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Dumas et al.

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[54] **ELECTRON TUBE SOCKET**

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[52] **U.S. Cl.** **313/51**, 313/318, 313/325

[51] **Int. Cl.** **H01j 5/50**

[58] **Field of Search** 315/36; 313/318, 313/51, 325

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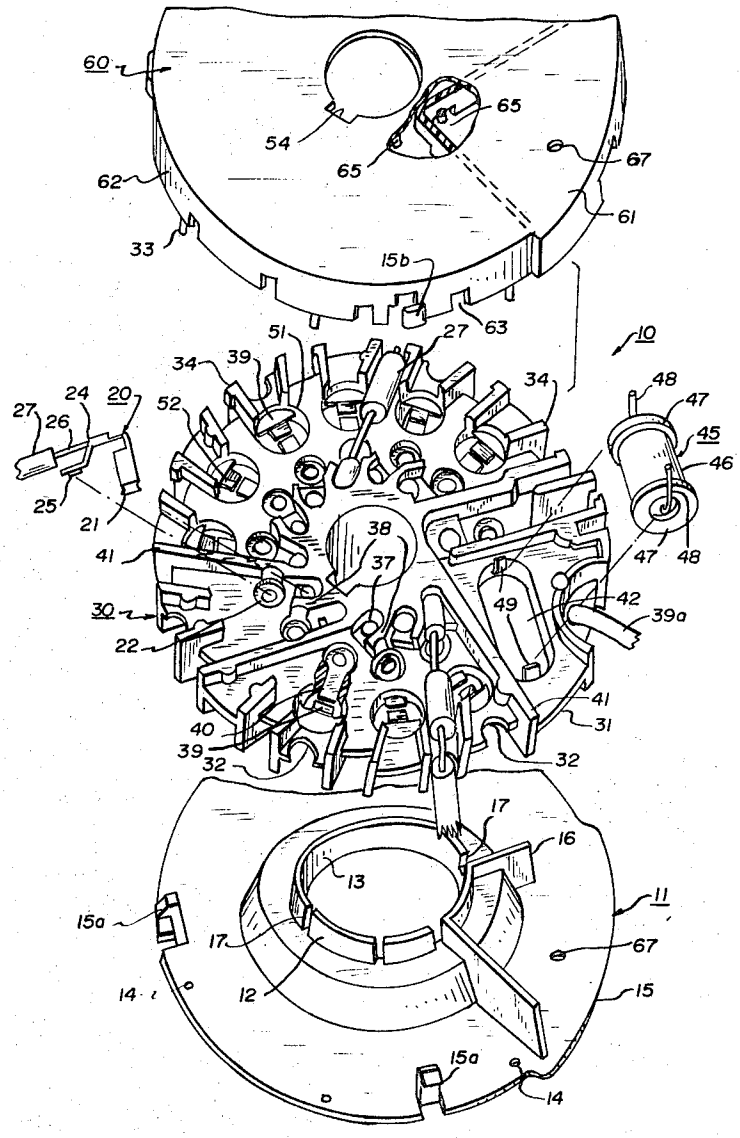
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Primary Examiner—Roy Lake
Assistant Examiner—James B. Mullins
Attorney—Roy E. Petherbridge et al.

[57] **ABSTRACT**

An electron tube socket having a plurality of terminal pin contacts coupled to electrically conductive connectors which define a predetermined spacial distance or spark gap between the connector and a conductor ring for dissipating surges of high voltage electrical energy. The tube socket has discrete gaps formed between the connectors and conductor ring such that arcing is initiated across contiguous edges of the spark gap and the surfaces adjacent the contiguous edges are positioned such that after initiation of arcing, the arcing energy is dissipated along these surfaces. A controlled atmosphere spark gap is positioned within the socket to provide fast response time and accurate breakdown voltage for protection against overvoltage transients.

17 Claims, 6 Drawing Figures



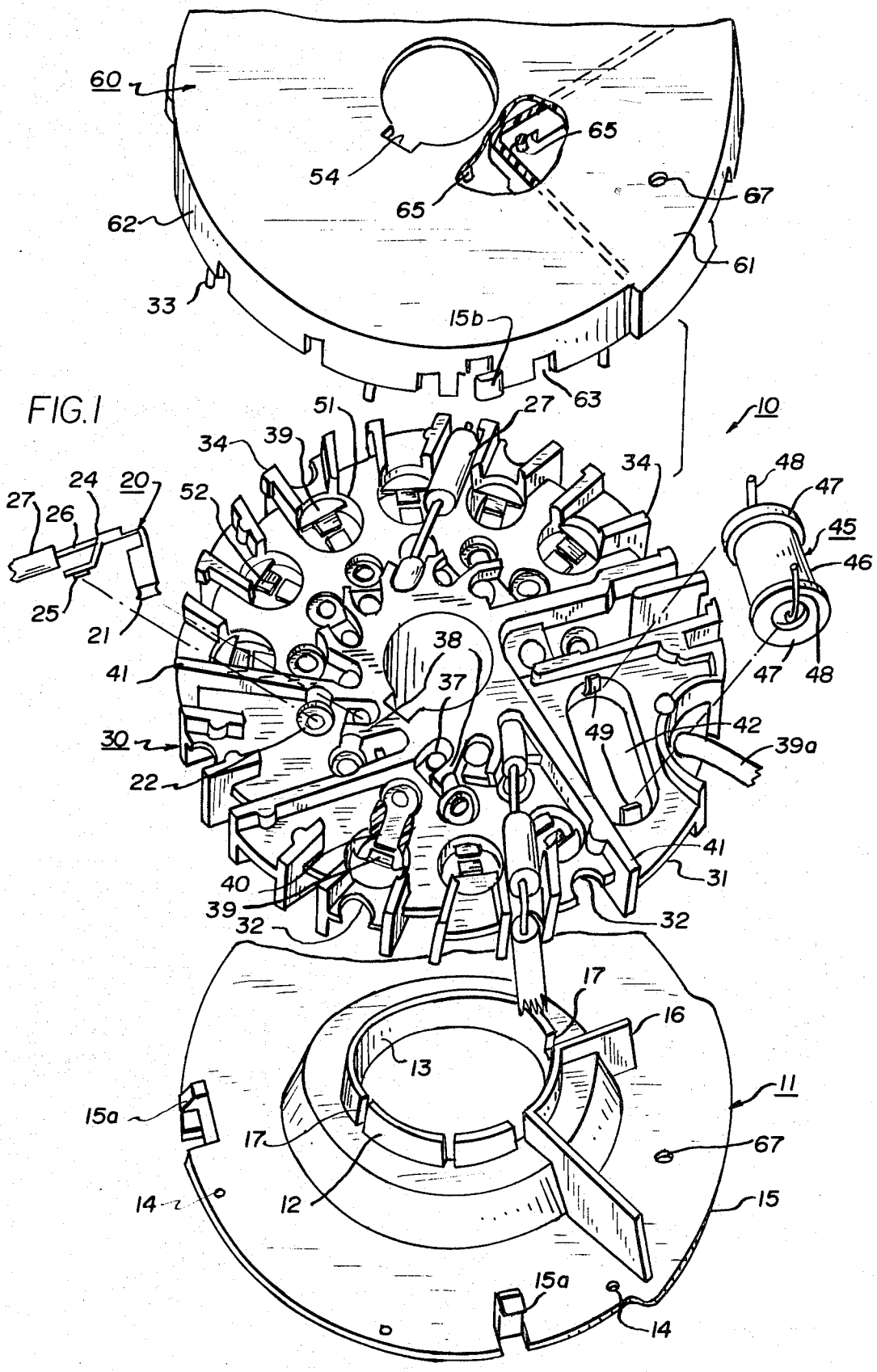

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FIG. 1

FIG. 2

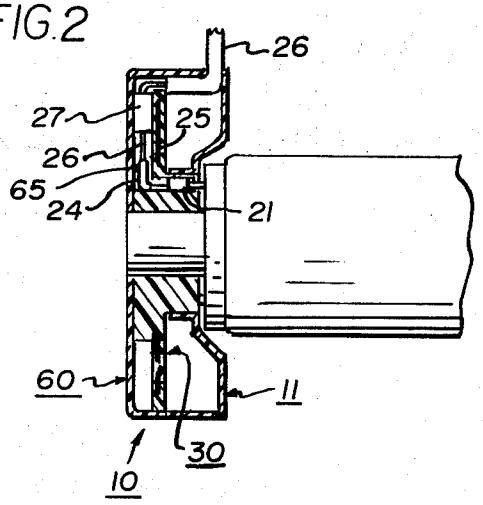


FIG. 3

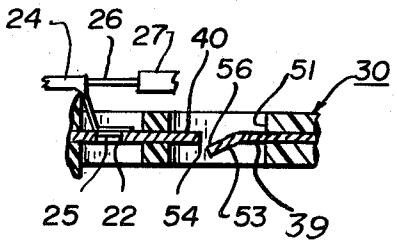


FIG. 4

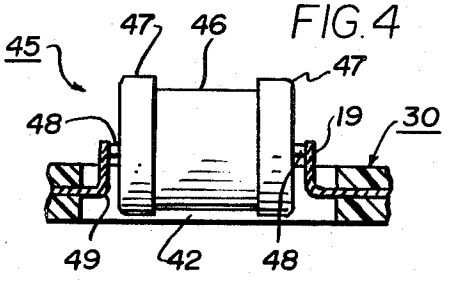


FIG. 5

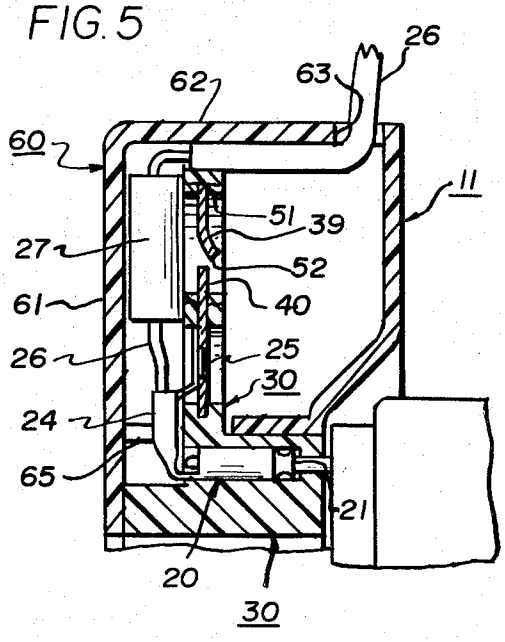
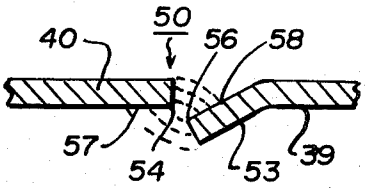


FIG. 6



ELECTRON TUBE SOCKET

BACKGROUND OF THE INVENTION

This invention relates in general to electron tube sockets and, in particular, to tube sockets having spark gaps for dissipating high voltage electrical energy transients.

More specifically this invention relates to an electron tube socket including spark gaps formed between contiguous edges of a conductor electrically coupled to the terminal pin contact of an electron tube and a conductor ring electrically connected to ground, and an internal controlled atmosphere spark gap for over-voltage transient protection of one or more terminal pins.

In electron tubes, for example television picture tubes, extremely high voltages in the order of 10,000 to 26,000 volts are used to accelerate cathode ray beams to the screen of the picture tube display device. These picture tubes have narrow neck portions with the terminal pins spaced circumferentially thereabout so closely that occasional arcing results regardless of all known prior attempts to provide an insulation barrier between the terminal pins or between the terminal sockets for the pins. When arcing occurs, the high voltage is conducted through the tube pins, terminal sockets, and lead wires to other components in the television set. These violent and incipient cathode ray tube arcs cause the television display tube (CRT) to destroy itself. Serious repetitious and violent cascading arcing will cause a failure in the associated chassis circuitry and in certain cases can result in fires.

This arcing is a result of the ionization and breakdown of air or other gas media between two or more points of high potential difference. The arc occurs in the form of an electric current or plasma which is entirely dependent on the origin, mode and dwell period resulting from high voltage energy stored in the picture tube and certain transformer circuits. When arcing occurs, the stored energy is discharged through some low resistance path, causing the high voltage on the CRT to drop to a very low value. The loaded high voltage system will cause the high voltage regulator to lose control of this circuit varying the output impedance as much as two or three times its nominal level.

When arcing occurs the accelerating force from the cathode ray beams is removed resulting in a zero brightness on the display device during the arc event period. This eliminates the dynamic load for the high voltage supply which rises again to a very high value resulting in arc cascading. The high voltage rises, in the order of 50,000 to 65,000 volts, since the regulator circuit cannot recover quickly enough which, therefore, allows the uncontrolled high voltage supply to rise to its maximum voltage level. This excessive high voltage transient energy over-stresses the picture tube, high voltage components, and wiring resulting in damage to the CRT and associated circuity.

Several types of arc protection have been utilized to eliminate or attempt to minimize this serious problem in television picture tube manufacture and maintenance. For example, individual spark gap devices have been employed, which, while initially effective, are usually constructed of materials that break down after continuous arcing. Such materials once tracked, or arced, become carbonized and lose the efficiency and accuracy of the spark gap protection requiring frequent replacement.

Another attempt has been to use twisted insulated wire pairs which also has not been satisfactory since these elements will break down after repeated arcing. These twisted wire pairs usually employ a film or minimal plastic insulation designed for a predetermined breakover voltage. The materials usually track and provide a lower resistance value requiring replacement after repeated arcing due to carbonization and variations which occur in the spacial distance forming the arc gap.

Another attempt to solve this problem has been the discrete use of metal to define a spacing between the terminal strip lug. Various combinations have been internally designed to accomplish this end. However, this type of system requires hand adjusted or internally designed mechanical spacings which are very difficult to control in production. They are also very susceptible to being damaged or having the spacial distance defining the spark gap varied thorugh normal production handling. This variation in spacial distance destroys the breakover voltage spark adjustment and the insulated mounting surfaces usually track and carbonize resulting in frequent replacement after repeated arcing.

A further attempt to provide arc protection has been the use of slot spacings between two co-positioned cut foil patterns formed on printed circuit boards with one of the patterns being grounded. However, printed circuit boards having slotted spark gaps carbonize and the foil material has been found to lift from the board due to the intense heat generated during the arcing event. These failures result in the gap becoming ineffective and in cases of severe repeated or cascaded arcing, the circuit boards have been found to ignite within the TV set.

In addition, certain arcing events involving particular terminal pins, such as the terminal pin associated with the focus element of the picture tube, require extremely accurate control of the break-over or arc-over voltage. The spark gap associated with such terminals must minimize extraneous circuit loading so that the arcing event can be closely and precisely controlled.

It has been found that a controlled atmosphere spark gap positioned within the socket assembly provides such precise control by eliminating capacitive and inductive loading due to the electrical leads. Minimization of the electrical leads minimizes the tuned circuit normally associated with electrical leads, when the arcing event occurs within the controlled atmosphere spark gap, due to an over-voltage occurrence in the receiver or picture tube. The controlled atmosphere spark gap has a fast and accurate response to the occurrence of over-voltage surges and acts as a direct short circuit to the energy being disposed during the strike-over or arc-over voltage event. The internally mounted unit has a high current carrying capability and a very low capacitive load to the external circuitry during its operation in the tube socket. In addition, positioning the controlled atmosphere spark gap within the tube socket assembly facilitates electrical insulation thereby preventing exposure of the approximately 5,000 volts normally associated with this unit.

SUMMARY OF THE INVENTION

It is, therefore, an object of this invention to improve electron tube sockets for dissipating high voltage transients.

Another object of this invention is to immediately dissipate to ground high voltage surges occurring in electron tubes to protect the tubes and associated circuitry.

A further object of this invention is to maintain a protective spark gap system stable through cohered arcing paths to ground such that a high current arc will clear the arc source quickly thereby minimizing the cascading arc phenomena.

Still another object of this invention is to precisely control the spark gap spacing such that the breakdown voltage is precisely controlled and the arc plasma is dissipated to prevent erosion of the precise spark gap spacing configuration.

Yet another object of this invention is to precisely control the arc-over voltage of certain specific terminal pins through the use of a controlled atmosphere spark gap positioned within the tube socket.

These and other objects are attained in accordance with the present invention wherein there is provided an electron tube socket having discretely formed spark gaps which function to precisely control the arc-over voltage and dissipate the arc energy or plasma level in a manner such taht the spacial distance defining the spark gap is not effected by sustained arcing, and a controlled atmosphere spark gap carried internal of the socket for more precise control of the response time and accuracy of breakdown voltage.

DESCRIPTION OF THE DRAWINGS

Further objects of this invention, together with additional features contributing thereto and advantages accrueing therefrom, will be apparent from the following description of one embodiment of the invention when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is an exploded perspective view of the tube socket showing the cover plate, terminal pin contact assembly, and baseplate;

FIG. 2 is a cross-sectional view of one embodiment of the tube socket illustrating the socket positioned on a cathode ray tube;

FIG. 3 is an enlarged view of the cross section of one of the spark gaps utilized in the tube socket;

FIG. 4 is an enlarged planar view of a portion of the tube socket to illustrate the high voltage arc chamber and controlled atmosphere spark gap positioned therein;

FIG. 5 is an enlarged sectional portion of the tube socket illustrating the connection of electron tube terminal pins and associated circuitry with the spark gap means; and

FIG. 6 is a schematical representation of the elements comprising the spark gap to illustrate the occurrence of arcing and dissipation of the arc plasma thereafter.

Referring to the embodiment shown in FIG. 1 of the drawings, the tube socket assembly is generally referred to by the numeral 10 and includes a stepped base-plate 11 having a central opening 13 disposed therethrough with a depending peripheral flange 12 extending outwardly from the inner periphery of the baseplate 11. A series of positioning holes 14 are circumferentially spaced around the base portion 15 of the baseplate 11 between the central opening 13 and the outer periphery of the plate. The positioning holes 14 are formed for a purpose which will be hereinafter described. The baseplate 11 also includes a series of latch forming members 15*a* which extend outwardly from the base portion of the baseplate 11 and are used in cooperation with another element of the tube socket assembly to removably secure the parts thereof.

The baseplate 11 further includes a plurality of upper barrier walls 16 which depend outwardly from the base portion or planar surface of the baseplate 11. The peripheral flange 12 circumferentially extends outward from the periphery of the central opening 13, and is formed with a plurality of notches 17 for receiving mating portions of barrier walls extending from a central mounting plate 30.

The central mounting plate 30 supports a plurality of terminal pin contact assemblies 20 (three of which are shown in FIG. 1) with each contact assembly having an inner end 21 forming a tube pin receptacle for connecting to the terminal pins of a cathode ray tube and a support contact 25 which functions to mechanically support the tube pin receptacle 21 in apertures 22 formed in the mounting plate and electrically functions to connect the tube pins to elongated radial members 40 which form a portion of the spark gap assembly 50. Extending from the outer end 24 of the terminal pin contact is a lead wire 26 which is coupled through a resistor 27 to an appropriate circuit wire connected within the television receiver or other appropriate device.

The terminal pin contact assembly 20 is mechanically supported by the central mounting plate 30 which is formed as a planar disc 31 having a plurality of U-shaped notches 32 circumferentially spaced about the periphery thereof. The U-shape notches are positioned to engage lugs 33 extending from a cover plate 60 to be described in detail hereinafter. A plurality of barrier walls 34 extend circumferentially outward from the outer periphery of the mounting plate to engage and retain the resistors 27 and/or circuit wires to provide mechanical strain relief and electrical insulation between the respective electrical components. The barrier walls 34 extend outwardly from both planar sides of the mounting plate 30 and on the lower surface as seen in FIG. 1 provide an electrical isolation barrier between electrical leads and between the spark gap assembly 50. The central mounting plate 30 includes a central opening 35 co-axial with the central opening 13 in the baseplate 11 and a series of smaller openings 36 which are circumferentially spaced about the mounting plate 30 to mechanically and electrically couple the support section 23 of the terminal pin connectors to a portion of the radial member 40*a* which forms a dart of the spark gap assembly 50. A second plurality of openings 59 are formed in the mounting plate 30 between the connecting openings 36 for the support section 23 and the outer periphery of the mounting plate 30 to form arc chambers 51.

The central mounting plate 30 includes a conductive ring 39 molded into the body thereof. The mounting plate 30 having a conductive ring 39 molded therein is placed in a shearing die which shears and forms the arc gap assembly 50. Arc chambers 51 are formed in the mounting plate and the shearing dies may be extended through these chambers to form the spark gap 52.

The arc gap assembly 50 is formed in the elongated radial members 40 by shearing the elongated members across their width to form a gap or opening 52, as best shown in FIGS. 3 and 5. As the radial members 40 are

sheared, the lower edge **53** (referring to FIG. 3) of the right-hand end portion of the gap assembly **50** is bent downward relative to the adjacent left-hand end portion such that the edge **56** is positioned contiguous to or adjacent the lower edge **54** of the left-hand portion. The term contiguous herein is used in the dictionary meaning of "near" but not in actual contact. An angled surface **58** is formed during this operation which functions in a manner as will be more fully explained hereinafter.

One more important advantage of the construction of the sheared gap assembly, as best described with reference to FIG. **6**, is that the arc gap spacing between the edges **54** and **56** can be precisely formed and controlled to provide protection against undesired arcing relative to the terminal pins of the electron tube. This precise and accurately controlled arc gap assembly **50** dissipates any high voltage energy before this energy can produce arcing, for example, across adjacent terminal pins of the electron tube. The graduated electrical spacing formed by the shearing operation disperses the arc energy along selected paths as a mathematical function. An initial arcing is developed across the gap **52** between the contiguous edges **54** and **56** to thereby provide a precise controllable arc-over voltage due to the edge-to-edge spacing. The two spaced edges, **54** and **56**, separated by air are sufficiently close to each other such than an arc will be formed therebetween upon the occurrence of a voltage surge of a predetermined magnitude. This disruptive discharge or arcing event is usually accompanied by a sharp, quick snap or crackle and the phenomenon may be explained by noting that the few ions which are always present in air are hurtled violently so that they produce other ions by collision; these latter ions in turn produce still more ions, and by this accumulative action the air dielectric breaks down and the voltage surge and any other energies present in the circuit is dissipated across the air gap during the arcing occurrence.

Once the arcing or break-over voltage occurs, the space between the two edges function somewhat like a defined conduction chamber. Thus, when ionization occurs a low impedance is presented to the current flowing across the gap. The electrons stream from one edge and encounter air or gas molecules on the way to the other edge; when an electron collides with a molecule the energy transmitted by the collision may cause the molecules to release an electron and become a positively charged ion. The sheared or shear-formed gap assembly enables the arcing or ignition voltage to initiate an arcing event and, then, permits the arcing energy to be dissipated along the adjacent surfaces it is believed according to a mathematical function, apparently a logarithmic function. When arcing is initiated between edges **54** and **56** the ionization phenomenon will spread in the space between the electrodes because of the decreased impedance across the air gap. After ionization has been initiated, the action maintains itself and relatively large currents flow at a voltage considerably lower than the ignition or break-over ionizing potential. For example, it has been found that after arcing is initiated, the arcing current is gradually dispersed away from the edge-to-edge gap (elements **54** and **56**) and is dissipated throughout the large angular planar surfaces **57** and **58**, thereby providing a large energy handling capacity while retaining a structure having a precise accurate controllable arc-over striking voltage and/or ignition voltage.

The area of the dissipating surfaces may be theoretically or empirically determined with relation to the desired arc-over or break-down voltage, distance or width of gap **52**, the gage or thickness of the width of the radial member **40**, and the angle of the inclined surface **58**. A particular advantage of the construction of the invention is that gap integrity is maintained. For example, if the structure is designed to cause sparking at 1,500 volts, arcing will still occur at **1500** volts plus or minus a preselected tolerance even after extensive arcing occurrence. The inclination of the surface **58** allows dissipation of the arc energy preventing the point of arc ignition (edges **54** and **56**) from over-heating and oxidizing thereby forming a higher resistance barrier across the gap which affects the ignition or arc-over voltage required to establish the next arcing event.

The shearing of the radial member **40** to form the arc gap assembly accentuates the formation of a space or gap where the edges (**54** and **56**) are the closest spaced surfaces and the respective adjacent or associated surfaces **57** and **58** are positioned at an angle with respect to the opposing edge. The angle at which surface **58** is inclined is predetermined by the forming die and a preferred embodiment has been found to be a surface forming an angle of approximately 30° relative to the plane of the member **40**. The arc-over protective spark gap **52** is based on the concept of dissipating the energy resulting from the initial arc occurrence. Or, particularly, the structure forms a defined edge or point in combination with a graduated electrical spacing operating somewhat as a so-called "Jacob's ladder" or "horn gap." The arc is initiated at a predetermined break-over voltage level and then effectively dissipated to thereby afford positive protection against arcing damage of the associated electronic components or the gap ignition elements.

The central mounting plate **30** has a plurality of mutually spaced holes **37** arranged circumferentially about and spaced inwardly from the central opening **35** to receive a corresponding number of terminal pin contacts **20** which function to electrically connect the terminal pins of the electron tube with the tube socket assembly. Each of these holes **37** is enlarged in diameter at the end which is to receive the terminal pins of the electron tube to guide the tube pins into the terminal contacts and to allow for any misalignment of the terminals. Any selected number of holes **37** are provided depending upon the electronic characteristics of the tube to be mounted to the socket. A plurality of barrier walls **38** are interposed between adjacent holes **37** to electrically insulate and isolate the adjacent terminal pin contacts **21** one from the other.

The central mounting plate **30** is provided with a plurality of structural ribs **41** which extend radially from the central opening **35** outwardly to the outer periphery thereof, each structural rib **41** extending upwardly from the upper surface of the central mounting plate **30** for a distance equal to the height of the barrier walls **38** and barrier walls **34** positioned at the outer peripheral edge of the planar disc **31**.

The barrier walls **34** formed at the outer peripheral edge of the planar disc **31** provides insulation for each separate circuit wire leading into the terminal pin contacts **20**. In addition, these barriers which extend upwardly and downwardly from the planar surface as best

shown in FIGS. 1 and 3 improve lead retention and provide strain relief for the connecting circuit wires. This strain relief in combination with the cover plate **60** provides omnipositional strain relief for all of the circuit wires.

An elliptically shaped opening **42** is formed in the planar disc **31** and functions to retain the controlled atmosphere spark gap **45** positioned within the socket assembly.

The controlled atmosphere spark gap **45** comprises a sealed capsule **46,** hermatically sealed, such that the integrity of the atmosphere within the capsule is maintained without allowing any outside atmosphere to be introduced. For example, the controlled atmosphere spark gap may be formed as a glass or ceramic capsule enclosed at either end by a pair of electrodes **47** such that the atmosphere within the device is either a vacuum, an inert gas or an inert gas compounded with an irradiating material. The atmosphere within the capsule controls the firing characteristics of the spark gap formed between the two opposed electrodes. The electrodes **47** are provided with a pair of leads **48** to be connected to electrical contacts **49** such that the spark gap is formed by virtue of the discrete spacing between the electrodes and the atmosphere within the capsule. Such a controlled atmosphere spark gap preferably comprises two main electrodes properly spaced by a glass or ceramic insulator. The main electrodes **47** are bonded to the insulator **46** and form a hermatically sealed discharge chamber which contains an inert gas. Such devices are available from Siemens Corporation of Ifelin, New Jersey, part number Ka 6, button type.

Positioning the controlled atmosphere spark gap **45** within the body of the tube socket assembly **10** eliminates the need for any type of conformal sleeving or insulated coating as would be required if this device were carried outside of the socket assembly. The material from which the socket assembly is formed is highly insulating such as a thermal setting or thermal plastic material like polyethylene, or a ceramic or Bakelite, or any other such material having the requisite shape retaining characteristics and dielectric properties. Therefore, by placing the controlled atmosphere spark gap **45** within the body of the assembly **10** any external requirements for insulation are eliminated. In addition, assembly costs are substantially reduced and good mechanical security is provided eliminating any possibilities of the controlled atmosphere spark gap being accidentally broken or removed from the tube socket. In addition, placing this device within the body of the tube socket will meet all safety requirements of recognized certifying authorities such as Underwriter's Laboratories and the Canadian Standards Association as well as the safety requirements of various local municipalities.

As previously described, the conductive or ground ring **39** is molded into the central mounting plate **30** and forms a peripheral planar ground ring adjacent the peripheral edge of the planar disc **31** encircling the entire socket assembly. The ground ring **39** has a strap **39***a* connected between the ring **39** and electrical ground.

The formation of the arc ring in this manner provides a substantial mechanical support for the insulating material due to the thickness of the ring of approximately 0.0025 or greater. The arc ring being formed in this manner provides better dumping or disposing of unwanted high voltage energy transients. In addition, the ground ring forms a shorted loop system to effectively control cascaded arcing, as previously discussed, which produces large transients. If the ground ring were formed as an open ring, as in prior art devices, these voltage transients, occurring in an open loop, through a combination of capacitive and conductive properties associated with the adjacent ends of an open loop system, form a tuned circuit. By forming the arc ring as a closed peripheral planar ground ring this tuned circuit is heavily loaded by its own Q because it is a shorted loop. Therefore, any arc energy present throughout the ring is quickly disposed or dissipated in both directions which thereby short outs or shunts the high frequency surface current.

The cover plate **60** comprises a planar disc having a depending peripheral flange **62** extending downwardly from the planar disc (FIG. **1**) and having a series of openings **63.**

The openings **63** are formed to correspond to the circuit wires **26** providing entrance into the tube socket assembly **10.** The planar disc also has an opening **54** having a key way formed on the disc surface which is co-axial with the central opening **35** of the mounting plate and the central opening **13** of the baseplate to receive the central neck portion of the electron tube. The inner surface of planar disc **61** (as seen in FIG. **1**) is formed with a plurality of spaced lugs **65** which are coaxial with the terminal pin contacts or end **21** to mechanically secure each of the terminal pin contacts in the hole **37** formed in the central mounting plate. Barrier walls **66** are formed on this same planar surface extending downwardly to function in cooperation with the barrier walls **16** of the base plate **11** to form an electrically isolated chamber to isolate the controlled atmosphere spark gap **45.**

The planar surface **61** of the cover plate is formed with a vent hole **67** (which may also be formed in the base plate **11** as shown in FIG. **1**) which functions to vent any gases formed during an arcing event to the atmosphere outside of the socket assembly such that these gases will not build up within the tube socket apparatus.

The tube socket assembly **10** is sealed after assembly to prevent accidental removal or displacement of any of the internal components of the socket assembly. To seal the three elements **11, 30** and **60** of the socket assembly, the central mounting plate is positioned between the cover plate **60** and the base plate **11** with the sealing bosses **33** of the cover plate passing through the holes **14** in the mounting plate. The bosses **33** are then flared at their external end, as by applying heat, to form a unitary construction which prevents accidental removal or displacement of any internal components of thee socket assembly. A plurality of latch portions **15***b* are secured to the outer depending peripheral flange **62** to function in cooperation with the latch elements **15***a* of the base plate **11** to secure the elements of the socket assembly. However, if it should become necessary or desirable to replace or service any internal components within the tube socket assembly, the latches **15***a* and **15***b* are operable such that the socket assembly may be opened for access to the internal components. The bosses **33,** may be utilized individually or in combination for a semi-permanent assembly of the tube socket such that access to the internal components thereof may be had only through intentional opening of

the socket assembly such as by removal of the flared end of the bosses 33.

While the invention has been described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that this invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A tube socket assembly for dissipating transient surges of high voltage occurring at the terminal pins of an electron tube comprising

enclosure means to form an electrically insulated internal chamber,

terminal receiving means for electrical coupling to the terminal pins of an electron tube carried by said enclosure means,

gap defining means within said enclosure means electrically coupled to said terminal receiving means comprising a first electrode having the terminal pin voltage imposed thereon and a grounded electrode separated in ambient atmosphere by a dielectric material, and

spaced electrodes carried within a non-ambient controlled atmosphere to define a spark gap for electrical coupling to a terminal pin of an electron tube and ground carried within said enclosure means providing a precise voltage limiting control for a terminal pin coupled thereto.

2. The apparatus of claim 1 wherein said dielectric material separating said electrodes in ambient atmosphere provides a variable impedance therebetween.

3. The apparatus of claim 1 wherein said electrodes separated in ambient atmosphere by a dielectric material include first means across which an arc is initiated and second means for dissipating the arc energy.

4. The apparatus of claim 3 wherein said dielectric material comprises air and said second means for dissipating the arc energy comprises a graduated spacing between said electrodes.

5. The apparatus of claim 4 wherein said graduated spacing between said electrodes comprises an angled surface formed on one of said electrodes.

6. The apparatus of claim 1 wherein said grounded electrode separated in ambient atmosphere from said first electrode comprises an electrical conductor forming a closed loop having a protrusion spaced from said first electrode.

7. The apparatus of claim 6 wherein said closed loop is formed in a circular configuration.

8. The apparatus of claim 6 wherein further including a grounded lead electrically coupled to said closed loop.

9. The apparatus of claim 1 wherein said spaced electrodes carried within said controlled atmosphere to define a spark gap comprises a hermetically sealed chamber having spaced electrodes therein.

10. The apparatus of claim 9 wherein said hermetically sealed chamber is filled with an inert gas.

11. The apparatus of claim 1 wherein said enclosure means includes an internal aperture for retaining said spaced electrodes carried within said controlled atmosphere to define a spark gap.

12. The apparatus of claim 1 further including electrical leads electrically coupled to said terminal receiving means and said gap defining means.

13. The apparatus of claim 12 wherein said enclosure means includes means for providing stress relief on said electrical leads.

14. The apparatus of claim 13 wherein said stress relief means effects omnipositioned stress relief.

15. The apparatus of claim 13 wherein said stress relief means includes support means extending transversely about said lead wires.

16. The apparatus of claim 15 wherein said stress relief means further includes support means extending parallel to said lead wires.

17. The apparatus of claim 12 wherein said enclosure means includes barrier walls for electrically isolating said leads from each other.

* * * * *