March 17, 1959 M. SCHNEE ET AL 2,877,975

END GRIP RETAINER FOR ELECTRON TUBES

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Fig. 1.

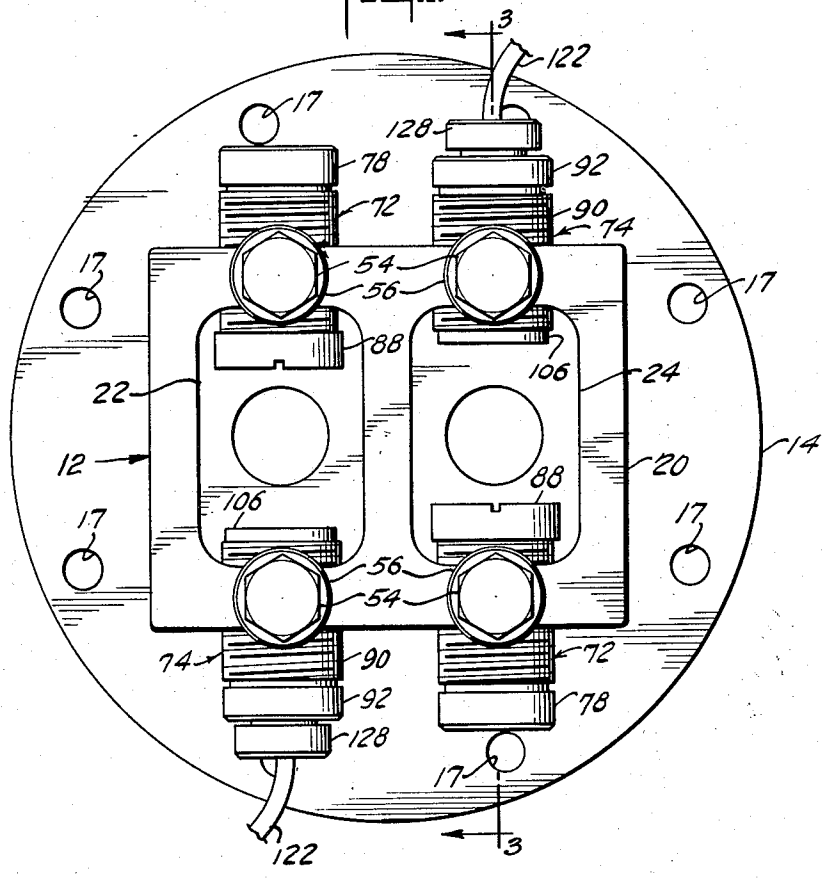
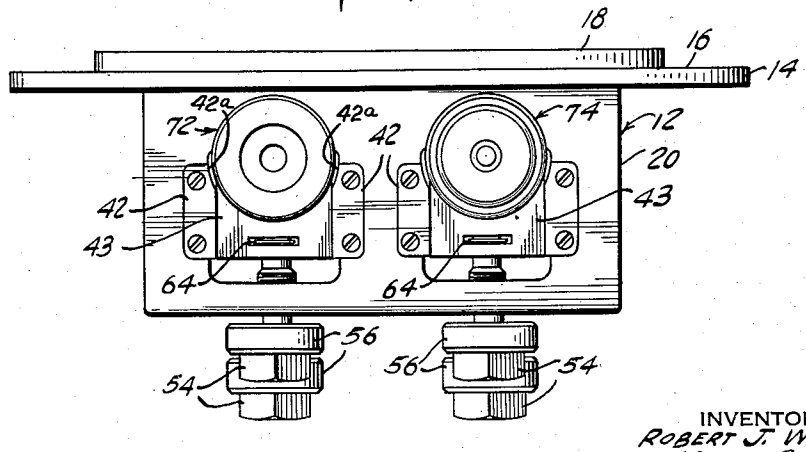


Fig. 2.



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Fig. 5.

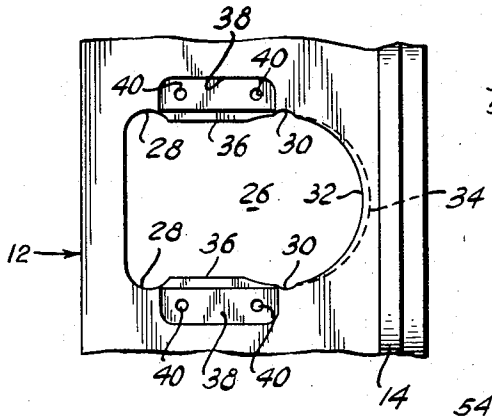


Fig. 3.

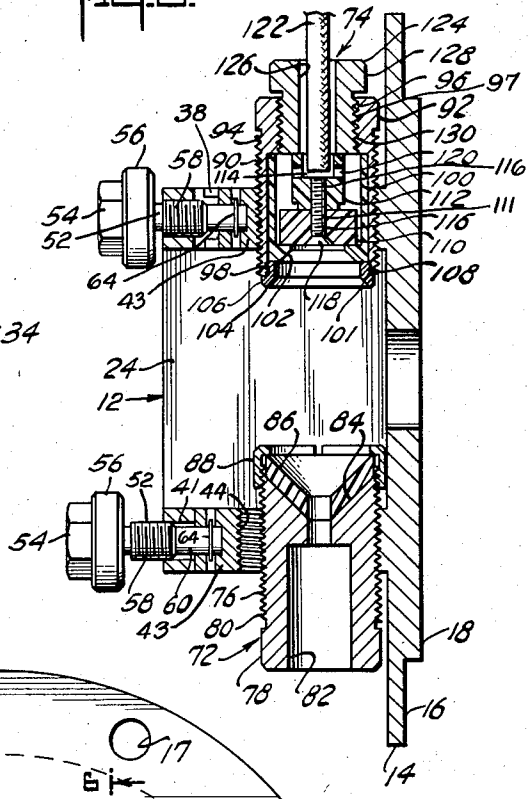
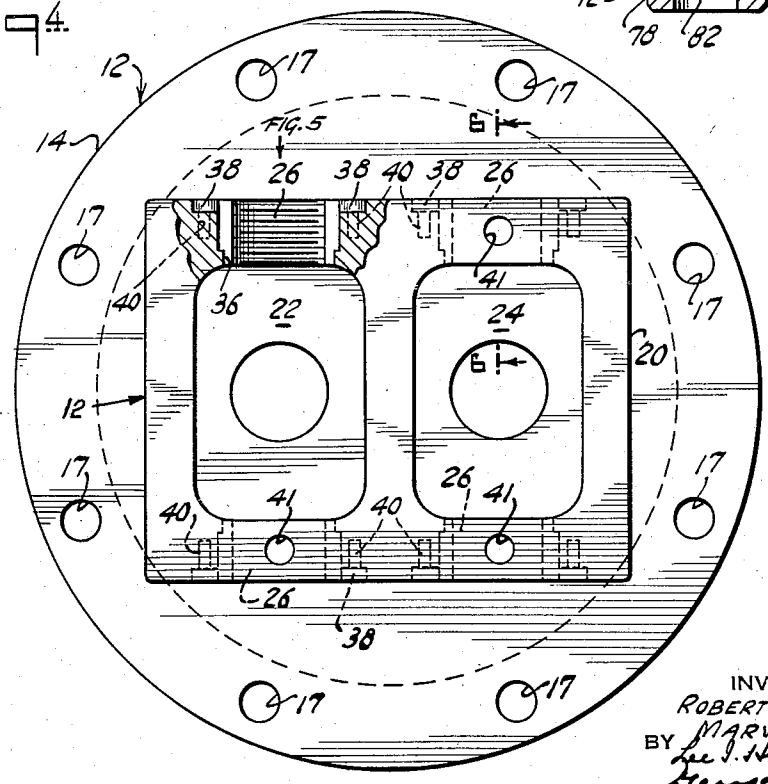


Fig. 4.



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Fig. 6.

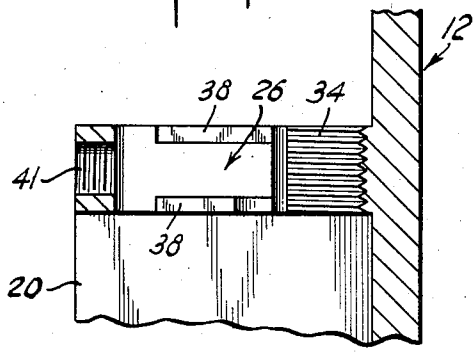


Fig. 7.

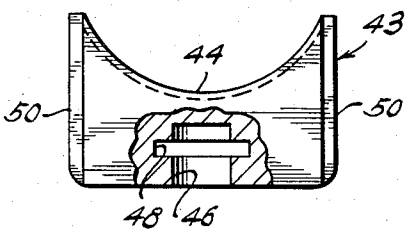


Fig. 8.

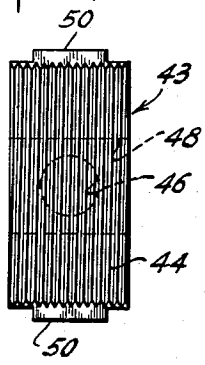


Fig. 9.

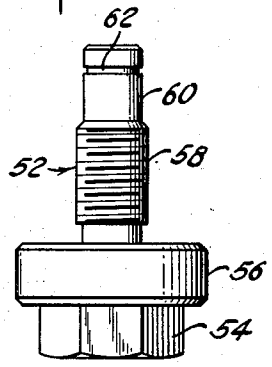
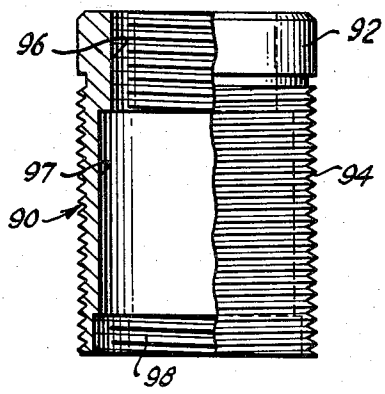


Fig. 10.



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END GRIP RETAINER FOR ELECTRON TUBES

Marvin Schnee and Robert James Wohl, New York, N. Y.

Application August 29, 1956, Serial No. 606,936

13 Claims. (Cl. 248—316)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention concerns an improved end-grip retainer for electron tubes and more particularly an improved end-grip retainer for electron tubes for use in mounting electron tubes on a shock machine for shock tests.

Electron tubes are exposed to a great deal of mechanical shock and vibration, particularly in the environments of military applications. In order to minimize mechanical shock failure among electron tubes, the tubes are tested during design and production stages on a shock machine. A retainer positions and fastens each tube to be tested on the shock machine.

One type of shock machine currently in use for shock testing electron tubes is described hereinafter. It includes a rigid base. A heavy table member is slidable horizontally on the base. One end of the table member terminates in a flat anvil. A hammer having a flat striking face is pendulously supported by the base about an axis perpendicular the direction of sliding movement of the table member. The table member is adapted to be slid to a position where the face of the anvil is coincident with the flat striking face of the hammer when the latter is at zero or straight down position. The shock machine is adapted to be set for any angle of hammer fall up to ninety degrees. When the hammer strikes the anvil, the table member is displaced about a foot more or less depending upon the hammer fall angle. The table member has considerable inertia. The shock impulse which essentially is a force having a steep rise time is transmitted through the table member and the retainer to the tube under test mounted in the retainer.

An object of this invention is to provide an improved end-grip retainer for electron tubes.

A further object is to provide an improved end-grip retainer for electron tubes for use in mounting electron tubes on a shock machine.

A further object is to provide an improved end-grip retainer for electron tubes for use in mounting electron tubes on a shock machine and which has a very high shock transmission coefficient.

A further object is to provide an improved end-grip retainer for electron tubes for use in mounting electron tubes on a shock machine without damaging or rupturing the tube envelope during mounting and during a shock test.

A further object is to provide an improved end-grip retainer for electron tubes for use in mounting electron tubes on a shock machine and which is of durable construction, is readily fabricated, is readily reproduced elsewhere and provides objective and repeatable results.

A further object is to provide an improved end-grip retainer for electron tubes for used in mounting electron tubes on a shock machine and which is easy to use and which permits rapid operation.

A further object is to provide an improved end-grip

retainer for electron tubes for use in mounting electron tubes on a shock machine and which will not distort the intended shock waveform by/frequency selective attenuation or amplification.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a top plan view of a preferred embodiment of this invention;

Fig. 2 is an end view of the embodiment shown in Fig. 1;

Fig. 3 is a cross-sectional view taken along the line 3—3 of Fig. 1;

Fig. 4 is a top plan view with portions shown in section of the body portion of the embodiment shown in Fig 1;

Fig. 5 is a fragmentary end view of the body as seen from arrow line identified by the designation "Fig. 5," of Fig. 4;

Fig. 6 is a fragmentary sectional view taken along the lines 6—6 of Fig. 4;

Fig. 7 is a side view, partly in section, of a slider comprising part of the embodiment of Fig. 1;

Fig. 8 is a plan view of one slider forming part of the embodiment of Fig. 1;

Fig. 9 is a plan view of one slider reciprocating screw forming part of the embodiment of Fig. 1; and

Fig. 10 is a view partly in section and partly in elevation of the socket end-gripper barrel.

In the illustrated embodiment of the invention an integral body **12** (Figs. 1–5) includes a base **14** in the form of a disc having two coaxial steps **16** and **18**. The step **16** of base **14** is formed with a plurality of circularly spaced bolt holes **17** and the disc is not chamfered in order that the strength of the material around the bolt circle not be lessened. There is no significance in the circular design of base **14**; this particular design as shown, when fabricated according to particular dimensions, permits the retainer to be mounted on one of the shock machines available in the art. If the mounting structure of the shock machine selected dictates a differently shaped base, the base may be designed accordingly. The body **12** further includes a rectangular specimen mount **20** integral with the base **14** and centrally located on the base. The body structure formed without mechanically coupled parts is important in that it precludes relative movement when shock is applied. The relative orientations of rectangular specimen mount **20** and the bolt holes **17** in base **14** is such that when the invention is mounted on the shock machine and a specimen is mounted therein, a shock pulse can be transmitted to the test specimen in the desired direction. The desired direction generally is either axially or transversely relative to the test specimen.

The rectangular specimen mount **20** is formed with two thick-walled specimen receiving chambers **22** and **24**. There is no particular significance to the fact that two specimen receiving chambers are shown; one chamber is adequate. Two chambers are shown because there is room for two specimen receiving chambers on the base **14** as designed for one particular shock machine available in the art. The size of the specimen receiving chambers is determined by the sizes of the specimens to be accommodated.

The two halves of the rectangular specimen mount **20** formed with the specimen receiving chambers **22** and **24** respectively and including the elements secured to each half, are substantially identical. Therefore only one half of the rectangular specimen mount **20** is described in detail.

The end walls of each of the specimen receiving chambers are formed with substantially identical aligned open-

ings 26 (Figs. 4 and 5). Each of the openings 26 include two opposed arcuate recesses 28 and two opposed arcuate recesses 30. A flat surface portion joins the recesses 28. The two arcuate recesses 30 are joined by a substantially semicircular arcuate portion 32 that is formed with screw threads 34 with a pitch of about twenty threads per inch. The portion between each arcuate recess 28 and the recess 30 adjacent thereto is stepped transversely to leave inner lips 36 (Figs. 4 and 5). The outside surfaces of the end walls are recessed at 38 to form seats parallel to lips 36. A pair of tapped holes 40 are formed in each recessed seat 38 in the end walls. A slider guide 42 (Fig. 2) seats in and is screw-fastened in each of the recessed seats 38; the slider guides 42 are wider than the recesses 38 whereby there is provided slider guiding channels between the slider guides 42 and the lips 36. One corner of each slider guide 42 is cut away at 42*a* for clearance. Each of the end walls of the specimen receiving chambers is formed with a threaded bore 41 extending through the bridge portion thereof; the axis of each threaded bore 41 is perpendicular to the base 14.

Sliders 43 (shown in detail in Figs. 7 and 8) are slidably disposed in the channels defined by lips 36 and slider guides 42. Each slider 43 is formed with a substantially semicircular screw threaded portion 44 adapted to form a continuation of the substantially semicircular screw threaded portion 34 in each end wall of the specimen mount 20. A cylindrical recess 46 is formed centrally in each slider 43 and a rectangular slot 48 is formed to extend transversely through each slider 43 intersecting the recess 46 therein. Each end of the slider terminates in a central step 50 that registers at assembly with a channel defined by a lip 36 and a slider guide 42.

A screw 52 (Figs. 3 and 9) is provided for reciprocating each slider 43. The head of screw 52 includes a hexagonal portion 54 adapted to be gripped by a wrench and a knurled portion 56 of larger diameter adapted to be finger-gripped. Each screw 52 is formed with threaded portion 58 for assembly in threaded bore 41, a reduced end portion 60 for seating in the circular recess 46 of a slider 43, and a circular slot 62 for receiving a retaining ring 64 at assembly whereby the slider 43 is reciprocable by rotation of screw 52.

Two tube end-gripping members including an envelope end-gripper 72 and a socket end-gripper 74 are provided for each of the specimen receiving chambers 22, 24. The end-gripping member 72 includes a barrel 76 that is knurled at one end 78 to provide a finger grip and is formed with external threads 80 between the knurled end portion 78 and the opposite end thereof for engagement with the screw threaded portion 44 of a slider 43 and the screw-threaded portion 34 of the end wall opening 26 in which the slider reciprocates. The barrel 76 is hollowed at 82 to reduce the weight thereof. The opposite end of the barrel 76 is conically recessed at 84. A hollow conical member 86 of phenolic material formed with a hole through its apex is seated in the conical recess 84. A clamp ring 88 is threadedly assembled onto the end of the barrel 76 for retaining the conical member 86 firmly seated in the conical recess 84.

The socket end-gripper 74 includes a barrel 90 (Figs. 3 and 10). The barrel 90 is knurled at one end 92 to provide a finger grip and is formed with threads 94 between the knurled end 92 and the opposite end thereof for engagement with the screw-threaded portion 44 of a slider 43 and the screw-threaded portion 34 of the end wall opening 26 in which the slider reciprocates. The barrel 90 is formed with a stepped bore. The smaller diameter end 96 of the bore is formed with screw threads 97. The intermediate portion of the bore is continuous and smooth. The other end 98 of the bore is formed with screw threads. A cylindrical sleeve-like spacer 100 of phenolic material formed with an inside lip 102 at one end thereof is positioned in the intermediate portion of the bore in the barrel 90 with its lip 102 located adjacent the screw-threaded end 98 of the barrel 90. A retaining ring 104 having a larger diameter knurled portion 106 and a smaller diameter threaded portion 108 is assembled with the threaded end 98 of the barrel 90 to retain the spacer 100 therein. A conventional tube socket 110 of phenolic material, and formed with a central bore 111, is assembled through the threaded end 96 of barrel 90 (Fig. 10) and is held in the bore by engagement of it with the lip 102 of the spacer 100. The outside diameter of socket 110 is somewhat smaller than the inside diameter of the spacer 100. This permits the socket 110 to be adjustably secured in the sleeve 100 whereby it is either coaxial therewith or the axes are spaced transversely within the range permitted by the clearance between socket 110 and sleeve 100. This is an important feature; its function is discussed below. The conductive elements of the socket are not shown on the drawing. A socket extension 112 formed with a circular recess 114 opening at one end and a threaded bore 116 coaxial therewith opening at the other end is assembled through threaded end 96 of the barrel 90; a screw 118 affixes the socket extension 112 to the socket 110. The socket extension 112 is formed with radial bores 120. Electrical leads 122 are provided for connection to the socket. The leads 122 enter into the recess 114 in the socket extension, are adapted to be threaded through the radial bores 120 in the socket extension, and are connected to respective terminals (not shown) of socket 110. A locking screw 124 having a bore 126, a knurled portion 128 providing a finger grip, and a threaded portion 130 is assembled in the threaded end 96 of barrel 90 to clamp the socket 110 in the selected position. The wires 122 extend through the bore 126 of the locking screw 124.

The retainer elements are fabricated from a commercial stainless steel that is nonmagnetic and noncorrosive under ordinary conditions.

In operation, the envelope end-gripper 72 is clamped in a fixed position by slider 43 and bolt 52. The position selected for the envelope end-gripper 72 is based upon the length of the tube specimen to be tested. The tube specimen to be tested is positioned centrally in the specimen receiving chamber. If test of a tube specimen of one length is followed by test of a tube specimen of a substantially different length the envelope end-gripper 72 is repositioned; otherwise the end-gripper 72 remains in the same position undisturbed. If the retainer is to be used for tube specimens of one length only, the retainer may be simplified by providing a permanently secured envelope end-gripper. The screw 52 and the slider 43 for the socket end-gripper 74 are withdrawn. The socket end-gripper is disassembled from the body by lifting it clear of the threaded portion 34 of the opening 26 and then extracting it. A tube specimen is inserted and firmly seated in the socket 110. The locking screw 124 is loosened just enough to permit the socket 110 to be shiftable radially in the barrel 90. The socket end-gripper with the tube mounted therein is inserted into the opening 26 so as to bring the envelope of the tube into abutment with the phenolic member 86 of the envelope end-gripper. The screw 52 (at the top in Fig. 3) is turned until the threads in the slider 43 loosely engage the threads of the barrel 90. The locking screw 124 is finger tightened. The self-aligning character of socket 110 in barrel 90 compensates for misalignment between envelope and base of the tube specimen. Then the barrel 90 is turned till finger tight thereby putting some pressure on the tube. The threads on the barrel 90 then react back on the threads 44 in the slide and the threads 34 in the retainer body. Then the screw 52 (at the top in Fig. 3) is tightened with a wrench; this results not only in clamping of the barrel 90 but also, by the cam action between the engaging threads of the barrel, slide and retainer body, forces the socket end-gripper 74 to be displaced axially into the retainer a slight distance more by wedging action of the threads of the slide on the

threads of the socket end-gripper thereby putting additional compressive force on the tube. It was found that with 1¼–20 threads per inch, turning the barrel till finger tight, and then tightening the screw **52** with a wrench, clamped the tube satisfactorily without rupturing or damaging the tube envelope for all of the tubes tested thereby. The wires **122** connected in circuit with the tube pins are connected to suitable circuitry for indicating interelectrode shorts and effects of shock and vibration on the tube parameters.

The invention is easy to use and rapid in operation. It was found by experiment that it took little more than thirty seconds as an average for an inexperienced operator to assemble a tube in this improved end-grip retainer.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

We claim:

1. An improved end-grip retainer comprising a rigid one piece body adapted to be secured to a shock machine, and a pair of opposed electron tube end-grips in said body, at least one of said end-grips being adjustable in said body toward and away the other end-grips, one of said end-grips including a seat for the envelope end of an electron tube, and the other of said end grips including a seat for the base end of an electron tube, and one of said seats being adjustable in all transverse directions on its end grip to accommodate itself to any misalignment of envelope and base of an electron tube.

2. An improved end-grip retainer comprising a rigid one piece body adapted to be secured to a shock machine, a pair of opposed electron tube end-grips in said body adjustable toward and away from each other, a pair of means movable in said body transversely to said end-grips respectively for releasably securing said end-grips in said body, one of said end-grips including a seat for the envelope end of an electron tube and the other of said end-grips including a seat for the base end of an electron tube, one of said seats being adjustable in all transverse directions to compensate for any misalignment of envelope and base of an electron tube held between said seats.

3. An improved end-grip retainer comprising a rigid one piece body adapted to be secured to a shock machine and formed with an electron tube receiving chamber, said body being formed with a pair of opposed aligned openings in communication with the electron tube receiving chamber, each of said aligned openings having opposed guiding channels for a slide, a slide disposed in the channels of each of said openings, each said slide and the opening in which it is disposed being formed with a substantially semicircular threaded portion, each said slide being adapted to be so positioned that the screw-threaded semicircular portion thereof is effectively a continuation of the semicircular screw-threaded portion of the respective opening, each said slide being slidable to increase the distance between the semicircular screw-threaded portion thereof and the semicircular screw-threaded portion of the respective opening, a screw engaging said body and each of said sliders for moving said sliders, an externally threaded cylindrical end-grip in each of said openings and clampable therein by the respective slider, one of said end-grips including a seat for the envelope end of an electron tube, and the other of said end-grips including a seat for the base end of an electron tube, one of said seats being transversely adjustable in the respective end-grip to compensate for misalignment of envelope and base of an electron tube.

4. An improved end-grip retainer as defined in claim 3 wherein said rigid body is in the form of a base and a rectangular wall structure projecting from the center of the base and open at the top.

5. An improved end-grip retainer as defined in claim 4 wherein said end-grip having a seat for the base end of an electron tube includes a barrel having a circular seat, a circular socket of lesser diameter than the wall of the circular seat being disposed in the circular seat, and a locking screw engaging said barrel for clamping and unclamping said socket.

6. An improved end-grip retainer as defined in claim 5 wherein said openings in said body are of such size that when said slides are withdrawn furthermost from the threaded portions of said respective openings, said end-grips may be inserted freely into and taken freely out of the openings.

7. An improved end-grip retainer as defined in claim 6 wherein each end-grip has a knurled fingergrip and wherein each said screw which engages said body and said sliders has a knurled fingergrip and a wrench grip.

8. A device for detachably mounting an electron tube for shock treatment testing in a shock machine, which comprises a rigid body having a tube receiving chamber therein opening through a face of said body, and also having aligned passages in its ends leading to said chamber, a pair of screws threaded into said body from said face thereof, one extending into one of said passages and the other into the other of said passages, a slide element in each passage at one side thereof and mounted by said body for movement toward and from the opposite side of said passage, said opposite side of each said passage and the face of said slide element towards said opposite side being sections of cylindrical surfaces with approximately the same radii of curvature, and said cylindrical surface sections having screw threads extending crosswise thereof about the axis of said passage, a cylindrical holder in each of said passages, only partially filling it transversely, and having screw threads on its periphery that are gripped by the threads on said slide element and said passage when the slide element in that passage is moved toward the holder in that passage by operation of said screw, one of said holders at its end within the chamber being formed to receive and hold the base end of an electronic tube with the tube extending toward the other holder, and said other holder at its end within the chamber being recessed to receive and hold the free end of any electronic tube whose base end is held in said one holder.

9. A device for detachably mounting an electron tube for shock treatment testing in a shock machine, which comprises a rigid body having a tube receiving chamber therein opening through a face of said body, and also having aligned passages in its ends leading into said chamber, a pair of screws threaded into said body from said face thereof, one extending into one of said passages and the other into the other of said passages, said body having a recess in each of its said ends opening into the said passage at that end, one slide element having side flanges received in one of said recesses and guiding said element for movement in a direction across its adjacent passage, means covering said recess and detachably confining said element in said recess, another slide element having side flanges received in the other of said recesses and guiding said another element for movement in a direction across its adjacent passage, means covering said recess and detachably confining said another element in its recess, the sides of said passages toward which said elements move and the advancing faces of said elements being segments of cylindrical surfaces carrying surface undulations running in directions crosswise of the axes of said passages, a holder in each passage and having surface undulations in its periphery running in directions peripherally about the same, said undulations of said elements and said passage wall in each passage gripping between them the undulations of said holder in that passage when said elements are advanced by said screws, said holders at their ends within the chamber being

formed to receive and firmly hold the opposite ends of an electronic tube in said chamber.

10. A device for detachably mounting an electron tube for shock treatment testing in a shock machine, which comprises a rigid body having endwise aligned passages separated by a space large enough to receive an electronic tube to be tested, a sleeve in each passage, only partially filling the passage in a transverse direction, and having a screw threaded periphery, a clamping member disposed in each passage at one side of the sleeve and having guided sliding movement on said body toward and from said sleeve, a screw threaded into said body adjacent each of said passages, extending at one end into the adjacent passage, and having a rotatable coupling to the clamping member in that passage, each member at its face towards said sleeve and the side of the passage at the opposite side of the sleeve in that passage having screw thread sections extending in the same direction as the threads on said sleeve, whereby when each of said screws is threaded into said body it will advance its related clamping member and through it clamp the related sleeve between it and the threaded wall section of said passage, the engagement of the threads of each sleeve with the thread sections of the adjacent member and passage wall firmly holding that sleeve against movement from the axial position in the passage in which said sleeve may be placed, said sleeves at their ends facing each other being formed to receive and firmly hold the opposite ends of an electronic tube during shock test of the tube.

11. The device as set forth in claim 10, wherein the interior of that end of the sleeve which engages and holds the base end of a tube has a socket to receive and hold that end of a tube, and a shoulder against which said socket is confined in said sleeve, said shoulder guiding said socket for limited lateral movement to accommodate any misalignment of the ends of any electronic tube so mounted, and means adjustable within that sleeve that engages the base end of a tube, in a direction endwise of the sleeve for releasably clamping said socket against said shoulder in any laterally adjusted position into which it may be moved in accommodating it to a tube.

12. A device for detachably mounting an electron tube for testing of its operation while under shock, which comprises a rigid body having endwise aligned passages separated by a space large enough to receive an electronic tube to be tested, a tube holding element in each passage with a cylindrical periphery, and only partially filling the passage in a direction transverse to the length of the passage, a clamping member disposed in each passage at one side of the element and guided by said body for movement toward and from said element in that passage, means acting between said body and each member for moving that member toward said element to clamp that element against a side of said passage, said side of each of said passages being a section of a cylindrical surface, the element engaging surface of each member being also a section of a cylindrical surface, both cylindrical surfaces having approximately the same radii of curvature as the periphery of said element engaged thereby and fitting said periphery when engaged with the element of that passage, said cylindrical surfaces and the element clamped between them in each passage having interengaging ribs and grooves that positively limit endwise movement of such element in its passage from any endwise position in which is clamped, the ends of said elements nearest each other being formed to engage and hold between them the ends of an electronic tube to be tested, one of said tube holding element ends including a socket for receiving and holding the base end of said held tube.

13. The device as set forth in claim 12, where said element that receives and holds the base end of a held tube includes a sleeve in which said socket is disposed and has an internal shoulder against which said socket abuts, and the same element has a part adjustable endwise therein to engage said socket and confine it releasably against said shoulder, said socket being somewhat smaller in cross sectional dimensions than the interior of the sleeve in which it is confined to permit limited adjustment of the socket in all transverse directions for accommodating it to a tube being held between said sleeves.

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