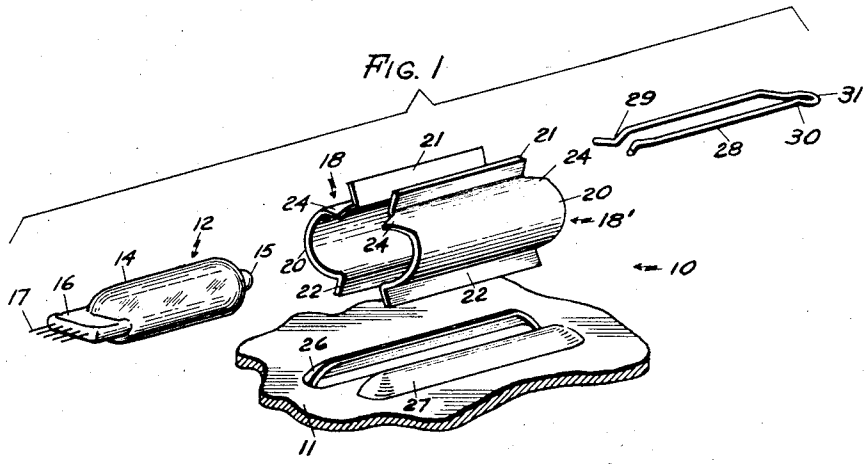
May 26, 1959 F. T. JARVIS 2,888,228

ELECTRON DISCHARGE TUBE MOUNTING

Filed Aug. 30, 1954

FIG. 1



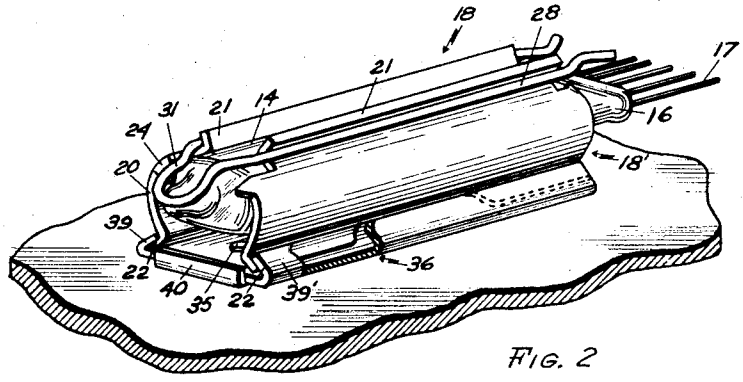
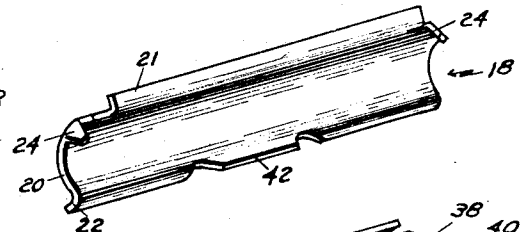


FIG. 2

FIG. 3



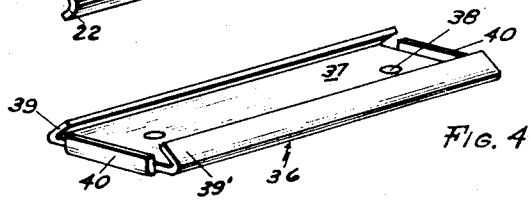


FIG. 4

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ELECTRON DISCHARGE TUBE MOUNTING

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9 Claims. (Cl. 248—316)

This invention relates to apparatus for mounting electron discharge tubes, particularly subminiature tubes, or other circuit components in a fixed position on a chassis.

The electron tube mounting means currently in use require a location either at an edge of the chassis or special cut-outs using considerable chassis area. Present tube mounts protrude beyond the surface of the chassis opposite that upon which the tube is mounted by an amount at least equal to the thickness of the stock used. Existing tube mounts permit removal of the tube along the longitudinal axis only, which in certain components is difficult to accomplish. The thermal dissipation in many existing tube mounting arrangements is relatively poor, either because of the relatively low thermal conductivity of the materials, such as spring steel or Phosphor bronze, now in use, or because of the comparatively small contact area between retainer and chassis.

The tube mounting assembly of the subject invention comprises two substantially identical retaining shells or retainers whose lower portions are held either by louvers formed in the chassis or by a channel-shaped member attached to the chassis and having two portions inclined with respect to said chassis. The tube is inserted in the louvers or channel-shaped member and a self-positioning and locking spring clip positioned over the upper portions of the shells lock the shells about the tube envelope. The shells preferably are made of a material, such as aluminum, which has a comparatively large coefficient of thermal conductivity. Since many chasses now in use are made of aluminum, corrosion resulting from metal-to-metal contact of the shells and the chassis is eliminated.

Because of the increased thermal conductivity of the shells and the larger shell-to-chassis contact area, hot spots on the tube envelopes are eliminated and dissipation of heat from the tube is substantially increased. A further increase in heat dissipation may be had by coating the inner surface of each shell which is in contact with the tube with a dark material such as black enamel.

The retaining shell may be installed simply. In order to receive said retaining shell, a louver may be formed by a simple louver-type punch and die process, or a channel with sloping sides and upturned end portions may be fastened to the chassis by small rivets or other fastening means. The corner portions of the louvers or the end portions of the channel, as the case may be, serve to restrict the longitudinal movement of the shells with respect to the chassis.

The mounting means of the subject invention may be installed at any location on the chassis and may be moved readily from one location to another simply by punching a new louver or by moving the channel to a new position. The mounting means requires no projecting portions beyond the opposing surface of the chassis.

By means of the subject invention, a tube may be removed easily either in a direction along the axis of the tube, or in a direction perpendicular to said axis. Once locked, however, positive retention of the tube within the mounting means is possible up to relatively high

values of acceleration. A small portion of each retaining shell may be folded over during fabrication to form a tab thereby insuring against longitudinal movement of the tube within said retaining shell.

Although the invention has been found particularly appropriate for mounting subminiature tubes, it is also applicable for mounting other electrical components, particularly components such as condensers which are of generally cylindrical configuration.

In the drawing:

Fig. 1 is an exploded view of a mounting arrangement particularly adapted for mounting subminiature tubes whose envelopes are cylindrical;

Fig. 2 is a perspective view of a mounting arrangement suitable for mounting flat or non-cylindrical subminiature tubes;

Fig. 3 is a view of a retaining shell suitable for enclosing tubes of flat or non-cylindrical configuration; and

Fig. 4 is a view of a channel used in the mounting arrangement of Fig. 2.

The component parts of the mounting assembly **10** for mounting tube **12** to chassis **11** is shown in Fig. 1. Tube **12** is a subminiature tube having a substantially cylindrical envelope **14** except for the exhaust tubulature **15** at one end and a flattened press or base **16** at the other end. From the press **16** of tube **12** extends a plurality of terminal leads **17** whose number depend upon the tube type.

A pair of similar resilient retaining shells **18** and **18'** also form a portion of the mounting arrangement. Each retaining shell, which may be fabricated from aluminum sheet, is formed in a single machining operation and includes an arcuate portion **20** conforming substantially to the configuration of the envelope **14** of tube **12** and terminating in a pair of oppositely inclined flat flange portions **21** and **22**. One of the flange portions **21** of each retaining shell may be made somewhat shorter than the other flange portion **22**, so that a corner may be bent over to form a tab **24** whose purpose will be explained later. The retaining shells may be made of any thin sheet metal which is of sufficient thickness to adequately conduct heat away from the tube. For example, the thickness of each shell may be of the order of 0.031 inch.

A pair of louvers **26** and **27** are formed in chassis **11** by means of a standard louver punch and die operation. These louvers extend on the upper side of the chassis only and present a pair of parallel inclined surfaces of substantially equal angle of inclination with said chassis plate **11** but of opposite slope. If the angle of inclination to the chassis is too great, that is, if the louver is too nearly vertical, the louver is apt to be torn at the corners. Furthermore, the spring tension necessary to retain the tube is increased and at angles approaching 90° it is difficult to keep the retainers in place. If the louver surface, on the other hand, is too nearly horizontal the shells will protrude beyond the opposite side of the chassis. An angle of about 45° has been found acceptable.

The flanged portions **22** of shells **18** and **18'** are so inclined as to be parallel to the inclined surface of the corresponding louver. Portions **22** are then inserted within the louvers so as to rest in substantial contact with said inclined surface. Once positioned in the louvers, tube **12** is inserted preferably with the plane of the terminal leads parallel to the chassis so as to facilitate wiring to chassis components.

A self-positioning spring clip **28** which is open at one end and contains crimped portions **29** and **30** locks the shells about the tubes. Clip **28**, which may be made of spring steel wire or any other resilient material, is inserted about flange portions **21** of the retaining shells, as shown in Fig. 2, so that the crimped portion **29** lies adjacent one end of flange portions **21**. The loop end

31 of clip 28 is inclined with respect to the remainder of the clip and if the latter is inserted with the loop end 31 extending downwardly a saving of head space is effected. If two tubes are to be mounted close together end-to-end, however, it is preferable to insert the clip for one tube mount with the loop end extending upwardly and to insert the clip for the other tube mount with the loop end extending downwardly. The clip is preferably inserted with the loop end adjacent the exhaust tubulature so that the loop end does not interfere with the terminal leads 17 of tube 12. The crimped portion 30 in the loop end 31 of clip 28 provides the necessary spring pressure for urging together the two shells 18 and 18' while the crimped portion 29 in the open end of the clip serves to retain the clip in position about the shells.

Where extreme vibrations are likely to be encountered, the open end of clip 28 may be wrapped with fine keeper wire, not shown, in order to insure against relative movement of the parts of the assembly.

The tabs 24 serve to prevent longitudinal movement of the tube within the retaining shells. These tabs are preferably provided at both ends of each shell to prevent movement in both directions. Moreover, tabs may be formed at both extremities of the arcuate portion 20 at each end of a given shell, instead of a single tab as shown in Fig. 1.

The corners of the louvers prevent the shells from moving relative to the chassis.

As shown in Fig. 2 the mounting arrangement may instead of louvers include a channel member 36 which is secured to the top surface of chassis 11, as by rivets 35. The channel member 36, shown in detail in Fig. 4, has a base portion 37 adapted to rest on the chassis 11 and containing holes 38 through which rivets or other fastening devices may be inserted for attaching the channel to the chassis. In addition, channel 36 includes a pair of spaced extensions 39 and 39' inclined at an angle to said chassis. The flange portions 22 of retaining shells 18 and 18' are inserted against the under surface of extensions 39 and 39', respectively, of channel 36. Upturned portions 40 at each end of the channel act to retain the shells 18 and 18' from movement in a direction parallel to the longitudinal axis of the mounting assembly. The remainder of the mounting assembly of Fig. 2 would be identical to that shown in Fig. 1 in the event that cylindrical tubes, such as shown in Fig. 1, are to be mounted therein. In other words, the channel and louver methods of mounting may be used interchangeably for any type of subminiature tube.

In Fig. 2 the mounted tube is of the flat bulb or non-cylindrical type. Although a louver or channel may be equally satisfactory for mounting such a tube, the shells of the mounting assembly for the flat tube differ somewhat from those used for mounting cylindrical or round bulb tubes.

The flat tube of Fig. 2, when mounted horizontally, that is, in the position shown in Fig. 2, has a tendency to rotate up into a vertical position 90° removed from that shown whenever pressure is exerted on the shells by the spring clip 28. To prevent this twisting of the flat tube from the horizontal position the lower flange portion 22 of each shell contains an inwardly projecting tab 42, as shown in Fig. 3.

The corners of the flat bulb tube are sharper than those of the cylindrical tube. Because of the smaller radius of curvature of the flat tube it has been found desirable to cut back the flange portion of the shells slightly and to bend the tabs 24 some distance from the end of the flange portion 22, as shown in Fig. 2.

The channel-type mounting arrangement is more flexible than the louver type, since the channel may be readily removed and shifted to a new position simply by removing the small rivets and securing the channels in the desired new position. The holes left in the former position are quite small as compared with those of the louvers and do not appreciably disturb the chassis. The louvers, on the other hand, must be punched down and new ones formed and it is sometimes difficult to mount any other components over the once-formed louvers.

As stated previously, the mounting arrangement of this invention is not limited to tubes but may be used to mount other circuit components, such as capacitors, resistors, transformers and the like, particularly those having either a cylindrical outer configuration or those encased in a cylindrical container.

This invention is not limited to the particular details of construction, materials and processes described, as many equivalents will suggest themselves to those skilled in the art. It is accordingly desired that the appended claims be given a broad interpretation commensurate with the scope of the invention within the art.

What is claimed is:

1. A structure for mounting a subminiature electron discharge tube on a chassis comprising a pair of similar shells each having an arcuate portion conforming generally to the configuration of the envelope of said tube and first and second flanged portions forming extensions of said arcuate portions, said first flanged portions of each of said shells removably engaging said chassis and having the longitudinal axes thereof extending parallel to the mounting surface of said chassis, each of said arcuate portions extending beyond the ends of the tube, said arcuate portions at least partially surrounding said tube and in substantial contact therewith, said shells being positioned entirely on one side of said chassis, and a resilient member inserted about said second flanged portions for drawing together said shells around said tube and for securing said tube within said shells, a corner of both ends of said arcuate portions being bent radially inward from the major surface of said arcuate portions for preventing longitudinal movement of said tubes within said shells.

2. A structure for mounting a subminiature electron discharge tube on a chassis comprising a pair of similar shells each having an arcuate portion conforming gengenerally to the configuration of the envelope of said tube, and first and second flanged portions forming extensions of said arcuate portions, a mounting member affixed to one surface only of said chassis and having a pair of spaced principal surfaces which are oppositely inclined with respect to said chassis, said first flanged portions of each of said shells removably engaging a corresponding surface of said mounting member and having the longitudinal axes thereof extending parallel to the mounting surface of said chassis, each of said arcuate portions extending beyond the ends of the tube, said arcuate portions at least partially surrounding said tube and in substantial contact therewith, said shells being positioned entirely on one side of said chassis, and a resilient member inserted about said second flanged portions for drawing together said shells around said tube.

3. A structure for mounting a subminiature electron discharge tube on a chassis comprising a pair of similar shells each having an arcuate portion conforming generally to the configuration of the envelope of said tube, and first and second flanged portions forming extensions of said arcuate portions, a mounting member affixed to one surface only of said chassis and having a pair of spaced principal surfaces which are oppositely inclined with respect to said chassis, said first flanged portions of each of said shells removably engaging a corresponding surface of said mounting member and having the longitudinal axes thereof extending substantially parallel to the mounting surface of said chassis, each of said arcuate portions extending beyond the ends of the tube, said arcuate portions at least partially surrounding said tube and in substantial contact therewith, said shells being positioned entirely on one side of said chassis, and a resilient member inserted about said second flanged portions for drawing together said shells around said tube,

a corner of both ends of said arcuate portions being bent radially inward from the major surface of said arcuate portions for preventing longitudinal movement of said tube within said shells.

4. A structure for mounting a subminiature electron discharge tube on a chassis comprising a pair of similar shells each having an arcuate portion conforming generally to the configuration of the envelope of said tube and first and second flanged portions forming extensions of said arcuate portions, a mounting member affixed to one surface only of said chassis and having a pair of spaced principal surfaces which are oppositely inclined with respect to said chassis, said first flanged portions of each of said shells removably engaging a corresponding surface of said mounting member and having the longitudinal axes thereof extending substantially parallel to the mounting surface of said chassis, each of said arcuate portions extending beyond the ends of the tube, said arcuate portions at least partially surrounding said tube and in substantial contact therewith, said shells being positioned entirely on one side of said chassis, and a resilient member inserted about said second flanged portions for drawing together said shells around said tube, said shells and the tube enclosed thereby being in thermal contact with said mounting member, a corner of both ends of said arcuate portions being bent radially inward from the major surface of said arcuate portions for preventing longitudinal movement of said tube within said shells, said mounting member including upturned flanges at each end thereof for preventing longitudinal movement of said shells with respect to said chassis.

5. A structure for mounting a subminiature electron discharge tube on a chassis comprising a pair of similar shells each having an arcuate portion conforming generally to the configuration of the envelope of said tube and first and second flanged portions forming extensions of said arcuate portions, said first flanged portions of each of said shells removably engaging said chassis, each of said arcuate portions at least partially surrounding said tube and in substantial contact therewith, said shells being positioned entirely on one side of said chassis, and a resilient spring clip having an open end and a closed end, each end extending beyond the longitudinal extremities of said shells, said spring clip being engageable with said second flanged portions of said shells, said open end of said clip being crimped to urge together said shells, and said closed end of said clip being crimped to retain said clip in said position about said shells.

6. A structure for mounting a subminiature electron discharge tube on a chassis comprising a pair of similar shells each having an arcuate portion conforming generally to the configuration of the envelope of said tube and first and second flanged portions forming extensions of said arcuate portions, said first flanged portions of each of said shells removably engaging said chassis, each of said arcuate portions at least partially surrounding said tube and in substantial contact therewith, said shells being positioned entirely on one side of said chassis, and a resilient spring clip having an open end and a closed end, each end extending beyond the longitudinal extremities of said shells, said spring clip being engageable with said second flanged portions of said shells, said open end of said clip being crimped to urge together said shells, and said closed end of said clip being crimped to retain said clip in said position about said shells, said spring clip being positioned nearer said chassis than the outer edge of said second flanged portions.

7. A structure for mounting a subminiature electron discharge tube on a chassis comprising a pair of similar

shells each having an arcuate portion conforming generally to the configuration of the envelope of said tube, and first and second flanged portions forming extensions of said arcuate portions, a mounting member affixed to one surface only of said chassis and having a pair of spaced principal surfaces which are oppositely inclined with respect to said chassis, said first flanged portions of each of said shells removably engaging a corresponding surface of said mounting member, said shells being positioned entirely on one side of said chassis, and a resilient spring clip having an open end and a closed end, each end extending beyond the longitudinal extremities of said shells, said spring clip being engageable with said second flanged portions of said shells, said open end of said clip being crimped to urge together said shells, and said closed end of said clip being crimped to retain said clip in said position about said shells.

8. A structure for mounting a subminiature electron discharge tube on a chassis comprising a pair of similar shells each having an arcuate portion conforming generally to the configuration of the envelope of said tube and first and second flanged portions forming extensions of said arcuate portions, a pair of parallel upturned mounting members formed in said chassis having principal surfaces oppositely inclined with respect to said chassis, said first flanged portions of each of said shells removably engaging said principal surface of a corresponding mounting member and having the longitudinal axes thereof extending substantially parallel to the mounting surface of said chassis, each of said arcuate portions at least partially surrounding said tube and in substantial contact therewith, and a resilient spring clip having an open end and a closed end, each end extending beyond the longitudinal extremities of said shells, said spring clip being engageable with said second flanged portions of said shells, said open end of said clip being crimped to urge together said shells, and said closed end of said clip being crimped to retain said clip in said position about said shells.

9. A structure for mounting an electron discharge tube on a chassis comprising a pair of similar retaining elements each having an arcuate portion conforming generally to the configuration of the envelope of said tube and first and second flanged portions forming extensions of said arcuate portions, said first flanged portions of each of said retaining elements removably engaging said chassis, said flanged portion of said retaining elements each having its longitudinal axis parallel to said chassis, each of said arcuate portions extending beyond the ends of the tube, said arcuate portions at least partially surrounding said tube and in substantial contact therewith, said retaining elements being positioned entirely on one side of said chassis, and a resilient member inserted about said second flanged portions for drawing together said retaining elements around said tube and for securing said tube within said retaining elements, said first flanged portions each including at least one inwardly projecting tab which lies in a plane substantially parallel to said chassis, said resilient member being engageable with said second flanged portions of said shells.

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