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3,114,199

ASSEMBLY APPARATUS

Filed March 16, 1962

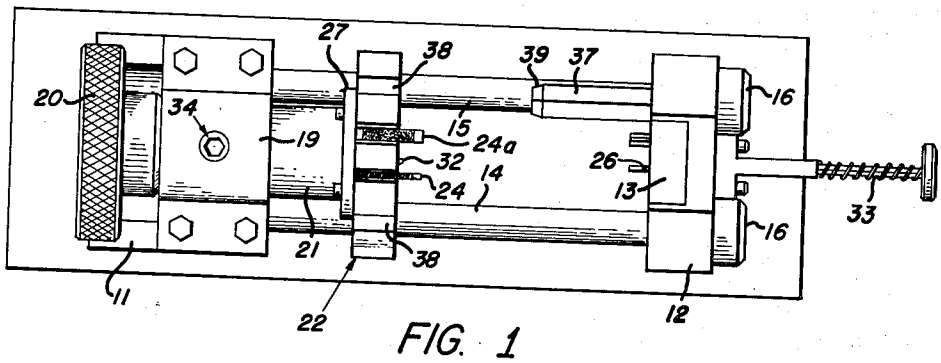


FIG. 1

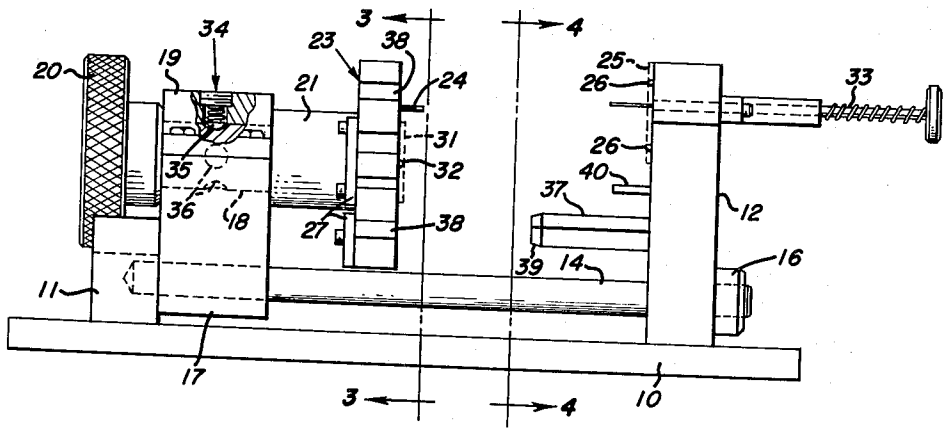


FIG. 2

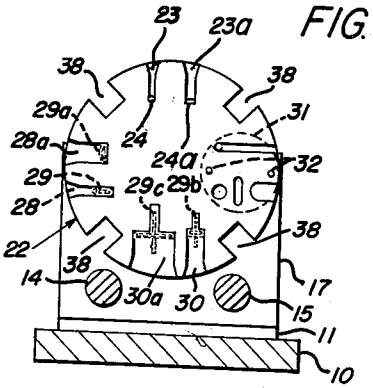


FIG. 3

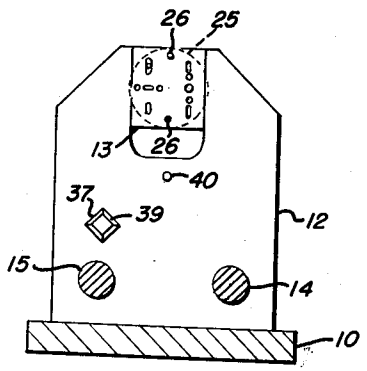


FIG. 4

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ASSEMBLY APPARATUS

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This invention relates to novel apparatus for assembling into a composite structure a plurality of parts requiring critical controlled relative spatial relationships, and has particular reference to apparatus for assembling the electrodes of an electron tube.

A device especially well suited for the use of apparatus embodying this invention is an electron tube of the type known as a receiving tube, the fabrication of which usually involves preparation of sub-assemblies wherein the components or elements are arranged in fixed predetermined critical relative spacial relations. One of such sub-assemblies usually comprises a cathode, at least one grid electrode, and a plate or anode, all of which are mounted coaxially in encircling or critical close-spaced relation to one another and are supported by means of insulating discs at each end of the assembled unit, which discs hold the elements in their proper preselected positions.

Many sub-assemblies of this type are fabricated by hand methods which are not only time consuming but also inefficient, due primarily to the fact that inexperienced or careless assemblers often damage elements during an assembly operation. For example, when forcing a cathode into openings provided therefor in an insulating disc, care must be exercised to insure that the electron-emissive coating on the cathode surface is not removed or that the cathode is not bowed by the applied pressure. When mounting a grid over a cathode, care must be taken to prevent grid wires from engaging the cathode and thus either removing the emissive coating on the cathode or disturbing the critically spaced grid windings. Careless assembly of a plate or anode over a grid can also cause damage to the grid windings.

The present invention overcomes the above and other disadvantages of hand methods of assembling elements of such devices by the provision of a compact unit or fixture for performing such assembly operations, which fixture embodies means for receiving and holding elements to be assembled, such means being rotational to sequentially align elements in position for assembly and slidable to move the elements easily and efficiently into proper spaced relation with other elements whereby the assembled elements are mounted and fixed in precise predetermined spaced relations whereupon the assembled unit may be ejected from the fixture.

Accordingly, it is one of the primary objects of this invention to provide novel improved means for mechanically assembling a multiplicity of components in precise, critical, cooperative spaced, assembled relationships.

Another object is to provide novel means for assembling components of an electron tube.

Another object is the provision of a device for assembling the electrodes of an electron tube in precise spaced relations.

Another object is to provide a device for transferring elements such as electrodes of an electron tube sequentially from a movable support into a receiving area where the elements are mounted, supported, and maintained in critical interelectrode spacial relationships.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, wherein:

FIG. 1 is a top plan view of apparatus embodying the invention;

FIG. 2 is a side elevational view of the apparatus shown in FIG. 1;

FIG. 3 is an elevational view, partly in section, taken on line 3—3 of FIG. 2 and looking in the direction of the arrows, showing the turret for supporting components to be assembled, and

FIG. 4 is an elevational view, partly in section, taken on line 4—4 of FIG. 2 and looking in the direction of the arrows, showing the nest on which components are assembled.

Referring more particularly to the drawings, wherein like characters of reference designate like parts throughout the several views, the apparatus includes a base 10 having fixed on the upper surface thereof two spaced uprights 11 and 12. Upright 12 is provided on its surface facing upright 11 with a nest 13. Nest 13 is a disc or plate which is fitted into a cavity or recess 14 (FIG. 4) and held therein by bolts or the like, whereby nests may be interchanged as desired.

Connecting the lower areas of the uprights 11 and 12 and spaced above base 10 are a pair of slide rods 14 and 15 which may be maintained immovably in the uprights by any suitable means, such as nuts 16. Slidably mounted on rods 14 and 15 is a support 17 which is adapted to be moved along the rods from a position adjacent one upright to a position adjacent the other upright. Means is provided in the support 17 for rotatable reception of a shaft 18 (FIG. 2), which means may take any suitable form such as a semicircular groove formed in the upper surface of the support and in which the shaft 18 is disposed, with a cap or cover 19 being located over the shaft and bolted or otherwise fixedly secured to the support 17 to retain the shaft in position.

The outer end of shaft 18 carries a knurled knob 20 by which the shaft may be manually rotated. The opposite end of shaft 18 is formed with an enlarged portion 21 to which is bolted, or otherwise removably secured, a turret 22. Thus, the turret is rotatable with shaft 18 and knob 20, and may be moved with the support 17 longitudinally of the device along slide rods 14—15.

The periphery of the turret 22 is provided with a series of notches or grooves which are adapted to receive components to be assembled by operation of the device into a single unitary structure. For example, electrodes of an electron discharge device, such as a receiving tube, may be positioned in selected grooves and subsequently moved into a position where they will be automatically assembled into a sub-assembly unit comprised of the electrodes and insulating supports therefor.

In the present example, the electrodes of a receiving tube of the type known as a "dual purpose" tube are utilized. This structure actually comprises two separate electrode structures, each embodying a cathode, grid, and plate or anode, and both electrode structures being supported in the assembled unit in side-by-side relation and held together at each end by one or more insulating discs of mica or the like.

In carrying out this example, turret 22 is first positioned by manual rotation of knob 20 in a position where the cathode-receiving grooves or notches 23 and 23*a* are located at the top of the turret, as shown in FIG. 3. Cathodes 24 and 24*a* are inserted in the grooves 23—23*a* and project outwardly from the face of the turret as shown in FIGS. 1 and 2.

The cathodes and other electrodes are to be assembled with an insulating disc 25 of mica, or the like, which is mounted by means of openings therein on a pair of short pins 26 provided on nest 13. Disc 25, which is shown by dotted lines to avoid obscuration of theadjacent parts of the device, is provided with suitable preformed openings for receiving end portions of the electrodes whereby, when all the electrodes are assembled with disc 25, the

disc will function to suitably support the electrodes as well as to space the electrodes properly from one another in controlled predetermined critical inter-electrode spacial relationship.

With the turret 22 located as shown in FIG. 3, and with cathodes 24—24*a* in respective grooves 23—23*a*, the support 17 carrying turret 22 is moved by manual, mechanical, or other suitable means toward upright 12. This will cause the exposed ends of the cathodes to enter the proper openings provided therefor in insulating member 25. Nest 13 is provided with a plurality of openings therein aligned with the openings in insulating disc 25 whereby the electrodes being assembled with disc 25 may project through the disc to the desired extent.

In the turret 22, the openings which receive electrodes are formed through the entire thickness of the turret as shown, and the electrodes are, during assembly, forced against backing plates 27 which are secured to the rear surface of the turret over the slots or grooves, as shown in FIGS. 1 and 2. The plates 27 also may be provided with grooves (not shown) in which electrodes may extend, if desired, for control of the extent to which the electrodes penetrate the disc 25.

After a cathode has been mounted in disc 25, as described, support 17 will be withdrawn along rails 14—15 to again locate turret 22 at the loading position. At this point, by manual operation of knob 19, the turret 22 is rotated 90 degrees to locate grooves 28 and 28*a* in an uppermost position, whereupon grids 29 and 29*a* are dropped into grooves 28—28*a*. The support, turret, and associated elements, are then again moved into a position adjacent upright 12, whereupon the grids will penetrate the insulating disc 25 in encircling relation to respective cathodes 24—24*a*, which were previously assembled with disc 25, and will be retained by the disc 25 when the turret is again returned to loading position.

Upon subsequent rotation of turret 22, anodes 29*b*—29*c* are loaded in grooves 30—30*a* and will be subsequently successively moved into engagement with disc 25, whereupon they will also be maintained and retained in encircling relation to the respective previously assembled components to provide an assembled electrode structure. However, to finally complete the structure, a second insulating disc, designated by numeral 31 in FIG. 3, is thereafter mounted on pins 32 carried by turret 22 and the turret is then moved to assemble the disc 31 upon the adjacent exposed ends of the electrodes which were previously mounted on disc 25. This completes the assembly of a single unitary electrode structure suitable for use in at least one type of electron tube.

The actual means by which the electrodes are retained in discs 25 and 31 does not comprise a part of this invention. However, in respect to the cathodes and grids, such means may consist merely of frictional engagement between the components and the respective walls of the corresponding openings in the discs. The ends of the anodes 29*b*—29*c*, however, are provided with tabs (not shown) which extend through openings in the discs and which thereafter are bent or twisted into overlying relation with the outer surfaces of the discs.

To remove the unit from nest 13, upright 12 carries an outwardly extending spring-tensioned plunger 33, the inner end of which projects through the upright 12 into engagement with the rear surface of insulating disc 25, whereby upon manual operation of the plunger 29, disc 25 and the parts assembled therewith will be ejected from pins 26.

In accordance with this invention, it is important that the components to be assembled be properly aligned with respect to the openings in the supporting insulating disc 25 and, of course, with the comating openings in the nest behind the disc. To locate the components in approximate alignment with the disc 25, there is provided spring detent means 34 (FIG. 2) which comprises a spring compressed ball member 35, which is adapted to drop into

one of a number of recesses 36 in shaft 18 as the shaft is rotated. The recesses are provided in shaft 18 in a number corresponding to the number of electrode supporting positions or stations formed in the periphery of turret 22. For example, ball member 35 will engage one recess when the cathodes are positioned in substantial alignment with the cathode openings in insulating disc 25. Likewise, as the turret is rotated to position the other components successively in alignment with their corresponding openings in disc 25, the ball will engage other recesses in the shaft.

However, to provide the exact critical alignment that is necessary, a guide bar 37 is mounted on upright 12 and extends toward the turret 22. The periphery of the turret is provided with notches 38 in a number corresponding to the number of stations which the turret is adapted to assume. The notches 38 are of a shape closely interfitting with guide bar 37 when the turret is moved toward upright 12. The exposed end of the guide bar 37 is provided with a tapered portion 39 which permits the guide bar to readily enter a notch 38 and to guide the turret in the proper manner as it continues in its path toward the upright 12. In this manner, each of the components is properly guided so that the most critical spacing between components is efficiently achieved during assembly of the device.

A stop pin 40 is also carried by the upright 12 in a position to be engaged by the adjacent surface of the turret for limiting the extent of movement of the turret, whereby the components will extend only the desired extent through insulating disc 25.

From the foregoing, it will be apparent that all of the objects of this invention have been accomplished by providing the described novel device for assembling a plurality of components into a unitary composite structure wherein the components will be maintained in critical controlled relative positions.

It is to be understood, however, that various modifications may be made in the apparatus shown and described by those skilled in the art without departing from the spirit of the invention as expressed in the accompanying claims.

I claim:

1. Apparatus for use in positioning and assembling a number of electrodes to a common support, comprising holder means for supporting the common support in a given plane, support means for the electrodes spaced from the holder means and comprising a turret rotatable about an axis perpendicular to the plane of the common support and embodying a plurality of retaining means thereon disposed radially of said axis for supporting said electrodes, means for rotating the turret to position the electrodes successively in alignment with the common support, and means for moving said turret toward the holder means to cause engagement of the successively aligned electrodes with the common support for assembly therewith.

2. Apparatus substantially as set forth in claim 1 wherein means is provided between said support and turret for indexing of the turret in positions where components thereof are approximately aligned with said first member.

3. Apparatus substantially as set forth in claim 1 wherein guide means is provided for aligning the turret with respect to the second upright whereby the components are consequently aligned with said first member.

4. Apparatus substantially as set forth in claim 3 wherein said guide means comprises a tapered indexing member on the second upright and a series of means on the turret each of which is adapted to be positioned in approximate alignment with said indexing member when the turret is located with components in approximate alignment with said first member, said series of means selectively receiving the indexing member in a closely

interfitting relationship as the turret is moved toward the second upright.

5. Apparatus substantially as set forth in claim 1 wherein means is mounted adjacent said second upright for ejecting an assembled unit from said holding means.

6. Apparatus for use in positioning and assembling a plurality of components to a common support, comprising holder means for supporting the common support in a given plane, support means for the components spaced from the holder means and comprising a turret rotatable about an axis perpendicular to the plane of the common support and embodying a plurality of retaining means

thereon disposed radially on said axis for simultaneously supporting said plurality of components, means for rotating the turret to position the components successively in alignment with the support, and means for moving said turret toward the holder means to cause engagement of the successively aligned components with the common support for assembly therewith.

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