Jan. 19, 1937. H. P. KRONENWETTER ET AL 2,068,628

APPARATUS FOR TRIMMING GRID ELECTRODES

Filed June 12, 1935

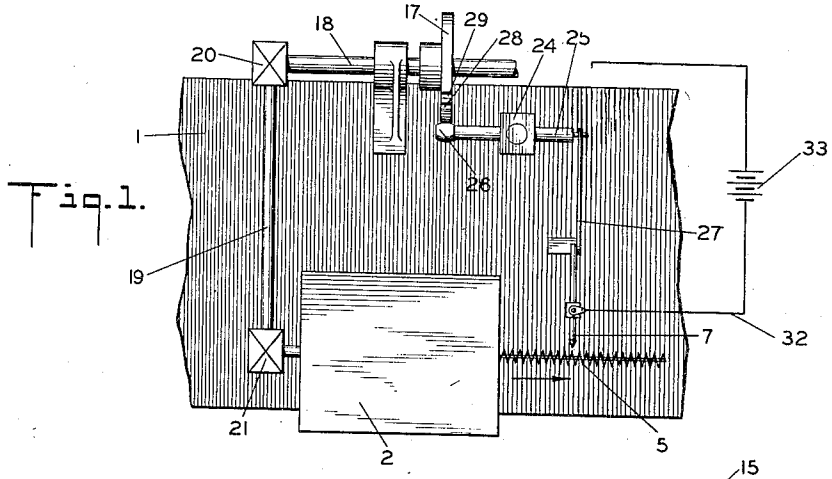


Fig. 1.

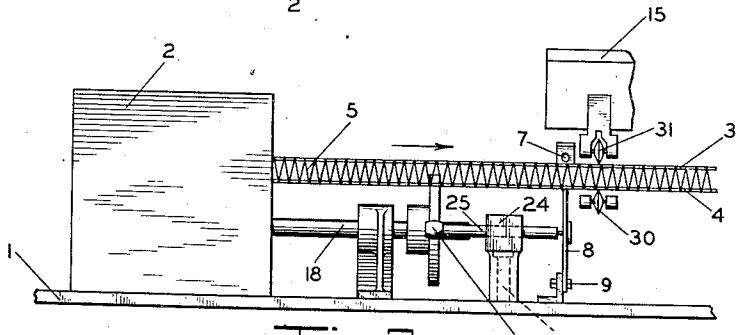


Fig. 2.

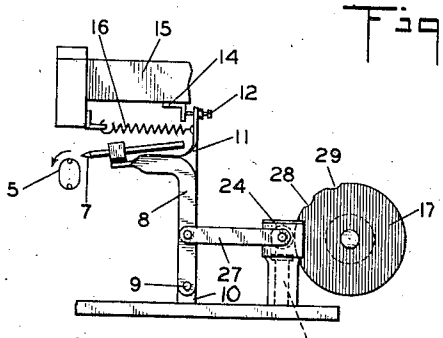


Fig. 3.

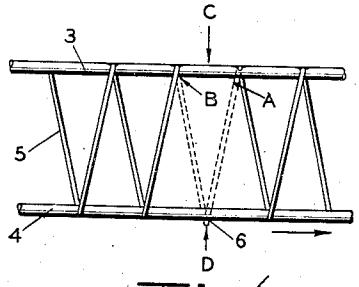


Fig. 4.

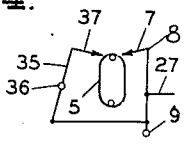


Fig. 6.

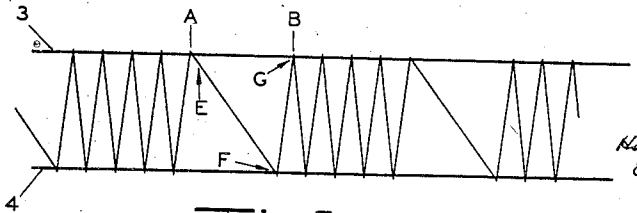


Fig. 5.

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APPARATUS FOR TRIMMING GRID ELECTRODES

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11 Claims. (Cl. 140—71)

This invention relates to grid making machines and with particularity to improvements in apparatus for making wire grids for radio tubes or the like.

An object of the invention is to provide an efficient and economical apparatus for trimming the loose ends of so-called wire-wound grid electrodes such as are ordinarily employed in electric discharge tubes and the like.

Another object of the invention is to provide a grid trimming attachment that may be readily applied to existing machines for winding grid electrodes, as examples of such machines may be mentioned those illustrated in Patent No. 1,814,770 and Patent No. 1,897,460.

It has been the customary practice heretofore in winding grids in continuous "grid-strips" to fasten the individual turns or lateral wires to the grid side-rod or side-rods by a welding, peening or swaging operation, and to leave one or more turns unfastened so that the grid strip may be cut into unit lengths with the side-rods extending beyond the lateral wires. In these prior machines this results in the leaving of a considerable loose length of the cut end of the lateral wire, and has necessitated the services of an operative who manually trims the loose unfastened ends, but in order to facilitate this manual trimming operation it has been found necessary to leave more than one grid turn unfastened so that the operative may have sufficient length of wire to grasp during the trimming operation. Where a large number of grids are being manufactured these trimmed turns become waste products and add appreciably to the cost of the finished tube into which the grid is incorporated. Apart from the increased cost is the fact that with the ordinary manual method of trimming these loose grid-ends, the manual contact with the grid wires results in an unavoidable percent of contamination of the grid surface which contamination may cause wide divergences between the characteristics of the tubes into which the grids are assembled.

Accordingly it is another object of this invention to provide a device which automatically trims the loose ends of wire-wound grid electrodes so as to reduce to a minimum the percent of waste wire and to avoid the contamination and other undesirable effects incidental to the handling of the grids during the manual trimming operation.

A feature of the invention relates to a device whereby the loose ends of a grid electrode wire may be accurately trimmed without affecting the usual grid side-rod.

Another feature relates to a method of fusing the loose ends of a wire-wound grid.

A further feature relates to an automatic device for trimming the loose ends of a wire-wound grid, which device may be readily applied to a so-called continuous grid-strip winding machine.

A still further feature relates to the novel organization, arrangement and relative location of parts which go to make up an efficient and accurate grid-electrode trimming device.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following descriptions and the appended claims.

While the invention will be described herein as applied to certain wellknown types of grid winding machines, it will be understood that this is done merely for explanatory purposes and not by way of limitation and furthermore since these grid-winding machines are wellknown in the art the drawing herein represents the mechanism of such machines in diagrammatic form only. In the drawing,

Fig. 1 shows in diagrammatic plane view the invention as applied to a continuous grid-strip winding machine.

Fig. 2 is a diagrammatic elevational view of part of the mechanism of Fig. 1.

Fig. 3 is a diagrammatic end view of the mechanism shown in Figs. 1 and 2.

Fig. 4 is an enlarged view of part of a grid-strip showing the points at which the unfastened turn of the grid wire is cut according to the invention.

Fig. 5 shows a section of grid-strip wound in one known manner.

Referring to the drawing the numeral 1 represents a suitable base upon which are supported the various parts of the mechanism, and the numeral 2 represents schematically any well-known form of continuous grid-strip winding machine such for example as illustrated in Patent No. 1,814,770 or Patent No. 1,897,460. In general the grid-winding mechanism includes means for feeding and rotating a pair of grid-support side-rods 3, 4, and for simultaneously winding helically thereabout, the relatively fine-wire 5. At a suitable point in the grid-winding machine the side-rods 3, 4, are notched to receive the fine wire turns, and suitable mechanism is provided to peen, or swage the notched side-rod so as to hold the turns of the fine wire firmly in place in

the said notches. When the requisite number of turns have been wound the feeding mechanism may advance the side-rods so as to increase the pitch of the next turn as indicated in Fig. 5. The purpose of this "skip-turn" is to provide the operative with a sufficient length of loose wire so that the grid section may be handled and trimmed by hand. In another type of grid winding machine instead of producing the "skip-turn" for this purpose, the grid is wound with uniform pitch except that at regular intervals one or more turns are left unfastened. With this latter type of machine, in order that the loose ends may be trimmed it is necessary for the operative to unwind the unfastened turns prior to trimming the same. In accordance with the present invention either method of winding may be employed, preferably however the mechanism 2 is arranged to wind the fine wire 5 with uniform pitch as shown in Fig. 2 and at regular intervals the peening or swaging is omitted from a single turn as indicated by the numeral 6 in Fig. 4 and by suitable mechanism about to be described the fine wire 5 is electrically cut at the points marked by the arrows. For this purpose the wound grid-strip is fed past a pointed electrode 7 which is insulatingly supported on an arm 8 pivoted at the point 9 on a bracket 10 attached to base 1, it being understood that the arbor in machine 2 which carries the side rods 3 and 4 is rotated in the direction of the arrow (Fig. 3) at the same time that the grid strip is being fed forwardly from the machine as indicated. Arm 8 is provided with an extension 11 in which is adjustably mounted the tension adjusting screw 12 which is adapted to bear against a stop 14 fastened to a support 15 rigidly mounted on base 1. A tension spring 16 has one end fastened to support 15 and the other end to arm 11 thus impelling the electrode 7 toward the grid-strip. The spacing between the pointed end of electrode 7 and the grid-strip may be accurately regulated by the adjusting screw 12. Preferably the electrode 7 is so mounted that when moved to cutting position it is in registry with the part of the grid-strip marked by the arrows (Fig. 4) and when current passes, the lateral grid wire is cut by a fusing operation as close as possible to the side-rod 3 but without this latter rod. In this connection it should be noted that the electrode 7 is so pointed and is moved at such an angle that it first fuses the loose grid turn at the point A in front of the side-rod 3 and subsequently fuses this turn at the point B in back of the side-rod 3.

In order that the electrode 7 may be operated in proper timed relation with respect to the rate at which the grid-strip is fed from the winding machine 2, there is provided a cam 17 affixed to a shaft 18 which may be driven in the proper timed relation from the main shaft 19 which drives the winding machine 2, it being understood that appropriate gearing and bearing brackets are provided for shaft 18 as indicated by numerals 20, 21. Affixed to base 1 is a pivot pin 23 on which is mounted the pivot block 24 for vertical rotation about said pin 23. Passing through block 24 is an arm 25 which has fastened to one end the cam follower 26 adapted to ride on cam 17. The opposite end of arm 25 is connected by a link 27 to the electrode support arm 8. As will be seen the cam 17 is provided with two low sectors 28, 29, so that when the follower 26 is in these sectors the electrode 7 is advanced to cutting position as indicated by the arrows in Fig. 4. The speed of rotation of cam 17 is related to the speed of feeding of the grid-strip so that when the follower is in sector 28, the electrode 7 is in alignment with the point A of the unfastened grid wire turn (see Fig. 4) and when the follower later engages sector 29 the electrode 7 is in alignment with the point B of this unfastened grid wire turn, it being understood that while the grid-strip is being fed the distance between points A, B, the cam follower removes the electrode away from the grid-strip. In other words the movement of electrode into and out of cutting position is so timed with the feeding movement of the grid-strip that the unfastened turn of the fine grid wire alone is cut and during the remainder of the feeding movement the electrode 7 is out of cutting relation with the grid-strip. It will also be understood that since the grid-strip is wound so that successive unit lengths thereof have the grid wires fastened, the cam 17 maintains the electrode 7 out of cutting relation so long as the fastened turns are passing the cutting electrode. If desired a pair of cutting knives or rollers indicated by the numerals 30, 31, may be mounted in such a way that as the trimmed unit lengths of the grid-strip are fed past these cutters the side-rods 3 and 4 are cut at the points C, D, thus producing finished wound grids of unit length with the fine grid-wires accurately trimmed and with sufficient length of side-rods 3, 4, left to serve as attachment lugs or supports for the grid. In this connection it will be understood of course that the winding unit 2 may be so arranged that two or more turns of the grid wire are left unfastened, and the cam 17 may be correspondingly designed to trim only these loose turns, thus allowing a greater length of exposed side-rod for grid supporting purposes. It will also be obvious that instead of employing only one cutting electrode, a pair of aligned cutting electrodes may be employed so that the grid-wire may be trimmed adjacent both side rods. Thus in connection with the type of grid-strip shown in Fig. 5 where all the grid turns are fastened to the side-rods 3, 4, a set of three cutting electrodes similar to electrode 7 may be insulatingly mounted on the arm 8 so that one electrode cuts the grid wire at point E, the second electrode at point F, and the third electrode at point G thus completely trimming the "skip-turn" between adjacent unit lengths of the grid-strip.

In accordance with the present invention it is preferred to affect the trimming of the loose grid turns by electrical means. Thus as shown in Fig. 1 the electrode 7 is connected by a conductor 32 to one terminal of a suitable source of current 33, the opposite terminal of which is connected to the base 1 and thence conductively through the various parts described above, to the grid-strip. Consequently when the electrode 7 is moved into cutting position as described, the flow of current at the point of contact with the grid wire causes a fusion of the latter resulting in a clean cut and without burning or affecting the adjacent side-rod. If desired the devices 30 and 31 which are employed to cut the side-rods may be replaced by electrodes similar to electrode 7 to affect the cutting of the side-rods electrically. In this case of course the side-rod cutting electrodes will be moved into and out of cutting engagement with the side-rods, by mechanism similar to that for moving electrode 7.

In certain types of grids having relatively coarse wires or mesh, it may be impractical to move the pointed electrode 7 so that it fuses the

loose turn in back of the side-rod as described in connection with the fusing of the turn at the point B. In this case two separate fusing electrodes may be employed. Thus as indicated schematically in Fig. 6, arm 8 which carries the electrode 7 is linked to another arm 35 which is pivotally mounted at 36 so that when the arm 8 is operated by the link 27 the arm 35 is likewise operated. Arm 35 will then carry a pointed electrode 37 similar to electrode 7 but displaced the distance of one turn. With this arrangement therefore, a single cam such as the cam 17 may operate the mechanism so that electrode 7 fuses the loose grid turn (Fig. 4) at the point A in front of the side-rod 3 while simultaneously therewith, the pointed electrode 37 fuses the loose turn at the point B in back of the side rod. If desired the electrodes 37 and 7 may be adjustably mounted in their holders so as to accommodate the mechanism to different pitch grids. It will also be obvious that instead of employing a single cam to operate the electrodes 7 and 37, two separate cams may be employed so that the said electrodes 7 and 37 may be operated independently in any desired timed relation with respect to each other.

Various changes and modifications may be made herein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a machine for trimming cage-like grid electrodes of the type having a metal side-rod and a fine wire wound therearound, a wire severing electrode, means to feed a wound grid-strip past said electrode and to rotate said grid strip in front of said electrode, means for moving said electrode into severing relation with said grid-strip, and means for operating said severing means and said feeding and rotating means in timed relation to each other.

2. In combination, a grid winding and feeding unit including means to rotate said grid about its longitudinal axis, a grid wire trimming unit, an electrode for severing the wound grid wire at predetermined spaced intervals and means for oscillating said electrode into and out of severing relation with the grid wire in timed relations to the said feeding and rotating means.

3. In a device of the character described a grid-strip feeding unit including means to rotate said grid about its longitudinal axis, a grid wire trimming unit, an electrode for severing a grid wire adjacent its support rod, a timing cam for controlling the operation of said severing means and means for operating said cam in timed relation to the operation of said feeding and rotating means.

4. In a machine for trimming cage-like grid electrodes of the type comprising a metal side-rod and a fine wire helically wound around and fastened to the side-rod, the combination of a severing electrode, means to feed the grid with its side-rod and fine wire past said electrode, said severing electrode being normally disposed away from said fine wire, and means to move said electrode toward the fine wire but at an angle tc the side-rod to sever the fine wire adjacent the side-rod and without affecting said side-rod.

5. In a machine for trimming cage-like grid electrodes of the type comprising a metal side-rod and a fine wire helically wound around and fastened to the side-rod, the combination of a pointed cutting electrode, means to feed a grid with the side-rod and fine wire past said cutting electrode, a source of current having one terminal connected to the grid and the other terminal connected to said electrode, and means to move said electrode toward the fine wire to strike an arc between the pointed end of the electrode and the fine wire only.

6. In a machine for trimming cage-like grid electrodes of the type comprising a metal side-rod and a fine wire helically wound and fastened to said side-rod, the combination of a trimming electrode, means to rotate the grid around its longitudinal axis and to feed the grid longitudinally past the trimming electrode, said grid having at least one turn of the fine wire unfastened, means to move the trimming electrode toward said fine wire, the last-mentioned means being automatically operated in timed relation to said feeding and rotating means so that the trimming electrode first trims the end of the unfastened turn in front of the side-rod and then trims the end of the unfastened turn on the rear of the side-rod.

7. In a machine for trimming cage-like grid electrodes of the type comprising a metal side-rod and a fine wire helically wound around and fastened to the side-rod, the combination of a pointed trimming electrode, means for forming and feeding a grid strip past said trimming electrode said strip having at least one turn unfastened to the side-rod, means for moving said trimming electrode into and out of arc forming relation with one end of said unfastened turn, means to rotate the grid strip to bring the other end of said unfastened turn into arc forming relation with said trimming electrode, and means for maintaining said electrode away from said grid strip when the latter is rotating.

8. In a machine of the character described, the combination of a unit for winding and feeding longitudinally a cage-like grid in the form of a fine wire helically wound around a metal side-rod, a unit for severing the fine wire at predetermined intervals including a pointed arc-producing electrode, and means for automatically operating both said units in timed relation so that one side of the grid strip is first presented to said pointed electrode, and then the other side of the grid strip is presented to said pointed electrode.

9. In a machine for trimming cage-like grid electrodes of the type comprising a rigid metal side-rod and a plurality of fine lateral wires bent around said side-rod, a pair of pointed electrodes, means for feeding a grid strip past said electrodes, one of said electrodes being disposed with its point adjacent the lateral wires on one side of the grid strip, and the other of said electrodes being disposed with its point adjacent the lateral wires on the other side of the grid strip, and means for moving said pointed electrodes into and out of arc-producing relation with said lateral wires in timed relation to the feeding movement of the grid strip so that said pointed electrodes strike an arc to said lateral wires closely adjacent the side-rod but without affecting said side-rod.

10. A machine according to claim 9 in which certain of the lateral wires are fastened to the side-rod and other lateral wires are unfastened, and the movement of the pointed electrodes is timed so that an arc is produced only when the ends of the unfastened lateral wires are in registry with the said pointed electrodes.

11. In a machine for manufacturing radio tube electrodes of the cage-like type, means for winding a fine wire around a pair of metal side-rods with some of the turns fastened to the side-rods

and other turns unfastened, means for severing the unfastened turns comprising a pointed arc-producing electrode, a member in which said electrode is adjustably mounted, a cam for operating said member, and means for operating said cam in timed relation to the winding of said fine wire so that said pointed electrode is moved to severing position only when the ends of the unfastened turns are in registry therewith.

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