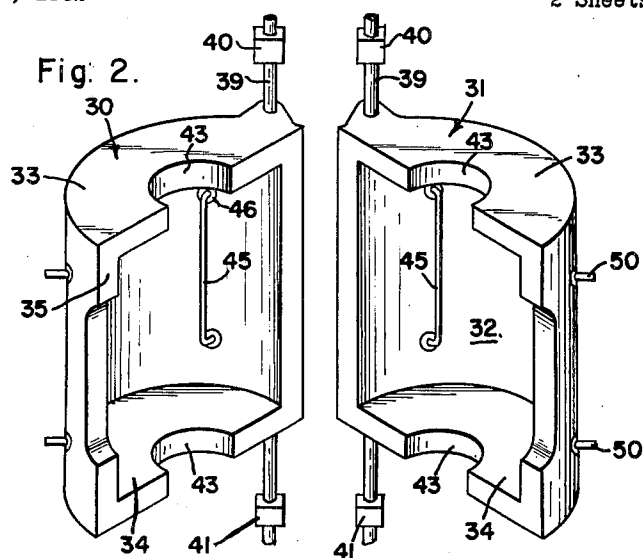
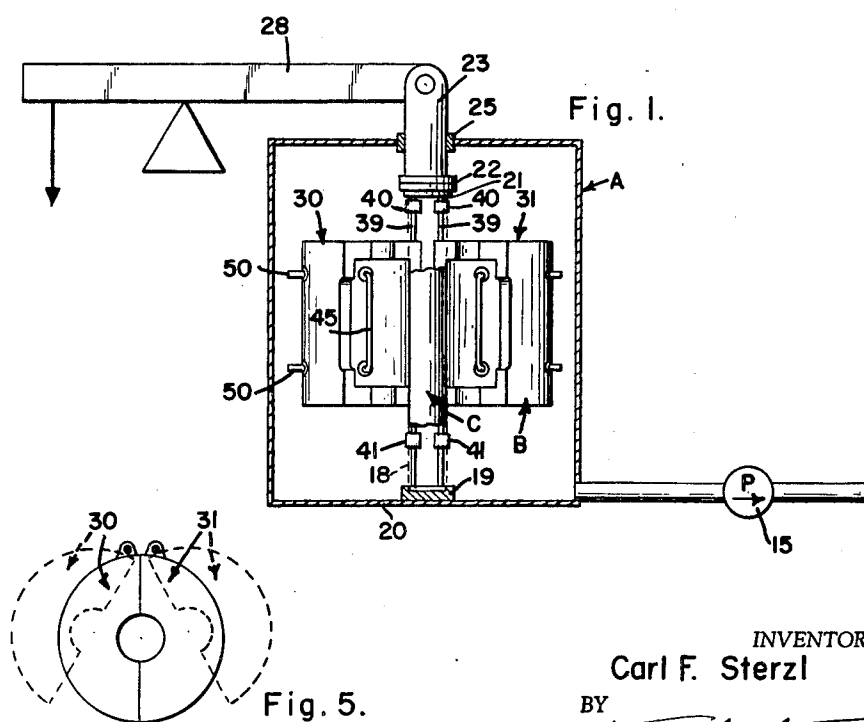
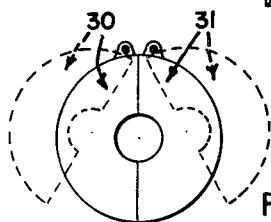


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CATHODIC HOUSING STRUCTURE

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Fig. 3.

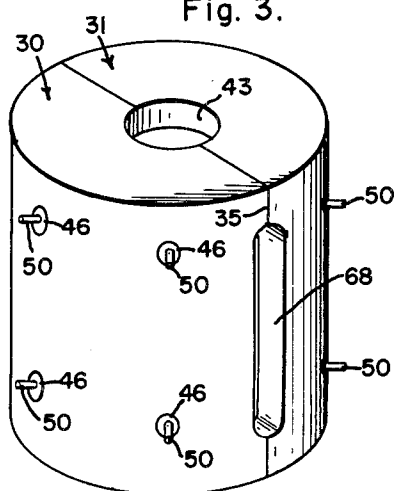


Fig. 4.

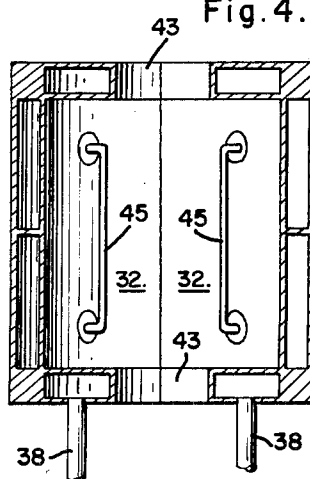


Fig. 7.

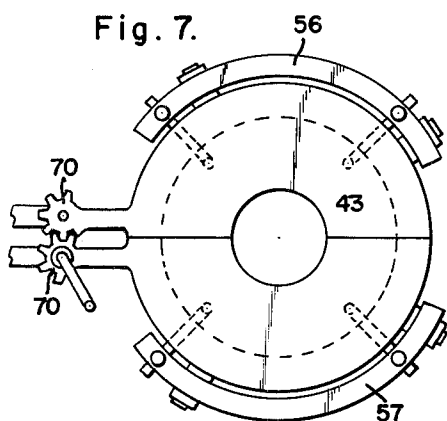


Fig. 8.

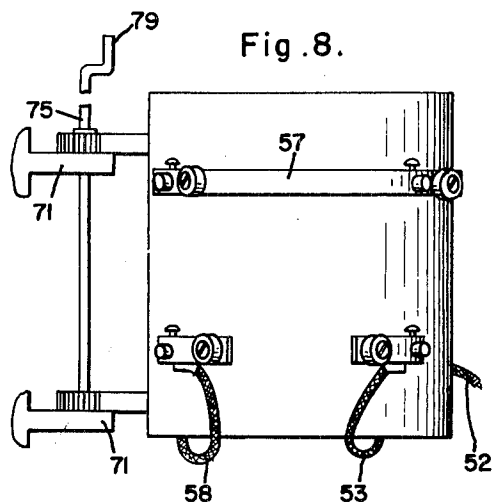
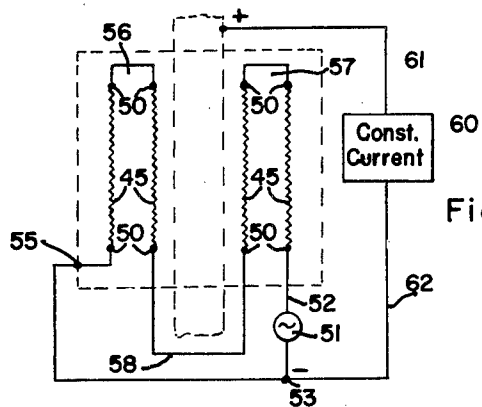


Fig. 6.



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CATHODIC HOUSING STRUCTURE

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10 Claims. (Cl. 13—1)

This invention relates to an improved electron beam gun assembly particularly useful for heating strips of highly purified refractory metals.

The electron beam gun of this invention is an improvement of the type of gun described in the copending, commonly assigned patent application No. 185,639 of Albert A. Donlevy entitled Electron Beam Gun. The electron beam gun assembly of the aforesaid patent application includes a generally cylindrical cathode housing having heating filaments mounted on and spaced from the cathode housing wall and in which a test strip is positioned axially within the cathode housing to function as an anode whereby electrons emitted from the filaments are arranged to bombard the elongate anode test specimen or strip. Electron guns of this type are ideal means for heating metal test samples under test conditions because of their simple structure and their ability to effectively and quickly transfer heat within confined physical limits. The test specimen is made anodic in such a furnace and is concentrically aligned within the cathodic cylindrical housing so that the filaments and the anodic test specimen produce an even bombardment on the test specimen.

In the improved gun assembly of this invention there is provided a cathodic housing which allows easy access to its interior while providing an adjustable viewing slit which will have little effect on the symmetry of the electrostatic field and which further has a contained manifold which allows the cathodic housing to be cooled during operation.

The objects of this invention are effected by forming the cathodic housing in two half cylindrical sections and hinged in such a manner so that the two half sections can be swung about to an open condition to allow completely free access into the interior of the housing structure and to a closed condition in which the two half cylinders form a completely cylindrical enclosure.

In a gun assembly of this type it is desirable to view the anodic test specimen during heating so that it can be visually analyzed to determine color temperature and stress conditions. In the present invention the viewing window is formed by a slit on the two mating edges of the half cylindrical sections so that the viewing slit is at an area of juncture of the two sections. This structure allows the opening to be functionally enlarged by slightly opening the two half sections should it become necessary to have a wider viewing area either prior to, during, or subsequent to the heating phase of operation. Because of the novel half section construction of the cathodic housing, a completely integrated internal manifold can be created by forming the cylindrical housing in a double walled structure so that the area between the double walls can function as a water carrying manifold. Thus the novel structure of the invention affords an easy vehicle for effecting the cooling of the cathodic housing.

The invention further provides a convenient structural relationship which will allow the filaments to be moved outwardly or inwardly relative to the anodic specimen by causing the two half sections to either be spread apart or be brought closer together. By this means some dynamic control of the field pattern can be obtained.

These and other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

FIG. 1 is a schematic view of a typical stress furnace structure in which the improved electron gun assembly of this invention is mounted showing the anodic housing in an opened position.

FIG. 2 is a perspective view showing the cathodic housing in an opened position.

FIG. 3 is a perspective view showing the cathodic housing in a closed position.

FIG. 4 is a cross sectional view of the gun assembly.

FIG. 5 is a diagrammatic view showing the cathodic housing in closed position in solid lines and in open position in broken lines.

FIG. 6 is a schematic view showing the electrical circuit connections for the gun assembly of this invention.

FIG. 7 is a top plan view of an alternate embodiment of this invention; and

FIG. 8 is a side plan view of the embodiment shown in FIG. 7.

In the principal embodiment of the invention there is provided a vacuum chamber A evacuated by a pump 15 of sufficient capacity to bring the pressure within chamber A down to a level of at least below 0.1 micron of mercury and preferably to a level of .01 micron of mercury.

The gun structure B is mounted in the center portion of housing A and is adapted to receive an anodic test member C vertically supported in axial alignment within gun assembly B. The bottom portion 18 of anodic specimen C is connected by a lock 19 to the bottom 20 of vacuum chamber A. The top portion 21 of the anodic specimen is connected by a locking member 22 to a reciprocally slideable pulling block 23 which is allowed reciprocal movement through the top 24 of chamber A by virtue of an air seal bearing 25. A pulling mechanism 28 of conventional design is arranged to apply calculated stress of sufficient intensity to cause controlled stress rupture of the anodic specimen.

The cathodic housing B is formed in two half sections 30 and 31. Each half section is formed by a half cylindrical wall 32 having a top plate 33 and a bottom plate 34. The entire wall structure including the cylindrical side wall 32 and the top and bottom plates 33 and 34 are formed by two spaced apart substantially parallel walls to provide water circulating spaces within the interior of the respective walls.

The edges 35 of the cylindrical top and bottom portions 32, 33 and 34, respectively, are sealed to provide a completely enclosed chamber through which water is allowed to circulate. Water is fed in to the chambers through flexible conduits 38. The half sections 30 and 31 of the cathodic gun structure B is hingeably supported by shafts 39 in which bearings 40 are formed on the outside rear walls of the two half sections. The shafts 39 are insulated from chamber A by support insulators 41 on both the top and bottom so that the entire cathodic structure is supportably held in the electrical isolation from the body of chamber A.

The central portion of top and bottom walls 33 and 34, respectively, are formed with apertures 43 of larger diameter than the maximum diameter of the anodic test specimen C and are aligned in axial alignment with the test specimen so that there will be a sufficient space between the anode and the top and bottom walls to electrically insulate the two members from each other.

It can be seen that by virtue of the hinged structure relationship of the two half sections 30 and 31 that the cathodic housing can be opened to provide a complete access to the interior of the housing into which the test specimen C can be mounted without mechanical interference by the housing structure. The cathodic housing can then be closed about the anode to provide a sub-

stantially complete electrostatic enclosure within the test area.

Four filaments 45 are mounted by electric insulators 46 so that their opposite ends project in supporting relationship through the insulators 46 exteriorly of the walls of the cathodic housing. The external tips 50 of the tungsten filaments form connector terminals by which electrical connections can be made to the filaments from a position external of the housing structure. The interior of the filaments are formed in elongated straight members spaced substantially from the interior walls of the housing.

The electrical circuit for this device comprises an A.C. power source 51 connected by cables 52 and 53 to the filaments 45. Leads 52 and 53 connect to two bottom terminals 50. One of the terminals 50 is grounded to the cathodic housing as illustrated in the schematic at 55. The two top leads 50 are connected together by buses 56, 57 and flexible cable 58 in such a way that the filaments 45 are in series connection with the A.C. power source 51. A D.C. constant current power supply 60 is arranged to supply positive potential to the anodic specimen C through lead 61 and negative potential through lead 62 to the lead 53 which is grounded to the cathodic housing at junction 55.

In operation the test specimen C is placed between the support blocks 19 and 22 so that the pulling mechanism 28 can exert stress on the specimen. The cathodic housing B is then closed to completely enclose the anodic structure internally within cathodic housing B. The apertures 43 are of sufficiently large diameter to form a space between the anodic specimen C so that the two members are electrically isolated from each other and to provide a space through which they can be exhausted from the anodic housing.

The abutting edges 35 are deformed as at 68 to provide an elongate slot through which the anodic structure can be observed during the heating operation. The provision of the slot at this point allows the slot to occur at the abutment of the two half sections 30 and 31. In some cases it may be desirable to eliminate slot 68 and to view the test specimen momentarily by opening the two half sections 30 and 31 sufficiently to allow observation of the anodic test specimen C. Thus the slot 68 can be optionally formed if desired.

In FIGS. 7 and 8 there is a modification of the hinge structure for the housing in which sprockets 70 are arranged on an insulated support 71 and in which an axle 75 is arranged with an insulated handle 79 projecting exteriorly of the vacuum housing A. The two half sections 30 and 31 thus can be opened and closed from outside chamber A by merely rotating handle 79. It is, of course, obvious that other means for rotating the gears 70 can be employed such as by the use of multiple gears, motors and the like.

Although the foregoing invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be practiced within the spirit of the invention as limited only by the scope of the appended claims.

What is claimed is:

1. An electron beam gun for heating an elongate anodic member within a vacuum chamber comprising: a cylindrical cathodic housing enclosed by end plates on opposite ends of the cylindrical housing means connected to said anodic member and said cathodic housing to supply electrical potential to said member and housing, said cylindrical cathodic housing being bisected to form two half sections, means pivotally mounting each half section to allow the half sections to rotate to a first position forming a complete cylinder and to a second position to define a large open space between the two half sections to allow installation of the anodic member, means to align the anodic member in axially aligned relationship with said

cathodic member when said half sections are in the first position, the two plates being apertured in sufficient dimension to space the anodic member in electrical insulation from the cathodic member and electron emission means mounted on the inside of each of said sections.

2. A gun according to claim 1 and wherein each of said half sections are formed by double walls to provide an internal manifold within said vacuum chamber and means to provide fluid communication to the manifold.

3. A device according to claim 1 and wherein the means pivotally supporting said half sections comprises a pair of vertically spaced apart rods electrically insulated from the body of the vacuum chamber and said cathodic housing carries hinge connections for said rods.

4. A device according to claim 1 and wherein said cathodic housing includes means to interlock said half sections to allow the half sections to rotate simultaneously equally from a first to a second position and means connected to said half sections from a point external of the vacuum chamber to allow the half sections to be moved between the first and second positions from a point exterior the chamber.

5. An electron gun according to claim 1 and wherein aligned grooves are formed in abutting edges of the half sections to provide a viewing aperture through which the anodic member within the cathodic housing can be viewed while said half sections are in the first position.

6. An electron beam gun for evenly heating test specimens of metal in an evacuated stress rupture furnace, the improvement comprising: a cylindrical metal housing having end walls, said housing formed of two semi-circular half sections having a plane of separation along a diametric-axial plane, the end walls having apertures concentrically aligned around the cylinder axis, pivot means supporting said half sections for movement about an axis which is longitudinally displaced from the cylinder axis to form a clam-shell arrangement for opening and closing said hollow cylinder for allowing insertion and removal of a test specimen, an elongated electrically conducting test specimen concentrically and cylindrically aligned within said apertures in spaced relationship to the end walls of said hollow cylinder, electrical power connected between said hollow cylinder and said test specimen making said hollow cylinder cathodic and said test specimen anodic creating a symmetrical electrostatic field therebetween, and a plurality of electron emissive filaments mounted on the inside wall of said housing in spaced relation to said housing and said test specimen.

7. An electron beam gun for evenly heating test specimens of metal in an evacuated stress rupture furnace, the improvement comprising: a cylindrical metal housing having end walls, said housing formed of two semi-circular half sections having a plane of separation along a diametric-axial plane, the end walls having apertures concentrically aligned around the cylinder axis, each of said half sections being pivotally supported about an axis which is longitudinally displaced from the cylinder axis to form a clam-shell arrangement for opening and closing said hollow cylinder by allowing insertion and removal of a test specimen, a narrow viewing slit positioned in the side wall of said cylinder along a portion of the plane of separation, an elongated electrically conducting test specimen cylindrically aligned within said apertures in spaced relationship to the end walls of said hollow cylinder, electrical power connected between said hollow cylinder and said test specimen anodic creating a symmetrical electrostatic field therebetween, and a plurality of electron emissive filaments mounted on the inside wall of each housing in spaced relation to said housing and said test specimen.

8. An electron beam gun for evenly heating test specimens of metal in an evacuated stress rupture furnace, the improvement comprising: a cylindrical metal housing having end walls, said housing formed of two semi-circular half sections having a plane of separation along a diametric-axial plane, the end walls having apertures con-

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centrically aligned around the cylinder axis, each of said half sections being pivotally supported about an axis which is longitudinally displaced from the cylinder axis to form a clam-shell arrangement for opening and closing said hollow cylinder by allowing insertion and removal of a test specimen, a narrow viewing slit positioned in the side wall of said cylinder along a portion of the plane of separation, an elongated electrically conducting test specimen concentrically and cylindrically aligned with said apertures in spaced relationship to the end walls of said hollow cylinder, electrical power connected between said hollow cylinder and said test specimen making said hollow cylinder cathodic and said test specimen anodic creating a symmetrical electrostatic field between them, at least two sets of axially aligned upper and lower openings through the side wall of said cylinder, each set being symmetrically displaced in the circumferential direction, support means mounted in electrically isolated relationship on the exterior of said housing, wire filaments capable of high thermionic emission, each end of said wire filaments extending through one of the side wall openings in said cathodic cylinder in spaced electrically isolated relationship, the center portion of said filament being spaced intermediate of said cathodic housing and said anodic test specimen in axial alignment relationship.

9. A device according to claim 8 and wherein said filaments are connected in series relationship with a low voltage source of alternating current, and a portion of said filament and said housing are connected to the negative terminal of a source of direct current and said test specimen is connected to the positive terminal of the source of direct current.

10. An electron beam gun for evenly heating test specimens of metal in a stress rupture furnace, the improvement comprising: a hollow cylindrical metal housing having end walls, said housing formed of two semi-circular half sections having a plane of separation along a diametric-axial plane, the end walls having apertures concentrically aligned around the cylinder axis, each of said

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half sections being pivotally supported about an axis which is longitudinally displaced from the cylinder axis to form a clam-shell arrangement for opening and closing said hollow cylinder by allowing insertion and removal of a test specimen, a narrow viewing slit positioned in the side wall of said cylinder along a portion of the plane of separation, an elongated electrically conducting test specimen concentrically and cylindrically aligned within said apertures in spaced relationship to the end walls of said hollow cylinder, electrical power connected between said hollow cylinder and said test specimen making said hollow cylinder cathodic and said test specimen anodic creating a symmetrical electrostatic field between them, at least two sets of axially aligned upper and lower openings through the side wall of said cylinder, each set being symmetrically displaced in the circumferential direction, support means mounted in electrically isolated relationship on the exterior of said housing, wire filaments capable of high thermionic emission, each end of said wire filaments extending through one of the side wall openings in said cathodic cylinder in spaced electrically isolated relationship, the center portion of said filament being spaced intermediate of said cathodic housing and said anodic test specimen in axial alignment relationship, the interior of said housing forming cooling passageways extending between substantially all of the surface areas of the housing, and means to flow fluid into the interior of said passageways.

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