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GRID WINDING MACHINE

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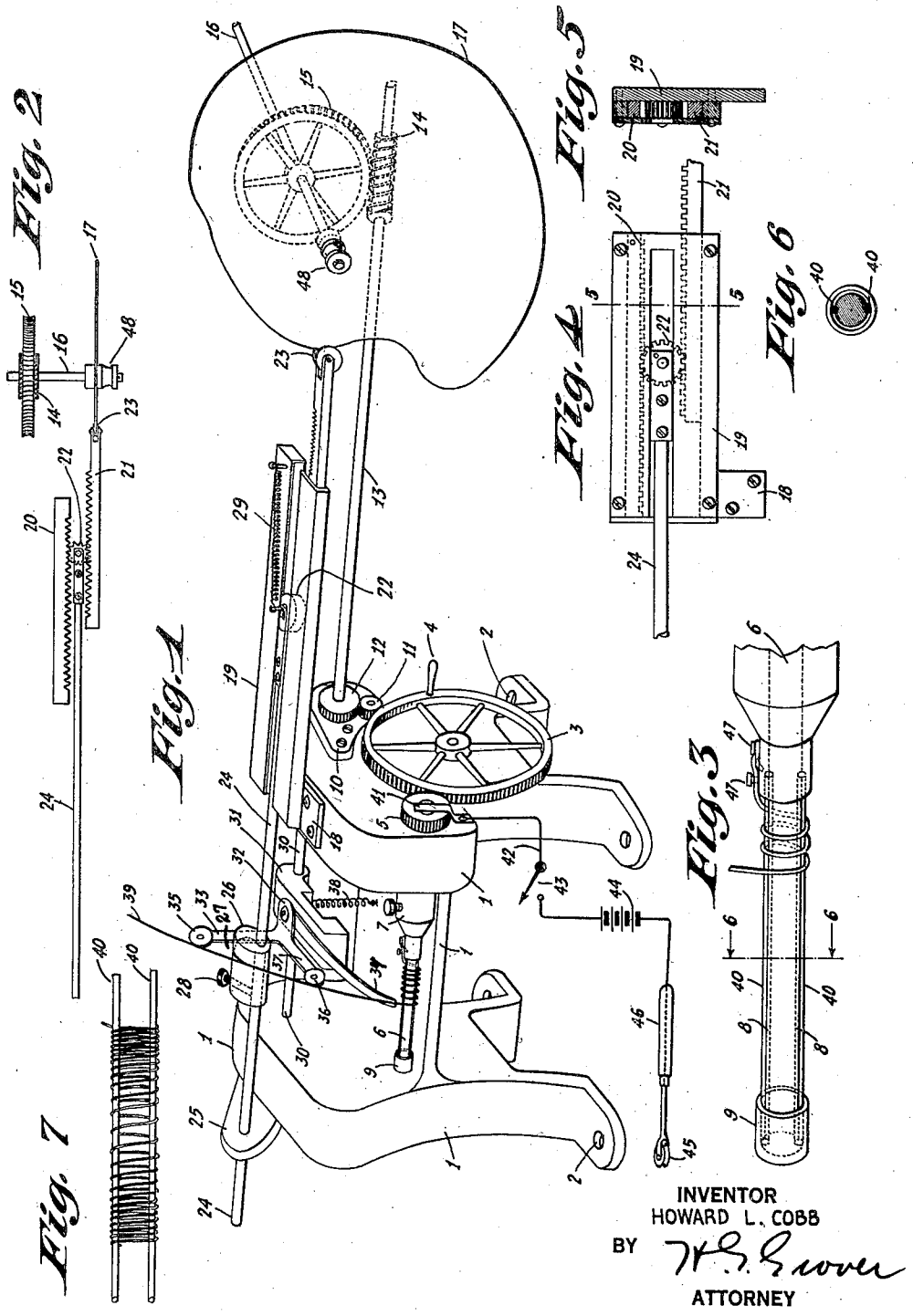


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

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GRID WINDING MACHINE

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8 Claims. (Cl. 140—71)

This invention relates broadly to grid winding machines and more particularly to a machine for winding irregular grids.

An object of the invention is to devise a machine particularly adapted to wind grids for electron discharge tubes.

Another object of the invention is to devise means for winding grids of an electron discharge tube having certain predetermined characteristics.

Another object of the invention is to devise means for winding grids of electron discharge tubes for giving said tubes predetermined novel characteristics.

A specific object of the invention is to devise means for winding grids for so-called "exponential" tubes.

Other objects of this invention will be apparent from the following specification when read in connection with the accompanying drawing, in which;

Figure 1 generally illustrates a machine for winding grids in accordance with my invention;

Figure 2 is a detail of the machine shown in Figure 1 illustrating the cam controlled member;

Figure 3 is an enlarged detail showing of the machine illustrating the grid winding spindle;

Figure 4 is an enlarged detail showing of a portion of the cam controlled member including the rack mechanism;

Figure 5 is an end view of the rack mechanism illustrating certain features thereof;

Figure 6 is a sectional view along the line 6—6 of Figure 3; and,

Figure 7 illustrates a grid that may be wound by the mechanism shown generally in Figure 1.

Referring to Figure 1 it will be seen that the machine comprises a framework 1 composed of two supporting legs and a cross table member. The framework 1 has provisions comprising screw holes 2 for fixedly supporting the mechanism on a table or any other suitable foundation. A gear wheel 3 is rotatably mounted on one of the legs of frame 1. Said gear wheel is provided with a handle 4 by means of which the operator may rotate the wheel. Operatively associated with the gear wheel 3 and also mounted on the frame 1 I provide a gear wheel 5 having its teeth in engagement with the teeth of wheel 3. Gear wheel 5 is mounted on a shaft 6 which has bearing on the framework 1. The said shaft 6 is provided with a sleeve member 7 adapted to maintain the shaft in the proper position with respect to the frame 1. Shaft 6 protrudes through the sleeve 7 intermediate the two supports and forms a winding spindle. The part of the shaft forming the spindle is provided with two grooves 8 for receiving and supporting in position grid supporting members or grid frame members 40. A cap 9 is provided and is adapted to slide over the free end of shaft 6. Cap 9 is constructed so as to act as a gripping means for the grid frame members 40 when placed in the grooves 8. It should be noted that the grooves 8 on the shaft 6 extend along the shaft 6 a small distance within the sleeve member 7. This, as is evident, is for the purpose of having the sleeve member 6 form a supporting surface for the other ends of the grid frame members. While I have shown two grid frame members 40 it is to be understood that the grid construction may call for only one or more than two in which case the shaft 6 would contain the proper number of grooves 8.

Also supported on the frame 1 by means of a supporting member 10, I provide another gear wheel 11 adapted to mesh with the gear wheel 3. Gear wheel 11 also is adapted to mesh with a second gear wheel 12 supported through the medium of shaft 13 on member 10. Shaft 13 has at one end a worm 14 which is adapted to cooperate with worm wheel 15. Worm wheel 15 is fixedly suported by a shaft 16. For the sake of simplicity the supports and bearing members for the shaft 16 are not shown; however, it is to be distinctly understood that these supports may take any desired form. One end of the shaft 16 is adapted to form a support for a cam member 17 which cam member is adapted to rotate with shaft 16. Fixedly attached on the frame 1 by means of member 18 I provide a rack mechanism generally designated as 19. The rack mechanism comprises a fixed rack 20, Fig. 4, and a movable rack 21. The movable rack 21 cooperates with the fixed rack 20 through the medium of a gear wheel 22 which gear wheel meshes with the teeth of both racks 20 and 21. One end of the movable rack 21 is provided with a cam follower 23. Cam follower 23 is adapted to cooperate with the cam surface of cam member 17 in well known manner. Gear wheel 22 is rotatably mounted to one end of a sliding member 24 which member 24 is adapted to slide between supports associated with the rack mechanism 19 as shown more in detail in Figure 4. The other end of the sliding member 24 is supported by a member 25 which is attached to the framework 1 in any desired manner. Intermediate its supports, the sliding member 24 is provided with an adjustable cam block 26. The cam block 26 is slidably movable and rotatably movable with respect to the sliding member 24.

Cam lock 26 is provided with a groove 27 which groove extends partially around the cam block. For the purpose of locking cam block 26 in any desired position with respect to sliding member 24 I provide a lock screw 28 which operates to lock the cam block to member 24 in well known manner. In order to maintain the cam follower 23 in engagement with cam surface 17 I provide a spring 29 attached at one end to the rack mechanism 19 and at the other end to the shaft 24. Of course, it is to be understood that any other type of mechanism which is adapted to maintain the cam member and the cam follower in contact may be utilized. Mounted between the support members 1—1 I provide a carriage support shaft 30 upon which is slidably and rotatably mounted a carriage 31. The carriage 31 has mounted thereon a guide support 32 comprising an upright member 33 and a horizontal member 34. The upper end of the upright member 33 is provided with a wire guiding wheel 35 while the outer end of the horizontal member 34 is provided with a wire guiding wheel 36. As is clear in the drawing, Figure 1, it will be seen that the groove 27 extending partially about the cam block 26 is adapted to cooperate with the inner edge of the vertical or upright member 33. Also mounted upon the carriage 31 I provide a wire guide arm 37. It will be seen that by means of the cam block 26 and the groove 27 cooperating with vertical member 33 there is provided an adjustment for the carriage 31. In other words, by the mechanism thus far described it is possible to adjust the end of the guide arm 37 with respect to the shaft 6 as desired. As shown in Figure 1 the grid wire 39 is fed to the mechanism from a spool or other source not shown through wire guiding wheels 35 and 36 and guide arm 37. A spring 38 fixedly attached at one end to the table portion of frame 1 and at the other end to the carriage 31 is provided for maintaining the upright arm 33 always in contact with the cam block groove 27. It will be seen that with the arrangement shown and the cooperation existing between groove 27 and upright arm 33, the carriage 31 will be forced to move with the block 26 which in turn when locked to sliding member 24 is displaced in accordance therewith. For the purpose of welding the grid wire 39 to the grid frames 40 (see Figures 6 and 3) I provide a contact brush 41 adapted to cooperate with shaft 6. Brush 41 is mounted through suitable insulation means on the framework 1. It is also desirable to mount the shaft 6 so as to be insulated from any other part of the machine except the brush 41. By means of a conductor 42 and a switch 43, brush 41 is connected to one side of the battery 44. The other side of the battery is conductively connected to a roller 45 which has provided a handle 46 insulated therefrom. It will be seen that if the roller 45 is rolled along the grid frames 40 after the grid wire 39 has been wound around them, a current will flow through grid wire and grid frames with the result that the grid wire is welded to the frames. The sleeve member 7 is provided with two wire holding screws or members 47 which are adapted to hold the grid wire 39 in position during the winding operation.

With the rack mechanism shown it will be seen that the relative movement of rack 21 due to the cam 17 will be twice the corresponding movement of the carriage 31. This construction makes possible a more accurate winding mechanism since the cam may be made to have larger dimensions. It is, of course, evident that errors in manufacturing the cam would be proportionally smaller in a large cam than in a smaller one.

In practice I have found that with the same cam, grids giving tubes widely varying characteristics may be made by simply changing the distance between the overhanging end of guide 37 and the spindle shaft 6. This may be done by loosening screw 28 and turning cam block 26 about member 24.

It is to be understood that the cam 17 which I have shown in the drawing is merely illustrative of an infinite number of cams having varying shapes that may be employed. As inferred heretofore the spacing of the grid windings may be made to vary in any desired manner by simply changing the cam. The cam may be removed by unscrewing nut 48 and a new cam substituted. Roughly speaking the cam shown in Fig. 1 will wind a grid such as shown in Fig. 7.

The operation of my device is as follows:

Cap 9 is removed from the end of shaft 6 and two grid support wires 40 are inserted in the two grooves on the shaft 6, care being taken that one end of each of the grid support wires is inserted in the respective hole provided for in the sleeve 7 as clearly shown in Fig. 3. The cap 9 is then replaced over the end of the shaft in such a way that the two grid support wires 40 are clamped in position. The gear wheel 3 is then turned by means of handle 4 a distance sufficient to place the cam at the starting position. For convenience, the cam may be marked in any desired manner so as to indicate the position that it should occupy at the start of a winding cycle and also marked so as to indicate the position it should occupy. After the cam is properly placed in the correct starting position wire 39 is drawn from the supply through the guide wheel 35, guide wheel 36, guide arm 37 and placed around wire holding members 47 where the wire is held in position. The distance of arm 37 from the shaft 6 is then adjusted by means of the cam block 26 to whatever position is desired. The operator then turns the gear wheel 3 by means of handle 4 until a marker on the cam 17 comes opposite the proper end of cycle point. It will be seen from the drawing that by turning the gear wheel 3, cam 17 is made to rotate with the result that carriage 31 is fed along carriage support shaft 30 at the proper rate. The rate, of course, may be constant or variable depending upon the cam surface. When the grid has been wound the operator takes the roller 45 and places it at one end of one of the grid support wires 40, contact 43 is then closed and roller 45 is rolled along the length of the wire 40. It will be seen that the current passing through the circuit will weld the small grid wires to the grid support member 40. The same is done to the other grid wire 40 after which the cap 9 is removed and the wound grid and supports 40 slid out of the shaft 6. The loose wires at both ends of the grid may be cut off or broken off. I have found that it is better practice to place the roller against the wire support 40 before switch 43 is closed as otherwise it is likely that a spark will jump between the roller and the grid support wire before the two come in contact. This spark is usually of sufficient intensity to melt the wire and thus break the grid structure. After the grid has been removed the machine is turned again until the cam is in the correct starting position after which the machine is ready to wind another grid.

While I have shown only one embodiment of

my invention it is to be understood that I have done so only for the sake of simplicity in describing the broad idea involved. It is evident, of course, that the invention is capable of being applied in coil winding apparatus as well as grid winding machines and in fact in any system that may require a winding operation.

I claim:

1. In a grid winding machine, a winding spindle having provision for holding at least one grid support wire, rotating means for rotating said spindle at a velocity proportional to the velocity of said rotating means, means comprising a carriage and guide arm for feeding a continuous strip of grid wire longitudinally of said spindle during the rotation thereof whereby said wire is wrapped about said spindle, means for varying the distance between said guide arm and said spindle comprising a cam block and means including said cam block for producing a variable velocity of longitudinal motion of said guide arm relative to said spindle for varying the concentration of said grid wire thereon.

2. In a machine of the kind described a mandrel having means adapted to receive a supporting wire, rotary means for rotating the mandrel, a carriage, a guide arm mounted on said carriage for feeding a continuous strip of material longitudinally of said mandrel during the rotation thereof whereby the material is wrapped about said mandrel in contact with the support wire, a cam controlled means for producing a variable velocity of longitudinal motion of said carriage and guide arm relative to said mandrel for varying in predetermined fashion the concentration of said wound strip thereon and means acting upon said carriage for determining the distance between said guide arm and said mandrel whereby the characteristics of said wound strip may be varied independently of said cam.

3. In a grid winding machine, a winding spindle having at least one groove extending longitudinally thereof for receiving a grid support wire, means for clamping the support wire on said spindle so as to maintain it in position within the groove, rotating means for rotating the spindle at a velocity proportional to the velocity of the rotating means, a carriage, a guide arm mounted on the carriage, said guide arm being adapted to guide a continuous strip of grid wire longitudinally of said spindle during rotation thereof, means comprising a cam adapted to be operated by the rotating means for producing a variable velocity of longitudinal motion of the carriage along the spindle with respect to the velocity of the rotating means for varying the concentration of the grid windings around the spindle and means comprising a current source, the spindle shaft and a roller device for welding the grid wire to the grid support wire.

4. A grid winding machine comprising a winding spindle having provision for holding at least one grid support wire thereon, rotating means for rotating the spindle at a velocity proportional to the velocity of the rotating means, a carriage, a guide arm mounted on the carriage, said guide arm being adapted to feed a continuous strip of grid wire longitudinally of said spindle during rotation thereof, a cam adapted to be operated by said rotating means, a cam follower, means including a reduction gear arrangement for connecting the cam follower to the carriage whereby movements of the cam follower caused by rotation of the cam are reproduced in a reduced scale by the carriage, said cam being arranged so as to produce a variable velocity of longitudinal motion of the carriage along the spindle with respect to the velocity of the rotating means for varying the concentration of the grid windings about the spindle in predetermined fashion depending upon the shape of the cam and means for adjusting the distance between the guide arm and the spindle whereby the characteristics of the wound grid may be varied independently of variation caused by the cam.

5. The subject-matter recited in the next preceding claim in combination with an electrical circuit including at least a portion of the spindle for passing an electric current between the grid windings and the grid support wire whereby the grid wire is welded to the grid support wire.

6. In a grid winding machine, a winding spindle having provision for holding at least one grid support wire, rotating means for rotating the spindle at a velocity proportional to the velocity of the rotating means, means comprising a carriage and a guide arm for feeding a continuous strip of grid wire longitudinally of said spindle during the rotation thereof whereby said wire is wrapped about said spindle, means for varying the concentration of the grid wire on said spindle to thereby vary the characteristics of the grid comprising means for varying the distance between the guide arm and the spindle including a cam block and means including said cam block for producing a variable velocity of longitudinal motion of said guide arm relative to the spindle.

7. In a machine of the kind described a frame, a rotary winding mandrel mounted on the frame, a grid wire guide movably mounted on the frame to travel lengthwise of the mandrel, a cam mounted on a shaft journaled in the framework, a cam follower and means for connecting the cam follower to the grid wire guide whereby movements of the cam follower are imparted to the grid wire guide said cam having a contour which will vary the speed of travel of the grid wire guide along the mandrel so as to make a variable pitch grid, and a driving mechanism for driving the mandrel and cam in synchronism.

8. The device described in the next preceding claim further characterized by that the means for connecting the cam follower to the grid wire guide includes a mechanism arranged so as to make the travel of the grid wire guide proportional to but less than the travel of the cam follower.

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