Nov. 22, 1955 V. A. WOODELL 2,724,306

AUTOMATIC SPIRALING MACHINE FOR MAKING ELECTRICAL RESISTORS

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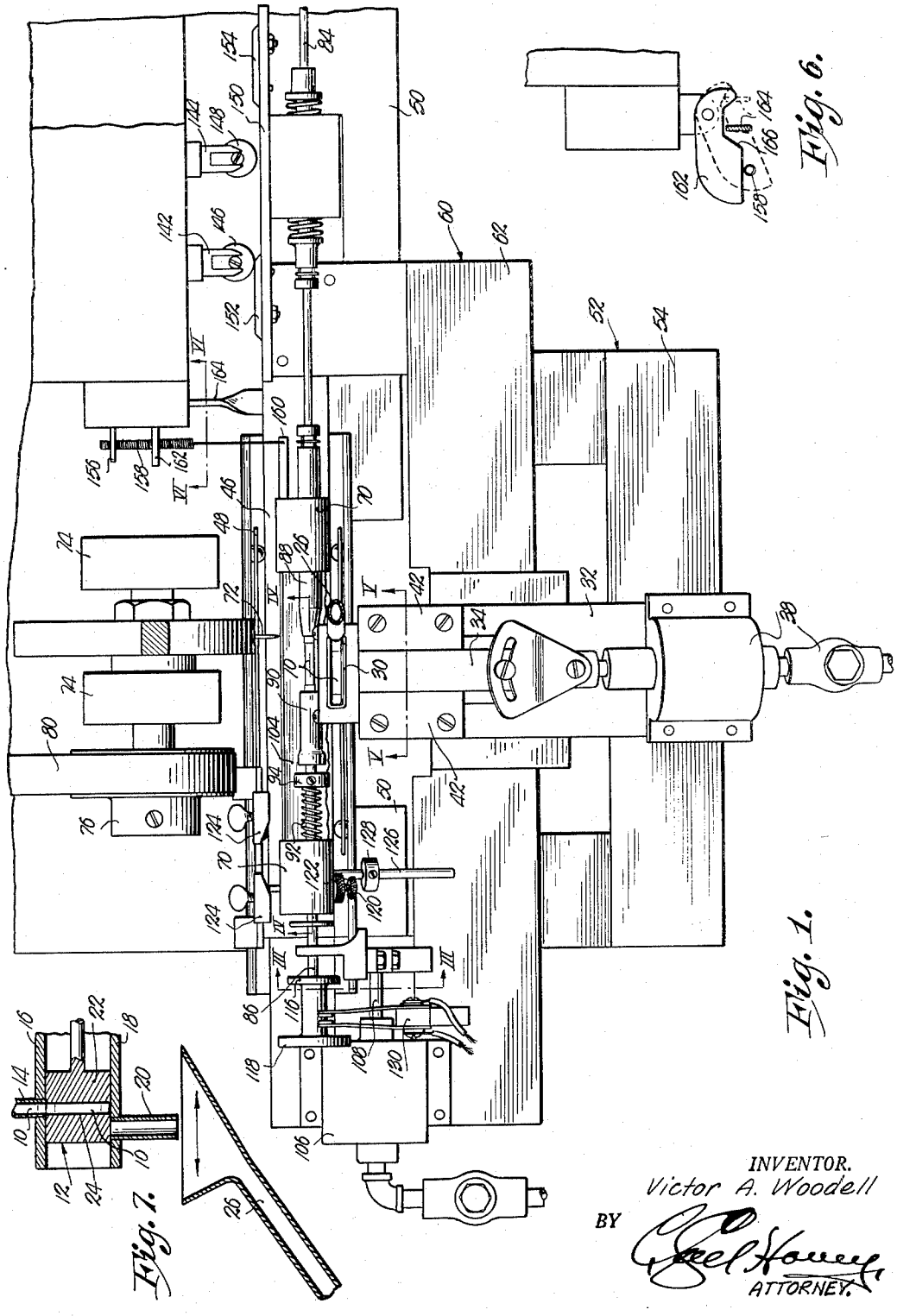

Fig. 1.

Fig. 6.

Fig. 7.

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Fig. 5.

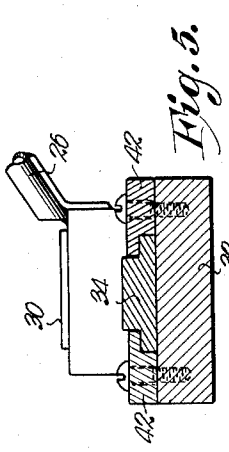

Fig. 2.

Fig. 4.

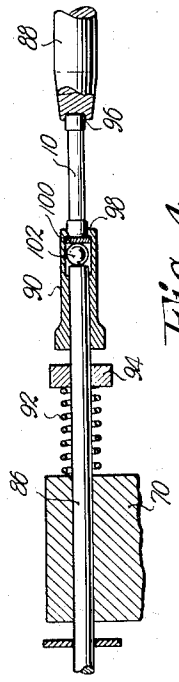

Fig. 3.

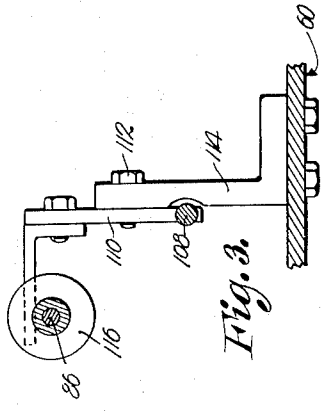

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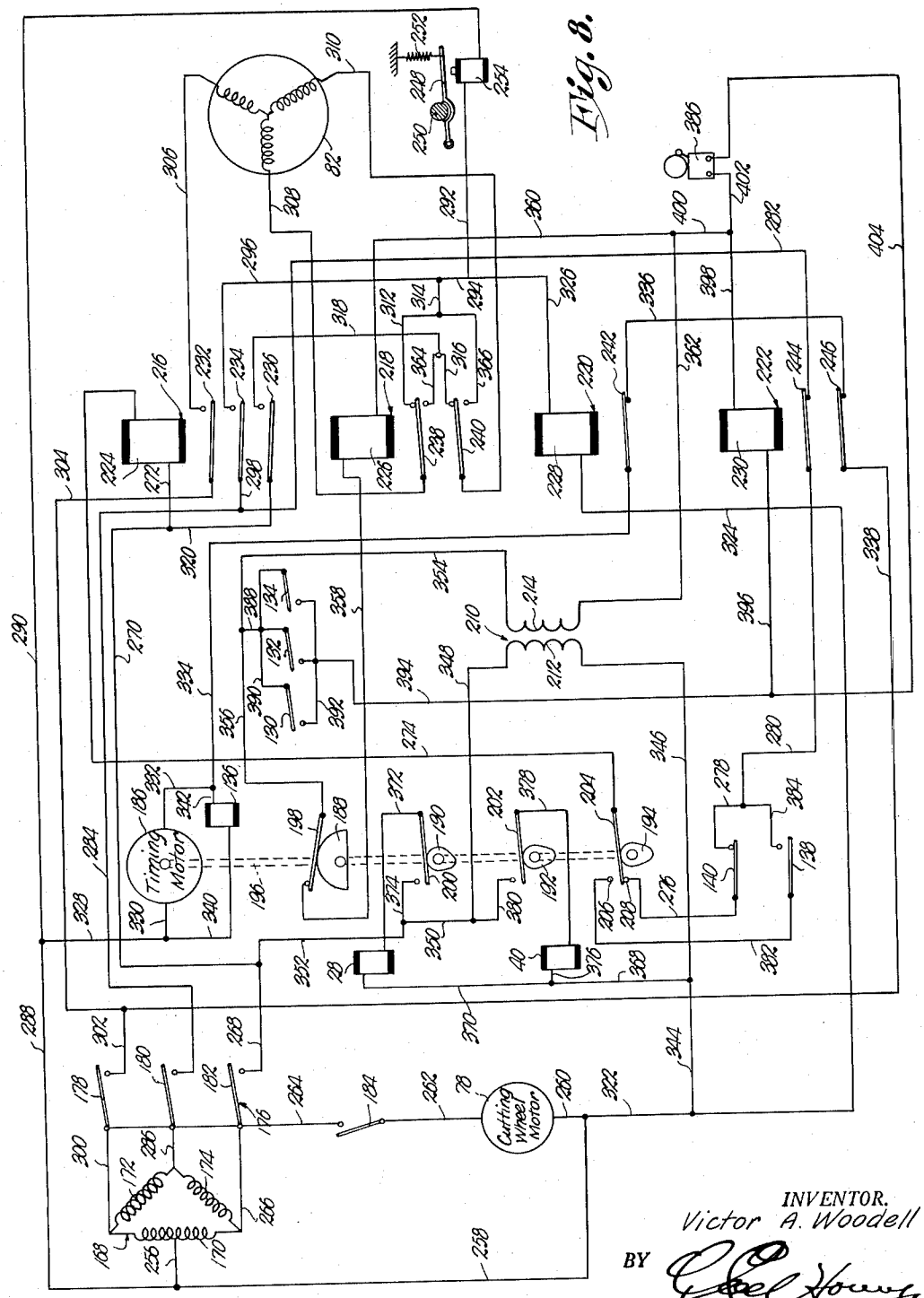
Fig. 8.



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2,724,306

AUTOMATIC SPIRALING MACHINE FOR MAKING ELECTRICAL RESISTORS

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Application April 14, 1952, Serial No. 282,101

2 Claims. (Cl. 90—11.46)

This invention relates to machines for cutting a spiral groove in articles, and has for its primary object the provision of apparatus for automatically feeding the articles to be grooved, advancing the same toward a holder, reciprocating the holder while the same is rotated and while the article is held in engagement with a rotatable cutter, and thereupon releasing the grooved article, all without operator attention so long as the machine is supplied with the material and is operating properly.

The machine of the present invention is adapted particularly for use in forming a spiral groove in an outermost carbon coating forming a part of an electrical resistor for the purpose of determining the resistance value thereof, all depending upon the amount of material removed in the grooving process.

Grooving machines much in the nature of a lathe have heretofore been provided, but for the most part, such machines required an operator to handle each and every resistor rendering the same time-consuming and making it necessary to utilize the time of a workman.

It is accordingly the most important object of the present invention to render a lathe-like grooving machine entirely automatic except only for maintaining a constant supply of resistors to be grooved and removing the completely grooved resistors therefrom by means of a suitable collection pan.

Another important object hereof is to provide a grooving machine that includes a lathe-like construction wherein a carriage is reciprocated and is provided with a resistor-holding means that rotates with respect to the carriage and to render the machine operable to groove a resistor during reciprocable movement in each direction.

Other objects include the way in which a chuck-like holding means for the resistors is automatically released at each end of its path of travel; the way in which a resistor for grooving is advanced to the releasable chuck means at each end of its path of travel; the way in which the carriage and therefore, the holder thereon, is swung toward and away from the continuously rotating cutter wheel; the manner of limiting the extent of reciprocable movement of the carriage; and the way in which the machine is rendered immobile in the event of failure of any of the primary control means therefor.

Other objects will be made clear or become apparent as the following specification progresses, reference being had to the drawings, wherein:

Figure 1 is a fragmentary top plan view of an automatic spiraling machine for making electrical resistors forming the subject matter of the present invention.

Fig. 2 is an end elevational view thereof, parts being broken away and in section for clearness.

Fig. 3 is a fragmentary, detailed, cross-sectional view taken on line III—III of Fig. 1.

Fig. 4 is an enlarged, fragmentary, cross-sectional view taken on line IV—IV of Fig. 1.

Fig. 5 is an enlarged, fragmentary, detailed cross-sectional view taken on line V—V of Fig. 1.

Fig. 6 is a detailed, cross-sectional view taken on line VI—VI of Fig. 1.

Fig. 7 is a vertical, cross-sectional view illustrating the type of feeder used with the machine shown in Figs. 1 and 2; and

Fig. 8 is a schematic wiring diagram showing the electrical components of the machine and the manner of intercoupling the same.

Resistors **10**, shown in Figs. 1, 2, 4 and 7 of the drawings, are advanced to a suitable feeder such as shown in Fig. 7 and broadly designated by the numeral **12** through the medium of automatic sorting and feeding mechanism not shown, and having an outlet tube **14**. A pair of spaced-apart, horizontal plates **16** and **18**, receive tubes **14** and **20** in offset relationship.

A reciprocable plunger **22** is provided with a vertical opening **24** for receiving resistors **10** one at a time from the tube **14**, advancing the same along the plate **18** and finally depositing such resistor **10** from the opening **24** into the tube **20** and thence into a hopper **26**, the lowermost end of the hopper **26** being also illustrated in Figs. 1, 2 and 5 of the drawings.

Reciprocable movement is imparted to the plunger portion **22** of the feeder **12** through the medium of an air valve that is magnetically operated by means of a solenoid **28** (see Fig. 8). During descent of the resistors **10** in the hopper **26**, they turn from a vertical position to a horizontal position as shown in Figs. 1 and 2 of the drawings. Resistors **10** gravitate into an elongated receiver **30** capable of receiving several resistors **10** in stacked relationship. The receiver **30** is mounted on one end of an elongated, inclined support **32** that underlies and slidably receives a reciprocable plate **34**. Plate **34** is notched as at **36** to receive the resistors **10** one at a time from the tubular receiver **30**.

An air valve **38** mounted on the support **32** is connected with the plate **34** to reciprocate the latter, valve **38** being operated by means of a solenoid **40** (see Fig. 8). It is noted in Fig. 5 of the drawings that the reciprocable plate **34** is T-shaped in cross-section and releasably held for free sliding movement on the support **32** by means of a pair of L-shaped strips **42**, the latter serving to support the tubular receiver **30**.

A carriage broadly designated by the numeral **44**, is provided with an elongated bar **46** mounted within an elongated, horizontal track **48** for longitudinal reciprocation within a vertical plane intersecting the inclined, reciprocable path of travel of the plate **34**. The track **48** is in turn carried by a bed **50** that has a U-shaped extension **52** provided with a horizontal bight **54** in spaced, parallelism to the path of travel of the carriage **44**. Bight **54** receives a roller **56** mounted on a bracket **58** depending from the support **32**.

A second U-shaped extension **60**, is mounted on the bar **46** of carriage **44** for reciprocation therewith and has a horizontal bight **62** spaced above and inwardly of the bight **54** of extension **52**. A bracket **64** rigidly interconnects the support **32** and the bight **62** of extension **60**.

The bar **46** of the carriage **44** has a plurality of upstanding lugs **66** that receive a shaft **68** overlying the bar **46** in parallelism with the longitudinal axis of the latter for swingably receiving a plurality of upstanding arms **70** and movable toward and away from a rotatable cutter disc **72**. Disc **72** is rotatably mounted on a bracket **74** extending upwardly from the bed **50**. A pulley **76** on the shaft of cutter disc **72** is coupled with an electric motor or other suitable prime mover **78** by means of a continuous belt **80**, the motor **78** (see also Fig. 8) being likewise mounted on the bed **50**.

A reversible electrical motor **82** (Fig. 8) is operably

coupled with a shaft **84** to rotate the latter and to reciprocate the carriage **44** in any well known manner and since such coupling has heretofore been used in lathes generally, the same has not been herein shown in detail. A second shaft **86** cooperates with the shaft **84** and, like the latter, is rotatably carried by the arms **70** at the uppermost end of the latter.

Holding means for the resistors **10** takes the form of opposed, spaced chucks **88** and **90** on the proximal ends of shaft **84** and **86** respectively. The shaft **86** is reciprocable within its supporting arm **70** and is yieldably held biased toward the chuck **88** by means of a spring **92** coiled thereabout between a collar **94** on the shaft **86** and the proximal arm **70** (see Fig. 4). Cavities **96** and **98** are formed in the ends of chucks **88** and **90** respectively to receive the resistor **10**, there being a small plate **100** within the cavity **98** of chuck **90** and a small ball **102** between plate **100** and the proximal end of shaft **86**, plate **100** and ball **102** both being loosely disposed in the cavity **98**.

An inclined deflector plate **104** carried by the arms **70** beneath the chucks **88** and **90**, receive grooved resistors **10** after release thereof by reciprocation of shaft **86** in one direction, such finished resistors gravitating to a receptacle not shown beneath bed **50**, the latter being cutaway as shown in Fig. 1, to clear the gravitating resistors **10**.

Movement of the shaft **86** on its longitudinal axis against the action of spring **92** to release a resistor **10** from beneath chucks **88** and **90**, is accomplished by means of an air valve **106** carried by the extension **60** at one end thereof. The air valve **106** is actuated by means of the solenoid **28** (see Fig. 8). The air valve **106** has a reciprocable plunger **108** disposed to swing an L-shaped arm **110** (see Fig. 3), pivotally carried as at **112** by an L-shaped bracket **114** secured to the extension **60**. The arm **110** extends into overlying relationship to the shaft **86** on one side of a disc **116**. Disc **116** is integrally connected with a second disc **118** in spaced parallelism to disc **116** and both of the discs **116—118** are joined rigidly to the shaft **86**. One of the arms **70** that includes a bearing for the shaft **86**, has an adjustable screw **120** that is held in an adjusted position by locknut **122**. The screw **120** extends between a pair of substantially wedge-shaped, spaced-apart stops **124** that are adjustable toward and away from each other and suitably mounted on the bed **50**.

A laterally extending arm **126** on the arm **70** for shaft **86** has an adjustable counterweight **128** tending to swing the interconnected arms **70** and therefore, the chucks **88** and **90** as well as resistor **10** carried thereby, away from the cutter wheel **72**. A safety switch **130** (see also Fig. 8), has a pair of resiliently mounted contacts disposed between the discs **116** and **118** as shown in Fig. 1.

The machine is also provided with an additional pair of safety switches **132** and **134** (see Fig. 8), disposed within the helix adjusting means forming a part of the interconnection between three-phase motor **82** and the carriage **44**, as well as the shaft **84**. In this connection, by means of a feed screw, an adjustable lever, and a suitable train of gears not herein illustrated, the pitch of the spiral groove to be formed in the resistors **10**, may be selected and it is within such mechanism that the safety switches **132** and **134** are disposed. The chucks **88** and **90** and the resistor **10** held thereby, are moved toward the cutter wheel **72** against the action of counterweight **128** by means of a spring **158**, after deenergization of solenoid **136** (Fig. 8), and its attendant air valve, not shown. A pair of limit switches **138** and **140** (Fig. 8), are provided with reciprocable, spring-loaded actuating plungers **142** and **144** respectively (Fig. 1), in turn provided with rollers **146** and **148** respectively. Rollers **146** and **148** ride along a plate **150** mounted on the carriage **44** for reciprocation therewith. Plate **150** is provided with a pair of elongated projections **152** and **154** for the rollers **146** and **148** respectively.

Bed **50** is provided with mounting means **156** for one end of spring **158** that has its opposite end pivotally connected with an extension **160** on the bearing arm **70** for shaft **84**, spring **158** thereby tending to hold the resistor **10** between chucks **88** and **90** biased toward the cuter wheel **72**. The tension of spring **158** is varied in one direction of reciprocable travel of the carriage **44** by means of a swingable dog **162** (see Fig. 6), that is moved into engagement with the spring **158** by means of an extension **164** on the carriage **44** and within notch **166** of dog **162**. Electrical components in addition to those hereinabove set forth, are illustrated in Fig. 8 of the drawings.

A source of energy not shown, is provided for a power transformer broadly designated by the numeral **168** having secondary windings **170**, **172** and **174** (see Fig. 8). A main manual switch broadly designated by the numeral **176**, is provided with three switch arms **178**, **180** and **182**, ganged together for simultaneous operation. A single switch **184** controls the cutting wheel motor **78**. A timing motor **186** is provided with cams **188**, **190**, **192** and **194** on its shaft **196** for switches **198**, **200**, **202** and **204** respectively. The switches **200** and **202** are normally open as illustrated in Fig. 8 of the drawings; switch **198** is opened during travel of the carriage **44** in one direction and closed as the carriage **44** reciprocates in the opposite direction; and switch **204** is always closed with respect to one of its two stationary contacts **206** and **208**. Switches **138** and **140** are closed when the plungers **142** and **144** thereof are forced away from the plate **150** by the corresponding extension **152** or **154** as the case may be.

The electrical circuit shown in Fig. 8 of the drawings includes additionally an auxiliary transformer broadly designated by the numeral **210** and having a primary winding **212** and a secondary winding **214**. Four relays, broadly designated by the numerals **216**, **218**, **220** and **222** are provided with coils **224**, **226**, **228** and **230** respectively. Relay **216** is provided with three normally open sets of contacts **232**, **234** and **236**. Relay **218** has a pair of double pole, double throw switches **238** and **240**. Relay **220** has a single set of normally closed contacts **242**. Relay **222** has two sets of contacts **244** and **246** that are normally closed. Motor **82** is provided with a brake **248** for its drive shaft **250**, brake **248** being normally biased against the shaft **250** by spring **252** and a solenoid **254** being provided to release the brake **248** against the action of spring **252**.

When the machine is initially placed in operation, switch **184** is closed and remains closed to continuously energize the motor **78** and thereby rotate the cutter wheel **72** through the following circuit:

From secondary **170** of transformer **168**, through lines **256**, **258** and **260**, motor **78**, line **262**, closed switch **184** and lines **264** and **266**, to secondary **170**.

Closing of the main switch **176** energizes the coil **224** of relay **216** through the following circuit:

From secondary **174**, through line **266**, switch **182**, lines **268**, **270** and **272**, coil **224**, line **274**, switch arm **204**, stationary contact **208**, line **276**, closed switch **140**, lines **278** and **280**, closed contacts **244** of relay **222**, lines **282** and **284**, closed switch **180** and line **286**, to secondary **174**.

Energization of the coil **224** of relay **216** closes switches **232**, **234** and **236**, releasing brake **248**, energizing motor **82** and deenergizing motor **186**. Solenoid **254** is energized to release brake **248** through the following circuit:

From secondary **170** through lines **256**, **288** and **290**, solenoid **254**, lines **292**, **294** and **296**, closed switch **234**, lines **298** and **284**, closed switch **180** and line **286** to transformer **168**.

Motor **82** is energized for rotation in one direction through the following circuit:

From secondary 172 of transformer 168, through line 300, closed switch 178, lines 302 and 304, closed switch 232, line 306, motor 82, lines 308 and 310, switches 238 and 240, lines 312, 314 and 296 to closed switch 234, lines 316 and 318 to closed switch 236, lines 298 and 284, to closed switch 180, lines 320, 270 and 268 to closed switch 182 and lines 266 and 286, to transformer 168.

Energization of coil 224 of relay 216 also energizes coil 228 of relay 220 to open the contacts 242, through the following circuit:

From secondary 170 of transformer 168, through lines 256, 258, 322 and 324, coil 228, lines 326, 294 and 296, closed contacts 234 of relay 216, lines 298 and 284, closed switch 180 and line 286 to transformer 168.

Opening of the contacts 242 of relay 220 deenergizes the following circuit for timing motor 186:

From secondary 170 of transformer 168, through lines 256, 288, 328 and 330, motor 186, lines 332 and 334, contacts 242 when closed, line 336, closed contacts 246 of relay 222, lines 338 and 302, closed switch 178 and line 300 to secondary 170.

Assuming that a resistor 10 has been positioned between the chucks 88 and 90 and releasably held therein by the bias of spring 92, release of the brake 248 and energization of motor 82, causes the carriage 44 and all parts mounted thereon to move in one direction, namely, from the left to the right, viewing Fig. 1 of the drawings. The aforementioned air valve coupled with the arms 70 to swing the same away from the cutter wheel 72 and operated by the solenoid 136, is also released by deenergization of the solenoid 136 and the resistor 10 between the chucks 88 and 90 moves into engagement with the cutter wheel 72. The energization of relay 220 to open contacts 242, deenergizes the solenoid 136 by virtue of its parallel coupling in the above traced circuit for motor 186.

It is to be noted in Fig. 8 that solenoid 136 is coupled with lines 328 and 330 by means of a line 340 and with lines 332 and 334 by a line 342. As soon as the carriage 44 moves a predetermined distance to the right, viewing Fig. 1, the roller 146 moves off of the extension 152 and commences riding on the plate 150. Plunger 142 moves toward the plate 150 by virtue of its being spring-loaded, thereby closing the switch 138 (see Fig. 8) readying the same for the return travel of carriage 44. Carriage 44 continues to move to the right, viewing Fig. 1, until the switch 140 is opened by virtue of roller 148 moving onto the extension 154.

As above set forth, the circuit for relay 216, i. e. the coil 224 thereof, includes the switch 140. Accordingly, opening of the latter deenergizes coil 224, opening switches 232, 234 and 236. This immediately deenergizes the motor 82 to stop further movement of the carriage to the right, viewing Fig. 1, and to discontinue the rotation of the resistor 10 held between the chucks 88 and 90. Deenergization of relay 216 also deenergizes the solenoid 254, causing the brake 248 to be applied to the shaft 250 and assuring an immediate stopping of motor 82. Deenergization of the relay 216 also deenergizes coil 228 of relay 220, whereupon the switch 242 closes, thereby making the circuits above traced through the timing motor 186 and through the solenoid 136. Energization of the solenoid 136 immediately causes operation of its associated air valve, which in turn operates to swing the carriage 44 against the action of spring 158, fully removing the grooved resistor 10 from engagement with the cutter wheel 72.

Primary 212 of transformer 210, is energized upon closing of the switch 176 through the following circuit:

From secondary 170 of transformer 168, through lines 256, 258, 322, 344 and 346, primary winding 212, lines 348, 350, 352 and 268, switch 182 and line 266 to secondary 170.

Operation of motor 186 actuates the cam 188 to open switch 198, thereby deenergizing coil 226 of relay 218 whose circuit is traced as follows:

From secondary 214 of transformer 210, through lines 354 and 356, closed switch 198, line 358, coil 226 of relay 218 and lines 360 and 362, to secondary wiring 214.

It is seen that while the carriage 44 was moving from the left to the right (viewing Fig. 1), switch 198 was closed and coil 218 thereby energized to hold the switches 238 and 240 in one of their two positions. Deenergization of the coil 226 causes the switches 238 and 240 to move downwardly, viewing Fig. 8, and when the relay 216 is again energized, the motor 82 operates in the reverse direction from that above traced, through the following circuit:

From secondary 170 through line 300, switch 178, lines 302 and 304, closed contacts 232, line 306, motor 82, lines 308 and 310, switches 238 and 240, lines 364 and 366, line 318 to switch 236, lines 314 and 296 to switch 234, lines 320, 270 and 268, to switch 182, lines 298 and 284, to switch 180 and lines 266 and 286, to transformer 168. Thereupon the cam 190 moves to a position closing switch 200 by operation of motor 186 to energize the solenoid 28, through the following circuit:

From secondary 170 of transformer 168, through lines 256, 258, 322, 344, 368 and 370, solenoid 28, line 372, switch 200, lines 374, 352 and 268, switch 182 and line 266, to secondary 170.

Such energization of solenoid 28 supplies air to the valve 106 (Fig. 1) to move plunger 108 thereof against the arm 110. Swinging of the arm 110 against the disc 116 retracts the shaft 86 and therefore, the chuck 90 against the action of spring 92, permitting gravitational movement of the grooved resistor 10 to the deflector plate 104, and thence to a receptacle therebelow. Energization of the solenoid 28 also operates the plunger 22 (Fig. 7) to feed a resistor 10 into the tube 20 and thence into the hopper 26 where it gravitates into the receiver 30. While the solenoid 28 is energized, the cam 192 moves to a position closing the switch 202, thereby energizing the solenoid 40 through the following circuit:

From secondary 170 of transformer 168, through lines 256, 258, 322, 344, 368 and 376, solenoid 40, line 378, switch 202, lines 380, 350, 352 and 268, switch 182 and line 266 to secondary 170.

Energization of the solenoid 40 supplies air to the valve 38, thereby causing the plate 34 to shift upwardly along the support 32, carrying therewith a resistor 10 within the notch 36 for reception by the chucks 88 and 90. Before the solenoid 40 is deenergized, the cam 190 moves to a position opening the switch 200, deenergizing the solenoid 28, which not only retracts the plunger 22 (Fig. 7) so that it will receive another resistor 10 in its opening 24 from the tube 14, but releases the plunger 108 of valve 106, thereby releasing the arm 110 (Fig. 3) and causing the chuck 90 to move by the action of spring 92 to engagement with a resistor 10 being held in position by the reciprocable plate 34. Thereupon the cam 192 moves to a position opening switch 202 and deenergizing solenoid 40. Plate 34 thereupon moves back to the position illustrated in Fig. 2 of the drawings where it will be clear of the rotating resistor 10 between chucks 88 and 90, and where it will receive another resistor 10 from the receiver 30. Cam 194 then operates to move the switch arm 204 into engagement with stationary contact 206 and out of engagement with the stationary contact 208. Coil 224 of relay 216 is thereupon energized through the following circuit, it being remembered that switch 138 is closed and switch 140 is open:

Secondary 170, through line 266, switch 182, lines 268, 270 and 272, coil 224, line 274, switch 204, stationary contact 206, line 382, closed switch 138, lines 384 and 280, switch 244 of relay 222, lines 282 and 284, switch 180 and line 286 to transformer 168.

The operations above described are repeated in reverse order as the chucks 88 and 90 move from the right

to the left and thus to the position illustrated in Fig. 1 of the drawings. It is thus seen that during a complete cycle of reciprocation of the carriage **44**, two resistors **10** are grooved spirally and discharged to a receptacle below deflector **104**.

The adjustable stops **124—124** in the path of travel of the screw **120** operate to move the resistor **10** away from the cutter wheel **72**. Accordingly, the solenoid **136** and its associated air valve is utilized to swing the arms **70** still further and thereby positively clear the cutter wheel **72** for replacement of resistors between the chucks **88** and **90**.

In the event the machine fails to deliver a resistor **10** between the chucks **88** and **90**, release of the air valve **106** will cause the disc **118** to close the contacts of switch **130** by the action of spring **92**, see Figs. 1 and 8. Such action energizes coil **230** of relay **222** and a bell **386** (Fig. 8) through the following circuit:

From secondary winding **214** of transformer **210** through lines **354**, **388** and **390**, closed switch **130**, lines **392**, **394** and **396**, coil **230**, and lines **398**, **400** and **362** to secondary winding **214**.

The electrical bell **386** is coupled in parallel with the last mentioned circuit by means of lines **402** and **404**, the latter joining lines **394** and **396**. Opening of the contacts **244** and **246** within the circuits for coil **224** of relay **216** and within the circuits for motor **186**, and solenoid **136** respectively, causes a complete shut-down of the machine with the exception only of the continuously rotating cutter wheel **72**. Coupling of the safety switches **132** and **134** in the manner illustrated in Fig. 8 of the drawings, causes the same safety action and operation of alarm **386** when a mechanical defect takes place in the mechanism for rotating the shafts **84** and **86** and causing reciprocation of the carriage **44** through the action of motor **82**.

Since resistors **10** rotate in one direction when the carriage **44** moves to the left, viewing Fig. 1, and in the opposite direction when the carriage moves to the right, there will be a tendency of variance in pressure between the resistor being spirally grooved and the cutter **72**. Accordingly, when the carriage **44** moves in one direction, the extension **164** engages the dog **162** to swing the same against the spring **158**, increasing the tension thereof and thereby increasing the bias of the resistor **10** being cut upon the peripheral cutting edge of wheel **72**.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. In a machine for automatically forming spiral grooves in electrical resistors, said machine having a rotatable cutter disc, the improvement including a carriage reciprocable relative to the disc; a pair of spaced shafts rotatable on aligned axles parallel with the path of travel of the carriage and the axis of rotation of the disc, said shafts having chuck means adapted to receive a resistor therebetween, one of the shafts being longitudinally shiftable for releasing the chuck means when the one shaft is shifted away from the other shaft; resilient means yieldably biasing said one shaft toward said other shaft; a support for the shafts swingably mounted on the carriage for reciprocation therewith and for movement of the resistor held by the chuck means into and out of cutting engagement with the periphery of said disc; a reversible prime mover operably coupled with said other shaft for reciprocating the carriage and for rotating the shafts in one direction when the carriage moves in one direction and in the opposite direction when the carriage moves in the opposite direction; means mounted on the carriage for reciprocation therewith and connected with the support for swinging the same toward the disc; spaced, stationary elements engageable alternately with the support at each end of the path of travel of the carriage for swinging the support away from the disc; and means mounted on the carriage for reciprocation therewith and operably coupled with said one shaft for shifting the same away from the other shaft against the action of said resilient means when the support is swung away from the disc to release the chuck means at each end of said path of travel of the carriage.

2. In a machine for automatically forming spiral grooves in electrical resistors, said machine having a rotatable cutter disc and a feeder adapted to discharge the resistors singly, the improvement including a carriage reciprocable relative to the disc; a pair of spaced shafts rotatable on aligned axles parallel with the path of travel of the carriage and the axis of rotation of the disc, said shafts having chuck means adapted to receive a resistor therebetween, one of the shafts being longitudinally shiftable for releasing the chuck means when the one shaft is shifted away from the other shaft; resilient means yieldably biasing said one shaft toward said other shaft; a support for the shafts swingably mounted on the carriage for reciprocation therewith and for movement of the resistor held by the chuck means into and out of cutting engagement with the periphery of said disc; a reversible prime mover operably coupled with said other shaft for reciprocating the carriage and for rotating the shafts in one direction when the carriage moves in one direction and in the opposite direction when the carriage moves in the opposite direction; means mounted on the carriage for reciprocation therewith and connected with the support for swinging the same toward the disc; spaced, stationary elements engageable alternately with the support at each end of the path of travel of the carriage for swinging the support away from the disc; means mounted on the carriage for reciprocation therewith and operably coupled with said one shaft for shifting the same away from the other shaft against the action of said resilient means when the support is swung away from the disc to release the chuck means at each end of said path of travel of the carriage; and a device mounted on the carriage for reciprocation therewith and reciprocable toward and away from said chuck means for advancing a resistor from the feeder to the chuck means when the latter is released.

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