(No Model.) 3 Sheets—Sheet 1.

E. RIVETT.

BALL TURNING MACHINE.

No. 586,801. Patented July 20, 1897.

Fig. 1.

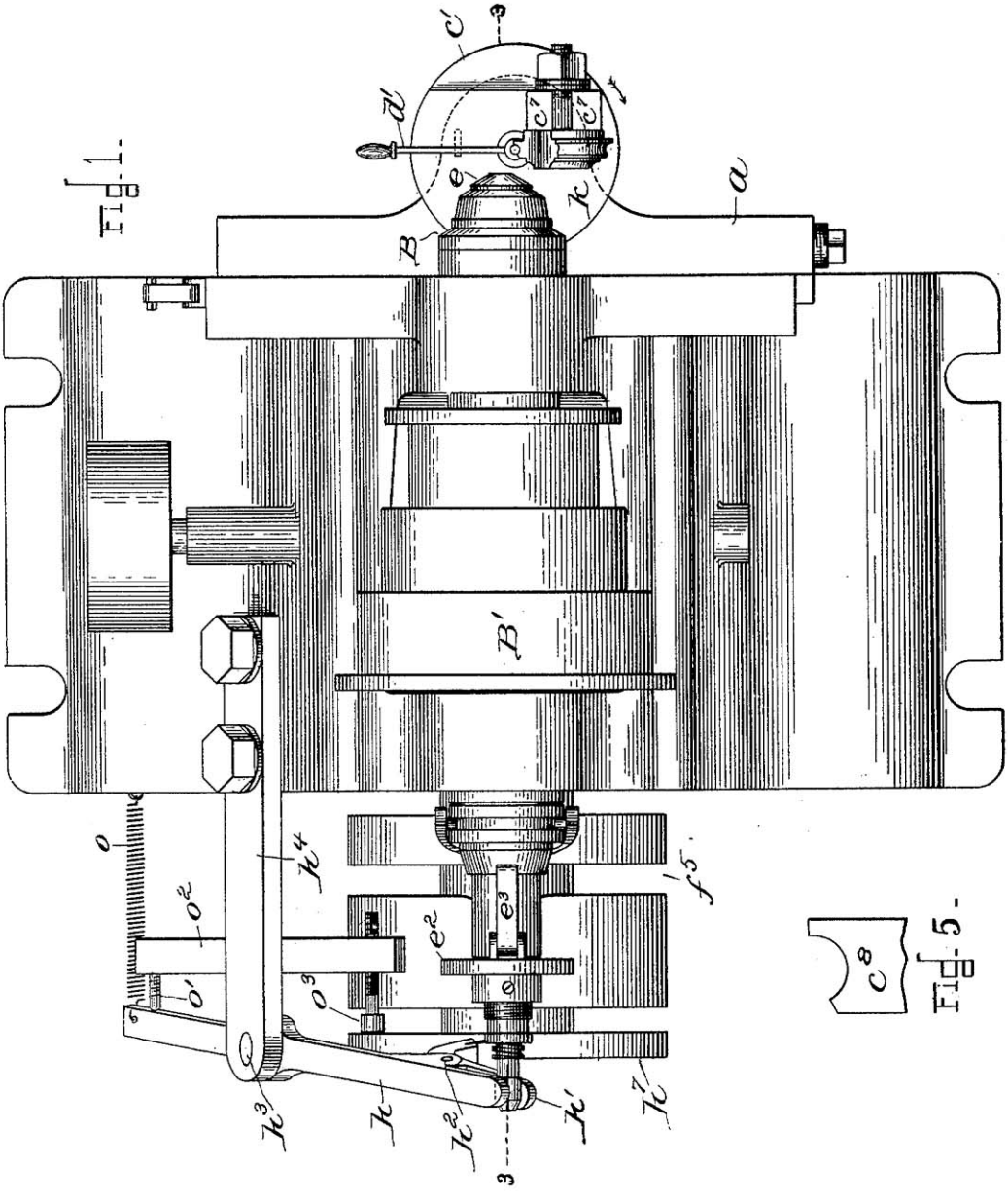

Fig. 5.

Witnesses.

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by B. J. Hayes atty.

(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

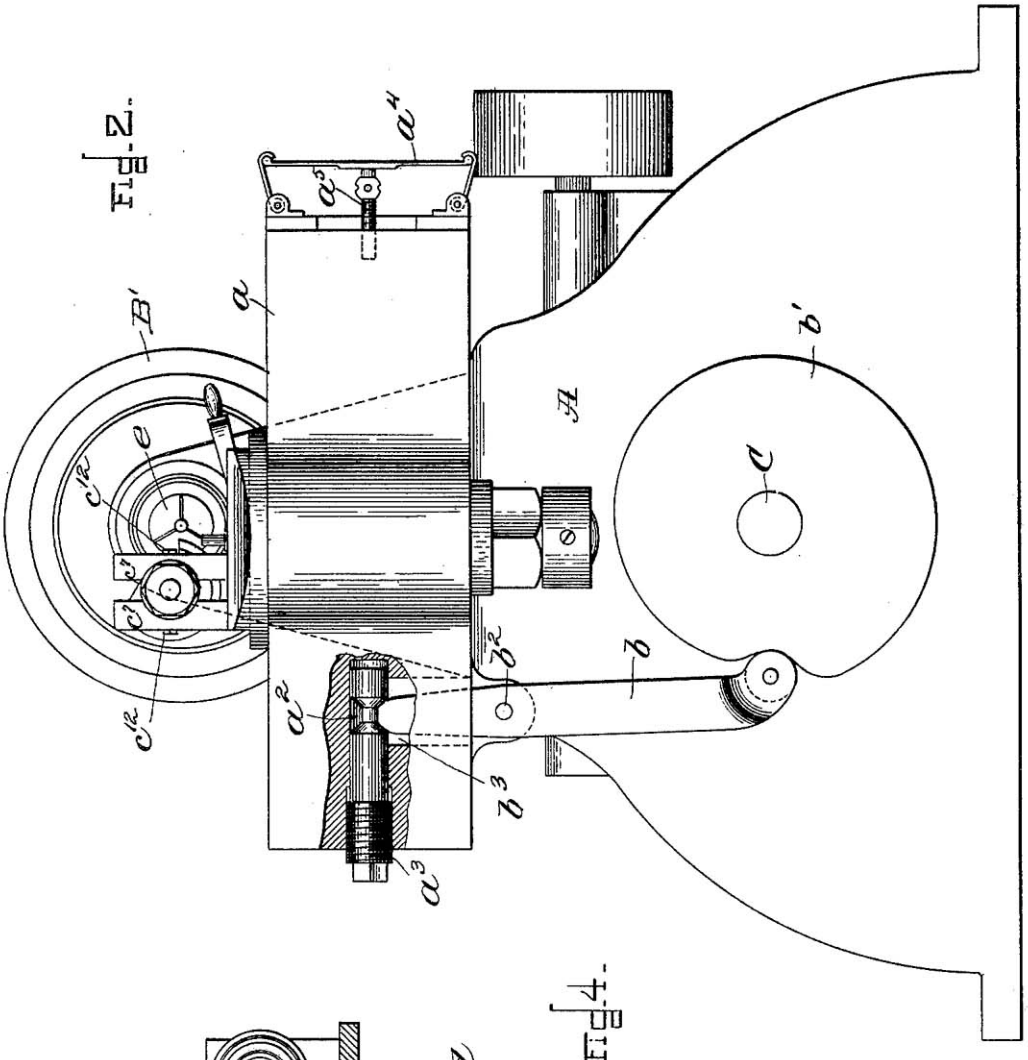
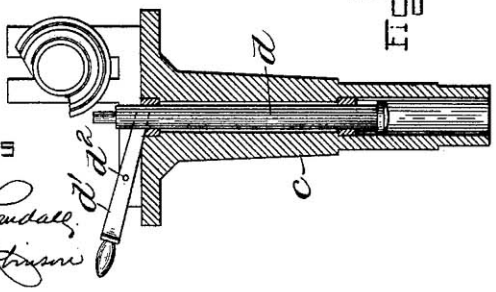


Fig. 4.



Witnesses

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(No Model.) 3 Sheets—Sheet 3.

E. RIVETT.

BALL TURNING MACHINE.

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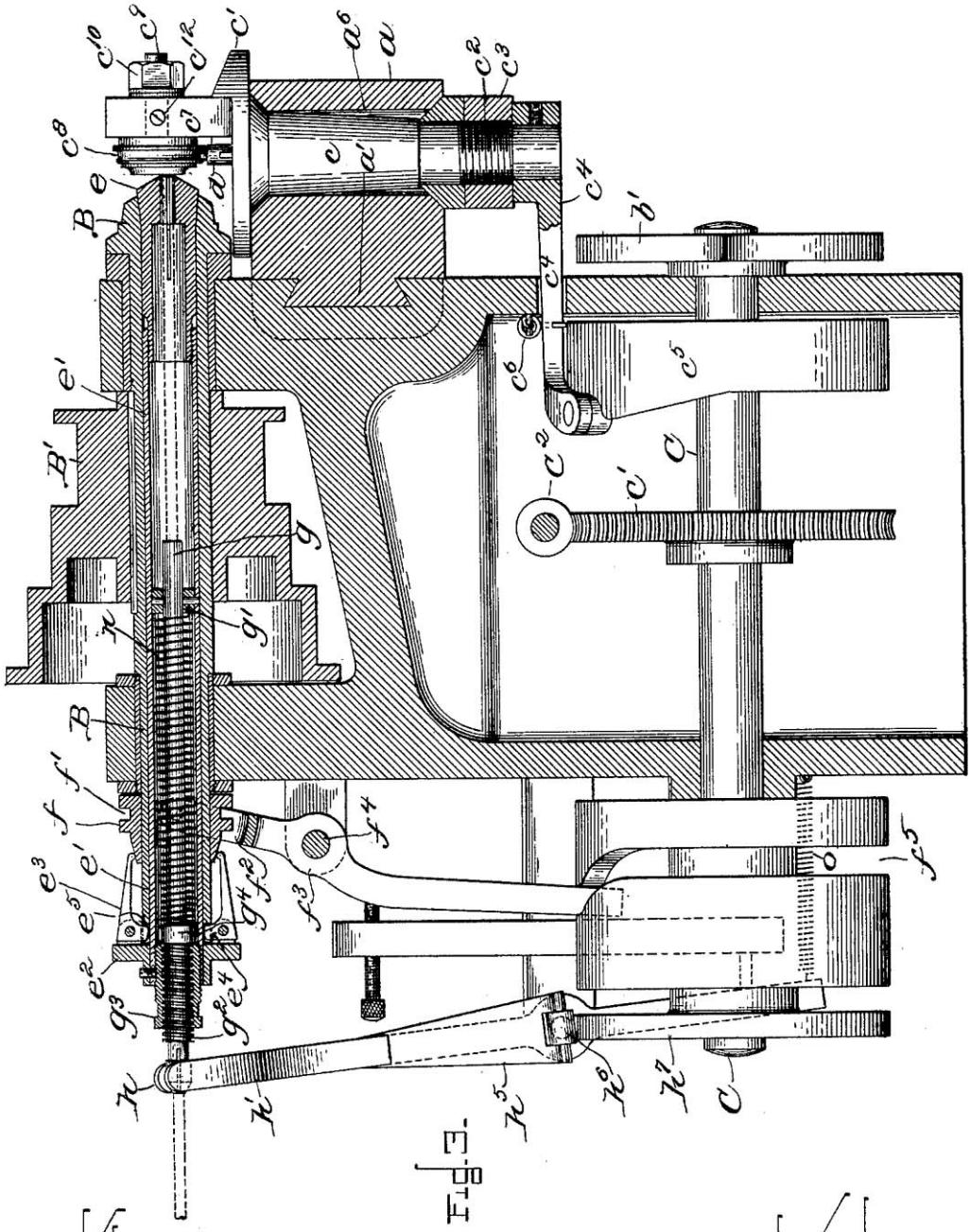

FIG. 3.

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UNITED STATES PATENT OFFICE.

EDWARD RIVETT, OF BOSTON, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO DAVID HUNT, OF SAME PLACE.

BALL-TURNING MACHINE.

SPECIFICATION forming part of Letters Patent No. 586,801, dated July 20, 1897.

Application filed February 19, 1897. Serial No. 624,162. (No model.)

To all whom it may concern:

Be it known that I, EDWARD RIVETT, of Boston, county of Suffolk, and State of Massachusetts, have invented an Improvement in Ball-Turning Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object to improve the construction of ball-turning machines, whereby the balls may be turned more truly spherical and may be cut or separated from the stock without forming or providing flat or other irregular or non-spherical faces or fins at such point of severance.

In carrying out this invention a blank—such, for instance, as a rod—is presented by a suitable rotatable chuck to a stationary cutting-tool, which is formed with a semicircular cutting face or edge, and said cutting-tool is borne by a tool-holder having a pivot-pin mounted to turn freely or oscillate in a sliding carriage. The semicircular cutting edge of said tool is arranged concentric to the axis upon which said tool-holder oscillates. The carriage supporting said oscillating tool-holder is moved in and out in a plane at right angles to the axis of the rotating rod, and the tool carried by it is consequently fed to and from said rotating rod, and means are provided for limiting the inward movement of said carriage at a point where the axis of the tool-holder is brought into coincidence with the axis of the ball being turned, at which point the semicircular cutting edge of the tool will be concentric to the axis of the ball being turned, and means are provided, which will be brought into operation when the carriage has been thus moved inward, for swinging the tool-holder on its axis in a direction to sever the partially-formed ball from the rod or blank. When the carriage has been moved inward far enough to bring the axis of the tool-holder coincident with the center or axis of the ball being formed, the semicircular cutting edge of the tool will have cut its way into the rod to a point concentric with the axis of the ball being formed, and by then oscillating the tool-holder or turning it on its axis the inner edge of the tool will be caused to travel inward and around the ball being formed in continuation of the concentric arc described by the cutting edge of the tool, such oscillating movement continuing until the ball has been severed from the rod or blank.

As the cutting-tool is frequently removed from the machine to be ground or otherwise repaired, to obviate any difficulty which may be encountered in replacing or resetting it, a gage is provided which enables said tool to be replaced or reset in the tool-holder with its semicircular cutting edge concentric to the axis thereof and with its cutting edge at a predetermined elevation to properly perform the work that it is intended for it to do.

My invention also comprehends means for operating the chuck to momentarily disengage or release the rod or blank at the completion of each ball and feeding mechanism for automatically feeding said rod or blank along a short distance when it is thus released.

The automatic feeding mechanism is constructed and arranged to very accurately feed forward the rod or blank a sufficient distance for the formation of the next ball, and it is made adjustable, and while it is especially adapted for use in connection with the ball-turning machine herein to be described it is capable of being used in other kinds of machines.

Figure 1 shows in plan view a ball-turning machine embodying this invention; Fig. 2, a right-hand end elevation of the same; Fig. 3, a central vertical section taken on the line 3 3, Fig. 1; Fig. 4, a detail of the tool-holder, which is turned on a vertical axis to complete and sever the ball from the rod, showing also the gage by which the cutting-tool is set and adjusted to the work; and Fig. 5 is an enlarged detail of the cutting-tool.

The main frame A is constructed and adapted to support the operating parts and affords bearings for a hollow shaft B, which contains the chuck which carries the rod or blank to be turned, said shaft being rotated continuously by a belt-pulley B′, secured to it.

At one side of the main frame A a carriage *a* is located, having a horizontal dovetailed projection *a′* on one side, which enters and

slides in a horizontal dovetailed recess formed in the side of the main frame, thus adapting the carriage to be moved in and out in a horizontal plane and at right angles to a vertical line passing through the axis of the rod which is carried by the rotating chuck. As a means of moving said carriage a in and out or sliding it in a horizontal plane I have herein shown a lever b, pivoted at b^2 to the main frame A, which extends downward and into engagement with a cam b', secured to a shaft C, having its bearings in the main frame, and said cam acts to operate said lever to and fro on its pivot, and said lever also extends upwardly above its pivot and projects up into a vertical hole or recess b^3, formed in the bottom of said carriage a, and the upper end of said lever enters a circumferential groove or recess formed in the shank of a horizontally-adjustable pin a^3, which is contained within or inserted into a hole in the carriage, said pin by its construction serving as a connection between the pivoted lever and carriage, whereby said carriage will be moved to and fro by said pivoted lever. The pin a^3 enters a hole a^2, drilled horizontally into one end of the carriage a, and said hole a^2 opens into and preferably crosses the vertical hole b^3 in the bottom of the carriage, up through which the lever b projects, and said pin has a circumferential groove opposite said vertical hole b^3, which receives the upper end of the lever b, and the pin a^3 is made of a size to substantially fit said hole a^2 to prevent rocking therein, and it has a screw-threaded portion which engages an interior-screw-threaded portion formed within the hole a^2, thereby adjustably connecting it with the carriage, and said pin a^3 has a squared end which projects a suitable distance to receive a wrench or other tool by which it may be turned for purposes of adjustment. By turning said pin in one or the other direction the position of the carriage relative to the work may be varied. In lieu of this particular form or construction of parts for moving the carriage a any other form or construction may be used.

To the main frame A and adjacent to one end of the carriage a strong leaf-spring a^4 is secured, which bears against an adjustable stud a^5, screwed into that end of the carriage a opposite to its connection with the pivoted lever b, and said spring a^4 acts at all times upon the carriage with a tendency to move it away from the work and to press the pivoted lever b into firm engagement with the cam C. As the cam operates the lever b to move the carriage a inward it will be moved against the stress of said spring, and said spring upon recovery returns the carriage when permitted to do so by the cam. Thus it will be seen that the carriage is moved inward positively by the cam against the action of the return-spring, and that the spring returns the carriage as the cam continues to revolve.

The carriage a has a vertical hole a^6 through it from top to bottom which receives a pivot-pin c, bearing a tool-holder c', which rests upon the top of and is supported by said carriage. The lower end of said pivot-pin c is screw-threaded, as at c^2, and receives upon it a nut or nuts c^3 to hold the tool-holder in position in the carriage, and to the lower end of said pivot-pin c an arm c^4 is secured by a set-screw or otherwise, which projects laterally and passes through a slot in the main frame, and its outer end is more or less bent and adapted to bear upon a cam c^5, which is secured to the cam-shaft C. The cam c^5 is so shaped as to operate the arm c^4 and turn the pivot-pin c and tool-holder borne by it through a short arc and to then return it, thereby oscillating the pivot-pin and tool-holder on its axis, and to thus oscillate the tool-holder at a predetermined time. A spring c^6 is attached at one end to the main frame and at the other end to said arm c^4 to move it in opposition to the movement given to it by the cam.

The tool-holder c' has formed upon its upper face or has erected upon it two standards or uprights c^7, located a short distance apart, or it may be a single standard or upright formed with a vertical slot, and a cutting-tool c^8 is fixed to one end of a pin c^9, which is contained in and passes through said slot, and said pin has a screw-threaded end which receives upon it a nut c^{10}, which, when turned up tightly against the standard, serves to clamp the cutting-tool c^8 in different elevations.

To further assist in holding the tool rigidly in place and to provide for lateral adjustment adjusting-screws c^{12} c^{12} pass through the uprights c^7 and impinge upon the shank of the tool-holding pin c^9.

The cutting-tool c^8 consists of a circular disk formed with a grooved periphery semicircular in cross-section, as shown in Fig. 5, and said disk has a segment or portion removed to present a flat face radial to the axis of the disk. The semicircular cutting edge of the cutting-tool is so proportioned and the tool is so set in the tool-holder that said semicircular cutting edge is concentric to the axis of said tool-holder. At one side of the peripheral groove the edge of the disk projects a short distance beyond the opposite side, as best shown in Fig. 1, wherein it will be seen that the outside edge projects beyond the inside edge, making the outside radius of the cutter greater than the inside radius, and when the tool is set the outside edge will project to a point, say, ninety degrees from the bottom of the groove, or from the deepest part of the groove, while the opposite edge will project a less distance, and by such formation on the cutting edge of the tool it will be seen that a complete quarter-circle is formed by the outside edge, which enables or permits the completion of the outer end of the ball as the tool cuts its way into the rotating rod.

The operation of this part of my invention is as follows: The cutting-tool having this particular form of cutting edge is set fixedly in

the tool-holder c' on the carriage a, and with the carriage removed farthest from the work, as shown in Fig. 2, said cutting-tool will occupy a position at one side of the rotating rod which is to be turned and operated upon in forming the ball. The carriage a is then moved inward by means of the cam b' and the cutting-tool caused to cut its way into the rotating rod, and the parts are so proportioned and adjusted that when the actuating-lever b rests upon the highest part of the cam b' said carriage will be moved so far inward as to bring the semicircular cutting edge of the tool concentric to the axis of the ball being formed, and consequently the tool-holder is brought into position with its axis coincident with the axis of the ball being formed, and at such time the outer edge of the cutting-tool will have formed truly spherical the outer end of the ball on the rod, while the inner edge of said cutting-tool, which projects a lesser distance, will not have severed the ball from the rod. The inward movement of the carriage a is thus limited accurately to this point, and when it has arrived at this point the cam c^5 will act upon the arm c^4 and turn the pivot-pin c and tool-holder c', borne by it, in the direction of the arrow, Fig. 1, to thereby swing the cutting-tool on a vertical axis to sever the ball from the rod, the line of severance being on an arc concentric to the axis of the tool-holder and in continuation of the concentric arc of the cutting edge of the tool. The ball having been thus severed from the rod, the tool-holder is returned to its normal position and the carriage also returned.

Thus it will be seen that the carriage a moves in and out in a horizontal plane, and that the tool-holder borne by it is adapted to oscillate on a vertical axis, and that the tool borne by said tool-holder has a semicircular cutting edge concentric to the axis of the oscillating tool-holder, and that by means of the cams b' and c^5 and connecting mechanism the operations are repeatedly and automatically carried on to successively form the balls.

The cutting-tool c^3 must be frequently removed for the purpose of grinding it, and to enable the operator to accurately and quickly reset it I have provided a gage, which, as herein shown, (see Fig. 4,) consists of a vertical rod d, contained in a hole formed in the center of the tool-holder, said rod having its upper end formed truly circular to serve as a curved rest, against which the semicircular cutting edge of the tool may be pressed in resetting it, and said pin is adapted to be moved up and down, as by a lever d', pivoted at d^2 and connected with it, depression of said lever raising the pin into proper position for use, which, when said lever is released, will fall into a position where it will not interfere with the operation of the machine. The elevation of said pin is adjusted so that the radial face of the cutting-tool may be set on a plane flush with the top of said pin when elevated. Thus to reset the cutting-tool the lever d' will be depressed, raising the pin d. Then the cutting-tool will be placed in the tool-holder and brought to bear against the upper end of said pin and in such relation thereto that its radial face is flush with the top of said pin, and then the pin is allowed to drop out of the way. It is obvious that this gage may be omitted; but its employment saves a great deal of time of the operator in resetting the cutting-tool.

The shaft B is hollow from end to end for the passing through it of the rod to be turned and for containing many of the coöperative parts or members of the rod holding and feeding mechanism. At the right-hand end of said hollow shaft B and projecting into it is a split chuck e of any usual or suitable construction adapted to grip and hold the rod, and said split rod-holding chuck is screwed into or otherwise connected to a sleeve e', which is contained within and extends the entire length of said hollow shaft and projects some little distance beyond the opposite or rear end thereof. The sleeve e' is adapted to be moved longitudinally or axially in the hollow shaft to thereby move the split chuck in and out, and such movements of the chuck cause it to engage and disengage the rod by contracting and expanding its split end or head. For the purpose of thus moving the split chuck e in and out of the hollow shaft the sleeve to which it is attached has fixed to its rear end by a set-screw or otherwise a disk e^2, on one side of which lugs or ears are formed or provided to which are pivoted short arms or dogs e^3, which extend in a direction substantially in parallelism with the sleeve e', but which project over the rear end of the hollow shaft B and into engagement with a cone f, which is mounted loosely upon said shaft B and which is adapted to be moved along on said shaft toward and from the disk e^2, said cone acting when thus moved toward said disk e^2 to separate the short arms and when moved in the opposite direction to permit said short arms to approach each other. The pivotal ends of said arms e^3 are formed or provided with laterally-projecting toes e^4, which enter slots or recesses e^5, formed in the rear end of the hollow shaft B, and also engage or bear against the rear end of said shaft, and when said short arms are separated said toes by bearing against the rear end of said shaft, which latter acts as an abutment, will act to move said sleeve e' rearwardly in the direction of its axis and thereby draw in the split chuck and cause it to grasp the rod, and when said short arms are permitted to approach each other the sleeve will be permitted to move in the opposite direction by means to be described to project outwardly the split chuck and thereby cause it to disengage the rod. Thus it will be seen that the sleeve will be moved longitudinally or axially in opposite ways to operate the split chuck to engage and release the rod. It will also be understood

that the hollow shaft B rotates continuously, and by the continuous engagement of the toes e^4 in the slots or recesses formed at the rear end of said shaft the sleeve carrying the rod-holding chuck will likewise be continuously rotated.

The cone f has a circumferential groove f', and the upper forked end f^2 of a lever f^3 engages said circumferentially-grooved cone f, said lever being pivoted at f^4 to the framework, and said lever f^3 extends down and into engagement with a cam f^5, which is secured to the cam-shaft C of the machine.

The cam f^5 is so formed and timed that it will operate the cone to withdraw the rod-holding chuck and engage and hold the rod while the cutting-tool is operating to form the ball and to then project said chuck and disengage the rod while the feeding mechanism operates to advance it.

For the purpose of feeding along the rod immediately after the completion of the balls and at a time when the rod-holding chuck has disengaged said rod I provide within the sleeve e' at its rear or left-hand end a tube g, the inner end of which is supported by and is free to turn in a block or bearing g', which is secured within the sleeve e' at a point substantially midway its length, the opposite or rear end of said tube projecting beyond the rear end of the sleeve e' for a short distance and having an exteriorly-screw-threaded end g^2, which is contained within and supported by an interiorly-screw-threaded nut g^3, which is secured within and to the outer or rear end of the sleeve e' by means of a set-screw or otherwise, so that said nut g^3 will be rotated continuously and in unison with the sleeve e' and shaft B.

The tube g serves as a carrier or holder for the rod, and hence will be referred to as a "tube" or "carrier."

The tube or carrier g has secured upon it a collar g^4, which bears against the inner end of a nut g^3 when said tube is in its rearmost position, and with the tube in such position and unrestrained from rotation it will rotate in unison with the sleeve e' by means of its connection with the rotating nut g^3.

The tube or carrier g has an internal diameter sufficient to receive the rod or blank from which the ball is to be formed, and said tube or carrier is supported within the sleeve e' coincident with the axis of said sleeve, so that the rod which passes through it is in line with a central hole through the rod-holding chuck.

The rearmost end of the tube or carrier g, beyond the screw-threaded portion g^2, is slitted longitudinally, and when said slitted end is contracted the rod which passes through it will be gripped tightly, and at the same time the tube will be restrained from rotation with the sleeve e', and a clamping device is provided for thus restraining the tube or carrier from rotation with the sleeve for a short interval of time and at the same time causing the tube to grip the rod, and when so gripping the rod and restrained from rotation it will be automatically fed forward by reason of its screw-threaded portion g^2 engaging the rotating nut g^3.

The clamping device herein shown, by means of which the slitted end of the tube or carrier g is caused to engage the rod, consists of two members h h', pivoted together at h^2, the member h being pivoted at h^3 to a bracket h^4, projecting from the frame, and the member h' is provided or formed with a spring-acting arm or portion h^5, bearing at its lower end a roll h^6, which engages a cam h^7, mounted upon the shaft C.

The pivoted clamping device h h' is held in its outermost position by means of a spring o, attached at one end to the frame and at the other end to the lower end of the member h, and such outermost position of the clamping device is adjusted by the adjusting pin or stop o', projecting laterally from a cross-bar o^2 on the bracket h^4.

By means of the cam h^7 the members or jaws h h' of the clamping device are operated to grip the split end of the tube g, to thereby grip the rod and to also restrain said tube from rotation, and when the clamping device is thus operated and while in engagement with the tube or carrier g said tube or carrier will be moved axially in a direction toward the right for a short distance, and the clamping device, by reason of its engagement with the split end of the tube or carrier g, will be turned on its pivot h^3 and moved with said tube or carrier g in opposition to the stress of the spring o; but such movement of the clamping device h h' is limited by the adjusting pin or screw o^3, projecting laterally from the cross-bar o^2. As soon as the tube or carrier g has been moved axially in a direction toward the right for a short distance for the purpose of advancing the rod and is stopped by the adjusting-screw o^3 the clamping device will be operated to disengage and release said tube or carrier, whereupon the tube will be restrained no longer. A long spiral spring n encircles said tube or carrier g, one end of which is attached to the block or bearing g' and the opposite end of which is attached to the collar g^4 or to the tube, and said spring is wound up by the continued rotation of the sleeve e' and block or bearing g', to which one end is attached during the time that the tube or carrier g is restrained from rotation, and as soon as it is disengaged and released said spring upon recovering will, by its torsional action, act to rotate the tube g, and by reason of its screw-threaded portion g^2, in engagement with the rotating nut g^3, it will be at such time and by such means returned to its normal position with its collar g^4 bearing against the inner end of the nut g^3.

Normally the rod passes freely through the tube or carrier g, and is held by the rod-holding chuck firmly to be presented to the cut-

ting-tool, and at such time it is not engaged by said tube or carrier; but when it is desired to feed along the rod the clamping device first operates to engage the split end of the tube g, which, it will be understood, causes said tube or carrier to engage the rod as well as restrains said tube or carrier from rotation, and the tube being thus restrained from rotation the revolving nut g^3 will immediately advance said tube a short distance, carrying with it the clamping device, and also winding up the spring n, and when said tube or carrier has been moved a distance that it is intended it shall move the clamping device releases the tube or carrier, returning to its normal position by the action of the spring o, while the tube or carrier g returns to its normal position by the torsional action of the spring n, and when said tube is thus released and caused to return to its normal position the rod contained within it will be disengaged by said tube or carrier and will remain in the position to which it has been advanced by said tube and the coöperating parts of the feeding mechanism.

It is designed and intended that the feeding mechanism and the rod-holding chuck shall so operate one with relation to the other that just as the rod-holding chuck releases the rod the feeding mechanism will engage it, and just as the feeding mechanism releases the rod the chuck will engage it, so that the rod will be positively held by one or the other device all the time and will be positively fed along at the required time.

While I have herein shown the automatic feeding mechanism as having a tube or carrier g for receiving and holding the rod to be fed, I do not desire to limit my invention to this particular form or construction of carrier for the rod, and hence I desire it to be understood that I include within the spirit and scope of this invention any other form or construction of carrier.

The cam-shaft C has secured to it a worm-wheel C′, which is engaged by a worm C^2, secured to any power-driven shaft.

I claim—

1. In a ball-turning machine, a rotating chuck carrying the rod to be turned, combined with a reciprocating carriage, an oscillating tool-holder mounted thereon and a cutting-tool borne by said oscillating tool-holder having a semicircular cutting edge concentric to the axis upon which said tool-holder oscillates, substantially as described.

2. In a ball-turning machine, a rotating chuck carrying the rod to be turned, a tool-holding carriage, means for moving it in and out, an oscillating tool-holder mounted on said reciprocating carriage, and a tool carried by said tool-holder having a semicircular cutting edge concentric to the axis upon which said tool-holder oscillates, and automatic means for oscillating said tool-holder, substantially as described.

3. In a ball-turning machine, a rotating chuck carrying the rod to be turned, a tool-holding carriage, automatic means for moving it in and out, an oscillating tool-holder mounted on said reciprocating carriage, and a tool carried by said tool-holder having a semicircular cutting edge concentric to the axis upon which said tool-holder oscillates, and automatic means for oscillating said tool-holder, substantially as described.

4. In a ball-turning machine, a rotating chuck carrying the rod to be turned, combined with a reciprocating carriage, an oscillating tool-holder mounted thereon, means for moving the carriage inward to bring the axis of the tool-holder coincident with the axis of the ball being turned, and means for then turning the tool-holder on its axis to sever the ball from the rod, substantially as described.

5. In a ball-turning machine, a rotating chuck carrying the rod to be turned, a cutting-tool having a semicircular cutting edge for forming the ball, an oscillating tool-holder carrying it, and means for oscillating said tool-holder to cause the cutting-tool to sever the ball from the rod on an arc concentric to the axis of the tool-holder, substantially as described.

6. In a ball-turning machine, a rotating chuck carrying the rod to be turned, a sliding carriage, an oscillating tool-holder borne by it, and a cutting-tool having a semicircular cutting edge concentric to the axis of said tool-holder, a pivoted lever adjustably connected with said sliding carriage, and a cam for actuating said lever, substantially as described.

7. In a ball-turning machine, a tool-holder, a sliding carriage bearing it, an adjustable pin a^3 screwed into one end of said carriage having a circumferential groove, an opening at the bottom of the carriage beneath the circumferential groove of said pin, a pivoted lever b, one end of which projects up through said opening and enters the circumferential groove of said pin, and the opposite end of which bears upon a cam by which it is actuated, substantially as described.

8. The cutting-tool having a semicircular cutting edge, an oscillating tool-holder bearing it, and a gage for setting said tool concentric to the axis of said tool-holder, substantially as described.

9. The cutting-tool having a semicircular cutting edge, an oscillating tool-holder bearing it, and a gage for setting said tool concentric to the axis of said tool-holder, and at a predetermined elevation, substantially as described.

10. An oscillating tool-holder, a cutting-tool carried by it having a semicircular cutting edge, a gage for setting said tool concentric to the axis of said tool-holder and at a predetermined elevation consisting of a circular pin movable vertically in a recess provided for it at the center of the oscillating tool-holder, substantially as described.

11. Feeding mechanism consisting of the tube or carrier g, means for causing it to engage a rod and for thereafter releasing it, means for moving said tube or carrier axially while the rod is engaged by it, and a torsional spring for returning it to its normal position after it has released the rod, substantially as described.

12. Feeding mechanism consisting of the tube or carrier g, having a screw-threaded portion g^2, a rotating nut g^3, a clamping device for engaging said tube or carrier to restrain it from rotation causing the nut to move it axially, means for operating said clamping device, and means for thereafter returning said tube or carrier to its normal position, substantially as described.

13. Feeding mechanism consisting of the tube or carrier g, having a screw-threaded portion g^2, a rotating nut g^3, means for restraining rotation of the tube or carrier causing said nut to move it axially, and a torsional spring for thereafter returning said tube or carrier to its normal position, substantially as described.

14. Feeding mechanism consisting of the tube or carrier g, having a screw-threaded portion g^2, a rotating nut g^3, means for restraining rotation of the tube or carrier causing the nut to move it axially, and an adjustable stop for limiting such axial movement, and means for thereafter returning it to its normal position, substantially as described.

15. Feeding mechanism consisting of the tube or carrier g, having a split end and a screw-threaded portion g^2, a rotating nut g^3, a clamping device for engaging said split end of the tube causing it to grip the rod and restraining it from rotation while the nut moves it axially, and means for thereafter returning said tube or carrier to its normal position, substantially as described.

16. Feeding mechanism consisting of the tube or carrier g having a split end, and a screw-threaded portion g^2, the rotating nut g^3, clamping device for engaging said split end of the tube causing it to grip the rod and restraining it from rotation while the nut moves it axially, and a torsional spring for thereafter returning said tube or carrier to its normal position, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD RIVETT.

Witnesses:
B. J. NOYES,
HARRY O. ROBINSON.