the screw-threaded collar on the spindle of the machine, to which an ordinary chuck or face-plate is attachable, removed to expose to view gearing immediately below such collar; Fig. 2, a front end view on line 2 2 of Fig. 1, viewed in the direction indicated by the arrows and showing one side in section; Fig. 3, a vertical sectional view, on an enlarged scale, on line 3 3 of Fig. 2, viewed in the direction indicated by the arrows; Fig. 4, a horizontal sectional view, on an enlarged scale, on line 4 4 of Fig. 2, viewed in the direction indicated by the arrows; Fig. 5, a rear end elevation of the machine with the front end omitted; Fig. 6, a longitudinal vertical sectional view on line 6 6 of Fig. 5, viewed in the direction indicated by the arrows, with the front end of the machine omitted and with the cone-driving pulley of the machine removed from its shaft to expose the construction of such shaft to view; and Fig.

7, a vertical sectional view on line 7 7 of Fig. 6, viewed in the direction indicated by the arrows. Fig. 8 is a perspective view of one end of a longitudinally-movable rod in the driving-shaft of the machine, a portion of the shifting-handle, and the connection between them.

A reference-letter used to designate a given part is employed to indicate such part throughout the several figures of the drawings wherever the same appears.

A is the base of the machine, and *a a* are side and end walls, firmly secured to base A, forming, together with such base, the frame of the machine.

B B are wings to the frame of the machine, rigidly secured to the front end of such frame and forming the means of connecting to the frame the tool-carriages C C, respectively.

D D are movable tool-post heads, mounted on carriages C C, respectively.

E E are wings rigidly secured to base A, on which wings, respectively, one end of the respective carriages C C rests and to which such carriages are respectively arranged to be rigidly secured by an ordinary fastening—as, say, bolt *e*, Fig. 2—upon and after their proper adjustment.

F is a frame forming part of the frame of the machine, in which are rotatably mounted the several shafts whereby feed motion to the boring-bar of the machine is obtained.

G is the boring-bar, rotatably mounted in the spindle H. Rotatable spindle H extends longitudinally through the frame of the machine in which it is mounted, and at the end thereof adjacent to the tool-carriages C C screw-threads I I are placed thereon, fitting into corresponding screw-threads in a chuck, face-plate, or other equivalent device for securing thereto the pulley or other thing to be bored or turned, or bored and turned, on the machine.

J J are journal-bearings of the spindle H in the frame of the machine.

K is a flange on spindle H, against which a chuck or face-plate abuts when in position on the spindle.

L is a flange on the rear or back end of spindle H, and M is a gear-wheel, the hub *m* whereof fits over the end of such spindle H, (and over the flange L on the spindle,) and also over boring-bar G, so as to turn loosely thereon, (but fitting reasonably close thereto.)

N is a feather or spline extending into hub *m* and into a groove in boring-bar G, so that rotation of such wheel M produces corresponding rotation of the boring-bar G. Longitudinal movement of the boring-bar in hub *m*, as well as in spindle H, is thus provided for.

O is a cone-pulley over which the driving-belt actuating the machine extends. Cone-pulley O is rigidly secured to shaft P. Shaft P is rotatably mounted in the frame of the machine in bearings Q Q.

To rotate the boring-bar G in either direction, I provide gear-wheel R, secured on so as to rotate with shaft P, gear-wheels S T engaging with gear-wheel R and gear-wheel U engaging with gear T. Gears S, T, and U are rotatably mounted on frame V, actuated (or the position thereof controlled) by the handle W, so that such gear-wheels S, T, and U may be alternately engaged with gear-wheel M, hereinbefore described. The rotation of gear-wheel M rotates boring-bar G by the interposed feather or spline N. The direction of rotation of such gear-wheel M is of course determined by the one of the gear-wheels S and U in engagement therewith. The longitudinal movement of the boring-bar G, either to feed the boring-bar to or to withdraw it from work, is effected by the following-described mechanism.

A′ is a rod secured in frame F and in the frame of the machine formed by parts *a a*.

B′ E′ is a combined cone-pulley and gear-wheel rotatably mounted on rod A′, such rod forming a shaft or axle therefor.

C′ is a cone-pulley on hub *m* of gear-wheel M, and D′ is a belt extending over cone-pulley C′ and part B′ of the combined cone-pulley and gear-wheel B′ E′, such belt being the driving-belt of the mechanisms moving the boring-bar longitudinally.

F′ is a gear-wheel engaging with gear-wheel E′. Gear-wheel F′ is mounted on rotatable shaft G′, so as to produce, when rotated, corresponding rotation thereof.

I′ J′ are gear-wheels rotatably mounted to engage with gear-wheel H′.

K′ is a rotatably-mounted gear-wheel engaging with gear-wheel J′. Wheels I′ and K′ are mounted on frame R′, controlled by handle S′, so as to be alternately in engagement with gear-wheel M′. The one of the gear-wheels I′ K′ in engagement with gear-wheel M′ is determined by the position of the handle S′ and frame R′. The direction of rotation of gear-wheel M′ is determined by the one of the gear-wheels I′ K′ in engagement therewith.

N′ is the rotatable shaft on which gear-wheel M′ is mounted, such shaft and gear-wheel rotating in unison.

O′ O′ are screw-threads on shaft N′, engaging with corresponding screw-threads in the traveler P′.

Q′ is a sleeve secured on boring-bar G by bolt T′. Sleeve Q′ is adjustable on the boring-bar G after loosening the bolt T′, and is immovable thereon when such bolt T′ is tightened against the boring-bar. Sleeve Q′ and traveler P′ are connected so as to move longitudinally in unison, as illustrated in Fig. 6.

A gear (or interposed gears) between wheels or cone-pulleys C′ and B′ may be used in place of the belt D′, if preferred; but I prefer to use the belt, as in such case the belt will be thrown off by an obstruction which would break the teeth of gear-wheels.

To rotate the spindle H at varying speeds, I have constructed the following-described mechanisms:

Shaft P is hollow a portion of its length, and rod or bar A^2, secured at one end thereof to handle B^2, is inserted therein, with pins C^2 D^2 extending through such rod A^2 and through slots E^2 F^2, respectively, in shaft P into engagement with gear-wheels G^2 H^2, respectively, so as to move such gear-wheels longitudinally on the shaft P, but not so as to affect in any way the rotation of such shaft P or the gear-wheels G^2 H^2 in unison with such shaft. Handle B^2 is pivotally secured to the frame of the machine by pin or bolt b^2, extending therethrough and through the lug b^3, and such handle is secured to the rod A^2, so as not to prevent the rotation of the rod, but to produce longitudinal movement therein, as by making groove b^4 in collar b^6 on the rod and extending the handle around the rod, with a pin extending in the groove, as at b^5.

I^2 is a sleeve rotatably mounted on spindle H.

J^2 is a gear-wheel on sleeve I^2, secured to the sleeve to rotate therewith, and K^2 is an additional gear-wheel on such sleeve, also secured thereto to rotate therewith. Sleeve I^2 turns on the spindle H freely, and when handle B^2 is in the position illustrated in Fig. 6 of the drawings gear-wheel G^2 on shaft P is in engagement with gear-wheel J^2, thereby (when shaft P is rotated) producing rotation of gear-wheel J^2, sleeve I^2, and gear-wheel K^2.

L^2 (see Fig. 1) is a gear-wheel rotatably mounted on the shaft M^2. Shaft M^2 is eccentrically mounted on part N^2 of the frame of the machine, so that when the handle O^2 is moved into the position thereof illustrated in Fig. 1 such gear-wheel L^2 is in engagement with gear-wheel K^2.

P^2 is a gear-wheel or a gear-pinion, also mounted on the shaft M^2 and secured to gear-wheel L^2 to rotate in unison therewith.

Q^2 is a gear-wheel mounted on spindle H to rotate in unison therewith. Gear-wheel P^2 is thrown into engagement with and out of engagement with gear-wheel Q^2 by the movement of the eccentric shaft M^2 when handle O^2 is turned. The gear-wheel H^2 on shaft P is thrown into and out of engagement with gear-wheel Q^2 by the movement of handle B^2. When such handle B^2 is in the position thereof illustrated in Figs. 1 and 6, gear-wheel H^2 is out of engagement with gear-wheel Q^2. When handle O^2 is in the position thereof illustrated in Figs. 1 and 2, gear-wheel L^2 is in engagement with gear-wheel K^2 and gear wheel or pinion P^2 is in engagement with gear-wheel Q^2. Handles B^2 and O^2 being in the position illustrated in Figs. 1, 2, and 6, rotation of shaft P produces rotation of gear-wheel J^2, sleeve I^2, and gear-wheels K^2, L^2, P^2, and Q^2. Gear-wheel Q^2 is secured to the spindle H in the ordinary way, as by a feather or spline, so that the rotation of gear-wheel Q^2 will produce corresponding rotation of the spindle. When the gear-wheel G^2 is out of engagement with gear-wheel J^2 by the placing of handle B^2 in proper relative position therefor and gear-wheel H^2 is forced into engagement with the gear-wheel Q^2, the rotation of such gear-wheel Q^2 and corresponding rotation of spindle H is at a greater or faster rate of speed than when the several parts are in the position illustrated in the drawings—that is, with gear-wheel G^2 in engagement with gear-wheel J^2.

To obtain the automatic movement of the tool-post head D on carriage C, I have constructed the following-described mechanisms:

A^3 A^3 are rotatably-mounted screws in the carriages C C, respectively, extending through the tool-post heads D D, respectively, and fitting into corresponding screw-threads in such tool-post heads.

B^3 B^3, Figs. 1 and 2, are crank-shafts by which the screw-shafts A^3 A^3 are rotated by hand when desired.

C^3 C^3 are beveled gear-wheels secured tightly on shafts A^3 A^3, respectively. D^3 D^3 are beveled gear-wheels secured tightly on vertical shafts E^3 E^3 to engage with beveled gear-wheels C^3 C^3, respectively, and F^3 F^3 are beveled gear-wheels secured tightly on the lower end of the vertical shafts E^3 E^3, respectively, to engage with the beveled gear-wheels H^3 H^3 and I^3 I^3, which are loosely mounted on shaft G^3.

J^3 (see Fig. 4) is a sleeve mounted on shaft G^3 to rotate therewith and also to move longitudinally thereon. K^3 is a fork fitting into a groove on sleeve J^3 (see Fig. 4) and secured by connection L^3 to handle M^3. Handle M^3 turns on pivotal point (or on fulcrum) m^3.

N^3 is an extension to handle M^3, and n^3 is a rod secured at one end to the extension N^3 and at the other end movably mounted in guide n^4. The turning on the pivot m^3 of the handle M^3 will move the rod n^3 longitudinally, and the movement of the rod longitudinally will turn the handle M^3 on the fulcrum thereof, thereby throwing sleeve J^3 into engagement with one or the other of the gear-wheels I^3 H^3, thereby turning vertical shaft E^3 in one or the other direction.

n^5 is a stop on the rod n^3, placed in the path of the arm d^3, (see Figs. 2 and 4,) so that as the arm d^3 (such arm being secured on the tool-post head D) is moved to the right and to the left it will engage with the arm N^3 of handle M^3 and stop n^5 of rod n^3 and so turn the handle on its pivot. The engagement of the arm d^3, as last aforedescribed, shifting the sleeve J^3, as stated, changes the direction of movement of the tool-post head. Rotation of the shaft G^3 in the operation of the machine is obtained by the beveled wheel N^3 engaging with beveled wheel O^3 on shaft Q^3, cone-pulley V^3, tightly secured on such shaft Q^3, hub R^3, loosely mounted on shaft Q^3, with gear-wheels on such hub, one of such gear-wheels q^3 engaging with gear-wheel Q^2, whereby it is rotated, and the other of such gear-wheels S^3 engaging with and turning gear-

wheel T^3, and such wheel T^3 rotatably mounted on shaft t^3 and secured to rotate with cone-pulley U^3, also on such shaft t^3, and the belt W^3 connecting cone-pulleys V^3 and U^3.

The tool-post carriages C C are adjusted relative to the spindle H and boring-bar G by means of screw-threaded shaft A^4 in wing or extension B of the frame of the machine (see Fig. 2) passing through the carriages and fitting into corresponding screw-threads in such carriage. The end of the screw-threaded rod or shaft A^4 is squared to permit a wrench being placed thereon to turn the same. As the carriages C C are moved to and from the longitudinal center of the machine the sleeves J^3 J^3 slide on the shaft G^3, such shaft being grooved and the shaft and sleeves having feathers or splines g^3 fitting therein. The sleeves J^3 J^3 therefore rotate with the shaft G^3, although movable longitudinally thereon.

In turning the face of a pulley, wheel, or other thing on the machine where it is designed to have such face convex the carriages C C are moved out of a position at right angles to the wing B and then bolted (by bolts *e*) in place. The manner in which the carriages C C are secured to the wings B, respectively, is well illustrated in Fig. 3 of the drawings.

B^4 is a groove in wing B, and C^4 a tongue from the carriage C, fitting into such groove. The fit of the tongue C^4 in groove B^4 permits all the movement required in the carriage C out of a right angle to the wing B to properly set such carriage. After the carriages C C are set they are respectively bolted in place to wings E E, respectively. In turning the convex face of the pulley or other thing it is designed that the cutting-tool on one tool-post base shall cut on one side of the center line of the pulley and the other cutting-tool on the other side thereof. One of such tools will of course be set below the center of the boring-bar and the other above such center.

The operation last described will not produce a true convex pulley-face, but will produce one that is angular, the angle formed by the meeting of the faces being preferably in a plane midway between the edges of the face of the pulley.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a turning and boring machine, the combination of a spindle journaled in a frame, means for securing a pulley on the spindle to rotate therewith, the axis of the pulley-hub being coincident with the extension of the axis of the spindle, a tool-carriage and tool-head adjustable to cutting contact of the tool therein with the face of the pulley, a boring-bar extending through the spindle, means for rotating the spindle, means for rotating the boring-bar, in either direction, independently of the spindle, and means for automatically advancing independently of the direction in which it is rotating, the boring-bar longitudinally in the spindle; substantially as described.

2. In a turning and boring machine, the combination of a spindle journaled in a frame, means for securing a pulley on the spindle to rotate therewith, the axis of the pulley-hub being coincident with the extension of the axis of the spindle, a tool-carriage and tool-head adjustable to cutting contact of the tool therein with the face of the pulley, a boring-bar extending through the spindle, means for rotating the spindle, means for rotating the boring-bar, in either direction, independently of the spindle, and means for automatically moving the boring-bar longitudinally in the spindle while such boring-bar is rotating in either direction; substantially as described.

3. A turning and boring machine, consisting of a rotatable spindle, a boring-bar extending through the spindle, cutting-tools on the boring-bar, adjustable tool-carriages on opposite sides of the machine, traveling tool-heads mounted on the respective carriages, cutting-tools mounted in the tool-heads, respectively with means for attaching a pulley or wheel to the spindle, means for rotating the spindle, means for independently rotating the boring-bar, and means for automatically advancing the boring-bar independently of its direction of rotation, substantially as described.

4. A turning and boring machine, consisting of a rotatable spindle, mounted in a frame, a boring-bar extending through the spindle, means for rotating the boring-bar in either direction, a cutting-tool on the boring-bar, means for attaching a pulley or wheel to the spindle, tool-heads, tools in the tool-heads engaging with the face of the pulley, on the spindle, a gear-wheel on the spindle engaging with a driving gear-wheel, a second gear-wheel mounted on the rear end of the spindle to turn loosely thereon and with the hub thereof extending beyond the spindle and turning loosely on the boring-bar, a feather interposed between such hub and boring-bar, such second-named gear-wheel engaging with a driving gear-wheel, whereby the relative movement of the part of the pulley being cut to the tool producing the cutting, and the relative movement of the cutting-tool and the part of the pulley cut thereby, may be suitably adjusted both for the boring and turning of the pulley or other wheel; substantially as described.

5. A turning and boring machine, consisting of a rotatable spindle, a boring-bar extending through the spindle tool-heads and cutting-tools in the tool-heads and in the boring-bar respectively, with means for attaching a pulley or wheel to the spindle, means for rotating the spindle and means for independently rotating the boring-bar in either direction, and means for automatically advancing the boring-bar, independently of the direction in which it is rotating, whereby the

proper relative speed of the boring-tool and the pulley, and at the same time the proper relative speed of the face of the pulley to the cutting-tools thereof in the tool-heads is obtained, such turning and boring being simultaneously done by the machine; substantially as described.

6. The combination of a frame, a spindle rotatably mounted therein, a boring-bar extending through the spindle, a sleeve loosely mounted on the spindle, gear-wheels on the sleeve, a gear-wheel rigidly mounted on the spindle, a rotatable driving-shaft, gear-wheels mounted on such shaft to rotate therewith and to be moved longitudinally thereon and means for moving such gear-wheels longitudinally on such shaft, whereby the gears on the driving-shaft may be disengaged from the gear on the spindle and from the gears on the sleeve, and may be alternately engaged with one of the gears on the sleeve and the gear on the spindle, and means for interposing connecting-gear between the gear on the spindle and one of the gears on the sleeve; substantially as described.

7. In a turning and boring machine, mechanism whereby a pulley or other wheel is held and rotated, thereby presenting the face or rim thereof to properly mounted and adjusted cutting-tools, and boring or drilling mechanism, adjusted to turn at a suitable rate of speed for the size of the hole being made, means for presenting such cutting mechanisms simultaneously to the face and to the hub respectively of the pulley or wheel; mechanisms whereby the rotatable mechanism holding the pulley can be rotated at different rates of speed, and mechanisms for turning such boring and drilling mechanism in either direction and for varying the rate of speed thereof; the boring and drilling mechanism arranged to be adjusted to project beyond the chuck or face-plate of the machine, and to be automatically moved longitudinally forward while rotating in either direction; substantially as described.

8. A frame having wings extending outward therefrom, a spindle rotatably mounted in the frame with means for attaching a pulley or wheel to the end thereof, tool-carriages adjustably mounted on such wings, means for moving the tool-carriages on the wings toward and away from the axis of the spindle, means for adjusting the angle of the tool-carriages relative to the wings and means for rigidly securing such tool-carriages in place when adjusted, tool-posts on the tool-carriages respectively, screw-threaded shafts rotatably mounted in the tool-carriages and extending through the bases of the tool-posts respectively, a shaft rotatably mounted in the wings of the frame, beveled gear-wheels loosely mounted on the shaft in the tool-carriage so as to be longitudinally movable thereon, a clutch on the shaft between the beveled gear-wheels, such clutch rotatable with the shaft and longitudinally movable thereon, a handle on the tool-carriage and a connection between the handle and the clutch whereby it can be brought into and out of engagement with the beveled gear-wheels, respectively, a vertical shaft rotatably mounted in the tool-carriage with a beveled gear thereon, engaging with both the beveled gears, and a gear-wheel on the other end thereof engaging with a beveled gear-wheel on the screw-threaded shaft; substantially as described.

9. In a turning and boring machine the combination of wings B, B, tool-carriages C, C, rotatable shaft G^3, beveled gears H^3, I^3, clutch J^3, handle M^3 having projection N^3, and longitudinally-movable rod n^3, a connection between the handle and the clutch, shaft E^3 having thereon beveled gear F^3 engaging with beveled gear H^3, I^3, and beveled gear D^3 engaging with beveled gear C^3, shaft A^3 on which the beveled gear C^3, is mounted, tool-head D which tool-head the shaft A^3 engages, and with an arm extending from such tool-head into the path of abutment, n^5 on rod n^3, and abutment N^3 on handle M^3; substantially as described.

PAUL FOSS.

In presence of—
CHARLES TURNER BROWN,
F. L. BROWN.