June 22, 1948. V. G. JARMAN 2,443,914

METHOD OF AND APPARATUS FOR FORMING ARTICLES

Filed Jan. 7, 1944 2 Sheets-Sheet 1

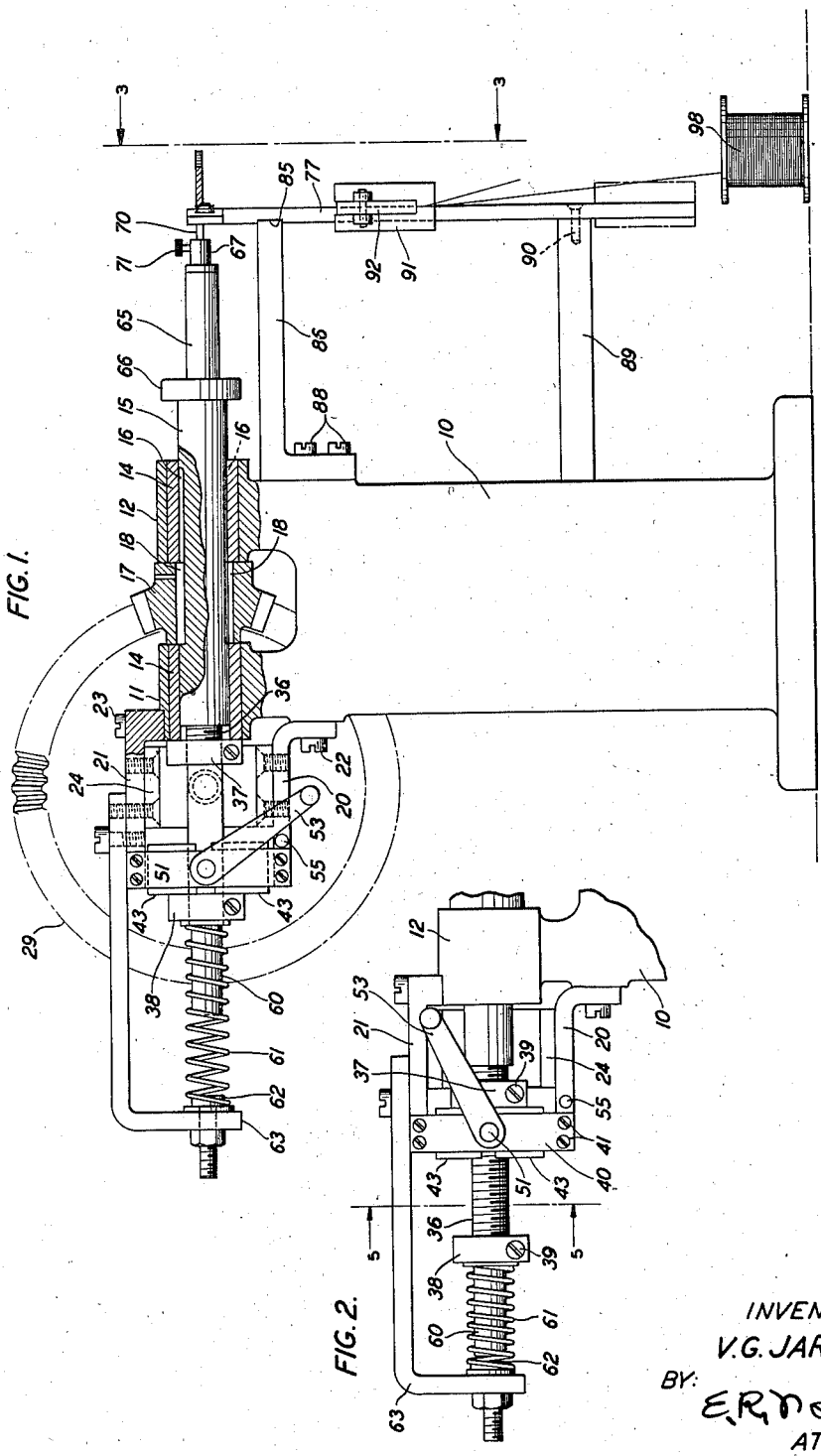


FIG. 1.

FIG. 2.

INVENTOR
V. G. JARMAN
BY: E. R. Doulan
ATTORNEY

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Filed Jan. 7, 1944 2 Sheets-Sheet 2

FIG. 3.

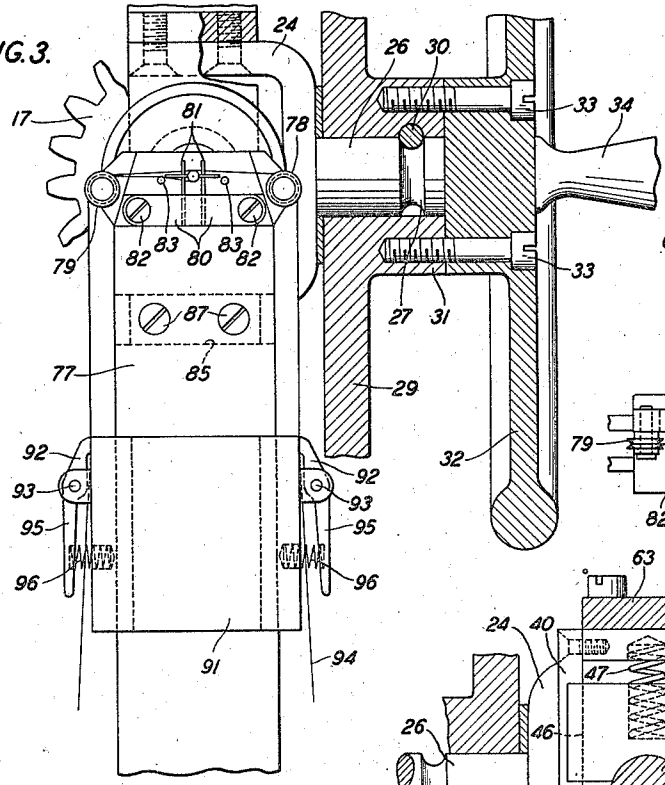


FIG. 4.

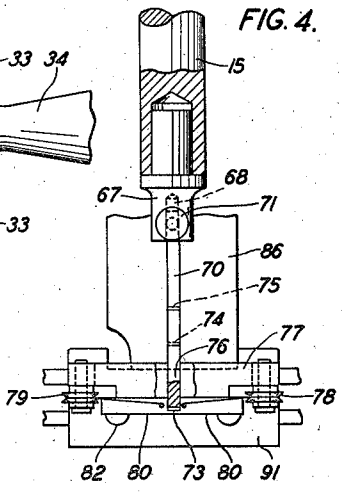


FIG. 5.

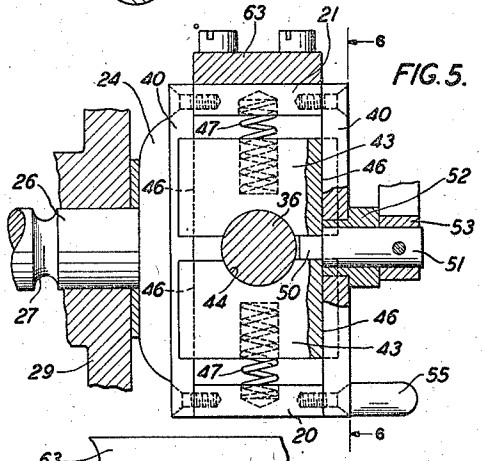


FIG. 7.

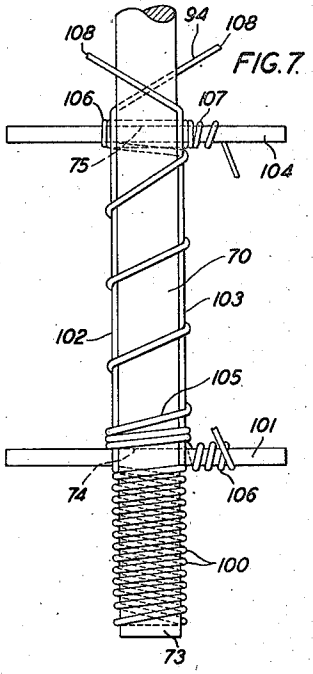
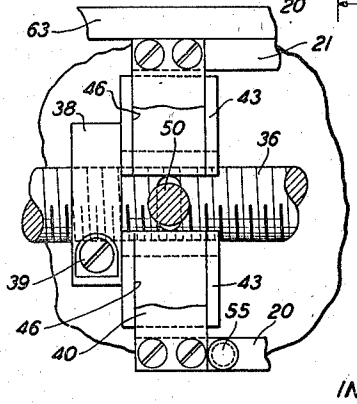


FIG. 6.



INVENTOR
V. G. JARMAN

BY: E. R. Newman
ATTORNEY

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METHOD OF AND APPARATUS FOR FORMING ARTICLES

Vincent G. Jarman, Watchung, N. J., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

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6 Claims. (Cl. 140—71.5)

1

This invention relates to method of and apparatus for forming articles, particularly filaments for vacuum tubes.

Objects of the invention are to provide a simple, efficient and practical method of forming articles, particularly filaments for vacuum tubes, and an apparatus by the aid of which the method may be practised.

With these and other objects in view, the invention includes an apparatus having mechanisms for controlling the rotation of a mandrel about its axis for the carrying out of the steps of forming double convolutions of strand materials thereon, and to cause movement of the mandrel axially to form parallel leg portions for the article.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a side elevational view of the apparatus, portions thereof being shown in section and illustrating the apparatus at the completion of an article forming operation;

Fig. 2 is a fragmentary side elevational view of a portion of the apparatus, illustrating the structure therein at the beginning of an article forming operation;

Fig. 3 is an enlarged fragmentary front elevational view taken substantially along the line 3—3 of Fig. 1, portions thereof being shown in section;

Fig. 4 is a fragmentary top plan view of the forward portion of the apparatus, illustrating the position of the mandrel at the beginning of the article forming operation;

Fig. 5 is an enlarged fragmentary sectional view taken along the line 5—5 of Fig. 2, illustrating portions thereof in engaging positions;

Fig. 6 is a fragmentary side elevational view taken substantially along the line 6—6 of Fig. 5, but with portions thereof shown in open or disengaging positions, and

Fig. 7 is a fragmentary top plan view of the mandrel at the completion of the article forming operation.

Referring now to the drawings, attention is first directed to Fig. 1, which illustrates a main support 10 having spaced bearing supporting members 11 and 12, the bearings 14 of which rotatably support a spindle 15. The spindle 15 is provided with keyways 16 for connection with a pinion 17, through keys 18 carried thereby. The pinion 17 is thus fixed for rotation with the spindle 15 between the members 11 and 12, the

2

spindle, however, being adapted for axial movement relative to the pinion through the aid of the keyways 16. Parallel brackets 20 and 21 are mounted upon the support 10 as indicated at 22 and 23.

A C-shaped bracket 24 (Figs. 1, 2, 3 and 5) has its legs fixed to the brackets 20 and 21 and is supported thereby. A stub shaft 26 (Figs. 3 and 5) is secured to or formed integral with the bracket 24 and extends outwardly therefrom a given distance, provided with an annular groove 27 therein disposed short of the outer end thereof. A bevelled gear 29 is mounted upon the stub shaft 26 for rotation thereon but held against displacement by a pin 30 carried by a hub 31 of the gear and positioned to ride in the groove 27 of the shaft 26. A hand wheel 32 is mounted upon the gear 29 in a manner illustrated at 33 in Fig. 3. Through the aid of a handle 34, the wheel 32 together with the gear 29 may be rotated to cause rotation of the spindle 15 through the actuation of the pinion 17.

A portion of the spindle 15, indicated at 36, is threaded and adjustable stop members 37 and 38 are disposed thereon, held in desired positions through the aid of screws 39. Retaining members 40, disposed in parallel positions upon opposite sides of brackets 20 and 21, are secured to the brackets as indicated at 41. Connecting elements 43, having threaded portions 44 adapted for interengagement with the threads of the portion 36 of the spindle 15, are disposed between the brackets 20 and 21 and the retaining members 40 and are provided with notches 46 in their side walls to receive and ride upon the retaining members. The elements 43 are normally urged toward and in engagement with the threaded portion 36 through the aid of springs 47, the latter being disposed in aligned recesses of the elements and their respective brackets 20 and 21, as shown in Fig. 5.

A cam or actuating element 50, disposed between the elements 43, is carried by a rotatable member 51 journalled in a member 52 carried by the adjacent retaining member 40 and provided with a crank 53 for manual actuation thereof. The general contour of the cam or actuating element 50 is shown in Fig. 6, this figure illustrating the cam in the position to open the elements 43 or move them away from the threaded portion 36 of the spindle. Through the aid of a stop 55, the crank 53 may be located in the open position.

The spindle 15 continues rearwardly from the threaded portion 36, providing a reduced portion

60 to receive one end of a spring 61. The other end of the spring 61 is supported at 62 by a bracket 63 of the contour shown in Figs. 1 and 2. The bracket 63 is secured to the bracket 21 as illustrated in these figures.

The forward portion of the spindle 15 is reduced, as at 65, and provided with a collar 66 and a chuck 67. The chuck 67 is apertured as at 68 (Fig. 4), to receive a mandrel 70, and through the aid of a screw 71, the mandrel is held in the chuck. The mandrel is of the contour illustrated in Figs. 1, 4 and 7, having a transverse slot 73 in the forward end thereof and apertures 74 and 75 at spaced positions intermediate its ends. The forward end of the mandrel 70, when the latter is disposed in the chuck, projects through an aperture 76 in a vertical guide 77. Sheaves 78 and 79 are rotatably supported at the upper end of the guide 77, as illustrated in Figs. 3 and 4. Brackets 80, supporting vertical locating pins 81, are mounted, as at 82, upon the guide 77. Lateral guide pins 83 are also carried by the guide 77 at spaced positions upon each side of the aperture 76 onto which the mandrel 70 is disposed.

The guide 77 has a slot 85 therein to receive the forward end of a bracket 86, to which it is secured as a 87, the bracket being mounted, as at 88, upon the support 10. A rod 89, carried by the support 10 and spaced from the bracket 86, as illustrated in Fig. 1, is secured, as at 90, to the guide 77 and further aids in supporting the guide. A tension control element 91 is slidably disposed upon the guide 77 for vertical movement thereon and carries clamps 92 at opposite sides thereof pivotally supported, at 93, for gripping portions of a strand 94 between their ends and the adjacent walls of the element. Handle portions 95 of the clamping elements 92 may serve for use in manual actuation of the elements into open position, springs 96 engaging these handle portions and carried in recesses in the control element 91, for normally urging the clamping elements 92 into their strand holding or clamping positions. In the present embodiment the strand 94 is a wire removed from a supply spool 98 and formed of suitable material for use in making filaments for vacuum tubes.

Considering now the operation through the aid of which the method may be practised, let it be assumed that the spindle 15 is in its rearmost position, as illustrated in Figs. 2 and 4. The wire or strand 94 may be threaded through the apparatus by drawing a sufficient length thereof from the spool 98, passing it over the sheave 78, over the pins 83, back of the pins 81, through the slot 73 in the mandrel 70, over the sheave 79, and downwardly to a position where it may be secured to the tension control element 91. At this time both sides or portions of the strand located adjacent the control element 91 are secured thereto through the aid of the clamping elements 92. The control element 91 is at this time in its lowermost position, where it may be held against further downward movement by suitable means (not shown). When the spindle 15 is in its rearmost position, the stop member 37 engages the elements 43, that is, the adjacent faces thereof, as illustrated in Fig. 2. The elements 43 are in their closed positions in engagement with the threaded portion 36 of the spindle. At this time the operator may rotate the hand wheel 32 a given number of revolutions counterclockwise (Fig. 1), depending upon the number of double convolutions desired in the filament or article.

As an illustration, attention is directed to Fig. 7, where the double convolutions are indicated at 100. The double convolutions are formed through the rotation of the mandrel resulting from the rotation of the hand wheel transmitting rotation through the gear 29, the pinion 17, and the spindle 15. During this rotation of the spindle, the pitch of the threads of the threaded portion 36 and the associated threads of the elements 43 controls the pitch of convolutions 100 and thus determines the spaces between the convolutions thereof. The aperture 74 in the mandrel is located at a known position, this being at the end of the convolutions 100. The apparatus is thus stopped at this position, discontinuing the forming of the convolutions 100, and at this interval a pin 101 is disposed in the aperture 74. Through the aid of means hereinafter described, portions of the strand or wire 94 are bent substantially at right angles about the pin 101, one leg, indicated at 102, extending over the pin, the other leg, indicated at 103, extending beneath the pin. These legs or portions of the strand are extended longitudinally of the mandrel, as shown in Fig. 7, to points beyond the aperture 75, in which another pin 104 is disposed. At this time a holding strand 105 is connected to the pin 101 through a plurality of convolutions 106, wound spirally about the mandrel and the legs 102 and 103, to hold the latter in the desired position relative to each other and the mandrel, and finally wound about both ends of the pin 104 as at 106 and 107, to secure this end of the strand 105, which is in the present instance a wire, against displacement. The portions of the strand 94 are then cut, as at 108, from the supply and this completes certain of the steps of the method for forming the article. Additional steps include annealing of the article, to cause it to retain the contour into which it is formed, and finally removing the article, which will include the double convolutions 100 and the straight legs 102 and 103 projecting therefrom in straight lines parallel with each other and with the axis or center line of the convolutions 100. The excess ends of the legs 102 and 103 may be removed as desired.

During the forming of the article, the weight of the element 91 creates a given tension in both ends of the strand secured thereto. As the mandrel is rotated, these ends are drawn up over the sheaves 78 and 79 controlled in their application to the mandrel through the aid of pins 81 and 83.

The means for rotating the mandrel to form the double convolutions 100 has been described as including the hand wheel 32, the gear 29, and the pinion 17. Means to cause forming of the legs 102 and 103 includes the spring 61 and the result of its force, when the elements 43 are released from the threaded portion 36 of the spindle. The elements 43 are released through the rotation of the crank 53 from the position shown in Fig. 2 to the position shown in Fig. 1, where the cam 50 will move from the position shown in Fig. 5 to the position shown in Fig. 6, moving the elements 43 free of the threaded portion 36 and allowing the spring 61 to move the spindle 15 forwardly a distance under the control of the member 38. The member 38, when moved to engage or abut the elements 43, will stop the forward movement of the spindle 15 and terminate the formation of the legs 102 and 103. At this time the strand 105 may be wound about the legs through the aid of the pins 101 and 104.

After the forming of one article, the mandrel 70 supporting it, as illustrated in Fig. 7, may be

removed from the chuck 67 and another mandrel inserted in place for use in forming the next article. However, the apparatus must be set for the next forming operation. This is accomplished through the aid of the collar 66 for manual movement of the spindle 15 rearwardly until the stop member 37 abuts the elements 43, after which the lever 53 may be moved from the position shown in Fig. 1 to the position shown in Fig. 2. The spring 61 is thus compressed and the new mandrel 70 is located to receive another portion of the strand in its slot 73.

It is, therefore, apparent that through the aid of the apparatus, the method may be practised assisted by a mandrel for forming double convolutions of a strand through the rotation of the mandrel on its axis and through axial movement thereof at a given speed comparable with the speed of rotation thereof for a given distance, then moving the mandrel axially free of rotation to form straight parallel legs of the strand. Additional steps include holding the article against displacement on the mandrel during annealing and setting of the portions of the article and the removal of the article from the mandrel.

Although specific improvements of the invention have been shown and described, it will be understood that they are but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined by the appended claims.

What is claimed is:

1. The method of forming an article from a strand on a mandrel having a strand receiving portion and a pin receiving aperture spaced from the said portion, the method comprising connecting a part of a strand intermediate portions thereof to the said receiving portion, rotating the mandrel about its axis while moving the mandrel longitudinally of its axis to form a double spiral of given length of the strand portions, inserting a pin through the said aperture, and forming legs for the convolutions by bending the strand portions about the pin and extending them longitudinally of the mandrel.

2. The method of forming an article from a strand on a mandrel having a strand receiving portion and a pin receiving aperture spaced from the said portion, the method comprising connecting a part of a strand intermediate portions thereof to the said receiving portion, rotating the mandrel about its axis while moving the mandrel longitudinally of its axis to form a double spiral of given length of the strand portions, inserting a pin through the aperture, and forming legs for the convolutions by moving the mandrel axially free of rotation to bend the strand portions about the pin and extend them longitudinally of the mandrel.

3. The method of forming an article from a strand on a mandrel having a strand receiving portion and a pin receiving aperture spaced from the said portion, the method comprising connecting a part of a strand intermediate portions thereof to the said receiving portion, rotating the mandrel about its axis while moving the mandrel longitudinally of its axis to form a double spiral of given length of the strand portions, inserting a pin through the said aperture, forming legs for the convolutions by bending the strand portions about the pin and extending them longitudinally

of the mandrel, and securing the legs to the mandrel.

4. The method of forming an article from a strand on a mandrel having a strand receiving portion and a pin receiving aperture spaced from the said portion, the method comprising connecting a part of a strand intermediate portions thereof to the said receiving portion, rotating the mandrel about its axis while moving the mandrel longitudinally of its axis to form a double spiral of given length of the strand portions, inserting a pin through the said aperture, forming legs for the convolutions by bending the strand portions about the pin and extending them longitudinally of the mandrel, and winding a wire about the legs and the mandrel to secure them together.

5. The method of forming an article from a strand on a mandrel having a strand receiving portion and a pin receiving aperture spaced from the said portion, the method comprising connecting a part of a strand intermediate portions thereof to the said receiving portion, rotating the mandrel about its axis while moving the mandrel longitudinally of its axis to form a double spiral of given length of the strand portions, inserting a pin through the said aperture, forming legs for the convolutions by bending the strand portions about the pin and extending them longitudinally of the mandrel, securing the legs to the mandrel, and annealing the article.

6. An apparatus for forming an article from a strand on a mandrel having a portion to receive a part of the strand intermediate its ends, the apparatus comprising a spindle having the mandrel removably secured thereto, means to rotate the spindle with the mandrel to wind both portions of the strand adjacent the said part on the mandrel, means to cause axial movement of the spindle with the mandrel during the rotation thereof to cause the windings of the strand portions to lay in overlapping spirals on the mandrel, and a spring having a force sufficient to move the spindle, and with it the mandrel, axially free of rotation to form straight legs of the portions of the strand adjacent the spiral windings, and means to render the spring effective.

VINCENT G. JARMAN.

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