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ELECTRONIC TUBE PACKET

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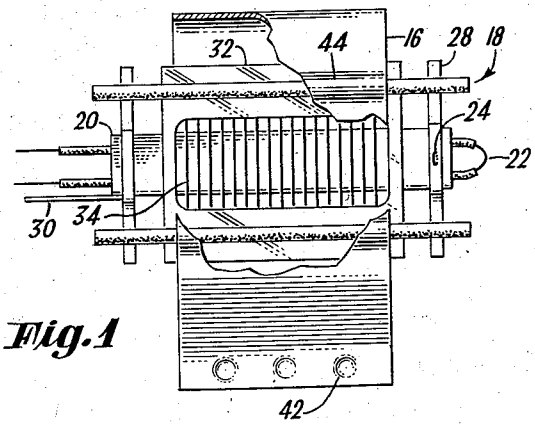

Fig. 1

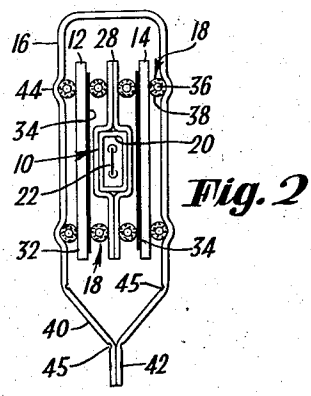

Fig. 2

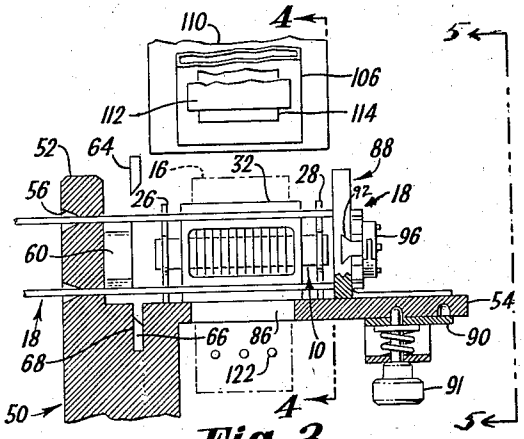

Fig. 3

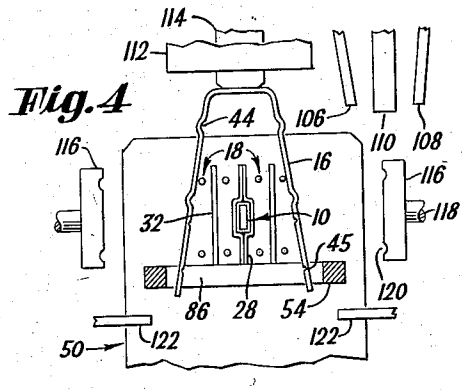

Fig. 4

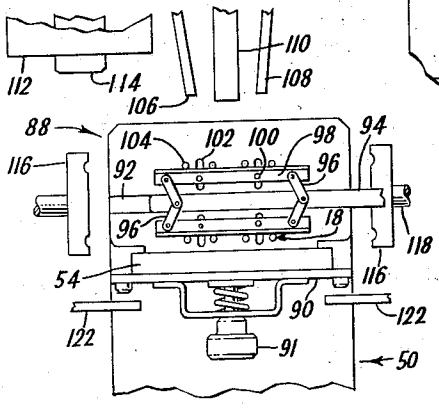

Fig. 5

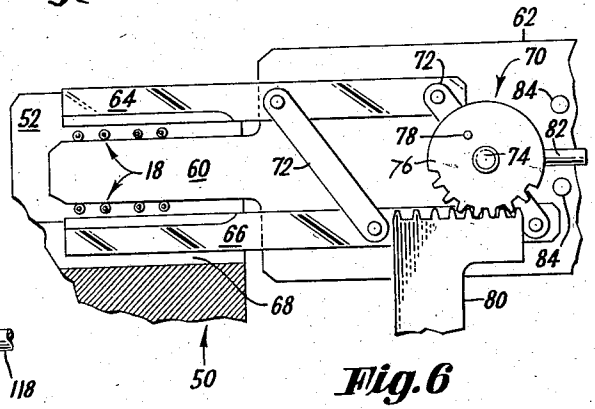

Fig. 6

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ELECTRONIC TUBE PACKET

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5 Claims. (Cl. 313—256)

This invention relates to electronic tube packet construction suitable for automatic production and to apparatus for assembling and unifying the parts of the packet.

It is an object of this invention to provide an electron tube packet which shall be compact, rugged in construction so as to give long life, and have reproducible characteristics.

It is a further object of the invention to provide a tube packet construction which shall lend itself toward ease in assembly of electrodes and spacers.

It is yet another object of the invention to provide a simple process for assembling the necessary electrodes and spacers into a mount and for compacting the same into a unified package.

Yet another object of the invention is to provide an apparatus for facilitating manufacture of the packet.

These and other objects will become apparent after reading the following specification in conjunction with the accompanying drawings, in which

Fig. 1 is a plan view of a tube mount with parts broken away to expose interior portions.

Fig. 2 is an end view of the packet.

Fig. 3 is a diagrammatic side view of a portion of apparatus utilized for the production of a mount, parts being shown in section.

Fig. 4 is a sectional view through the apparatus of Fig. 3 taken on the line 4—4 thereof.

Fig. 5 is an end view of the apparatus of Fig. 3 looking in the direction of the arrows 5—5 in Fig. 3, and

Fig. 6 is a side view of a cutter employed in the apparatus.

For the purposes of illustration only and for the sake of simplicity, the description has been limited to a triode although it should be understood that the principles of this invention may be applied to tube mounts with any number of electrodes.

The triode mount or packet here illustrated comprises an indirectly heated cathode **10**, a pair of grids **12** and **14**, and an anode **16**, with suitable spacer rods **18** between the elements. The rods **18** are of tungsten or the like coated with a suitable insulating material as alumina.

The cathode **10** comprises a metallic sleeve **20**, rectangular in cross section, in the exemplary form of the invention, with an emissive coating on the outside and with an insulated filamentary type of heater **22** internally of the sleeve. At one end of the cathode sleeve is welded, as at **24**, a pair of welded together metallic straps **28** of low heat conductivity, these straps being brought together at their ends as illustrated in Fig. 2, with the ends clamped between the insulated rods **18**. At the other end, a second pair of straps **26** welded to one another is employed but these are only form fitted around the cathode to allow for sliding of the sleeve on expansion and contraction of the same due to heating and cooling. A suitable tab **30** to be welded to a stem lead is welded to one end of the sleeve.

The grids are each comprised of a hollow rectangular metallic frame **32**, as of copper or molybdenum, with grid

wires **34** of tungsten or the like brazed or otherwise secured to one face of the frame. The frames are so related to the cathode, that the grid wires face the cathode, the spacing between grid wires and the cathode being determined by the diameter of the insulated spacer rods.

The spacer rods **18** each comprise a sheathed metal rod **36** of tungsten, nickel or the like coated, catephoretically, if desired, with an insulating coating **38** such as alumina. With the catephoretic method of coating, it is easily possible to maintain the coating diameter to ±.0005 inch, thus making it possible to produce these rods accurately as well as cheaply.

The anode **16** comprises a nickel plate bent to substantially U form with converging free ends **40**, as illustrated in Fig. 2, the free ends being spot welded together as shown at **42** to form a flat packet tightly holding the cathode and grids in position within the anode. The spacer rods **18** maintain suitable spacing between the cathode and grids and between the grids and the anode. The anode is further provided with longitudinal recesses **44** to accommodate the outside rods **18** to position them in the packet and also with very slightly weakened portions **45** to facilitate the forming of the convergent portions of the anode.

The grids and the anode may be provided with tabs, as is usual in the art, to connect these parts with stem leads.

There is thus provided a simple compact tube mount construction capable of jig or machine production.

The tube mount may be produced very simply in the jig described below.

A support **50** is provided having an upstanding rod guide wall **52** and a horizontal shelf **54**. The guide wall is provided with a number of holes with flaring mouths as at **56**, the number of holes corresponding to the number of rods **18** to be utilized in the construction of the tube mount and their spacing apart vertically corresponding to the spacing apart vertically of these rods in the finished mount. The horizontal spacing of the holes, however, is greater than the horizontal spacing of the rods **18** in the finished mounts by an amount sufficient to allow for the vertical sliding of the required cathode and grids in between the rods.

Adjacent to the wall **52** is located the cutting mechanism shown in side view in Fig. 6. This mechanism comprises a ledger blade **60** carried by a horizontal reciprocable operating bar **62** to a position between the rows of holes **56** and along the face of the wall **52**. The mechanism also comprises a pair of vertically spaced apart, horizontal, bevelled cutter blades **64**, **66**, the lower one of which, **66**, rides in a slot **68** cut into the support **50**. When these blades are brought into closing relationship with the ledger bar **60**, rods **18**, which had been threaded through the guide wall **52**, will be severed. The cutter blades are provided with parallel link mechanism **70** to cause the blades to approach the ledger bar in parallel sliding fashion to effect a sliding cut simultaneously on all of the rods. The mechanism **70** comprises a link **72** pivoted to both blades **64** and **66**, a second link **72** also pivoted to both blades **64** and **66**, said second link **72** being equal in length to the first link and pivoted centrally at **74** to the operating bar, a pinion **76** pinned at **78** to first link **72** and a stationary rack **80** on which the pinion rolls. A stop arm **82** on the pinion cooperating with stop pins **84**, **84**, on the bar **62** prevents excessive movement of the cutter blades. After the rods have been severed, the operating bar is moved to the right in Fig. 6 to clear the space in front of wall **52**.

The shelf **54** is provided with a rectangular opening **86** (see Figs. 3 and 4) of a length less than the long dimension of the grid frames **32** and of a width just a little longer than the spread dimension of the anode **16**, as seen in dotted lines in Fig. 3. Also associated with the shelf

is an L-shaped slidable tail block **88** having a strap **90** under the shelf. The block is held, in adjusted position, against slidable movement with respect to the shelf by stop pin **91**, as shown in Figs. 3 and 5 engaging in suitably spaced recesses in the under face of the shelf. On the rear face of the vertical wall of the block there is a dovetail groove **92** slidably engaging a cooperating clamp operating rod **94**. This rod operates the knees of a pair of like toggles **96**, the links of which are connected to parallel clamp jaws **98**. These jaws are each provided with pins **100** riding in slots **102** in the tail block to limit the motion of the jaws to rectilinear movement toward and from the rods **18** threaded through holes **104** in the block. The holes in the tail block are in registration with the holes **56** in guide wall **52**. The jaws are effective upon movement of bar **94** to the left in Fig. 5, to clamp the insulated rods **18** to the tail block **88**. When the bar **94** is moved to the right, the jaws are moved toward each other and the holes **104** are left unobstructed so that the rods **18** may freely thread themselves therethrough as will be described.

In the operation of the device as thus far described, the rods **18** are threaded through the holes **56** to an extent beyond the rear right hand face of the wall **52**. The cutter operating bar **62** is then moved to cutting position and the cutter blades operated by linear displacement of pinion **76** on stationary rack **80** to cut off the ends of the rods **18**, the rods of course initially being projected far enough over the ledger bar **60** so that all bars will extend equally beyond the rear face **52** after cutting. The bar **62** is then operated to withdraw the cutters and the tail block **88** is advanced into contact with wall **52** with the clamp jaws **98** in inoperative position. Since the holes in the tail block register with the holes in wall **52**, the rods **18** will thread themselves through the tail block and to an extent to project slightly therebeyond. The clamp jaws are now operated to clamp the rods to the tail block and the tail block is withdrawn to the position shown in Fig. 3, with the spring pressed detent **91** locking the tail block in position. With the rods held tightly by the clamp jaws, the cutter blades are brought into operation and the rods are severed. The rod sections held by the tail clamp **88** are sufficiently rigid, even though they are pliable, to maintain their alignment as determined by the spacing of the holes in the tail block **88**.

Above the jig there is suitably supported for conjoint lateral displacement, as viewed in Figs. 4 and 5, a number of chutes **106**, **108**, **110**, and **112**. The chutes **106** and **108**, when positioned as shown in Fig. 5, are in position to guide grid frames **32** with wires thereon into the spaces between the outside and inside coated rods **18**. At this time the chute **110** is in position to guide a cathode **10** in between the inner rods **18**. Fig. 4 shows the grids and cathode already in place with the chutes shifted preparatory to forcing an anode **16** over the assembly. It will be noted that the grid frames **32** will be located in between the rods by engagement of the lower edges of the frames with the upper surface of the shelf **54** on opposite sides of the opening **86**. So, too, the cathode **10** will be properly located by reason of the straps **26**, **28** similarly engaging the top surface of shelf **54**. When the chutes are shifted to the positions shown in Fig. 4, an anode **16**, performed as shown in Fig. 4, may be forced over the assembly as by being pressed down by a plunger **114** operative through the chute **112**. The plunger is depressed sufficiently to cause the upper recesses **44** in the anode to snap over the upper outer rods **18**.

Means are provided for effecting the compacting of the elements which comprise the mount assembly. These means comprise in part the press cheeks or plates **116**, each having an operating rod **118**. Recesses **120** are formed in the cheeks to conform to the configurations at **44** in the anode. After the anode has been forced into proper vertical downward position and so that the upper rods **18** are seated in the recesses, the plates **116** are simultaneously moved toward each other by suitable mechanism to cause the lower recesses **44** in the anode to embrace the lower outer rods **18**, and the whole assembly is compacted, the rods **18** flexing as necessary at their clamped ends to permit parallel approach of the portions of the rods **18** within the confines of the mount assembly. Substantially simultaneously with the movement of the press cheeks **116**, a suitable number of pairs of welding rods **122** are caused to approach each other to cause the free edges of the anode to approach each other to form the apex of the anode as shown in Fig. 2. When the free ends of the anodes are fully contacted, a welding shot is passed through the electrodes and anode to effect spot welding of the anode ends.

After the welding operation, the electrodes are withdrawn as are the press cheeks **116** and the clamp operating rod **94** is operated to release the clamps on the spacing rods **18**. The pin **91** is then withdrawn from its recess in shelf **54** and the tail block **88** is retracted so that pin **91** locks in the outer recess of the shelf. The compacted mount assembly may now be removed from the shelf **54** by any suitable means.

The cycle of operation is again started by moving the tail block **88** against the wall **52** and operating the clamps to grip the rods **18**, ready for withdrawal of the block **88** from the wall **52**.

After removal of the electrode assembly from the jig the filamentary heater and necessary tabs are added.

Having thus described my invention what is claimed is:

1. An electrode assembly comprising a cathode, a grid on each side of the cathode, an anode envelope surrounding the cathode and grids, and insulated spacer rods between the cathode and grids and between the grids and the anode envelope, the envelope tightly holding the parts in assembled relationship, the envelope having a U-shaped cross-section with the free ends of the legs convergent and firmly secured to one another.

2. An electrode assembly comprising a cathode sleeve, at least one strap athwart the sleeve and retaining the sleeve in position with respect to the strap, a grid on a side of the sleeve, an anode envelope surrounding the sleeve and grid, and insulated spacer rods between the strap and the grid and between the grid and the envelope, the envelope tightly holding the parts in assembled relationship.

3. An electrode assembly comprising a cathode sleeve, at least one strap athwart the sleeve and retaining the sleeve in position with respect to the strap, a grid on each side of the sleeve, an anode envelope surrounding the sleeve and grids, and insulated spacer rods between the strap and grids and between the grids and envelope, the envelope tightly holding the parts in assembled relationship.

4. An electrode assembly comprising a cathode sleeve, straps across the sleeve at spaced locations along the length of the sleeve, one of the straps being immovably secured to the sleeve and the other slidably retaining the sleeve, a grid on a side of the sleeve, an envelope surrounding the grid and sleeve, and insulated spacer rods between the straps and the grid and between the grid and the envelope, the envelope tightly holding the parts in assembled relationship.

5. An electrode assembly comprising a cathode sleeve, straps across the sleeve at spaced locations along the length of the sleeve, one of the straps being immovably secured to the sleeve and the other slidably retaining the sleeve, a grid on each side of the sleeve, an envelope surrounding the grids and sleeve, and insulated spacer rods between the straps and the grids and between the grids and the envelope, the envelope tightly holding the parts in assembled relationship.

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