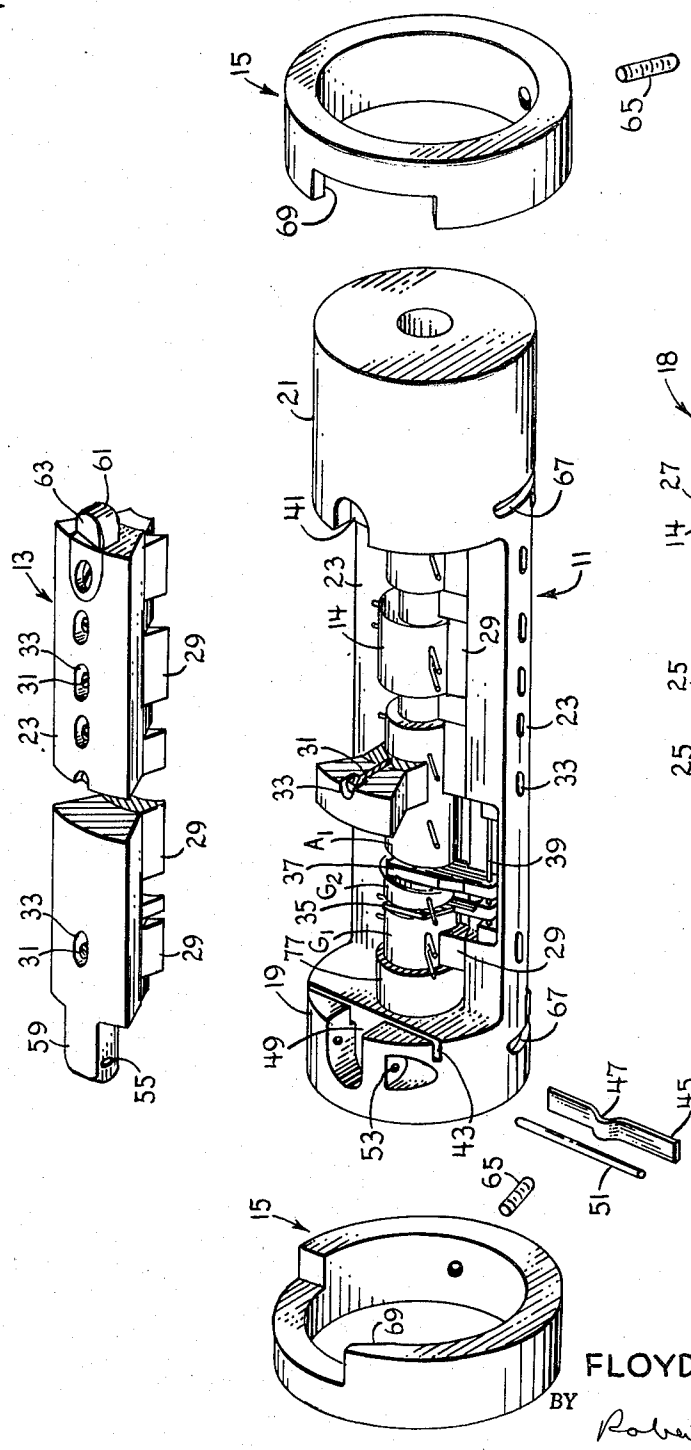
Oct. 4, 1960 F. K. COLLINS 2,954,972

ASSEMBLY JIG

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FIG. 1.



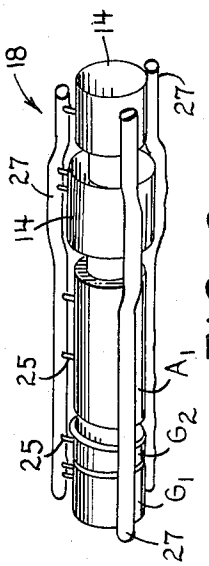


FIG. 2.

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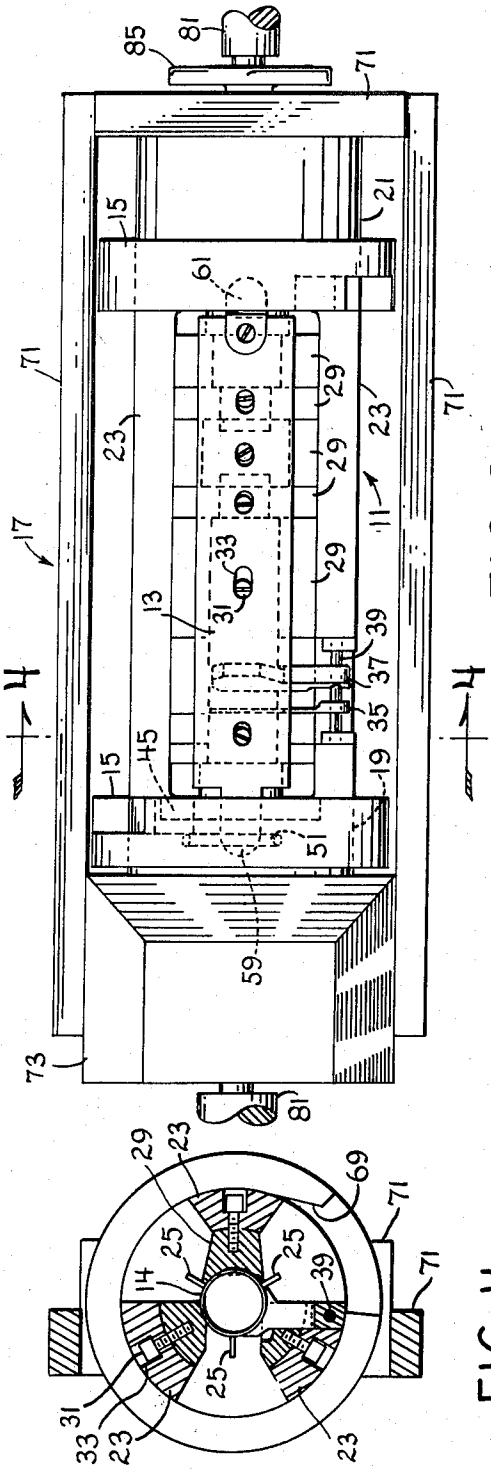


FIG. 3.

FIG. 4.

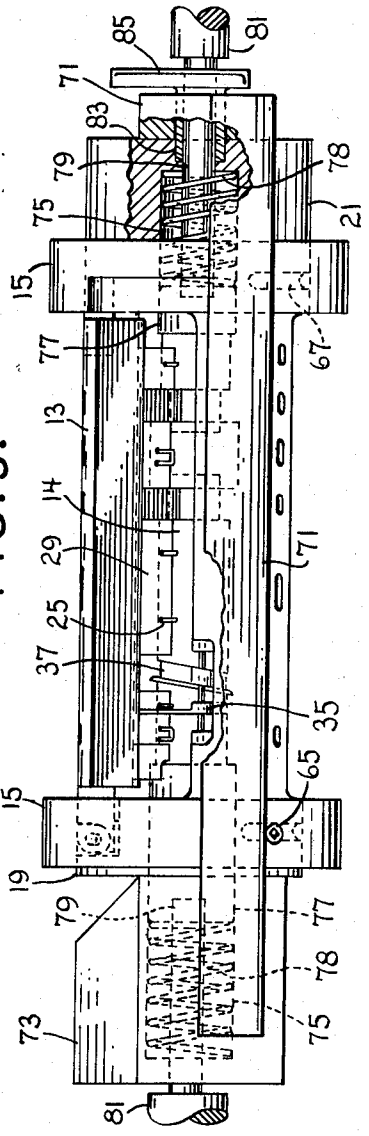


FIG. 5.

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ASSEMBLY JIG

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3 Claims. (Cl. 269—124)

This invention relates to assembly devices and more particularly to assembly jigs of the type adapted to be employed in the fabrication of cathode ray tube mounts.

A conventional cathode ray tube utilizes an electron gun structure which generally comprises a plurality of longitudinally arrayed spaced electrodes mounted in position relative to one another by either glass or ceramic side rods. During the mounting operation, these electrodes are usually maintained in alignment by a jig having a rotatably mounted cover and a recess defined by a tubular body portion. Several spacers are sometimes disposed within the recess and between, for instance, the cathode and first grid electrodes, to provide appropriate spacing of these components from one another. This type of jig is generally not acceptable for use with a mount of the type employing electrodes having variations in diameters or lateral dimensions and having configurations other than straight cylinders. In addition, such a jig does not provide sufficient spacing versatility for present manufacturing requirements, nor does it provide satisfactory means for holding and aligning the parts so that a rigidly aligned electrode assembly can be fabricated.

Accordingly, an object of the invention is to reduce the aforementioned disadvantages and to improve the fabrication of cathode ray tube mounts.

A further object is the provision of an assemblage of electrodes having properly aligned components correctly spaced from one another and mounted together in a rigid structure, and improved means for accomplishing the manufacture of such an assembly.

The foregoing objects are achieved in one aspect of the invention by the provision of an assembly jig employing spacing and aligning segments for the components and a cover member adapted to cooperate with the body portion of the jig to rigidly hold the electrodes relative to one another during the assembly operation.

For a better understanding of the invention, reference is made to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is an exploded perspective view of one embodiment of the invention;

Fig. 2 illustrates a cathode ray tube electrode assembly of the type adapted to be fabricated with the device shown in Fig. 1;

Fig. 3 is a plan view of the jig shown in Fig. 1;

Fig. 4 is a section taken along line 4—4 of Fig. 3; and

Fig. 5 is a front view of the jig shown in Fig. 1.

Referring to the drawings, a cathode ray tube gun structure assembly jig is shown in one embodiment of the invention as comprising a body portion 11 having a closure member 13 pivotally connected thereto for facilitating insertion and removal of the electrodes 14. Locking devices 15 are rotatably mounted upon the ends of the body portion to secure closure 13 thereto after the electrodes have been placed in position within the jig. A housing 17 may be provided to support the jig if it is to be employed with an automatic machine for assemblying the electrodes 14 to form a structure such as is shown in Figs. 3, 4 and 5.

Body portion 11 comprises a barrel 19 and a cylinder 21, which are mounted at opposite ends of longitudinal frame sections 23. Three such sections are shown in the drawings as being disposed approximately 120° apart, Fig. 4, to provide access to the electrodes 14 during the assembly operation. However, the invention described herein is also applicable to jigs employed in the fabrication of an electrode assembly having two positions or more than three positions whereat the electrodes 14 are to be supported.

Fig. 2 illustrates an electrostatic focusing type electrode mount 18 having a plurality of electrodes 14 spaced from one another and aligned in a longitudinal array. These electrodes are supported relative to one another by means of radially disposed substantially equally spaced studs, 25 which are embedded in glass rods 27. Since some of the electrodes have lateral dimensions and configurations different from others, the profile of the electrode mount is non-linear. In order to properly align and position such an array of electrodes, a plurality of appropriately shaped and positioned segments 29, which are mounted upon the interior surface of frame sections 23, are used.

During the assembly operation, the hinged closure member 13 is opened and electrodes 14 are placed into their correct nesting positions with one stud 25 extending intermediate the spaced frame sections 23, see Fig. 4. The closure member is then pivoted to the closed position and locking devices 15 are rotated to secure member 13 to body 11. During the closing operation, the edges of segments 29 in the closure member contact studs 25 so that the electrodes are automatically rotationally oriented relative to one another. This operation causes each stud at a given radial location on the electrodes to be rigidly positioned in longitudinal alignment with the associated studs on the other electrodes. The glass rod 27, which had been plasticized by any type of conventional beading machine, is then moved to a position where the studs become embedded in the glass. The jig may then be rotated about its own longitudinal axis until another group of studs are exposed to the beading machine and the glass beading operation is subsequently repeated. Three such operations would be used to fabricate an assembly of the type shown. However, the invention described herein is also applicable to construct an electrode mount employing more or less than three studs. Also, other types of support rods may be used, if desired. For instance, the electrodes may be provided with straps or pins which are formed to be welded to a rod having a form similar to that illustrated in Fig. 2 as rod 27. After completion of the assembly, locking devices 15 are rotated to the release position and closure member 13 is pivoted away from body portion 11. The electrode mount may then be removed from the jig since the opening opposite the closure member between spaced frame sections 23 allows the assembly rod 27 to pass therethrough.

It can be seen that electrodes 14 are nested within the surface defined by segments 29. These segments, which are arranged longitudinally, may be formed as a continuous surface from their respective support frames, or they may be constructed as a plurality of pieces to provide a surface which substantially conforms to the profile of the electrode mount. It is advantageous to use individual segments 29 which conform to at least a portion of each surface of the profile since they may then be separately mounted upon their respective support frames by any convenient means such as by screws 31, Fig. 1. This type of construction has advantages since openings 33 may be made oversized or elongated to facilitate longitudinal adjustment of the segments 29 relative to their respective supports 23. A continuous slot extending along the length of the support frames may be used instead of openings 33, if desired. Therefore,

electrodes having different lengths and different spacings can be handled by the jig with proper spacing adjustment of the segments. If desired, yieldable positioning means such as spring-loaded ball bearings may be mounted upon the peripheral surface of segments 29 to press upon electrodes 14 and thereby provide compensating means which accounts for variations in the diameters or lateral dimensions of these parts.

The segments 29 provide a nesting surface for properly aligning and positioning electrodes 14 relative to one another, and for spacing a number of the electrodes from one another. However, when an electrode mount of the type illustrated by the numeral 18 is employed, it has been found that the use of rotatably mounted spacers 35 and 37 has advantages due to the longitudinal configuration of the adjoining G_1 and G_2 electrodes and the bias-cut relationship between the G_2 and A_1 electrodes. These spacers are loosely held upon one of the body portion frame sections 23 by pin 39 in such a manner as to allow movement of the spacers longitudinally and rotatably relative to sections 23, transversely relative to sections 23, and rotatably, in a limited manner, relative to a pivot point located on pin 29. This type of spacer mounting is accomplished with the provision of apertures in the spacers which are larger than the diameter of the pin 39 which passes therethrough. Accordingly, due to the loose spacer mounting, the electrode structure can be easily removed from the jig after assembly without any binding action on the G_1, G_2 and A_1 electrodes. The utilization of one or more loosely mounted spacers is also applicable to jigs employed in the fabrication of electrode mounts which do not use a bias cut.

Disposed at one end of frame sections 23 is a cylinder 21 having a cut-out portion 41 formed in the external surface thereof to receive the end of closure member 13 as will be hereafter described. Disposed opposite to cylinder 21 is a barrel 19, which has a lateral slot 43 formed therein to receive resilient biasing means or spring 45. The spring has a knuckle 47 which is normally disposed within opening 49 in the barrel to operate on closure member 13. A bar or pin 51 is threaded through aperture 53 in the barrel and elongated opening 55 in the closure member to rotatably attach or hinge member 13 to the barrel.

Closure member 13 comprises a frame section 23 with segments 29 mounted thereon by means of the screws 31, which are disposed within the openings 33. A hinge tooth 59 extending from section 23 is positioned within the barrel opening 49 and is maintained therein by means of bar 51. Hinge tooth 59 may be provided with an upper surface which is beveled, if desired, to cooperate with its associated locking device 15 as will be hereafter described. The resilient knuckle 47 operates on the lower surface of the tooth to impart thereto a bias which is transverse to the longitudinal axis of the jig. Disposed opposite to tooth 59 on closure frame section 23 is a tongue 61 having a beveled surface 63. When closure member 13 is rotated to the closed position, tongue 61 becomes seated within cut-out 41 in cylinder 21.

Locking devices 15 are rotatably mounted on barrel 19 and cylinder 21 by virtue of the slidable engagement between pins 65 and grooves 67, which are formed circumferentially over at least a portion of the barrel and cylinder peripheral surfaces. Locking devices 15 are each provided with a tapered cam surface 69 formed to operate on tooth 59 and tongue 61 to secure closure member 13 to body portion 11 after the closure member has been rotated into position. The end of tooth 59 does not interfere with spring 45 during the pivoting action of the closure member since it traverses an arc within opening 49 which is behind the spring position.

Closure member 13 is mounted upon the body portion for rotative and transverse movement relative thereto during the electrode loading operation. After member 13 has been pivoted to the closed position, locking devices 15 are rotated to cause cams 69 to operate on the upper surface of tooth 59 and beveled surface 63 to provide a final transverse movement to the closure member counter to the bias of spring 45. Such an arrangement is advantageous since it allows the final pressure on electrodes 14 to be applied substantially perpendicular to the longitudinal axis of the electrodes. In addition, this type of movement achieves rigid positioning for the electrodes even though there is a slight variation in diameter or lateral dimension of the electrodes from one assembly to another. When the locking devices are rotated to the release position, spring 45 causes closure member 13 to initially move substantially transverse to the electrode assembly, thereby loosening the assembly for easy removal from the jig.

Housing 17 is formed with braces 71 and a block 73 connected together to circumscribe the jig and provide a rigid support upon which the jig may be revolved. Cylinder 21 and block 73 are formed with internal openings having enlarged cavities 75 which serve to house and maintain helical springs 78. These springs operate upon plungers 77, which are longitudinally slidable within the openings in the block, cylinder and barrel 19, to normally apply an inward pressure to the end ones of the electrodes. Rods 79 are connected to plungers 77 at one extremity and to shafts 81 at the opposite extremity so that an outward force exerted upon the shafts will compress the springs and retract the plungers from the electrode contact position. A sleeve 83 passes through an aperture in brace 71 and is rigidly affixed to cylinder 21 at one point and to a turning plate 85 disposed outside of the brace. With this arrangement, a turning movement of plate 85 will impart rotation to the jig. The plate may be shaped substantially as an equilateral triangle so that rotation of the jig to the three appropriate glass rod assembly positions may be easily achieved.

During the electrode loading and unloading operations, shafts 81 are pulled outwardly so that the plungers 77 are moved from the ends of the outer segments 29 and thereby to a non-interfering position from the electrodes. After the electrodes 14 have been nested within their associated segments 29, plungers 77 are allowed to move inwardly under the influence of springs 78. The longitudinal pressure on the end electrodes 14, which is imparted thereto by the plungers, aids in the alignment and spacing of the electrodes relative to one another. The jig may then be revolved to the appropriate glass rod receiving positions by means of the rotation of plate 85.

An assembly jig constructed in accordance with this invention is adaptable for use with an automatic electrode mount assembly machine since automatic means may be provided to operate, for instance, upon shaft 81 and plate 85 to align the electrodes and rotate the jig in a properly timed sequence during the assembly operation.

Although one embodiment of the invention has been shown and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. An assembly jig for cathode ray tube electrodes having a longitudinal axis comprising a tubular body portion terminating at one end thereof in a cylinder and formed with nests for holding the tube electrodes, a closure member having segments shaped and spaced in accordance with the profile of the tube electrodes and means for loosely hinge connecting said closure member to the body portion, biasing means mounted upon said cylinder adjacent the hinge connection pressing against the closure member after rotation thereof to a

position of close proximity to said electrodes to bias the segments away from the electrodes, and a locking device mounted on said cylinder formed to press against the cover member and overcome the pressure of said biasing means to move said segments substantially normal to the electrodes and into intimate contact therewith.

2. An assembly jig for cathode ray tube electrodes having a longitudinal axis comprising a tubular body portion terminating at one end thereof in a cylinder having a pin of given diameter attached thereto, said body portion being formed with nests for holding the tube electrodes, a closure member having segments shaped and spaced in accordance with the profile of the tube electrodes and an elongated opening provided at one end thereof having a length larger than said pin diameter for loosely receiving the pin to hinge connect said closure member to the body portion, a spring mounted upon said cylinder adjacent the hinge connection pressing against the closure member after rotation thereof to a position of close proximity to said electrodes for biasing the segments away from the electrodes, and a rotatable locking device mounted on said cylinder formed to press against the cover member and overcome the bias of said spring to move said segments substantially normal to and into intimate contact with the electrodes.

3. An assembly jig for cathode ray tube electrodes

having a longitudinal axis comprising a tubular body portion terminating at one end thereof in a cylinder having a pin of given diameter attached thereto, said body portion being formed with nests for holding the tube electrodes; a closure member having longitudinally adjustable segments shaped and spaced in accordance with the profile of the tube electrodes, an elongated opening provided at one end of the closure member having a length larger than said pin diameter for loosely receiving the pin to hinge connect said closure member to the body portion, and a protrusion formed at the opposite end thereof; a spring mounted upon said cylinder adjacent the hinge connection formed to press against the closure member after rotation thereof to a position of close proximity to said electrodes for biasing the segments away from the electrodes; and rotatable locking devices mounted on both ends of said body portion formed to press against the cover member adjacent the hinge and on the protrusion and overcome the bias of said spring to move said segments substantially normal to and into intimate contact with the electrodes.

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