Feb. 6, 1940. J. A. LACKEY 2,188,906

APPARATUS FOR MAKING GRIDS

Filed Feb. 10, 1938 4 Sheets-Sheet 1

Fig. 2.

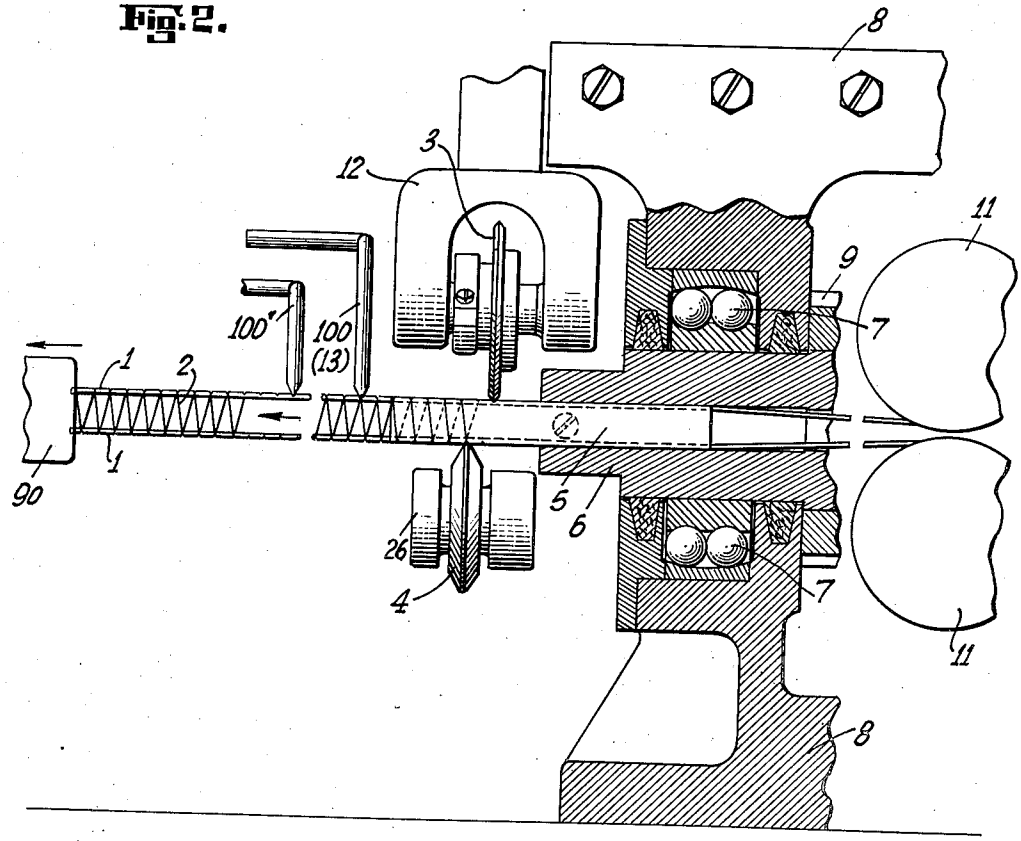
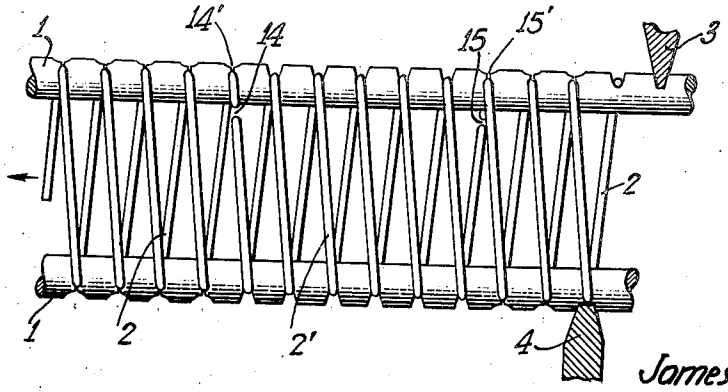


Fig. 1.



INVENTOR.
James A. Lockey
BY Bartlett Eyre Scott & Keel
ATTORNEYS.

Feb. 6, 1940. J. A. LACKEY 2,188,906

APPARATUS FOR MAKING GRIDS

Filed Feb. 10, 1938 4 Sheets-Sheet 2

Fig. 3.

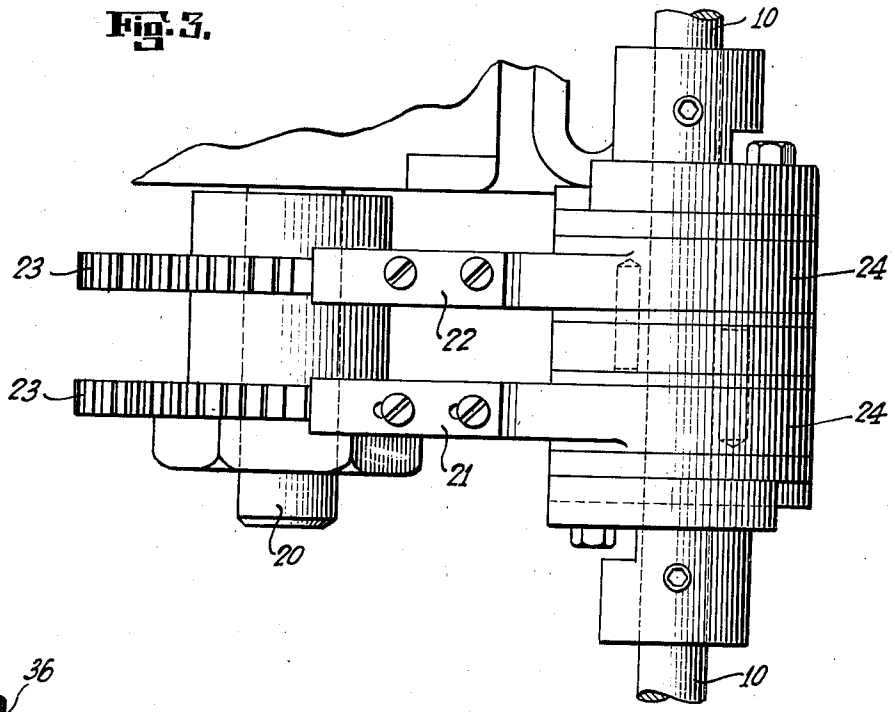
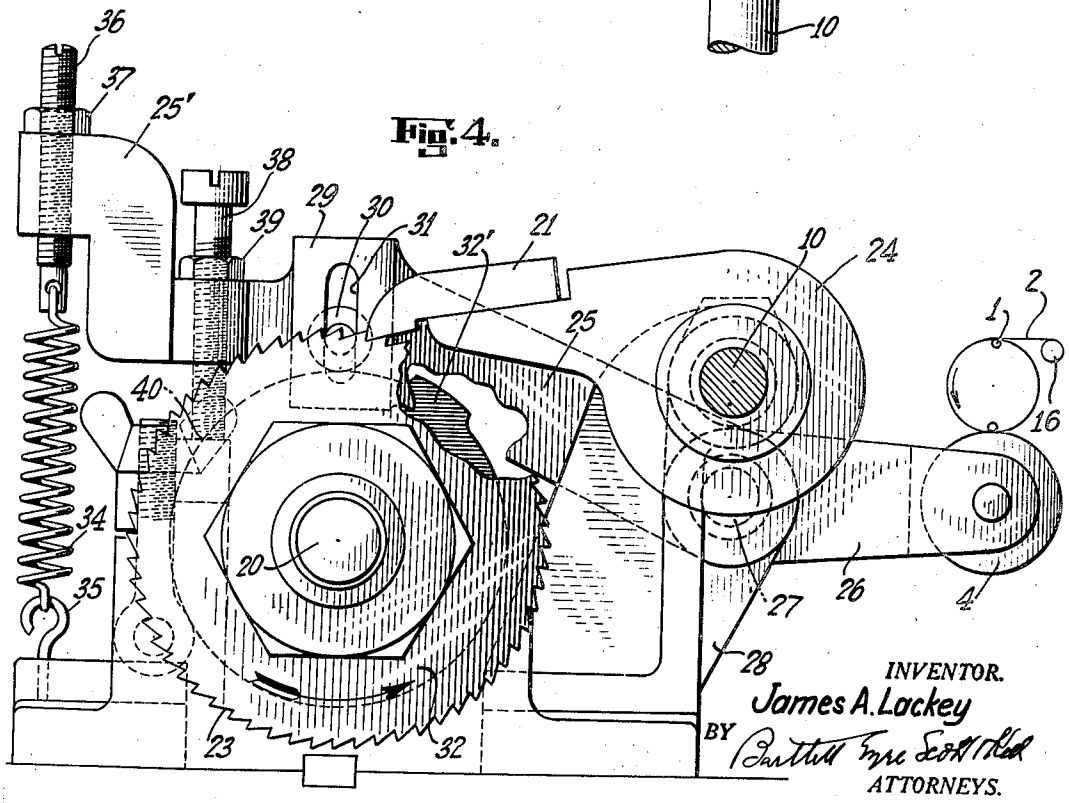


Fig. 4.



INVENTOR.
James A. Lackey
BY Bartlett Fyre Scott Reed
ATTORNEYS.

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APPARATUS FOR MAKING GRIDS

Filed Feb. 10, 1938 4 Sheets-Sheet 3

Fig. 5.

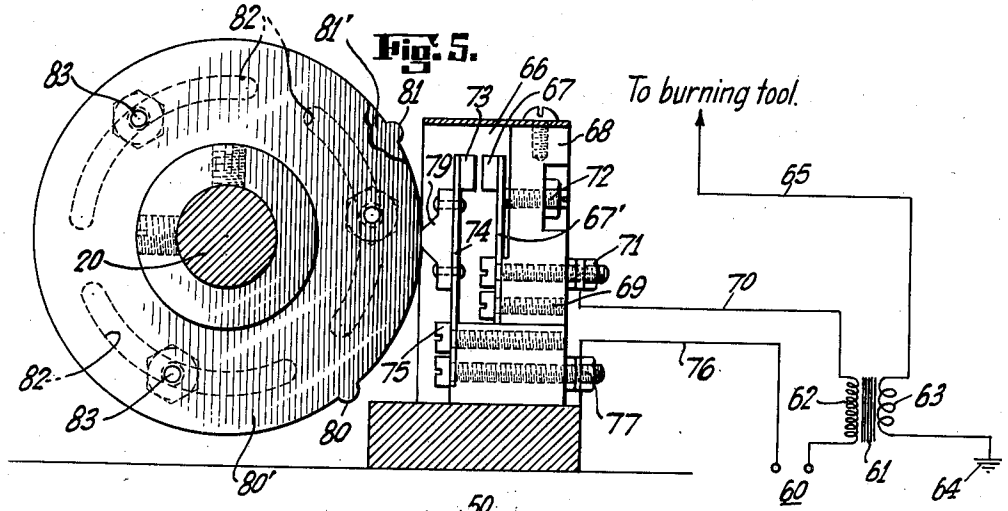
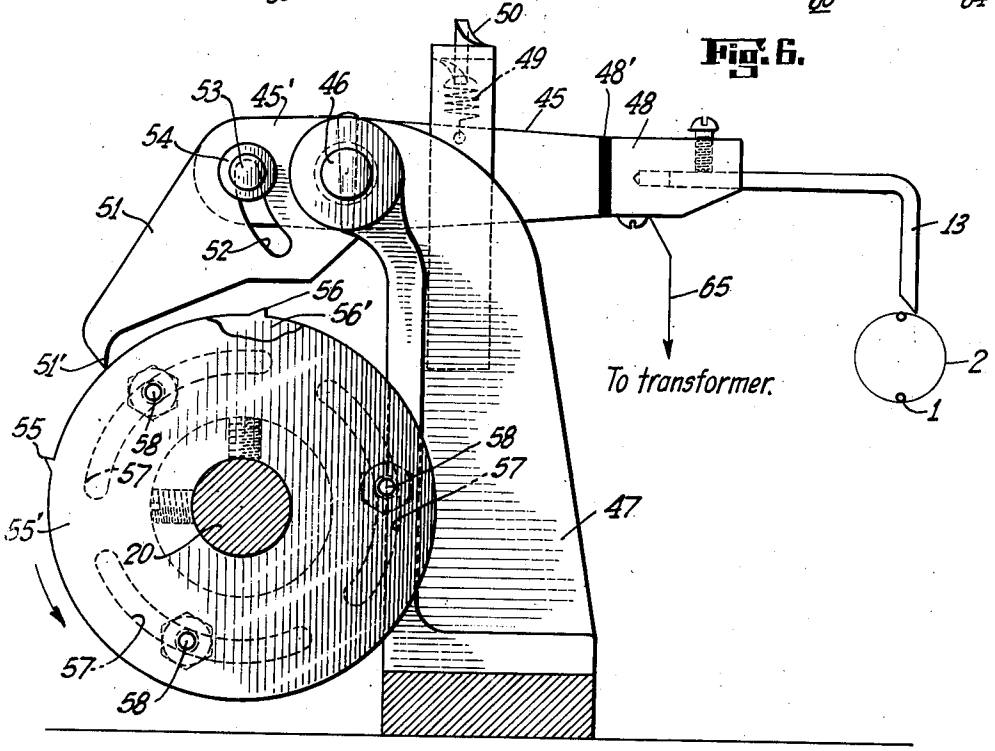


Fig. 6.



INVENTOR.
James A. Lackey.
BY
Bartlett Eyre Scott & Reed
ATTORNEYS.

Feb. 6, 1940. J. A. LACKEY 2,188,906

APPARATUS FOR MAKING GRIDS

Filed Feb. 10, 1938 4 Sheets-Sheet 4

Fig. 7.

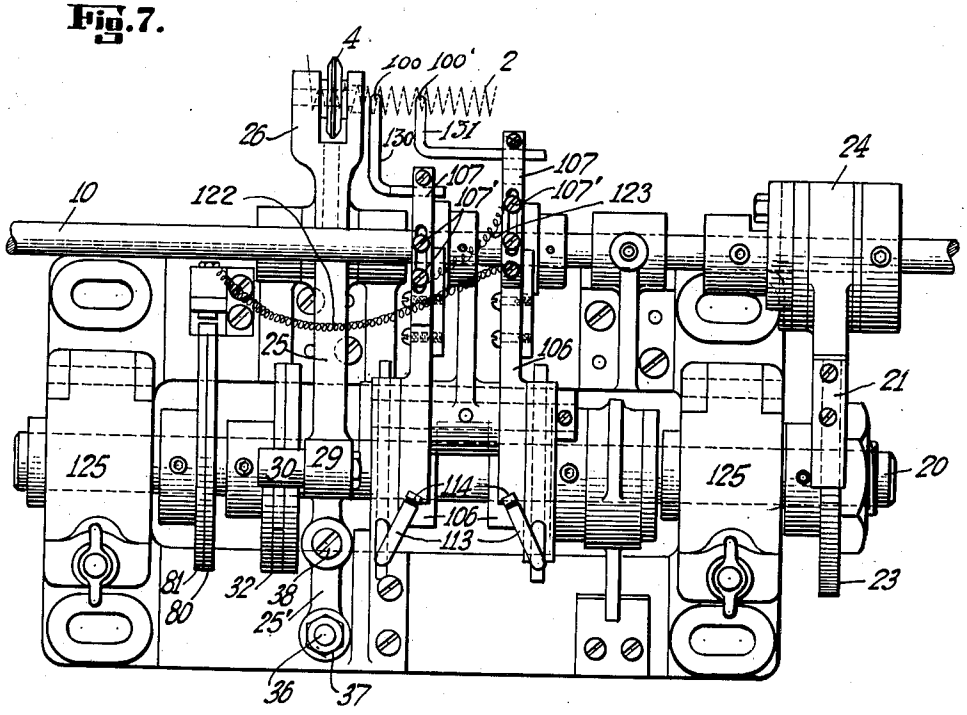
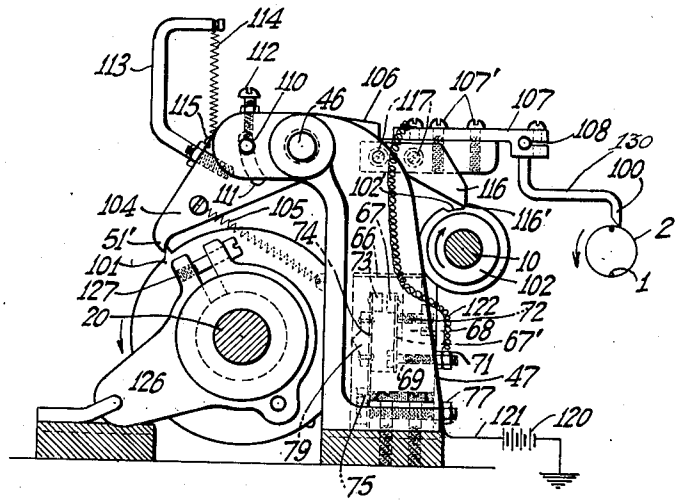


Fig. 8.



INVENTOR.
James A. Lackey
BY
Burton Fyre Scott & Hall
ATTORNEYS.

Patented Feb. 6, 1940 2,188,906

UNITED STATES PATENT OFFICE

2,188,906

APPARATUS FOR MAKING GRIDS

James A. Lackey, Belleville, N. J., assignor to Tung-Sol Lamp Works Inc., Newark, N. J., a corporation of Delaware

Application February 10, 1938, Serial No. 189,813

22 Claims. (Cl. 140—71)

This invention relates to the making of grids used in thermionic or electron discharge tubes and similar devices.

More particularly the invention relates to the manufacture of grids comprising a pair of parallel support wires with the grid wire wound thereabout in the form of a helix and with the turns lying in and fastened in notches formed in the support wires. The common practice in the manufacture of these grids is to form a multiple number of grid sections upon the support wires with the grid wire wound continuously about the support wires but wound loosely and unfastened about the support wires at predetermined intervals at points where the multiple grid length is to be severed to form the individual grid units. The invention relates particularly to a machine for forming such grids comprising a rotating mandrel for the support wires, a notching wheel for forming notches in the wire, means for feeding the support wire along the rotating mandrel and for feeding grid wire thereto, and an abrading wheel for fastening the grid turns within the notches formed in the support wire.

One object of the invention is the automatic severing of the unfastened sections of wound grid wire as the multiple grid length is progressively formed, whereby the unfastened and severed loosely wound grid wire may be readily removed from the adjacent grid sections, and particularly a novel method and apparatus for accomplishing that result.

A further object of the invention is a novel machine of the above indicated type wherein the loosely wound and unfastened sections of grid wire are severed by an electrical burning off tool or tools operating in timed relation with the other elements of the machine to burn off the ends of the unfastened sections at points adjacent the fastened ends of the fastened sections without impairing the latter.

A further object of the invention is a machine of the above indicated character wherein both the lengths of the fastened grid wire sections and the unfastened grid wire sections may be readily varied at will.

Further objects of the invention will hereinafter appear.

For a better understanding of the invention reference may be had to the accompanying drawings forming a part of this application wherein:

Fig. 1 shows a section of a multiple grid length to be formed;

Fig. 2 is an elevational view diagrammatically illustrating partly in section and with parts omitted a machine embodying the invention;

Fig. 3 is a plan view showing the drive for the control cam shaft;

Fig. 4 is an elevational view showing the mechanism for operating the abrading tool;

Fig. 5 is a view of the electrical circuit for the burning off tool together with means for controlling the circuit;

Fig. 6 is a view showing the mechanism for operating the burning off tool; and

Figs. 7 and 8 are views showing a modification of the invention.

Referring to Fig. 1 of the drawing there is shown a multiple section grid length having support wires 1, grid wire 2 coil therearound having its turns disposed in notches formed by the notching wheel 3 and fastened therein by an abrading wheel 4. At 2' is shown a section of the loosely wound unfastened grid wire between two adjacent grid sections having the wire fastened thereto.

Referring to Fig. 2 a conventional mandrel 5 is shown which is carried by a rotating sleeve or drum 6, the latter being revolubly mounted in bearings 7 carried by the frame 8. The sleeve 6 is driven by means omitted for convenience in illustration. A gear 9 keyed to the sleeve 6 meshes with a pinion or gear (not shown) on the drive shaft 10 (Fig. 3).

The mandrel 5 is of any conventional form having grooves on the opposite sides thereof for accommodating the support wires 1 which are unreeled from the reels 11, the latter being mounted for rotation with the mandrel 5 and the sleeve 6, this mounting being omitted for convenience in illustration. The notching wheel 3 is carried by a bracket 12 and this bracket 12 is readily adjustable in any suitable manner to obtain the desired depth of the notches in the support wires 1 as well as to enable the wheel to be removed entirely if desired from operative engagement with the support wires, the adjusting mechanism being omitted for convenience in illustration.

The abrading wheel 4 is carried and operated by the mechanism indicated in Figs. 3 and 4. A burning off tool 13 is indicated for burning the grid wire off at the points 14 and 15 (Fig. 1), and the circuit and mechanism for supplying electrical potential to the tool 13 at the required time and for operating the tool is shown in Figs. 5 and 6. A reel 16 for supplying the grid wire 2 to the rotating mandrel 5 is indicated diagrammatically in Fig. 4.

A cam shaft 20 suitably mounted and journaled in the machine frame is driven from the drive shaft 10. The particular drive illustrated comprises a pair of pawls 21 and 22, operating ratchet wheels 23 which are keyed to the cam shaft 20. These pawls 21 and 22 are driven by eccentrics 24 which are keyed to the drive shaft 10. By means of this doubled pawl ratchet drive mechanism a rotation is imparted to the cam or control shaft 20 which approaches a continuous rotational movement and at a high reduction ratio with respect to the drive shaft 10.

The abrading wheel 4 is carried by a lever 26 which is pivoted or fulcrumed at 27 on the frame part 28. On the opposite side of the fulcrum point 27 from the abrading wheel 4 the lever 26 comprises an elongated arm 25 having an enlargement 29 for adjustably carrying a roller 30, this roller 30 being adjustably carried in any suitable manner in a slot 31 formed in the enlargement 25. The roller 30 bears on the periphery of cam wheel 32 which is keyed or suitably fastened to the control shaft 20. This wheel 32 has a cylindrical bearing surface of equal radii from the axis of the control shaft 20 for the greater portion of its circumference, but is provided with a raised cam surface 32' for engaging the roller 30 during a certain portion of each revolution and thereby withdrawing the abrading wheel 4 from engagement with the support wires 1 disposed on the mandrel 5. The cam 32' of the wheel 32 corresponds to the unfastened section of the grid wire 2' and is of variable length circumferentially of the wheel 32 for varying the length of the unfastened grid wire sections relatively to that of the fastened sections. This variable cam 32' is of any conventional construction, as for example of adjustable mating discs and the adjustable feature is omitted for convenience in illustration. The outer end of the lever arm 25 is formed into a right angle part 25' and a spring 34 having one end fastened at 35 to the machine frame and having its other end fastened by an adjustable screw 36 to the part 25' of the lever is illustrated for yieldingly retaining the roller 30 of the lever 25 in engagement with the cam wheel 32. An adjustable set screw 38 is screw threadedly attached to the lever arm 25 with its lower end abutting against a bearing surface 40 on the frame for adjusting and limiting the movement of the abrading wheel 4 towards the mandrel 5. The adjustable set screw 38 and the adjustable roller 30 form together a means for accurately adjusting the abrading and fastening operations of the abrading wheel 4.

The burning off tool 13 is carried on one end of a lever 45 which is fulcrumed at 46 upon the frame part 47. The burning off tool or electrode 13 is insulatedly carried by the insulated holder 48, diagrammatically illustrated, which is suitably fastened to the end of the lever 45. The lever 45 and the electrode 13 are normally yieldingly held by a spring 49 in such position that the electrode 13 does not contact the grid wire of the mandrel 5, this spring 49 being attached at one end to the lever 45 and at the other end to a bracket or arm 50. The lever 45 has an end 45' overhanging the fulcrum point 46 and to this end 45' there is adjustably fastened a cam engaging part 51, the latter having a toe 51' for engaging the cams to be described below. The lever member 51 is pivotally mounted at 46 and is provided with an arcuate slot 52 which accommodates a screw 53 carried by the end 45' of the lever and a clamping nut 54 is illustrated for clamping the member 51 to the end 45' of the lever in any adjusted position.

The lever 45, 51 and electrode 13 are actuated by a pair of cams 55 and 56 which are keyed or otherwise fastened to the cam shaft 20. The cams 55 and 56 are mounted on separate abutting discs, one of which discs is provided with arcuate slots 57 and the other disc is provided with clamping screws 58 for clamping the two discs in adjustable relation to each other, these discs being indicated at 55' and 56'. Thus the arcuate distance between the cams 55 and 56 is adjusted to correspond to the relative lengths of the unfastened grid wire sections 2' and the fastened sections.

The electrical circuit for the burning off tool 13 is indicated in Fig. 5 and comprises terminals 60 for connection to the power line (not shown), a transformer 61 having a primary 62 and a secondary 63. The secondary 63 is connected at one side to the ground 64 and at the other side to the line 65 leading to the burning off tool or electrode 13. The circuit through the primary 62 is automatically closed and opened by means of a switch 66 comprising a contact 67 carried by a spring arm 67', the latter being attached to an insulating block 68 by a screw 69. The primary 62 is connected by means of a wire 70 with a terminal 71 fastened to the contact arm 67'. An adjustable set screw 72 is screw threadedly attached to the insulating block 68 and engages the back of the spring arm 67' to adjust the gap between the contacts of the switch or circuit breaker 66. The other contact 73 of the switch 66 is carried by a spring arm 74 which is fastened to the insulating block 68 by means of a screw 75. One terminal 60 is connected through line 76 with terminal 77 leading to the spring arm 74 and the contact 73. The spring arm 74 is provided with a boss or an abutment 79 having a part disposed in the path of the cams 80 and 81, which engage the abutment 79 to close the switch 66 while the electrode 13 is in contact with the grid wire to be severed. These cams 80 and 81 are carried by abutting discs 80' and 81' which are keyed or otherwise fastened to the control shaft 20. The cams 80 and 81 are adjustable towards or away from each other by the adjustment of the discs which carried them, one of these discs being provided with arcuate slots 82 and the other of said discs being provided with clamping screws 83 passing through said slots 82, whereby the two discs may be rotatably adjusted with respect to each other.

In Figs. 7 and 8 is shown a modification of the invention. According to this modification there is a separate electrode or burning off tool, 100 and 100', for severing the grid wire at the points 14 and 15 (Fig. 1) and each electrode is controlled and operated by two separate cams, one cam 101 on the cam or control shaft 20 and the other cam 102 on the shaft 10 which is geared to the sleeve 6 to run at the same speed as the latter. Each electrode or tool is carried by a lever mechanism pivotally mounted on the upper end of the frame member 47 at 46. This lever mechanism is formed of two relatively movable parts, both pivoting about the axis 46. One of these parts is indicated at 104 having a toe part 51' which rests on the periphery of the disc carrying the cam 101. The lever 104 is fastened by a spring 105 to the frame member 47 and this spring yieldingly holds the lever 104 into engagement with the disc carrying the cam 101.

The other relatively movable part of the electrode lever mechanism is indicated at 106 and is pivotally mounted on the frame member 47 to pivot about the axis 46. The electrode or tool is carried by a member 107 which is split at its outer end to form a pair of clamping jaws 108, these jaws being provided with a screw for adjustably clamping the electrode or tool therebetween. The electrode is preferably of copper or copper alloy and the carrying member 107 is of any suitable metal and is fastened to the upper surface of the right hand end (Fig. 8) of the lever part 106 by means of the screws 107'. The left hand portion of the lever member 106 carries a pin 110 which projects through an arcuate slot 111 formed in the lever member 104, and the latter carries a set screw 112 which projects into the upper end of the slot 111 whereby the relative pivotal movement between the two parts 104 and 106 is adjustably limited in one direction. The lever member 104 also carries an upright arm 113 having its upper end bent at right angles and to the latter is fastened a spring 114, the latter being fastened at its lower end by means of the screw 115 shown to the lever part 106. This spring 114 tends to maintain the lever part 106 in a position where the pin carried thereby engages the set screw 112. On the opposite side of the axis 46 from the lever part 104 the lever part 106 carries an actuating member 116 having a knife edge toe 116' in engagement with the cam 102, this member 116 being fastened to the side of the lever member 106 by means of the screws 117. The spring 14 tends to hold the member 116 in contact with the periphery of the cam disc 102, and the latter has a cut out portion 102' into which the member 116 abruptly drops when the cam disc 102 reaches that position and when so permitted by the lifting of lever 104 by cam 101. The adjustment is such that with the toe 51' of lever 104 in engagement with the periphery of the disc carrying the cam 101, the member 116 is prevented from falling into the cut out part 102' when the disc 102 carries its cut out 102' therepast; and the member 116 is permitted to drop into the cut out part to bring the electrode or tool into contact with the grid wire only when the cam 101 operates the member 104 to lift the set screw 112 and move it away from the pin 110. The cam disc 102 being disposed on the shaft 10 operates at a very much faster speed than that of control shaft 20 on which the cam 101 is mounted and the tool is in contact with the grid wire only while the cut out 102' is passing under the actuating member 116, which is just for an instant. The cam 101 determines the short period during which the tool may be brought into contact with the grid wire, and the cam 102, 102' determines the instant of contact during such period. The lever member 106 is of any insulating material for carrying and insulating the tool 100, 100', or it may be of metal and the tool insulatedly carried thereby.

There is, as indicated above, a separate cam and lever actuated mechanism for each of the electrodes or burning off tools 100 and 100' and these mechanisms are substantially alike and, accordingly, the description above answers for both. It is observed, however, that the carrying members 107 for the tools are of different lengths to correspond to the different lengths of the portions 130 and 131 of the tools 100 and 100' as shown in Fig. 7. These tools are otherwise substantially identical, and each comprises the four right angle bends indicated to bring the contacting ends of the tools to the desired positions adjacent the grid being formed and the cutting and swaging members.

Each of the cams 80 and 81, through the actuating projection 79, closes and opens the circuit in fairly rapid succession, and simultaneously therewith the electrode is brought into contact for an instant with the grid wire at the point where it is to be severed. In the modification of Figs. 3 and 6 the single electrode 13 is thus brought into contact with the grid wire to sever the grid wire both at the points 14 and 15, whereas in the modification of Figs. 7 and 8 the electrode 100 severs the wire at the point 15 and the electrode 100' severs the wire at the point 14. Since each electrode in the latter modification has an independent operating mechanism, each such latter may be adjusted entirely independently of the mechanism for the other electrode, and, accordingly, these mechanisms may be accurately adjusted to bring the electrodes into contact with the grid wire at the points 14 and 15 at the same time or at different times.

A single switch mechanism, identical with that illustrated in Fig. 5, functions to control the current supply to both electrodes 100 and 100' and electrical potential is, therefore, supplied between these electrodes and the grid wire at the same time. Whether the electrodes are operated by their cam mechanisms and brought into contact with the grid wire at the same instant or at different times, the burning off current can flow only when an electrode 100 or 100' is brought into contact with the grid wire, and the latter operations are governed by the independently adjustable operating mechanisms for the electrodes.

The circuits in the two cases Fig. 5 and Figs. 7, 8 are slightly different in that in Fig. 5 a transformer is interposed in the circuit with the switch 66 which opens and closes the primary 62 of the transformer, while the secondary 63 is connected with the burning off tool; whereas in the modification of Figs. 7 and 8 the transformer is not utilized but instead a battery 120 is connected directly with the tools 100 and 100' through the switch control mechanism. This circuit connection comprises a conductor 121 leading from the battery to the terminal 77 and a conductor 122 leading from the terminal 71 to a screw connection on the tool carrying member 107. The return circuit, of course, is through the ground. The two tools 100 and 100' are connected in multiple by a conductor 123.

The cams 55 and 56 of Fig. 6 and 101 of Figs. 7 and 8 are observed to have inclined surfaces on the leading side and substantially radial surfaces on the other, the inclined surfaces being disposed on the advancing side for engagement with the toe 51' of the actuator 51 of Fig. 6 and the toes 51' of the actuators 104 of Figs. 7 and 8. The radial surfaces of these cams 55, 56 to the rear effects a comparatively quick withdrawal of the electrode from contact with the grid wire. In the modification, however, of Figs. 7 and 8 the period during which the electrodes 100 and 100' are in actual contact with the wire is governed by the speed of the cams 102 and the length of the cut out 102' and this period of actual contact between the electrode and the grid wire is very much shorter than is the case with the modification of Fig. 8. This short period or instant of actual contact is important because of the fact that the mandrel and the grid being formed are rotating at a comparatively high speed, the same speed as the shaft 10. The speed of operation

of the grid forming mechanism therefore may be maintained at a high production rate, and the independently adjustable operating burning off tool mechanisms facilitate accurate adjustments for severing the grid wire at the points 14 and 15.

In the modification of Figs. 7 and 8 only one eccentric 24, pawl 21 and ratchet wheel 23 mechanism is utilized for driving the control shaft 20 from the eccentric or drive shaft 10. In the modification of Fig. 3 wherein the two eccentrics and pawl drive mechanisms are employed the drive of the control shaft 20, while intermittent approaches more nearly a uniform drive, but I have found that the degree of uniformity of drive of the shaft 20 is relatively unimportant in the modifications of Figs. 7 and 8 embodying the separate burning off tools and the separate actuating and control mechanisms therefor.

Referring to Fig. 7 the control shaft 20 is provided with a pair of split bearings 125 at the opposite ends whereby the shaft as a unit with the controls thereof adjusted for any particular grid may be removed as a unit and another unit for a different design of grid may be substituted.

At 126 there is illustrated a friction brake which prevents the overrunning of the control shaft 20, the degree of grip of this brake being adjustable through the tightening screw 127.

The operation is clear from above: Cam 32', for actuating the abrading wheel 4 to a position outside the path of the rotating support wires 1, is adjusted as to its circumferential length to obtain the desired relative lengths of fastened and unfastened sections of grid wire coils 2 and 2'. With that desired adjustment obtained, the cams 101 (and cams 55 and 56), 80, and 81 are then adjusted to operate the burning off tools 100, 100' (and 13) and supply electrical potential between the tools and the grid wire at the desired times and points for severing the unwound sections of the grid wire 2' at the points 14 and 15. For example, looking at Fig. 1 and with the top wire 1 moving away from the observer, the relative adjustments of the cams 101 and 80 and 81 are such as to bring the burning off tools 100 and 100' in contact with the grid wire at the points 15 and 14, and the severing at the point 15 is effected as soon after the abrading operation at 15' as is practicable. The severing at 14 occurs at any suitable time after the abrading operation at 14' and, as indicated above, the adjustments may be such, if desired, as to sever at the points 14 and 15 at the same instant. The electrode (100) which severs at the point 15 comes in contact with the grid wire when the upper wire 1 of Fig. 1 is advancing toward that electrode and the electrode (100') which severs at the point 14 makes contact with the grid wire just as the upper wire 1 has passed under and is moving away from that electrode, assuming the upper wire 1 in Fig. 1 is moving away from the observer.

In the modification wherein the single tool 13 is employed this single electrode is timed, of course, to sever the grid wire at both of the points 14 and 15 between two adjacent grid wire fastened sections. In the circuit of Fig. 5 either alternating current or direct current may be supplied to the terminals 60 preferably direct current, as from a storage battery 120, whereby electrical impulses are caused to pass through the primary 62 of the transformer by the opening and closing of the switch 66, which in turn sets up electrical impulses in the circuit including the secondary 63 for burning the grid wire.

The unfastened sections 2' of the grid wire thus severed may be easily and readily removed.

At 90 is illustrated any conventional rotating clamp for drawing the support wires 1 along the mandrel 5, as the notching wheel 3, and the abrading wheel 4 fastens the grid wire thereabout which is supplied from the reel 6 and as the burning off tools 100 and 100' (and 13) function as above described to sever the unwound sections 2' progressively as the grid length increases. When the clamp 90 reaches its limit of translational movement toward the left, the machine is stopped and the multiple grid length or unit thus formed is severed from the support wires 1 at any convenient point adjacent the wheels 3 and 4 and between two adjacent fastened coils 2.

The multiple grid length or unit comprising the elongated support wires 1 and the sections of fastened coils 2 is then severed into its component parts to form the separate grids, the severing in each case taking place at a point between the adjacent abraded notches at 14' and 15'. One turn of shaft 20 corresponds to one cycle of operation, namely one grid

I claim:

1. In a grid machine, in combination, a rotating mandrel for support wire including means for supplying support wire thereto, means for feeding the support wire along the mandrel, a notching wheel for forming notches in the wire as the latter is drawn along the mandrel, means for feeding grid wire to form the grid coils about the support wire with the grid wire disposed in the notches formed by the notching wheel, an abrading wheel for fastening the grid turns within the notches, including means for withdrawing the abrading wheel from engagement with the support wire at intervals to provide unfastened sections of grid wire turns alternating with fastened sections, movable electrode means and means for bringing the latter into contact with the grid wire to sever the unfastened grid wire sections, an electrical circuit for supplying electrical potential between the electrode and the grid wire, and means for closing said circuit simultaneously with the bringing of the electrode means into contact with the grid wire.

2. In a grid machine, in combination, relatively rotating mandrel and grid wire supply means, means for feeding a support wire along said mandrel about which the grid wire is wound, means for fastening the grid wire to said support wire at intervals with unfastened sections of grid wire between said intervals, electrode means together with means for causing the same to contact with the ends of the unfastened grid wire sections at points adjacent the fastened sections, and means for supplying electrical potential between said electrode means and the grid wire simultaneously with the bringing of the electrode means into contact with the unfastened grid wire sections.

3. In a grid machine, in combination, relatively rotating mandrel and grid wire supply means, means for feeding a support wire along said mandrel about which the grid wire is wound, means for fastening the grid wire to said support wire at intervals with unfastened sections of grid wire between said intervals, a pair of electrode mechanisms for burning off the unfastened sections, each of said mechanisms comprising a movable electrode, a pair of cams

rotating at different speeds for actuating said electrode to bring the electrode into contact with the grid wire and means for supplying electrical potential to said electrodes simultaneously with the bringing of the same into contact with the grid wire.

4. In a machine of the character set forth in claim 3 wherein each of the electrodes is carried by a lever mechanism including one part which is yieldingly held in engagement with a relatively slow speed cam and another relatively movable part having an interlock with the other part to limit the pivotal movement in one direction, said second named part being in operative engagement with a relatively faster moving cam and yielding means urging the second named part of the lever into engagement with the fast moving cam.

5. In a machine of the character set forth in claim 3 wherein each of the electrodes is carried by a lever mechanism including one part which is yieldingly held in engament with a relatively slow speed cam and another relatively movable part having an interlock with the other part to limit the pivotal movement in one direction, said second named part being in operative engagement with a relatively faster moving cam and yielding means urging the second named part of the lever into engagement with the fast moving cam, said interlock preventing the movement of the electrode to contact with the grid wire until the slow moving cam reaches a predetermined position, and said spring operating said electrode to contact the grid wire when permitted by said cam.

6. In a grid machine, in combination, relatively rotating mandrel and grid wire supply means, means for feeding a support wire along said mandrel about which the grid wire is wound, means for fastening the grid wire to the said support wire at intervals with unfastened sections of grid wire between fastened sections, and a burning off mechanism comprising a movable electrode adapted to be brought into contact with the unfastened sections of grid wire, a slow speed shaft and a relatively high speed shaft having cams thereon for controlling the electrode, with the slow speed cam determining periods during which the electrode may be brought into contact with the unfastened wire and the cam on the high speed shaft determining the instant during said period the electrode is brought into contact with the wire, and means operating in timed relation with the aforesaid cams for supplying electrical potential between the electrode and the grid wire simultaneously with the bringing of the electrode into contact with the grid wire.

7. In a machine of the character set forth in claim 6 wherein the electrode is controlled by two independently movable levers having limited pivotal movement with respect to each other, one of said levers engaging the cam on the slow speed shaft and the other of said levers engaging the cam on the high speed shaft, said low speed cam having a raised surface for establishing an angle through which the two levers may move relatively to each other and said fast speed cam having a lowered surface for permitting one of the levers to move through the angle permitted by the other lever when actuated by the raised cam surface.

8. In a grid machine, in combination, relatively rotating mandrel and grid wire supply means, means for feeding a support wire along said mandrel about which the grid wire was wound, means for fastening the grid wire to said support wire at intervals with unfastened sections of grid wire between fastened sections, a control shaft each of whose revolutions correspond to a grid length, a second shaft rotating at a higher speed, and means for severing the unfastened sections of grid wire comprising a movable electrode, cams on said shafts controlling the movements of said electrode to cause the came to make an instantaneous contact with the unfastened grid wire at each revolution of the first mentioned shaft and means operated in timed relation therewith for supplying electrical potential between the electrode and the grid wire simultaneously with the bringing of the electrode into contact with the grid wire.

9. In a machine of the character set forth in claim 8 wherein the electrode is mounted on a lever of insulating material having fastened thereto an actuating member yieldingly urged to operative engagement with the high speed cam, together with another lever in engagement with a slow speed cam and adjustable means limiting the relative pivotal movement between the levers.

10. In a machine of the character set forth, a rotating mandrel for support wire including means for supplying support wire thereto, means for feeding support wire along the mandrel, a notching wheel for forming notches in the wire as the latter is drawn along the mandrel, means for feeding grid wire to form the grid coils about the support wire with the grid wire disposed in the notches formed by the notching wheel, an abrading wheel for fastening the grid turns within the notches including means for withdrawing the abrading wheel from engagement with the support wire at intervals to form sections of fastened grid wire, separated by sections of unfastened grid wire, a shaft geared to rotate in unison with the mandrel, a control shaft with driving means for rotating the latter at a reduced speed from the first named shaft, a pair of independent severing mechanisms for severing the unfastened sections of grid wire at points adjacent the fastened sections on either side thereof, said mechanisms comprising a pair of electrodes spaced from each other in the direction of movement of the support wire, each of said mechanisms comprising cams on said shafts and lever members in engagement with the cams and carrying electrodes, an electrical circuit including a switch for supplying electrical potential between the electrodes and the grid wire and a cam on the second named shaft for operating said switch when the electrodes are in contact with the grid wire.

11. In a machine of the character set forth in claim 1 wherein the means for severing the unfastened sections of grid wire consists of a single electrode mechanism for severing the unfastened sections at both ends.

12. In a machine of the character set forth in claim 1 wherein the means for severing the unfastened sections comprises a pair of separate and independent electrode mechanisms for severing the unfastened sections at their opposite ends.

13. In a machine of the character set forth in claim 10 wherein the reduced speed shaft is driven from the other shaft by means of a pawl and the eccentric drive.

14. In a grid machine, in combination, a rotating mandrel for support wire including means for supplying support wire thereto, means for

feeding the support wire along the mandrel, a notching wheel for forming notches in the wire as the latter is drawn along the mandrel, means for feeding grid wire to form the grid coils about the support wire with the grid wire disposed in the notches formed by the notching wheel, an abrading wheel for fastening the grid turns within the notches, including means for withdrawing the abrading wheel from engagement with the support wire at intervals to provide unfastened sections of grid wire turns alternating with fastened sections, movable electrode means and means for bringing the latter into contact with the grid wire to sever the unfastened grid wire sections, an electrical circuit for supplying electrical potential between the electrode and the grid wire, and means for closing said circuit simultaneously with the bringing of the electrode means into contact with the grid wire, and a control shaft and a drive shaft for the control shaft, with a pair of separate eccentric and pawl drive mechanisms between the two shafts for driving the control shaft at a reduced speed.

15. In a machine of the character set forth in claim 10 wherein a friction brake is in operative engagement with the control shaft for the purpose set forth.

16. In a grid machine, in combination, relatively rotating mandrel and grid wire supply means, means for feeding a support wire along said mandrel about which the grid wire is wound, means for fastening the grid wire to said support wire at intervals with unfastened sections of grid wire between said intervals, electrode means together with means for causing the same to contact with the ends of the unfastened grid wire sections at points adjacent the fastened sections, and means for supplying electrical potential between said electrode means and the grid wire simultaneously with the bringing of the electrode means into contact with the unfastened grid wire sections, and a control shaft with means thereon for determining the character of the grid and means including split bearings whereby said shaft with the mechanisms thereon may be replaced with another unit adjusted for a different grid.

17. In a grid machine, in combination, relatively rotating mandrel and grid wire supply means, means for feeding a support wire along said mandrel about which the grid wire is wound, means for fastening the grid wire to the said support wire at intervals with unfastened sections of grid wire at said intervals, an electrode mechanism for burning off the unfastened sections, said mechanism comprising an electrode, a pair of cams rotating at different speeds for actuating said electrode to bring the electrode into contact with the grid wire and means for supplying electrical potential to said electrode.

18. In a grid machine in which there are relatively rotating mandrel and grid wire supply means, means for feeding a support wire along said mandrel about which the grid wire is wound, and means for fastening the grid wire to said support wire at intervals with unfastened sections of grid wire at said intervals, an electrode mechanism for burning off the unfastened grid wire comprising a movable electrode, a slow speed cam and a high speed cam for actuating said electrode to bring the electrode into contact with the grid wire, said slow speed cam determining the period during which the electrode may be brought into contact with the unfastened wire and said high speed cam determining the instant during said period the electrode is brought into contact with the wire and means for supplying electrical potential to said electrode.

19. A machine of the character set forth in claim 2 wherein the means for supplying electrical potential includes a circuit having therein a normally open switch and a cam operating in timed relation with means for actuating the electrode means for closing the circuit when the electrode contacts with the grid wire.

20. In a machine of the character set forth in claim 2 wherein the electrode means and means for causing the same to contact with the ends of the unfastened grid wire sections comprises a rotating cam, a lever carrying an electrode, one end of said lever being in operative engagement with said cam, and spring means for holding said end of the lever in engagement with the cam.

21. In a grid machine, in combination, relatively rotating mandrel and grid wire supply means, means for feeding a support wire along said mandrel about which the grid wire is wound, means for fastening the grid wire to the said support wire at intervals with unfastened sections of grid wire between fastened sections, and a burning off mechanism comprising a movable electrode adapted to be brought into contact with the unfastened sections of grid wire, a slow speed shaft and a relatively high speed shaft having cams thereon for controlling the electrode, with the slow speed cam determining periods during which the electrode may be brought into contact with the unfastened wire and the cam on the high speed shaft determining the instant during said period the electrode is brought into contact with the wire, and means supplying electrical potential to said electrode.

22. In a machine of the character set forth in claim 21 wherein the burning off mechanism comprises two relatively movable levers, one of said levers carrying the electrode and being in operative engagement with the high speed cam and the other of said levers being in engagement with the slow speed cam.

JAMES A. LACKEY.

CERTIFICATE OF CORRECTION.

Patent No. 2,188,906. February 6, 1940.

JAMES A. LACKEY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 34, for "spring 14" read spring 114; same page, second column, line 71, for "Fig. 8" read Fig. 6; page 5, second column, line 9, claim 8, for the word "came" read same; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 2nd day of April, A. D. 1940.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)