July 19, 1949. P. L. REED 2,476,454

MACHINE FOR MAKING ELECTRODE ASSEMBLIES

Filed Feb. 10, 1949 2 Sheets-Sheet 1

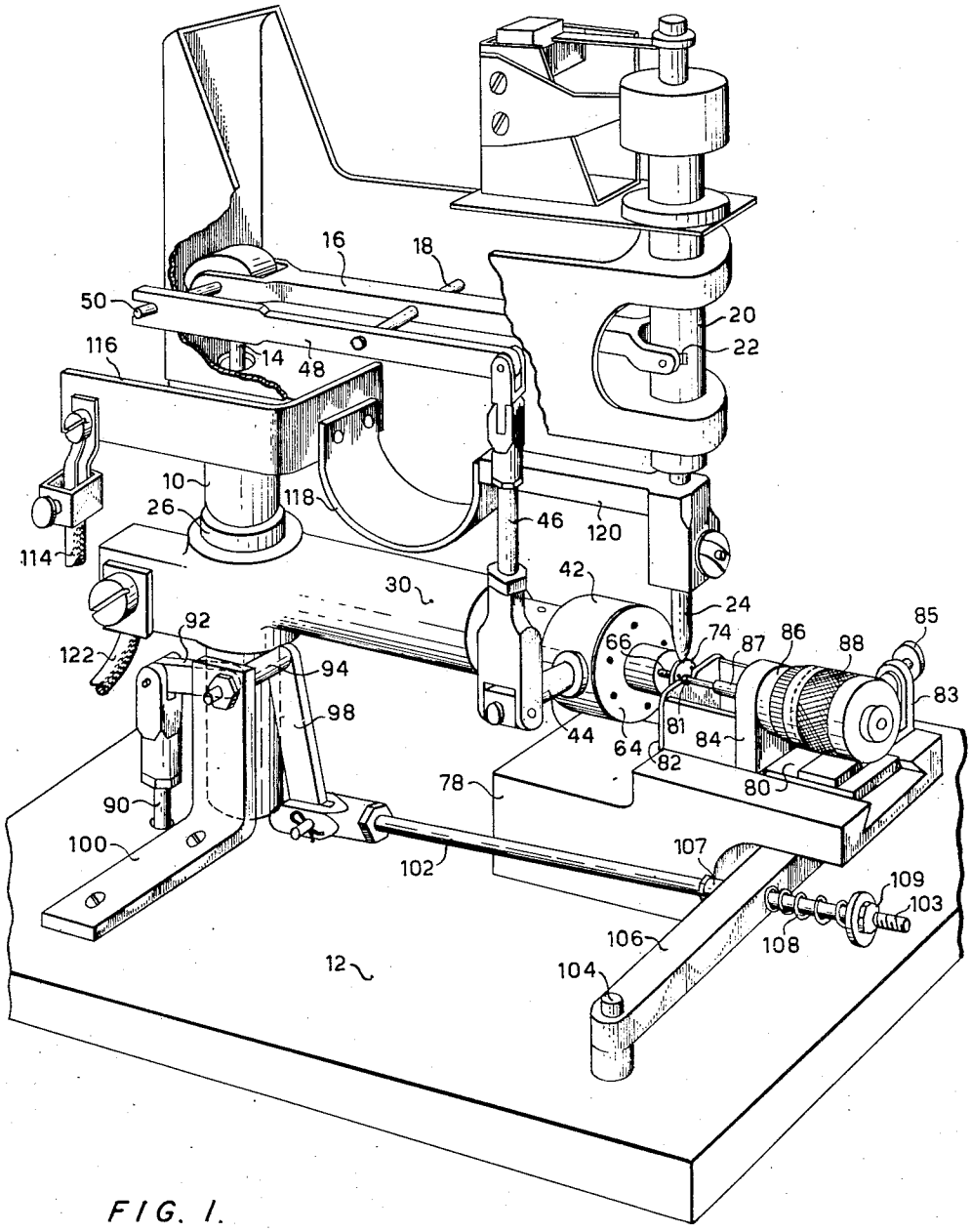

FIG. 1.

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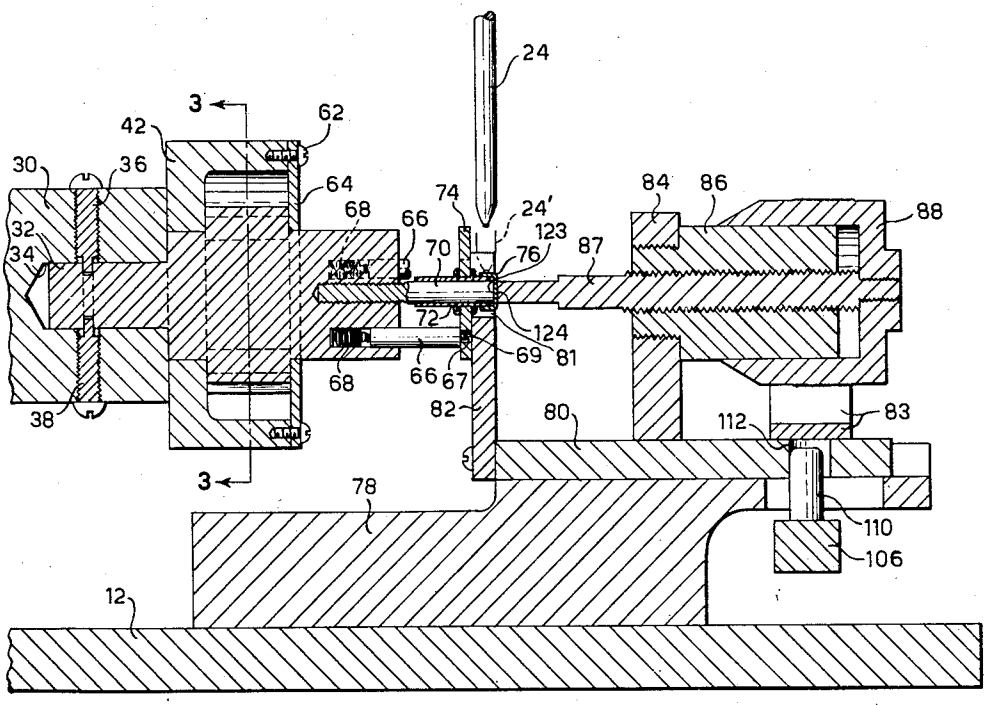

FIG. 2.

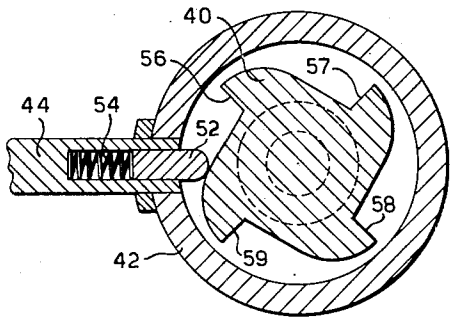

FIG. 3.

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UNITED STATES PATENT OFFICE

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MACHINE FOR MAKING ELECTRODE ASSEMBLIES

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Application February 10, 1949, Serial No. 75,578

6 Claims. (Cl. 219—4)

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This invention relates to the manufacture of cathodes for thermionic tubes and has particular reference to the disc type of cathode which is used in various cathode ray tubes, television pick-up tubes, and tubes of so-called lighthouse construction.

In tubes of the type just mentioned the thermionic emission is obtained from a relatively small, cup-shaped disc coated with alkaline earth oxides. The disc must be rigidly mounted within the tube a few thousandths of an inch from a grid member and in accurate plane alignment therewith. The disc is supported by a metal tubular member which may be of any of the conventional forms, i. e., seamless or of lockseam, welded, welded and drawn, boxed, or wrap-around ribbon type, and also serves as a means of conducting heat to the disc or cup carrying the oxides to heat it to electron-emitting temperature. An insulated tungsten, molybdenum or similar wire is usually placed inside the tube to provide sufficient heat by electrical resistance to make possible attainment of the proper temperature.

In order to support the cathode assembly ceramic or similar heat resistant insulators are employed. These insulators, generally in the form of a flat disc, are mounted on the tubular member prior to the attachment of the cup to the tubular member. The attachment of a cup to the tubular member is generally accomplished by inserting the tubular member into the cup which fits as a snug cap over the end of the tube and then welding the cap to the tube.

It is an object of this invention to maintain an accurate dimension longitudinally between the face of the disc and the face of the cap while welding the cap to the tube supporting the disc.

It is a further object of this invention to maintain accurate parallel plane alignment between the face of the disc and the face of the cap while welding the cap to the tube supporting the disc.

Another object of the invention is to provide means for automatically rotating the disc, tube and cap assembly while making a plurality of successive welds evenly spaced around the periphery of the cap.

These and other objects of the invention will become apparent from the following description read in conjunction with the accompanying drawings, in which:

Figure 1 is a perspective elevation of the apparatus involved;

Figure 2 is a vertical section of a portion of the apparatus shown in Figure 1, the section being

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taken through the axis of the cathode assembly; and

Figure 3 is a vertical section taken on the plane indicated by the trace 3—3 in Figure 2.

In Figure 1 there is shown a conventional bench type spot welder comprising a support post 10 which is mounted on a base plate 12. Moving within the support post is actuating rod 14 which extends downward through the base plate 12 and is coupled with a foot treadle (not shown) below the table on which the base plate rests. The upper end of the actuating rod 14 is pivotally connected to member 16, which is pivoted on pin 18. The other end of member 16 is forked and provided with inwardly directed pins engaging the slidable upper electrode assembly 20 within the slots 22.

When the foot treadle below the table is moved by the operator the actuating rod causes member 16 to rotate about pin 18 moving the upper electrode assembly 20 downward bringing the electrode 24 into contact with the work in a position hereinafter described in detail.

The upper electrode assembly 20 is a conventional assembly comprising a spring loading mechanism and welding current control timer initiating switch. These assemblies are well known to the art and need not be described here.

Also mounted on the support post 10 and insulated therefrom by insulating bushing 26 is the lower welding arm 30. Mounted in the lower arm 30, as shown in greater detail in Figure 2, is member 32 which is rotatably mounted within the bore 34 and held against axial movement by screws 36 and 38. Formed as part of the member 32 is a ratchet 40. Rotatably mounted on member 32 is the housing 42 to which is affixed operating arm 44. Mounted on the face of housing 42 by screws 62 is cover plate 64. Connecting link 46 connects operating arm 44 with the lever 48 which is pivotally mounted on pin 18 and is actuated by actuating rod 14 through the pin 50.

Contained within operating arm 44 is pawl 52 which is urged inwardly by the action of spring 54 and engages the faces of the ratchet lobes 56, 57, 58 and 59 as will be hereinafter described.

Mounted within the member 32 and equally spaced from each other are three pins such as are shown at 66. Each pin is backed by a spring similar to that shown at 68 and has at its outer end a portion 67 of reduced diameter which engages within one of three holes 69 provided therefor in the ceramic disc member 74. Centrally mounted within the member 32 is the conducting rod 70 over which is placed the tube member 72 support-

ing the disc member 74 and the cap member 76, these members forming the cathode assembly.

Also mounted on the base plate 12 is member 78 on which is slidably mounted member 80 mounting a face plate 82, micrometer support plate 84 and micrometer locking bracket 83 in which is threaded micrometer locking screw 85. Threaded into support plate 84 is the internal micrometer member 86 into which is threaded micrometer stem member 87 which mounts the external micrometer member 88.

The upper edge of the face plate 82 must rise sufficiently high above the center of the disc 74 that for any position of member 32 at least two of the pins will bear on the disc below the upper edge of the plate to provide stability in order that the disc will be held in a flat position against the plate 82 by the action of spring load pins 66. The plate is notched at 81 to provide clearance for the tube 72 and the cap 76.

Also coupled with the operating foot treadle (not shown) below the table is a second actuating rod 90 which is connected to rod 102, through arm 92, shaft 94 and arm 98, which are pivotally supported by mounting bracket 100. Pivoted on a fixed pin 104 is arm 106 which is yieldably engaged by rod 102 upon motion of the rod to the left through spring 108 and non-yieldably engaged by rod 102 upon motion of the rod to the right through stop 107. The pin 110 mounted on arm 106 engages the wall 112 of a bore within the member 80.

When the operating foot treadle is depressed the rod 14 actuates member 16, causing the welding electrode assembly 20 to move downward and the electrode comes into engagement with the cap member 76 as shown by 24'. Actuating rod 14 working through member 50 also actuates lever 48, connecting link 46 and actuating member 44, moving member 44 in a downward direction.

In Figure 3 the pawl 52 is sliding over the outer face of a ratchet tooth while the actuating lever 44 and the housing 42 are rotating in a counterclockwise direction, the lowermost extent of travel of which will allow the pawl 52 to spring radially inward into a position of engagement below the face 59 of a ratchet tooth.

Simultaneously with this action the actuating rod 90 acting on rod 102, member 106 and pin 110 moves the member 80, face plate 82, and the micrometer assembly 86, 87 and 88 to the left as viewed in Figure 2, causing the end face 124 of the micrometer rod 87 to press the cap member 76 against the end face 123 of the member 70 with a force dependent upon the resistance to compression afforded by spring 108. The force with which the spring acts can be adjusted by adjusting the position of nut 109 on the threaded portion 103 of the rod 102. Thus, the plane of the face of the cap member 75 is fixed by the plane of the end face 124 of the rod 87.

With the apparatus in the position shown the shoulders of the pins 66 are urged against the disc 74 by the action of springs 68 thereby holding the disc member 74 flat against the face of plate 82. It will be apparent that, by turning the external micrometer member 88, the dimension between the end face 124 of rod 87 and face of the plate 82 may be adjusted to any desired value, thereby accurately establishing the dimension between the face of the disc member 74 and the face of the cap member 76. When the micrometer has been adjusted to the desired position locking screw 85 is tightened against the micrometer

member 88 preventing subsequent motion thereof.

When the electrode member is in its lowermost position 24' as shown in construction lines in Figure 2, the welding current which may be supplied by a conventional welding current timer (not shown), passes through lead wire 114 into conducting member 116 through flexible jumper 118, conducting member 120, electrode 24, cap 76, tubular member 72, rod 70, member 34, lower arm 30 and returns to the welding current timer through conductor 122. This flow of current forms a weld between the tube member 72 and the cap member 76 in a manner well known in the spot welding art.

After the weld has been made the operator releases the foot treadle allowing actuating rod 14 to move downwardly thereby raising the electrode 24 and raising connecting link 46 and operating arm 44, thus rotating the ratchet 40 in a clockwise direction, as viewed in Figure 3, and thereby rotating the member 34, the pins 66 and the tube, disc and cap assembly through 90° to a position preparatory to making the next weld. When actuating rod 14 moves downwardly actuating rod 90 also moves downwardly thereby moving the rod 102 to the right allowing spring 108 to expand partially relieving the pressure applied on the cap member 76 between end faces 124 and 123 of the rods 87 while the tube, disc and cap assembly rotate as a result of the operation of the cam 40.

When the foot treadle is depressed for the next welding operation and the ratchet pawl 52 slides over the next successive ratchet tooth the member 32 is restrained from rotating by the friction resulting from the remaining contact pressure existing between the ends of rods 87 and 70 and between the disc 74 and the plate 82.

In my copending application, Serial No. 75,577, filed Feb. 10, 1949, there is disclosed a method and apparatus for mounting the disc 74 on the tube 72 by forming beads in the tube on each side of the disc.

In the copending application of Thomas H. Briggs, Jr., Serial No. 75,845, filed February 11, 1949, there is disclosed a method and apparatus for striking the beads, closing the beads and causing them to bear flatly against the disc as shown in the present application.

It is difficult to maintain the extreme degree of accuracy of dimension required between the face of the cap member 76 and the face of the disc member 74 by relying on providing the proper length of tubing 72 extending beyond the face of the disc. This problem is further complicated by the inconsistencies occurring in the bend radius obtained in the manufacture of a drawn cap such as member 76. The present invention provides means for assembling the cap to the tube with the high degree of accuracy required since neither the length of the tube nor the dimensions of the cap determine the final central spacing of the face of the insulating disc from the face of the cap.

When the foot treadle is released to an extreme forward position the actuating rod 90, operating through arm 92, shaft 94, arm 98, rod 102, stop 107, member 106 and pin 110, causes the member 80 to move to the right to a position entirely clear of the rod 70 and the electrode 24, thereby providing the necessary clearance required by the operator to insert the assembly for welding.

The operator having manually pressed cap 76 over the end of the tube of a tube and disc assembly slides the tube over the rod 70 and rotates

the tube and disc assembly to a position where the ends of the pins **66** drop into the holes **69** in the disc.

As the operator then depresses the foot treadle the member **80** moves to the left carrying with it the face plate **82** and micrometer member **87**. When the face plate **82** engages the ceramic disc the disc and tube assembly are carried to the left forcing the pins **65** into member **32** compressing the springs **68**. The spring loaded pins **66** hold the disc (in a flat position) against the plate **82**. The disc and tube will be moved to the left over member **70** until the cap **76** is firmly engaged between the ends of member **70** and member **87**. When this position has been attained the tube **72** will generally have been withdrawn slightly from the original extreme position, in which it was assembled by the operator, within cap **76** before motion of the plate **82** is arrested as a result of the rods **70** and **87** contacting the opposite faces of disc **76**. Thus there is established the parallel relation required between the planes of the faces of cap **76** and disc **74** in accordance with the parallel relation existing between the plate **82** and the end faces of rods **70** and **87** and the longitudinal dimension between these plane faces as determined by the longitudinal dimension between the plate **82** and the end of rod **87** which is accurately adjusted by the micrometer setting. Further motion of the foot treadle will cause the upper electrode to move downwardly and bear upon the cap in the position shown at **24'** and initiate a welding current impulse thereby forming a weld between cap **76** and the tube **72** in the location at which the electrode contacts the cap. When the welding current flow is completed the operator will release the foot treadle, raising the electrode from the cap, raising the operating arm **44** and operating the ratchet to cause a 90° revolution of the member **32** of the tube, disc and cap assembly as has been hereinbefore reviewed.

The operator will operate the foot treadle four times producing four welds spaced around the cap and will then release the treadle to an extreme forward position, again moving member **30** to the right to a position providing the clearance required for the removal of the welded assembly and the insertion of an assembly to be welded.

What I claim and desire to protect by Letters Patent is:

1. Apparatus for welding a member to a tube in accurate axial relationship to an element mounted on said tube comprising an elongated support on which said tube and element mounted thereon and said member may be mounted, a welding electrode movable transversely to the axis of said support, gauging means engageable with said element and with said member to fix their axial relationship, and means for bringing said electrode into contact with said member to effect welding thereof to said tube.

2. Apparatus for welding a member to a tube in accurate axial relationship to an element mounted on said tube with planes of said member and element accurately parallel comprising an elongated support on which said tube and element mounted thereon and said member may be mounted, a welding electrode movable transversely to the axis of said support, gauging means engageable with said element and with said member to fix their axial relationship, and means

for bringing said electrode into contact with said member to effect welding thereof to said tube.

3. Apparatus for welding a member to a tube in accurate axial relationship to an element mounted on said tube comprising an elongated support on which said tube and element mounted thereon and said member may be mounted, a welding electrode movable transversely to the axis of said support, gauging means engageable with said element and with said member to fix their axial relationship, means for bringing said electrode into contact with said member to effect welding thereof to said tube, and means for rotating said tube and member to successive welding positions with respect to said electrode.

4. Apparatus for welding a member to a tube in accurate axial relationship to an element mounted on said tube comprising an elongated support on which said tube and element mounted thereon and said member may be mounted, a welding electrode movable transversely to the axis of said support, gauging means including a fixed member and an adjustable member, said members having parallel surfaces, one of said surfaces being engageable with said element and the other being engageable with said member to fix their axial relationship, and means for bringing said electrode into contact with said member to effect welding thereof to said tube.

5. Apparatus for welding a member to a tube in accurate axial relationship to an element mounted on said tube with planes of said member and element accurately parallel comprising an elongated support on which said tube and element mounted thereon and said member may be mounted, a welding electrode movable transversely to the axis of said support, gauging means including a fixed member and an adjustable member, said members having parallel surfaces, one of said surfaces being engageable with said element and the other being engageable with said member to fix their axial relationship, and means for bringing said electrode into contact with said member to effect welding thereof to said tube.

6. Apparatus for welding a member to a tube in accurate axial relationship to an element mounted on said tube comprising an elongated support on which said tube and element mounted thereon and said member may be mounted, a welding electrode movable transversely to the axis of said support, gauging means including a fixed member and an adjustable member, said members having parallel surfaces, one of said surfaces being engageable with said element and the other being engageable with said member to fix their axial relationship, means for bringing said electrode into contact with said member to effect welding thereof to said tube, and means for rotating said tube and member to successive welding positions with respect to said electrode.

PRICE L. REED.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,008,628	Brown	Nov. 14, 1911
1,703,588	Meadowcraft	Feb. 26, 1929
2,393,719	Stull	Jan. 29, 1946
2,451,169	May et al.	Oct. 12, 1948