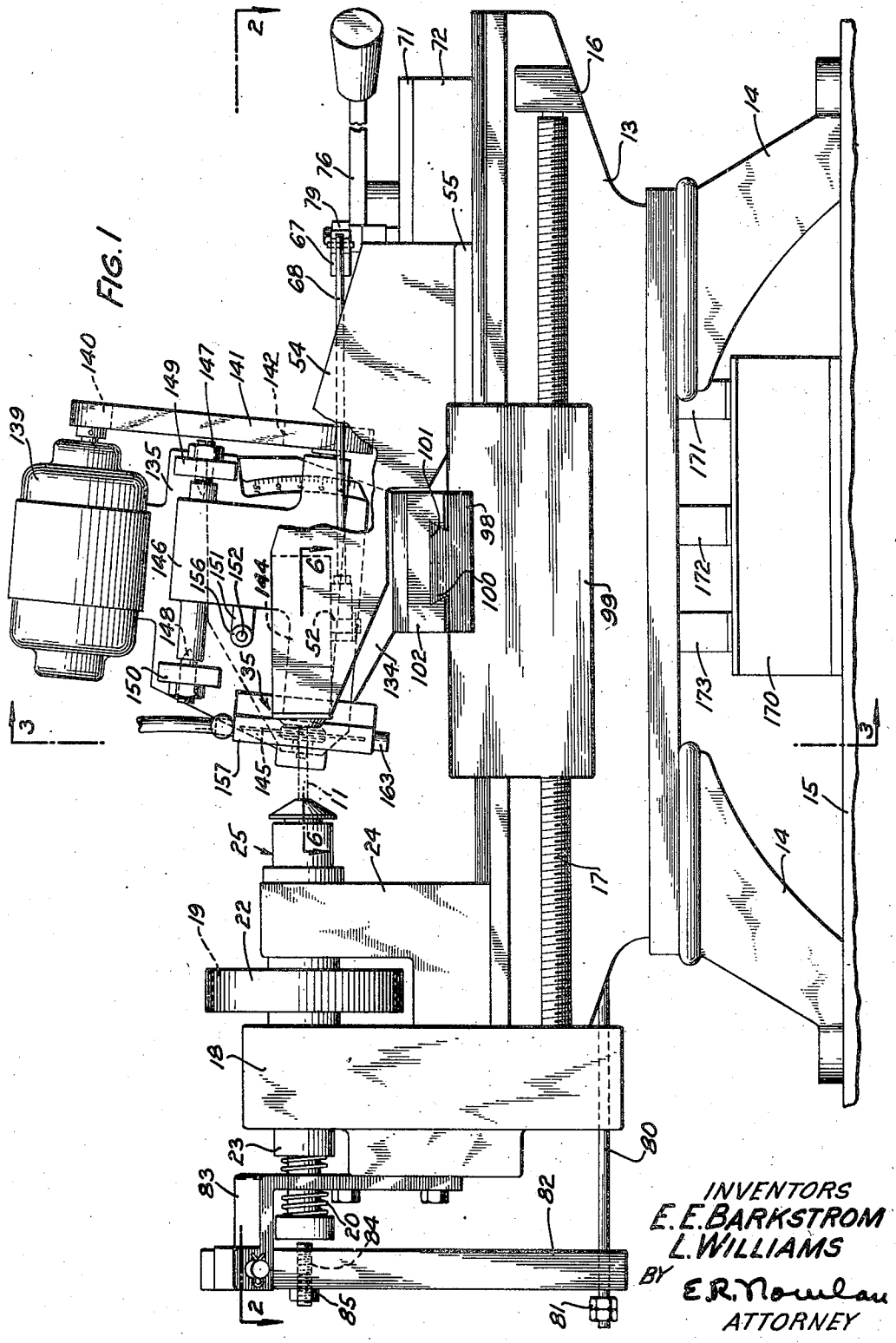
Aug. 6, 1946. E. E. BARKSTROM ET AL 2,405,485

ARTICLE FORMING APPARATUS

Filed Aug. 28, 1943 5 Sheets-Sheet 1

FIG. 1



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ARTICLE FORMING APPARATUS

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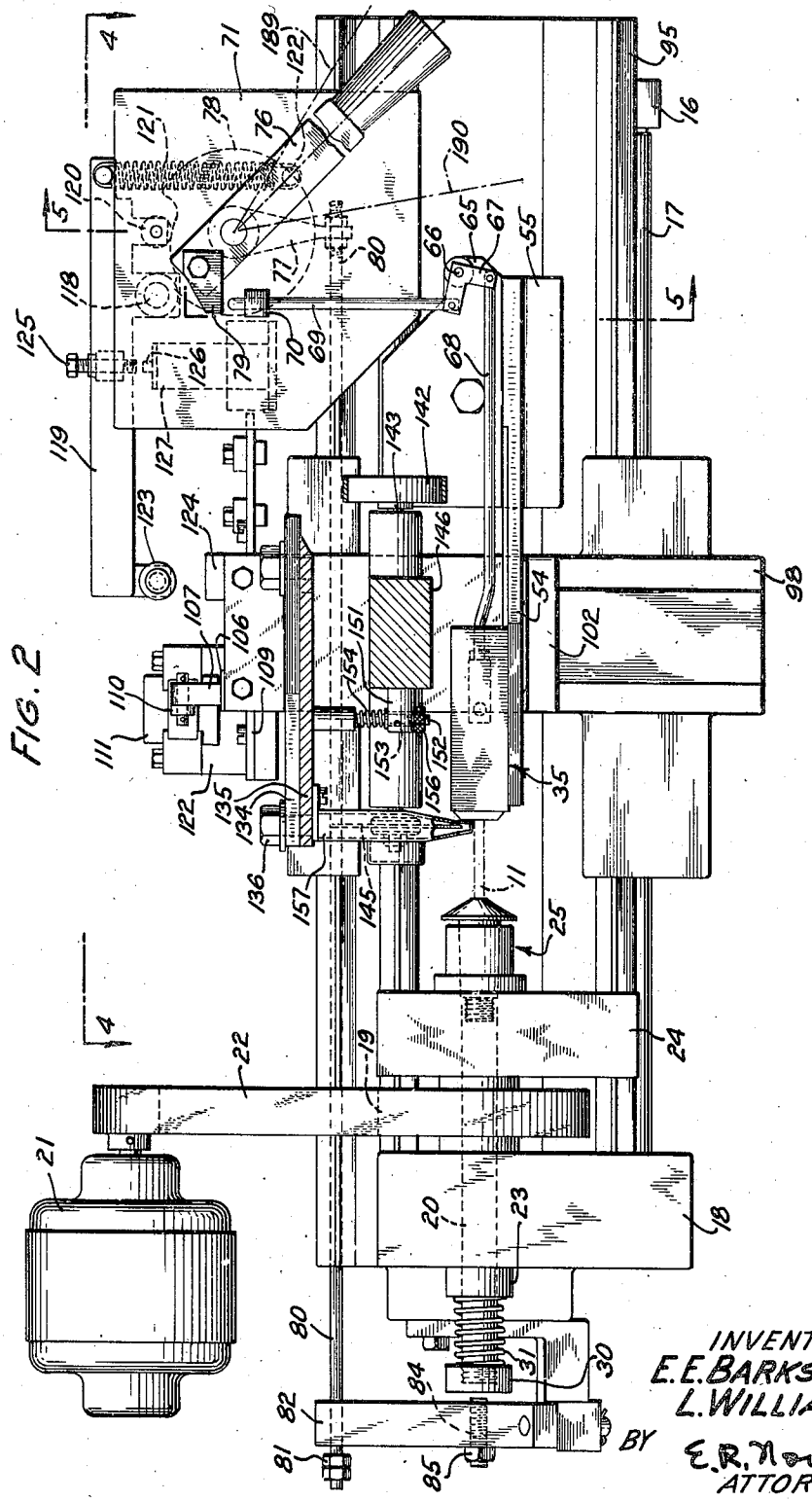


FIG. 2

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ARTICLE FORMING APPARATUS

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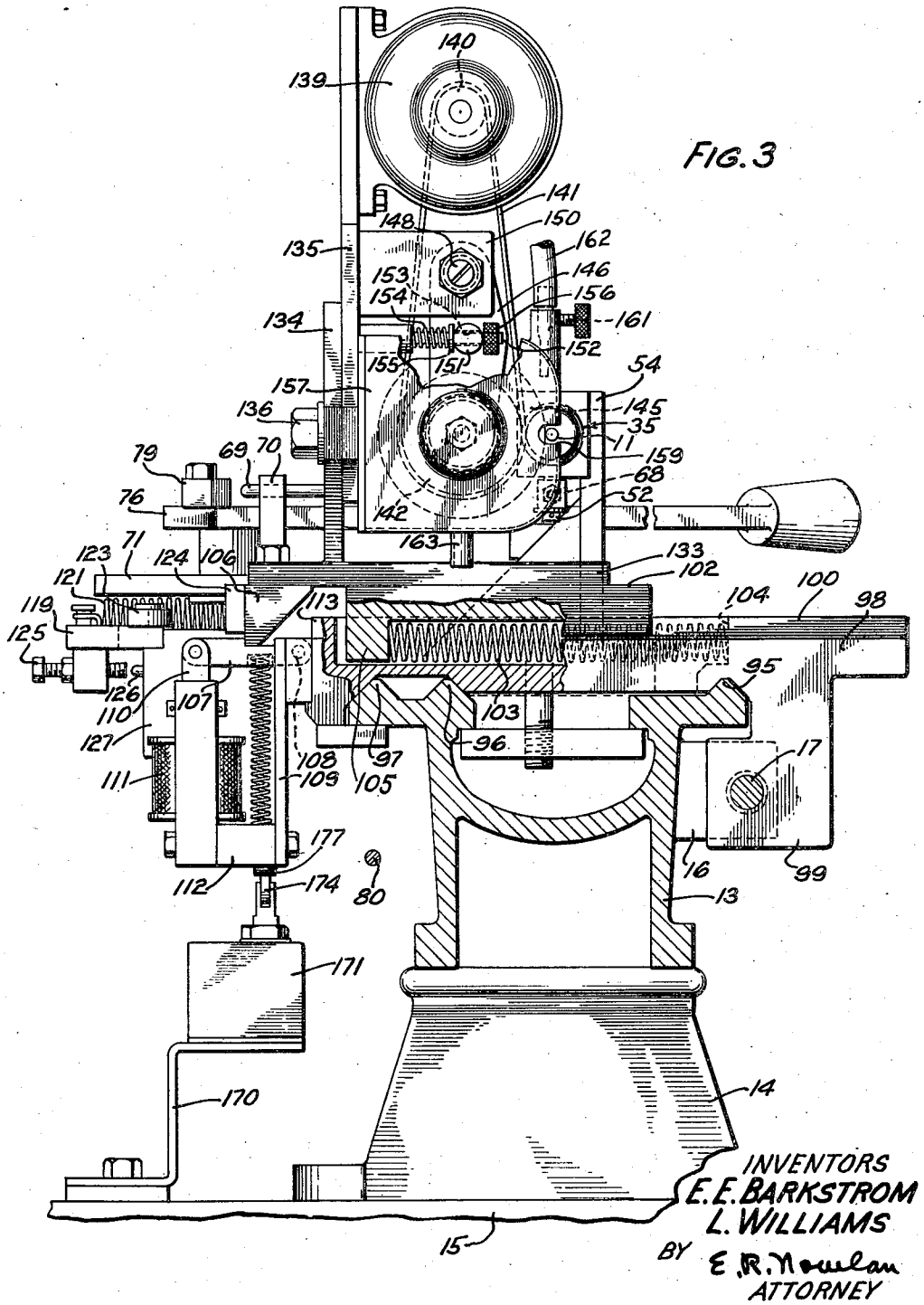


FIG. 3

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ARTICLE FORMING APPARATUS

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FIG. 4

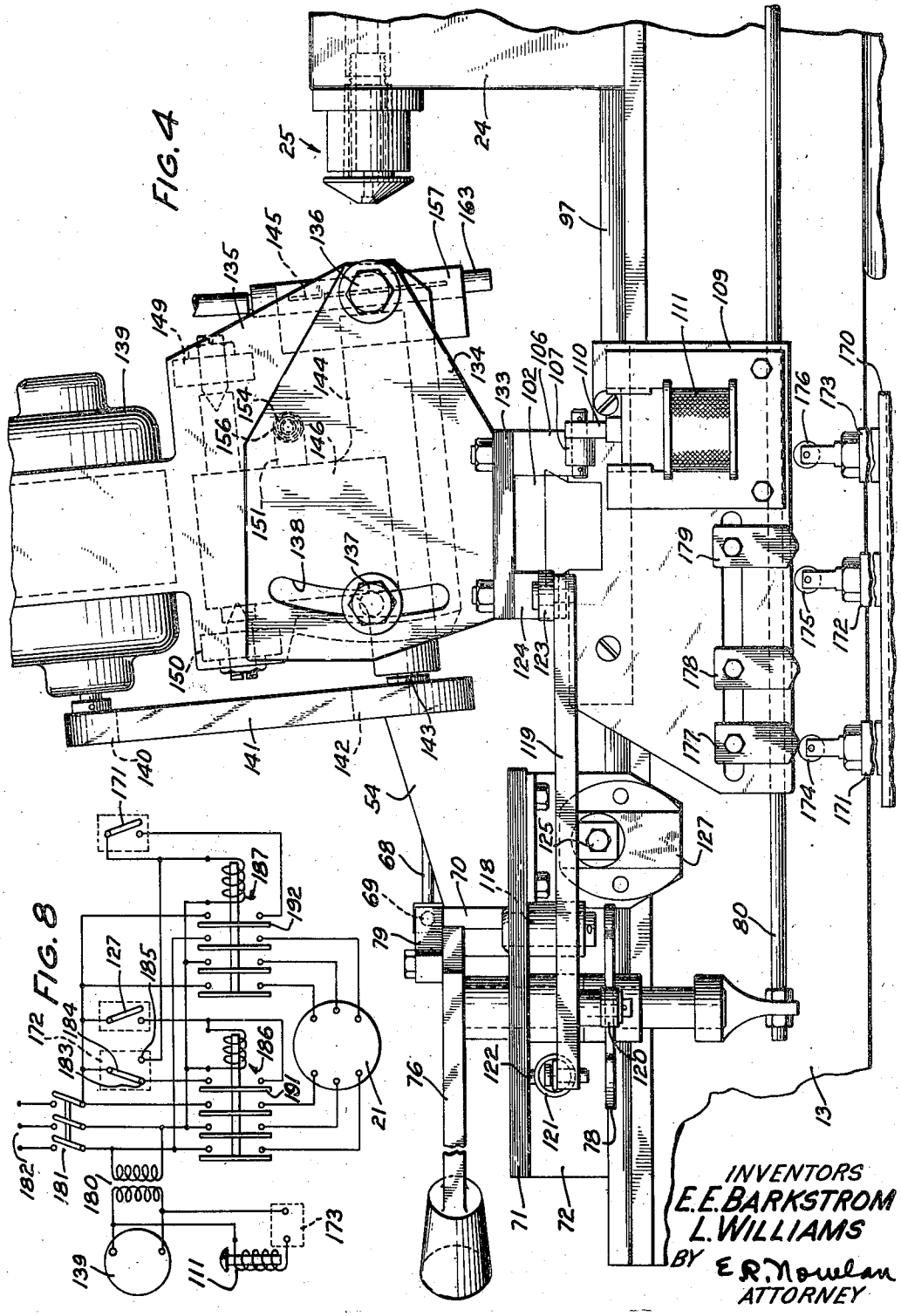


FIG. 8

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ARTICLE FORMING APPARATUS

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FIG. 6

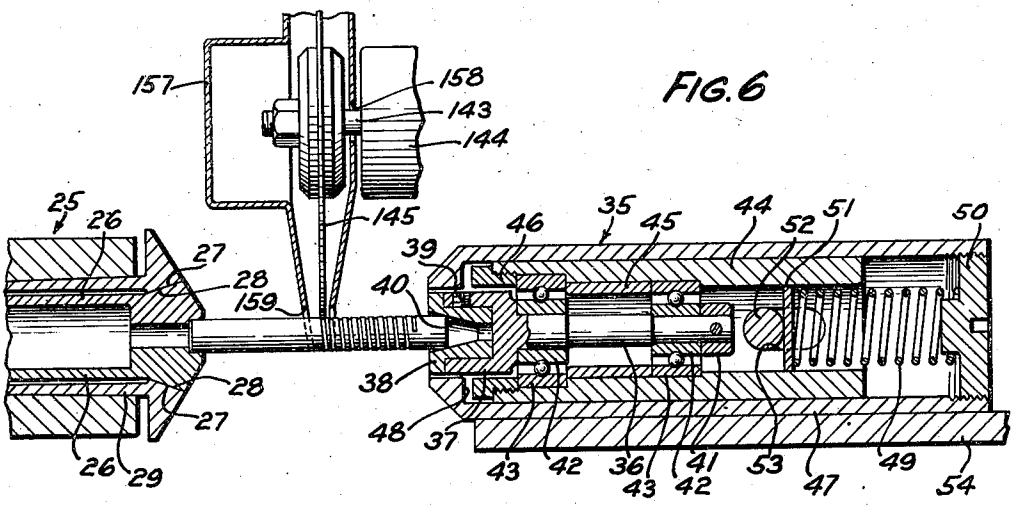


FIG. 7

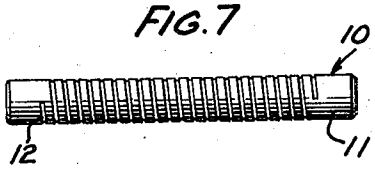
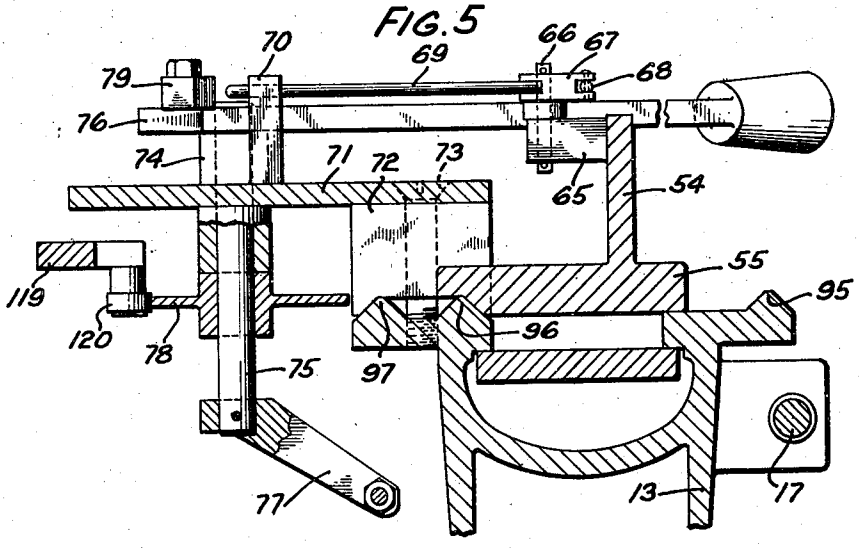


FIG. 5



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Patented Aug. 6, 1946

2,405,485

UNITED STATES PATENT OFFICE

2,405,485

ARTICLE FORMING APPARATUS

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Application August 28, 1943, Serial No. 500,362

10 Claims. (Cl. 90—11.64)

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This invention relates to article forming apparatus and more particularly to apparatus for forming spiral resistors.

It is an object of the present invention to provide a semi-automatic apparatus of simple construction for expeditiously forming articles.

In accordance with one embodiment of the invention, an apparatus is provided for forming resistors by cutting a spiral groove in a cylindrical member made of ceramic material and having an electrical conducting coating thereon. In this apparatus, the coated cylindrical member is placed in co-axially aligned chucks, one of which is positively driven and the other of which is mounted for free rotation and then, upon the operation of a single manually operable lever, a cycle of operation is initiated which moves a cutting disc or wheel into engagement with the coated cylindrical member and then causes the cutting wheel to travel longitudinally of the cylindrical member, which is simultaneously rotated at a relatively slow rate of speed, whereby the cutting wheel cuts a spiral groove in the cylindrical member. The cutting wheel is thus automatically advanced upon moving it into engagement with the coated cylindrical ceramic member and at the end of its cutting operation, is moved out of engagement with the cylindrical member and into engagement with a reversing screw, which returns the apparatus to its normal starting position, where it is automatically stopped for unloading and reloading of the apparatus.

A complete understanding of the invention may be had by reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a front elevational view of a preferred form of the apparatus;

Fig. 2 is a horizontal sectional view taken substantially along the line 2—2 of Fig. 1 in the direction of the arrows;

Fig. 3 is a vertical sectonal view taken substantially along the line 3—3 of Fig. 1 in the direction of the arrows and showing the apparatus on a somewhat larger scale than shown in Fig. 1;

Fig. 4 is a rear elevational view of a portion of the apparatus shown in Fig. 2, the view being taken in the direction of the arrows along line 4—4 of Fig. 2;

Fig. 5 is an enlarged fragmentary vertical sectional view taken substantially along the line 5—5 of Fig. 2 in the direction of the arrows;

Fig. 6 is a greatly enlarged plan section taken

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substantially along the line 6—6 of Fig. 1 in the direction of the arrows;

Fig. 7 is an enlarged view of the article manufactured in the apparatus shown in the other views;

Fig. 8 is a circuit diagram showing the control circuit of the apparatus.

Referring to the drawings, particular reference being first had to Fig. 7, wherein the article formed in the apparatus is shown on an enlarged scale, it will be seen that the resistor designated 10 formed in the apparatus comprises a cylindrical member 11, which may be any suitable ceramic coated with conducting material; for example, particularly a carbon deposit, and having a spiral groove 12 formed in it extending substantially the entire length of the member 11. It will be apparent that a resistor of this type may be formed with a high degree of accuracy by causing the current flowing through the resistor to travel around the circuitous path formed by the conducting material remaining upon the cylindrical member after the groove has been formed in the cylindrical member and that the resistance of the resistor may thus be controlled with a high degree of accuracy by adjusting the angularity by which the spiral groove is cut in the resistor.

As may be seen most clearly by reference to Figs. 1, 2 and 3, the apparatus includes a lathe frame 13 having suitable legs or standards 14—14, which may be positioned upon a bench or table 15 at a suitable height to accommodate an operator using the machine. The lathe frame 13 has a bearing 16 formed adjacent its right end (Fig. 1) for rotatably supporting one end of the feed screw 17, the other end of which extends into a gear box 18, in which suitable gearing may be mounted for transmitting motion from a pulley 19 to a spindle 20 and to the feed screw 17. The pulley 19 is adapted to be driven by a motor 21 through the belt 22. The spindle 20 is suitably journalled for rotary and sliding movement in a bearing 23 formed on the gear box 18 and in a bearing bracket 24. The spindle 20 carries a chuck 25, as seen most clearly in Figs. 1, 2 and 6, which may be of any suitable construction as long as it includes a pair of chuck jaws 26—26 adapted to be clamped onto a resistor 10 when the spindle 20 is moved to the left due to the engagement of cam faces 27—27 on the chuck jaws with cooperating cam faces 28—28 on a collar 29, which is fixed against slidable movement with respect to the bearing bracket 24, but which rotates with the spindle

20. The left end of the spindle 20 has a collar 30 threaded on it or otherwise suitably attached to it and between the collar 30 and the left of the bearing 23 a compression spring 31 is positioned around the spindle 20, whereby the spindle 20 is always urged to the left (Figs. 1 and 2), thus to urge the chuck jaws 26 to the left, where they will be cammed down into engagement with a resistor 10 to be grooved in the apparatus.

Mounted in axial alignment with the chuck 25 is a second resistor holding chuck 35, as seen most clearly in Fig. 6. This chuck comprises a spindle 36 having a shouldered portion 37 in which a resistor-holding tool 38 may be fixed by means of a set screw 39. The resistor holding tool 38 has a centrally positioned tapered aperture 40, in which the right end (Fig. 6) of a resistor may seat itself when the chucks 35 and 25 are in the position shown in Fig. 6. It will be understood that the tool 38 does not clamp the resistor 10 except insofar as the resistor 10 is pushed into the tapered aperture 40. The right end of the spindle 36 (Fig. 6) has a collar 41 fastened to it which cooperates with offset portions of the spindle to hold a pair of bearing races 42—42 in place on the spindle. The bearing races 42 cooperate with outer races 43—43 to rotatably support the spindle 36 in a sleeve 44 and the outer races 43 are clamped in the sleeve 44 by means of a spacer 45 and threaded collar 46. The sleeve 44 is slidably mounted in a cylinder 47, having an internal shoulder 48 towards which the sleeve 44 is normally urged by a compression spring 49 interposed between a threaded plug 50 threaded into the right end (Fig. 6) of the cylinder 47 and a disc 51 engaging the pin 52 which extends through the sleeve 44 and cylinder 47. The pin 52 is fixed to the sleeve 44 and is slidable in an aperture 53 in the cylinder 47. The cylinder 47 is mounted upon a tail stock bracket 54, which extends upwardly from a tail stock 55, suitably mounted upon the lathe frame 13.

Mounted upon the bracket 54 of the tail stock adjacent its right end (Fig. 2) is a block 65, carrying a pivot pin 66 (Figs. 2 and 5) on which there is, in turn, pivoted a bell crank lever 67. The bell crank 67 has links 68 and 69 connected to it and the link 68 is, in turn, pivotally connected, as shown most clearly in Fig. 3, to an enlarged portion of the pin 52, which serves to actuate the sleeve 44. The link 69 is slidable in a bearing 70 (Figs. 2 and 5) mounted upon a bearing plate 71, which is, in turn, attached to the lathe frame 13 by means of a block 72 and a machine screw 73. The bearing plate 71, in addition to supporting the bearing 70, supports a bearing 74, in which there is rotatably mounted a shaft 75. One end of the shaft 75 has a control lever 76 fixed to it. The other end of the shaft 75 has a lever 77 fixed to it, the purpose of which will be described hereinafter, and intermediate the bearing 74 and lever 77 the shaft 75 carries a cam 78. The control lever 76 has a camming block 79 suitably attached to it in position to engage the link 69 and through the link 69 rock the bell crank 67 in a counterclockwise direction (Fig. 2) for moving the link 68 to the right and releasing the resistor holding tool 38 from a resistor which has been grooved in the apparatus.

The lever 77 has a link 80 attached to it, which extends substantially the entire length of the apparatus, as shown in Fig. 2. At its left end, as viewed in Figs. 1 and 2, the link 80 has a lock nut assembly 81 threaded onto it to the left of a lever 82, which is suitably apertured to permit the link 80 to pass through it freely. The lever 82 is pivotally mounted on a bracket 83, which is, in turn, supported by the gear box 18. Intermediate its ends, the lever 82 has a threaded member 84 locked in it by means of a lock nut 85. The threaded member 84 is adapted to engage the collar 30 and move the spindle 20 to the right when the link 80 is moved to the right by control lever 76. From the foregoing, it is believed to be apparent that when the control lever 76 is rocked counterclockwise from the position shown in Fig. 2, the spindle 20 will be moved to the right to cause the chuck jaws 26 to move to the right and open and at the same time the resistor-holding tool 38 will be moved to the right at the same time that the chuck jaws move to the right. Further movement may be imparted to the resistor holding tool 38 and its associated spindle 36 manually at the end of an operation to disengage the resistor 10 from the chuck jaws 26.

The lathe frame 13 has ways 95, 96 and 97 formed on it, on which there is slidably mounted, as seen most clearly in Fig. 3, a tool carriage 98. The tool carriage 98 is provided with a depending portion 99, in which a suitably threaded device is positioned for engaging the feed screw 17 to move the tool carriage 98 longitudinally of the machine, that is, from left to right or vice versa (Figs. 1 and 2). The carriage 98 has a dove-tail 100 formed upon it for engaging in a dove-tail slot 101 formed in a cross slide 102. The cross slide 102 is normally urged to the left (Fig. 3) by a compression spring 103 seated in a slot 104 formed in the dove-tail 100 and engaging a downwardly extending portion 105 of the cross slide 102. In this manner, the cross slide 102 is urged toward the rear of the machine (to the left, Fig. 3) by the spring 103. However, the cross slide 102 is normally prevented from moving beyond the position shown in Fig. 3 due to the engagement of a latch member 106 formed thereon with a latch 107 which is pivotally mounted on a pin 108 fixed in a bracket 109 suitably attached to the tool carriage 98. The left end (Fig. 3) of the latch 107 is pivotally connected to a core 110 of a solenoid 111, also suitably mounted on the bracket 109 by means of a block 112. The cross slide 102 may be either locked in the position shown in Fig. 3 or may be pushed to the rear of the machine (the left, Fig. 3) to bring the downwardly extending portion 105 thereof into engagement with an abutment surface 113 formed on the tool carriage 98.

Pivoted on a pin 118 (Figs. 2 and 4), which extends downwardly from the bearing plate 71, is a cam actuated lever 119, which has a cam roller 120 mounted thereon in alignment with the cam 78. The cam roller 120 is urged into engagement with the surface of the cam 78 by a contractile spring 121 attached to the right end (Fig. 2) of the lever 119 and to a pin 122 extending downwardly from the bearing plate 71. The spring 121 normally tends to hold the lever 119 in the position shown in Fig. 2 to hold an actuator roller 123 mounted on the left end of the lever 119 (Fig. 2) out of engagement with an abutment 124 on the cross slide 102. The lever 119 in the position shown in Fig. 2 also carries a switch actuating screw 125 out of engagement with the actuating plunger 126 of a switch 127, which is also suspended from the bearing plate 71. When the control lever 76 is rocked in a clockwise direction (Fig. 2), the cam 78 will rock the lever 119 counter-clockwise to close switch 127 and to cause the actuator roller 123 to push the cross slide

102 over to the position shown in Fig. 3, where the cross slide will be latched by the interengagement of the latch member 107 with latch 106. Simultaneously with the shifting of the cross slide 102, switch 127 will be closed to initiate operation of the motor 21, as will be described more in detail in connection with the description of the operation of the apparatus.

Mounted on the cross slide 102 is a plate 133 having formed integrally with it an upwardly extending support plate 134. The plate 134, in turn, supports a plate 135, which, as seen most clearly in Fig. 4, is pivoted on a mounting screw 136 and may be held in any one of a plurality of adjusted positions by a positioning screw 137, which is threaded into the plate 135 and extends through a slot 138 in the plate 134 (Fig. 4). By this construction, the angular position of the plate 135 with respect to the plate 134 may be adjusted. Mounted upon the plate 135 adjacent its upper end is a motor 139 for driving a pulley 140, which, in turn, drives a belt 141. The belt 141 transmits motion to the pulley 142 mounted upon the end of a shaft 143. The shaft 143 is journalled in a bearing 144 and has fixed to it a cutting wheel 145. The bearing 144 is formed integrally with a block 146, which is pivotally mounted on pivot pins 147 and 148 threaded into brackets 149 and 150, respectively, extending outwardly from the plate 135 (Figs. 1 and 4). The block 146 has a post 151 extending outwardly therefrom through which extends a threaded pin 152. The threaded pin 152 is fixed to the plate 135 and extends through an aperture 153 in the post 151. Positioned around a reduced portion of the pin 152 is a compression spring 154, which engages an enlarged portion of the pin 152 and a washer 155, which bears against the post 151. From the foregoing, it is believed to be apparent that the spring 154 normally tends to hold the post 151 in the position shown in Fig. 3, where it is in engagement with a knurled thumb nut 156 threaded onto the pin 152. The lower end of the block 146 is thus urged to the right (Fig. 3) to carry the cutting wheel 145 into engagement with a resistor 10, the block 146 being urged to move to the right (Fig. 3) by the compression spring 154 pressing against the post 151. The plate 135 has an irregularly shaped housing 157 mounted upon it, in which the cutting wheel 145 is encased. The housing 157, as seen most clearly in Fig. 6, is provided with an aperture 158, through which the shaft 143 passes freely and it is also provided with an aperture 159 through which a portion of the cutting wheel 145 extends to engage the resistor 10. Coolant may be supplied to the housing 157 to cool the cutting wheel 145 through a port 161 from a hose connection 162 extending to a suitable source of supply. The bottom of the housing 157 has an outlet port 163, through which the coolant may drain.

A bracket 170, as shown most clearly in Fig. 3, is mounted upon the bench or table 15 and carries three switches 171, 172 and 173, having actuating rollers 174, 175 and 176, respectively, positioned to be engaged by cam members 177, 178 and 179, respectively, suitably mounted upon the bracket 109 in position to engage the rollers 174, 175 and 176 at predetermined times in the operation of the machine and thereby close their associated switches 171, 172 and 173. The switch 171, when the machine is in normal inoperative position, is held closed by cam member 179. This switch, however, is a normally open switch and, as soon as the cam member 179 moves away from

the roller 174, switch 171 will open. Switches 172 and 173 are adapted to be closed at approximately the same time at the end of a cutting or grinding operation on a resistor 10. As shown most clearly in Fig. 8, closure of switch 173 will energize solenoid 111 provided current has been supplied to the switch 173 from a transformer 180 due to the closure of a main control switch 181 connected to a suitable power source 182.

The switch 172 is a double-throw switch normally biased to close a circuit to a contact 183, but shiftable to transfer its movable contact 184 to engage a fixed contact 185 when the cam 178 engages actuating roller 175. The control circuit for the apparatus includes a pair of relays 186 and 187, which, upon alternate energization, serve to connect power from the source 182 through switch 181 to opposite sides of the motor 21, to thereby cause the motor to operate in opposite directions, as will be described more fully in connection with the following brief description of the operation of the apparatus.

In the operation of the apparatus, the lever 76 may be moved to the position indicated by the dot and dash lines 189 at the start of the operation of the apparatus to permit the loading of a cylindrical member 11 of ceramic material coated with a suitable conductor between the chucks 25 and 35. When the lever 76 is moved to the dot and dash line position 189, the camming block 79 will engage the end of the link 69 and will rock the bell crank 67 counter-clockwise, thereby, through link 68 and pin 52, to compress the spring 49 and retract the spindle 36 and resistor-holding tool 38 to the right. Simultaneously with the movement of the resistor-holding tool 38 to the right, lever 77 will move link 80 (Fig. 2) to the right to thus move chuck jaws 26 to the right and since these jaws are, as is usual in chucks of this type, resiliently urged to open, the chuck 25 will be moved to the right and will open its jaws, thus permitting an operator to insert a cylindrical member 11 between the chucks 25 and 35.

After a cylindrical member 11 has been mounted in the chucks 25 and 35, the lever 76 may be moved to assume the position indicated by the dot and dash lines 190 to initiate a groove-cutting operation on the member 11. When the lever 76 is moved to the position indicated by dot and dash line 190, the spring 31 will be permitted to shift the chuck jaws 26 to the left to clamp onto the cylindrical member 11 and the spring 49 will be permitted to push the resistor-holding tool 38 to the left (Fig. 6), thus to firmly grip the cylindrical member 11 between the two chucks. As the lever 76 moves to the position indicated by line 190, switch actuating screw 125 will close switch 127 and actuator roller 123 will force cross slide 102 to the position shown in Fig. 3, where it will be latched by the interaction of the latch member 106 and latch 107. It will be understood that prior to manipulation of the lever 76, switch 181 has been closed to supply power from the source 182 to the transformer 180 and thence to the motor 139, which is permanently connected to the secondary of the transformer 180. Thus the cutting wheel 145 will be continuously driven when power is supplied to operate the other portions of the apparatus. The switch 127, having been closed by the rocking of lever 119 counter-clockwise by the cam 78, will connect one of the leads from the switch 181 to the winding of relay 186, the other side of the winding of which is permanently connected to one of the leads leading to switch 181. Thus, the relay 186 will be en-

ergized and will, through its contacts, supply power to drive the motor 21 in a direction to cause the tool carriage 98 to move to the right, as viewed in Fig. 4, and to the left, as viewed in Figs. 1 and 2. As soon as the tool carriage starts to move, the spring 154 urging the block 146 to rock counterclockwise, as viewed in Fig. 3, will resiliently urge the cutting wheel 145 against the cylindrical member 11 and the gearing in the gear box 18 will drive the spindle 20, thereby to rotate the cylindrical member 11 at a relatively slow rate of speed while the tool carriage moves the cutting wheel longitudinally of the cylindrical member 11, thus to cut a spiral groove in the cylindrical member 11 and form the resistor 10. As soon as the cross slide 102 has been moved to the position shown in Fig. 3 and switch 127 has been momentarily closed, the lever 76 may be released and power will then be supplied to hold relay 186 energized over locking contact bar 191, through contacts 183 and 184 of switch 172. Thus the tool carriage 98 will continue to move to the left (Figs. 1 and 2; the right, Fig. 4) until cam members 178 and 179 engage their associated actuating rollers 175 and 176 to close switches 172 and 173. The two cam members 178 and 179 may be so arranged that they will simultaneously effect the closure of switches 172 or 173 or preferably switch 173 may be closed just a very short time before switch 172. When switch 173 closes, power will be supplied to energize the solenoid 111, thus releasing latch 107 from latch member 106 and permitting spring 103 to move the cross slide 102 to the left from the position shown in Fig. 3. As soon as switch 172 operates, the locking circuit for relay 186 will be broken at switch 172 and a circuit will be completed momentarily to energize relay 187. When relay 187 is momentarily energized, it will be locked up through locking contact bar 192 and the now closed switch 171. Energization of relay 187 will reverse the connections to the motor 21 and cause it to drive the spindle 20 and feed screw 17 in the opposite direction to return the tool carriage 98 to its right-hand position, as viewed in Figs. 1 and 2, or its left-hand position, as viewed in Fig. 4. The motor is a two-speed motor and the carriage is returned at a speed double that of the forward or cutting movement. The travel of the tool carriage back to normal position will continue until cam member 177 opens switch 171, which breaks the locking circuit for relay 187 and restores the circuit to normal.

If it be assumed that the plate 135 has been adjusted to proper angular relation with respect to the plate 134 and locked in that position prior to the initiation of the operation of cutting a groove in a cylindrical member 11, the width of the groove formed and its length may thus be controlled with a high degree of accuracy, whereby the resistance of the resistor 10 may be controlled. After the resistor has been formed by cutting the groove 12 in it, the lever 76 may be moved to the position indicated by dot and dash lines at 189 and the completed resistor may be removed from the chucks 25 and 35, which have now been shifted to the right (Fig. 2) due to the operation of the lever 76, by the operator manually moving the spindle 36 to the right, as seen in Fig. 6.

What is claimed is:

1. An article-forming apparatus comprising means for rotating a blank, cutting means engageable with the blank, lever means for moving the cutting means into engagement with the blank, a cam for actuating said lever means, means for advancing the cutting means longitudinally of the blank during the rotation of the blank, means actuated by said lever means for initiating operation of said advancing means, means operable for reversing the operation of the advancing means, and means movable with the cutting means during its advance for rendering the operation reversing means operative.

2. An article-forming apparatus comprising means for rotating a blank including chucks for holding the blank, cutting means engageable with the blank, means for advancing the cutting means longitudinally of the blank during the rotation of the blank, means for initiating operation of said advancing means, including lever means for shifting said cutting means into engagement with the blank, means operable for reversing the operation of the advancing means, means movable with the cutting means during its longitudinal advance for rendering the operation reversing means operative, cam means for actuating said lever means, a manually controlled shaft for supporting and operating said cam means, a second cam means on said shaft, and linkage means operated by said second cam means and chucks for operating said chucks.

3. An article-forming apparatus comprising means for rotating a blank, a cutting wheel engageable with the blank, a support for said cutting wheel, a lever for shifting said support to engage the cutting wheel with the blank, a switch operable by said lever for initiating operation of the rotating means, a carriage for carrying said support longitudinally of the blank, a reversible drive means for said carriage and said rotating means, switch actuators carried by said carriage, a control circuit for said reversible drive means, and switches positioned for actuation by said switch actuators and operable upon initiation of operation of the rotating means for sequentially effecting the disengagement of the cutting wheel from the blank and causing the control circuit to reverse the operation of the drive means.

4. An article-forming apparatus comprising means for rotating a blank, a cutting wheel engageable with the blank, a support for said cutting wheel, a lever for shifting said support to engage the cutting wheel with the blank, a latch for holding said support in position to hold the cutting wheel in engagement with the blank, a solenoid for releasing said latch, means for advancing the support longitudinally of the blank, means common to the rotating and advancing means for actuating them, means operable by said lever for initiating operation of the means common to the advancing and rotating means, and means actuated by the support at the end of its advance for energizing said solenoid.

5. An article-forming apparatus comprising means for rotating a blank, a cutting wheel engageable with the blank, a support for said cutting wheel, a lever for shifting said support to engage the cutting wheel with the blank, a latch for holding said support in position to hold the cutting wheel in engagement with the blank, a solenoid for releasing said latch, means for advancing the support longitudinally of the blank, means common to the rotating and advancing means for actuating them, means operable by said lever for initiating operation of the means common to the advancing and rotating means, means actuated by the support at the end of its advance for energizing said solenoid, and a sec-

ond means actuated by the support at the end of its advance for reversing the operation of the means common to the advancing and rotating means for returning the support to position to have operation of the advancing and rotating means initiated.

6. An article-forming apparatus comprising means for rotating a blank, a cutting wheel engageable with the blank, a support for said cutting wheel, a lever for shifting said support to engage the cutting wheel with the blank, a latch for holding said support in position to hold the cutting wheel in engagement with the blank, a solenoid for releasing said latch, means for advancing the support longitudinally of the blank, means common to the rotating and advancing means for actuating them, means operable by said lever for initiating operation of the means common to the advancing and rotating means, means actuated by the support at the end of its advance for energizing said solenoid, a second means actuated by the support at the end of its advance for reversing the operation of the means common to the advancing and rotating means for returning the support to position to have operation of the advancing and rotating means initiated, and a switch operable by the support upon its return to restore operability to the initiating means.

7. An article forming apparatus comprising chucks for supporting a blank, means for rotating said chucks to rotate the blank, cutting means engageable with the blank, lever means for moving the cutting means into engagement with a blank held by the chucks, means actuated by said lever means for operating said chucks, a carrier for supporting the cutting means for movement longitudinally of the blank during rotation of the blank, drive means for advancing and retracting the carrier means and for the means for rotating the chucks, means on said lever means for initiating operation of said driving means, a circuit operable under control of said means for initiating operation of the driving means, a plurality of switch actuators carried by the carrier means, a switch in said circuit operable by one of said actuators to prepare a circuit for reversing the direction of operation of the driving means when said carrier is in normal inoperative position, a second switch in said circuit for actuation by one of said actuators to cause a reversal of the driving means when the carrier means reaches a predetermined position, and a third switch for actuation by one of said

actuators when the carrier reaches its extreme advanced position for effecting the disengagement of the cutting means from the blank.

8. An article forming apparatus comprising means for holding and rotatably supporting an article, a cutting tool, means for supporting said cutting tool for relative movement longitudinally and toward and away from said article, an operating lever, means responsive to an initial movement of said operating lever for actuating said article holding means, means responsive to a further movement of said lever for relatively moving said cutting tool toward said article in said article support, means for relatively moving said cutting tool longitudinally of said article, means for initiating said longitudinal movement in response to said further movement of said operating lever, and means for relatively withdrawing said cutting tool from said article and restoring it to starting position after a predetermined longitudinal traverse.

9. An article forming apparatus comprising means for rotatably supporting an article, a cutting tool, means for supporting said tool for movement transversely and toward and away from said article, a reversible motor for moving said tool longitudinally of the article, a control circuit for said motor, a switch in said control circuit for initiating the energization of said motor, a holding circuit for maintaining said energization after said switch is released, means in said control circuit for reversing said motor after a predetermined travel, and means for stopping said motor when said cutting tool is restored to its initial position.

10. An article forming apparatus comprising means for rotating a blank, a cutting tool, a support for said cutting tool, means for shifting said support to engage the cutting tool with the blank, means operable to initiate operation of said rotating means, a carriage for carrying said support longitudinally of the blank, a reversible drive means for said carriage and said rotating means, switch actuators carried by said carriage, a control circuit for said reversible drive means, and switches positioned for actuation by said switch actuators and operable upon initiation of operation of the rotating means for sequentially effecting the disengagement of the cutting wheel from the blank and causing the control circuit to reverse the operation of the drive means.

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