Oct. 9, 1956

L. R. WOODS

2,766,020

ELECTRONIC TUBE CLAMP AND SHIELD

Filed Aug. 28, 1953

Fig. 1.

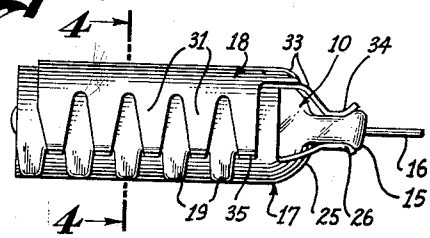


Fig. 2.

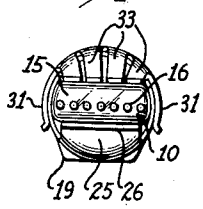


Fig. 3.

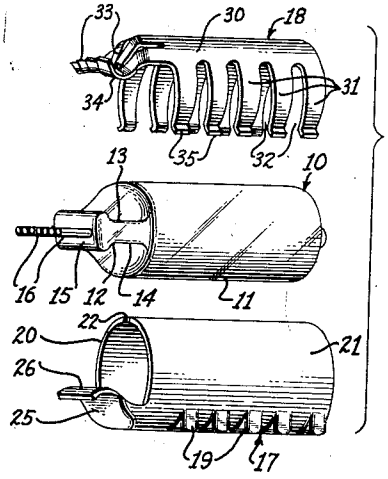


Fig. 4.

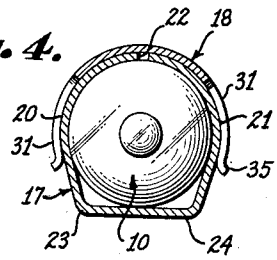


Fig. 5.

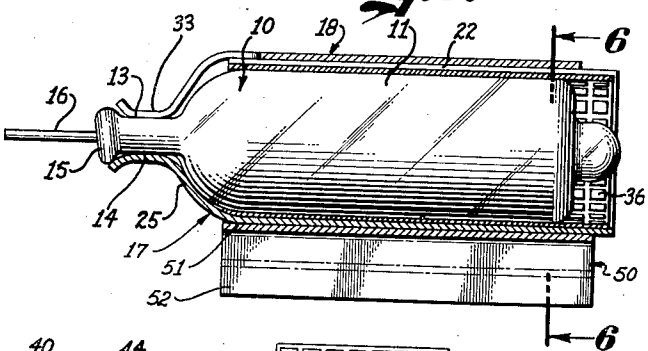


Fig. 6.

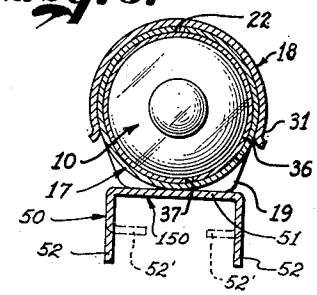


Fig. 7.

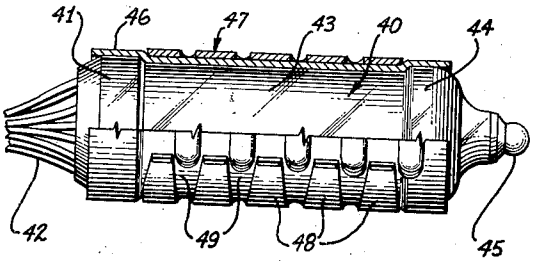
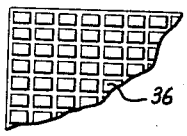


Fig. 8.



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ELECTRONIC TUBE CLAMP AND SHIELD

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9 Claims. (Cl. 257—263)

The invention relates to devices for securing electronic and similar types of vacuum tubes, which devices serve also as a means of cooling the tubes by conducting heat therefrom and also as cushions so as to minimize the effect of high frequency vibration on the tubes.

Two outstanding essentials in the employment of electronic tubes have been the provision of tube clamps capable of securely mounting the tubes in a selected location and devices for conducting away from the tubes heat generated during their operation. New developments in certain fields and particularly the fields devoted to aircraft and guided missiles have produced vibration conditions of far greater amplitude and intensity than previously experienced. Greater demands upon the performance of such electronic tubes have also necessitated more efficient means for conducting heat away from the glass exterior so as to more uniformly and more thoroughly cool the tubes.

Spring clips have often been resorted to for holding tubes in place. These have a number of objectionable features, one being that spring metal, when heated to temperatures frequently experienced in this particular field, tends to lose its resiliency and effectiveness.

It has also been known that glass is a relatively poor conductor of heat and for this reason tube clamps designed so as to grip the glass at scattered locations fail as a heat conducting medium in that, although heat may be conducted very rapidly away from those points on the glass touched by spring elements or fingers, there is sufficient heat remaining in the glass at locations between the points gripped by the fingers that excessive strains are set up resulting ultimately in cracking and failure of the tubes. With further respect to the new and highly intensive vibration conditions it has been found that on many occasions vibrations set up a resonant condition which greatly aggravates the objectionable effects normally experienced in the presence of very high frequency vibrations.

It has further been found that, particularly in flat press tubes where the area around wires emerging from the tubes is pressed into a flat form, normally unequal expansion between glass and the metal of the wire has caused a condition making it very necessary to cool tubes effectively at that point.

Efforts to improve the contact areas between the tube clamp and the glass have met with indifferent success partly by reason of the fact that relatively large tolerances are permitted in bulb diameter. Tolerances in surface areas have also been permitted to the extent that very frequently seams are present, high spots, and conditions of out-of-round form sufficient to considerably impair a close fit of the shield around the tube. This often results in a gradual diminution of the grip of the clamp on the tube until, after a period of use but long prior to exhaustion of the tube itself, the grip weakens and conditions begin to accumulate requiring constant servicing.

Good heat conductors can be found which include aluminum alloys and spring silver. Although both of these

metals are highly effective as a heat-conducting medium, they nevertheless lose their effectiveness when heated due to losing their temper and consequently their snug grip upon the tube.

A great deal of trouble has been experienced from snapping tubes into the spring type clamps. The snapping is sufficient often to start a slight strain not immediately detachable but which after use under vibration conditions ultimately contributes to fracturing of the tube at an inopportune time.

It is therefore among the objects of the invention to provide a new and improved tube clamp and heat-conducting shield device which is capable of uniformly cooling an electronic tube on which it may be used.

Another object of the invention is to provide a new and improved tube clamp and heat-conducting shield capable of operating at a low temperature gradient between tube and shield.

Still another object of the invention is to provide a new and improved construction for a tube clamp and heat-conducting shield such that the metal best able to conduct heat may be used for that purpose without impairing the ability of the clamp to maintain a tight grip upon the tube.

Still another object of the invention is to provide a tube clamping means consisting of a relatively dead metal so associated with a spring clamp that the dead metal is retained in place securely and uniformly by spring pressure which, because of the absence of heat in the spring clamp, will not weaken and deteriorate, thereby to diminish the efficiency of the tube installation.

Still further among the objects of the invention is to provide a new and improved tube clamp and heat-conducting shield which is especially well adapted to the clamping and cooling of flat pressed miniature and subminiature tubes.

Also included among the objects is to provide a new and improved cushioned clamp which permits insertion of the tube without undue strain upon the glass and which permits removal of the tube from the clamp with equal ease.

With these and other objects in view, the invention consists in the construction, arrangement and combination of the various parts of the device whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a side elevational view of one form of the tube clamp and heat-conducting shield device in place upon a flat press tube.

Figure 2 is a vertical end elevational view of Figure 1.

Figure 3 is an exploded view showing a tube and showing parts of the tube clamp and shield device in the positions from which they are advanced into contact with the tube.

Figure 4 is a cross-sectional view taken on the line 4—4 of Figure 1.

Figure 5 is a longitudinal sectional view of a subminiature tube wherein the tube clamp and shield device is illustrated with a modified type of liner.

Figure 6 is a vertical sectional view taken on the line 6—6 of Figure 5.

Figure 7 is a longitudinal view partially in section showing a form of the device applied to a button type tube.

Figure 8 is a fragmentary view of the innermost liner element employed in the form illustrated in Figures 5 and 6.

In a form of the device chosen to illustrate the invention there is shown a flat press tube **10** conventional in subminiature type tubes which consists of a cylindrical portion **11** and a flat press **12**. The flat press produces

opposite substantially parallel flat faces 13 and 14 at the end of which is a transverse bead 15 from which protrude wires 16.

For holding a tube of the flat press type there are provided, as illustrated in Figure 1, two principal elements comprising a chassis 17 and a clamp 18. These elements are shown in assembled condition in Figures 1 and 2 and separately in Figure 3.

More particularly the chassis is built from a dead metal. This dead metal is preferably very soft silver initially in sheet form which may be pressed by means of a die into the form illustrated in Figures 1, 2 and 3. The chassis as there shown is provided with protruding configurations 19 spaced longitudinally one from another and extending substantially throughout the length of the chassis. These protruding configurations extend across the chassis as is observable in Figure 4 so as to provide a series of flat base elements by means of which the chassis is supported upon some appropriate supporting surface. If the supporting surface be a metal, the chassis may readily be silver soldered or silver brazed to the base.

The chassis includes a pair of semi-cylindrical side walls 20 and 21 which can be folded around the cylindrical portion 11 of the tube after the tube is placed in the chassis. The semi-cylindrical walls are made of such width that they almost meet along a longitudinal meeting line 22. It is of interest to note that the protruding configurations 19 terminate on opposite sides in rounded ends 23 and 24 which stand out a slight distance from the exterior wall of the cylindrical portion of the tube. The configurations may be described as transverse ribs comprising a bottom support for the chassis.

At one end of the chassis is a tongue 25 dished to a limited extent for reception of the end of the cylindrical portion of the tube where it joins the flat press. The tongue turns upwardly to a transverse rounded contact 26 which is adapted to have the lower face 14 of the flat press rest thereon. Ordinarily the end of the chassis opposite the end at which the tongue is located is open.

After a tube has been set in the chassis and the semi-cylindrical sides 20 and 21 folded around it, the clamp 18 may be applied. The clamp is constructed of spring material. This clamp has a portion 30 slightly cylindrical so as to fit the exterior contour of the semi-cylindrical walls 20 and 21. Along each side of the portion 30 is a series of fingers 31 spaced longitudinally from each other and forming therebetween a series of spaces 32. The fingers continue to carry out the semi-cylindrical form of the clamp.

At one end of the clamp, namely, the end corresponding to the end at which the tongue 25 is located on the chassis, there are provided a series of spring legs 33 spaced laterally one from another and extending endwise and downwardly to a location where rounded ends 34 of the legs are adapted to engage in the face 13 of the flat press.

It will be noted further that the spring fingers 31 also terminate in rounded ends 35 and that these ends are adapted to fit between the rounded ends 23 and 24 of the protruding configurations on the chassis. By fitting thus snugly the fingers prevent endwise shifting of the clamp relative to the chassis as well as being depended upon to press the soft metal semi-cylindrical walls 20 and 21 into snug uniform contact with the glass exterior wall of the tube.

Because of the soft character of the semi-cylindrical walls 20 and 21 the metal of the walls is adapted to and does conform to irregularities in the exterior surface of the glass wall of the tube. The fingers therefore serve as a means of conforming the soft metal of the chassis into efficient heat-conducting relationship to the glass of the tube as well as serving to anchor the tube in its bed or position in the chassis. From this description it will be apparent that the tubes are merely laid in the soft silver chassis without there being any snapping of the tube in place which would otherwise tend to set up a strain in the glass.

After the chassis walls have been wrapped around the glass, application of the spring fingers 31, even though they might be snapped into place, does not set up any strain in the glass of the tube because of the fact that the soft metallic semi-cylindrical walls 20 and 21 absorb the shock of snapping the spring fingers into place.

Further by reason of pressing the tongue 25 into snug engagement with the flat press where it is held in snug engagement by the legs 33, the flat press is provided with a means of having heat conducted therefrom which as a consequence materially improves the cooling of the tube particularly at the critical point where the wires are embedded and emerge.

In a modified form of the invention illustrated in Figures 5 and 6 there is provided a liner or what may be aptly described as a cushion liner 36 which may advantageously comprise an initially relatively flat sheet of waffle embossed silver. This is a material frequently in the neighborhood of about .003 inch in thickness but wherein the effective thickness due to the waffle grid effect may be somewhat greater. Details of the cushion liner are shown in Figure 8.

The cushion liner is constructed of such width that it will substantially surround the cylindrical portion 11 of the tube leaving only a line 37 of separation.

The positioning of the liner is illustrated to good advantage in Figures 5 and 6. The length of the liner may be the same or slightly greater than the length of the cylindrical portion 11 of the tube. When applied the liner is initially wrapped around the tube and then the tube with the surrounding liner is rested in the chassis as an object might be rested in a cradle. The semi-cylindrical sides 20 and 21 of the chassis are then bent around the cushion liner and ultimately the clamp 18 is applied over the chassis semi-cylindrical side walls in the same manner as was initially described in connection with Figures 1, 2 and 3. This brings the spring fingers 31 into contact with the exterior of the chassis and thereby adding to the force of pressing the liner into conformation with any irregularities that may exist on the exterior of the glass wall.

An optional and convenient means of securing the chassis 17 to an appropriate mounting is illustrated in the modified form of Figures 6 and 7. For this purpose there is provided a channel-like clamp or elongated staple 50 having a flat web 51 silver soldered or otherwise attached to the configurations or transverse ribs 19 of the chassis. At each side of the web is a leg 52, adapted to be bent as shown by the dotted position 52' in Figure 6. The clamp thus described is an effective medium for use in mounting the chassis on one of the commercial forms of fibre mats in which slots may be cut for reception of the legs during the mounting operation. The clamp is one well adapted to mechanical assembly operations.

On those occasions where the tube clamp and shield device may be called upon to receive and mount a subminiature type tube of the so-called button type, such as the tube 40 of Figure 7, some slight modification may be found advantageous. The button type tube usually features an annular bead 41 at the pressed end through which wires 42 dispersed circumferentially about the end protrude. Frequently there is a cylindrical portion 43 at the other end of which may be a cap-like portion 44 adjacent a tip 45.

If the button type tube should have variations in the exterior contour such as those variations herein suggested or other variations due to roughness or a wide tolerance allowance in circumference, nevertheless the tube clamp and shield device may be counted upon to function efficiently and successfully. A chassis 46 substantially similar to the chassis 17 is employed except that there is omitted the tongue 25 and its transverse rounded contact 26. The chassis as previously noted is constructed of soft metal, soft silver being especially ap-

plicable, so that the metal of the chassis will conform to the irregularities of the surface of the tube.

A clamp **47** is employed having the same general shape and configuration as the clamp **18** except that the legs **33** are omitted. Fingers **48** extend along both sides and are spaced apart as previously noted by spaces **49** therebetween. The fingers fit into the usual spaces between protruding configurations **19'** of the chassis as shown in Figure 7 and of the same general form as shown and described in connection with Figures 1 through 6, inclusive.

Constructed as described the soft metal of the chassis can sustain a very considerable amount of heat and by reason of the fact that it can be constructed of the most efficient heat-conducting metal, the chassis is extremely efficient in conducting heat away from all sides of the tube and also from all portions of the tube surface. Continued heating or continued alternate heating and cooling conditions do not affect the efficiency in any adverse way. Such effect as might be experienced is more in the nature of a still closer conformation of the chassis to the glass as the installation continues in use. When the cushion liner **36** is employed the liner may be constructed of somewhat thinner material than the chassis can be constructed of and consequently the liner to a degree even greater than the chassis is adapted to conform to such irregularities as may exist due to variations in tolerance, seams, protrusions and other irregularities on the tube surface.

Whether the chassis be used alone or in company with the liner, the soft character of the metal has a very marked effect in dampening vibrations and destroying the tendency of the tube clamp to experience resonant conditions. This is as true of extremely high vibrations of the supersonic type as in ordinarily high vibrations heretofore experienced in aircraft and guided missiles. Uniform pick up of heat from all portions of the glass virtually eliminates mechanical and heat strains in the glass, even though portions of the glass may be heated to considerably higher temperatures than closely adjacent portions. Further by reason of the fact that the spring fingers of the clamp are not depended upon to contact the hot surface of the glass and further by reason of the fact that the chassis may be constructed of a material having greater heat-conducting qualities than the spring clamp, these spring fingers do not absorb a sufficient amount of heat to modify their temper and springy character. In consequence they maintain their initial firm grip, holding the sides of the chassis in place despite extreme conditions in temperature and vibration expected to be encountered in use. The possibility of the tube loosening from its mounting is therefore materially minimized.

There has been therefore disclosed herein a highly efficient tube clamp and shield device which combines the qualities of extremely efficient cooling with vibration-resistant qualities sufficient that the device may be depended upon to remain securely in place upon any suitable face and to securely hold the tube mounted therein in its proper position.

While I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A clamp and heat-conducting shield device for electronic components comprising a chassis of dead metal corresponding in length to the length of a component and having protruding configurations along a bottom thereof presenting longitudinally spaced transverse ribs and having substantially semi-cylindrical sides adapted to fold over the component, and a clamp of spring metal comprising a semi-cylindrical portion corresponding in length to the length of the chassis, said clamp having a series of longitudinally spaced spring fingers on each side of the clamp adapted to extend around the lower side of the chassis and into spaces between said ribs.

2. A tube clamp and heat-conducting shield device for electronic flat press tubes comprising a chassis of dead metal corresponding in length to the length of a tube and having protruding configurations along a bottom thereof and substantially semi-cylindrical sides adapted to fold over the tube, a tongue at one end of the chassis extending endwise and adapted to engage one side of the flat press of the tube, and a clamp of spring metal comprising a dished portion corresponding in length to the length of the chassis, said clamp having spring elements at the sides adapted to extend around the lower side of the chassis, and a spring means extending from one end of the clamp adapted to engage the other side of said flat press.

3. A tube clamp and heat-conducting shield device for electronic flat press tubes comprising a chassis of dead metal corresponding in length to the length of a tube and having protruding configurations along a bottom thereof presenting longitudinally spaced flat faced transverse ribs and having substantially semi-cylindrical sides adapted to fold over the tube to a longitudinal meeting line along the top, a tongue at one end of the chassis extending endwise and adapted to engage one side of the flat press of the tube, and a clamp of spring metal comprising a semi-cylindrical portion corresponding in length to the length of the chassis, a series of longitudinally spaced spring fingers on each side of the clamp adapted to extend around the lower side of the chassis and into spaces between said ribs, and a spring element extending from one end of the clamp to a position adapted to engage the other side of said flat press.

4. A tube clamp and heat-conducting shield device for electronic flat press tubes comprising a chassis of dead metal corresponding in length to the length of a tube and having protruding configurations uniformly spaced along a bottom thereof presenting substantially flat faced transverse ribs having spaced rounded ends and having substantially semi-cylindrical sides adapted to fold over the tube to a longitudinal meeting line along a side remote from the ribs, a tongue at one end of the chassis on the side adjacent the ribs extending endwise and outwardly and terminating in a transverse rounded contact adapted to engage one side of the flat press of the tube, and a clamp of spring metal comprising a semi-cylindrical portion corresponding in length to the length of the chassis, a series of longitudinally uniformly spaced spring fingers on each side of the clamp adapted to extend around the lower side of the chassis and into spaces between said rounded ends of the configurations, whereby to press the chassis uniformly into heat-absorbing contact with the tube, and a series of spring legs extending from one end of the clamp having rounded ends adapted to engage the other side of said flat press.

5. A clamp and shield device for electronic components comprising a chassis of dead metal corresponding in length to the length of a component and having high heat-conducting characteristics, said chassis having a bottom and semi-cylindrical side walls adapted to extend around the component, an inner liner of initially flat dead metal material adapted to lie between the exterior surface of the component and the interior surface of said chassis and adapted to extend throughout the cylindrical portion of the component, and a clamp of spring metal comprising a dished portion corresponding in length to the length of the component, said clamp having spring elements at the sides adapted to extend partly around the lower sides of the chassis, whereby said chassis and the inner liner are pressed into intimate contact with the exterior wall of the component.

6. A clamp and shield device for electronic tubes comprising a chassis of dead metal corresponding in length to the length of a tube and having high heat-conducting characteristics, said chassis having longitudinally spaced protruding configurations on one side forming a bottom and semi-cylindrical side walls extending to a separation line along one side, an inner liner of initially flat embossed dead sheet metal material adapted to lie between the exterior surface of a tube and the interior surface of said chassis and adapted to extend throughout the cylindrical portion of the tube, and a clamp of spring metal comprising a semi-cylindrical portion corresponding in length to the length of the chassis, said clamp having a series of longitudinally spaced spring fingers adapted to extend partly around the lower sides of the chassis and between the configurations, whereby said chassis and the inner liner are pressed into intimate contact with the exterior wall of the tube.

7. A tube clamp and shield device for flat press electronic tubes comprising a chassis of dead metal corresponding in length to the length of a tube and having longitudinally spaced transverse configurations on one side forming a bottom and semi-cylindrical side walls on the bottom adapted to extend around the tube, an inner liner of initially flat dead metal material adapted to lie between the exterior surface of a tube and the interior surface of said chassis and adapted to extend throughout the cylindrical portion of the tube, and a clamp of spring metal comprising a semi-cylindrical portion corresponding in length to the length of the tube, said clamp having spring elements adapted to extend partly around the lower sides of the chassis, whereby said chassis and the inner liner are pressed into intimate contact with the exterior wall of the tube, a tongue at one end of the chassis extending generally endwise into the flat press at one side of the tube and spring means on a corresponding end of the clamp extending generally endwise into the flat press at the other side of the tube.

8. A clamp and heat-conducting shield device for electronic components comprising a chassis of dead metal having a pocket conforming in general to the size and shape of the component and having side walls of breadth adapted to be pressed to positions overlying and substantially surrounding said component, a base-contacting portion comprising part of said chassis and having an area of the base-contacting portion adapted to be anchored to the base, and a clamp of spring metal comprising a dished portion corresponding in size and dimension to the exterior of the chassis, said clamp having separate longitudinally spaced spring elements at side edges thereof, said spring elements in assembled position extending around the side walls and beneath the chassis and in resilient contact therewith and separated by said chassis from direct contact with the component whereby to urge said chassis into heat dissipating contact with the component.

9. A clamp and heat-conducting shield device for electronic components comprising a chassis of dead metal corresponding in one lineal dimension to the corresponding dimension of the component and having a plurality of lineally spaced configurations defining engaging areas for said clamp on each opposite side, said chassis having sides of breadth adapted to substantially envelope sides and top portions of said component in an envelope of said dead metal, and a clamp having one lineal dimension corresponding to the first identified lineal dimension of said chassis, said clamp having a series of lineally spaced spring elements on each side integrally connected by a web portion and resiliently contacting said chassis, said clamp extending throughout substantially more than half the perimeter of said chassis and adapted to engage said lineally spaced areas on said chassis whereby to press said dead metal into engagement with the component.

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