Oct. 9, 1934. J. O. GARGAN 1,976,489

ELECTRON DISCHARGE DEVICE

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FIG. 1.

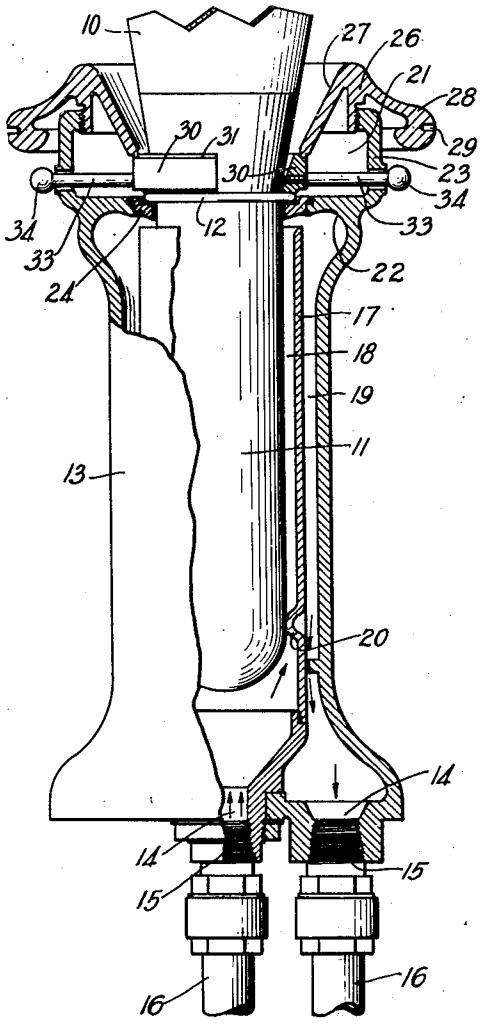


FIG. 2.

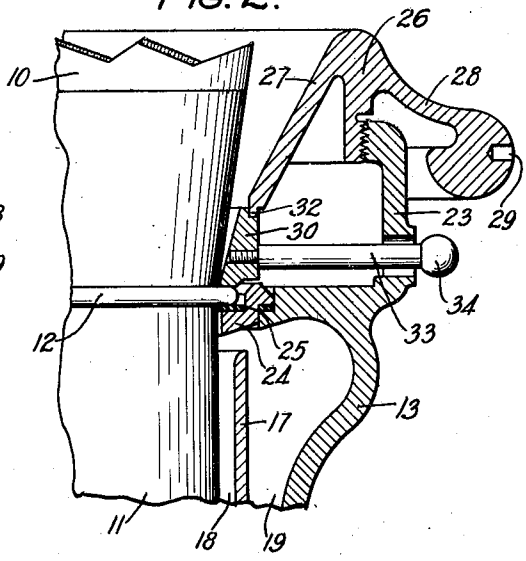
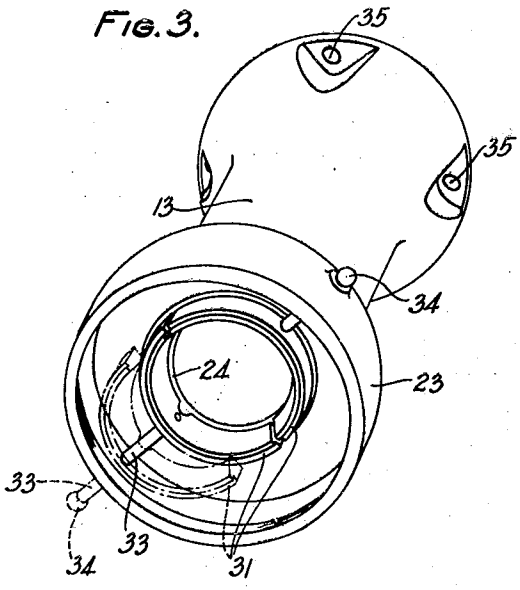


FIG. 3.



INVENTOR
J. O. GARGAN
BY
Walter C. Kiesel
ATTORNEY

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FIG. 4.

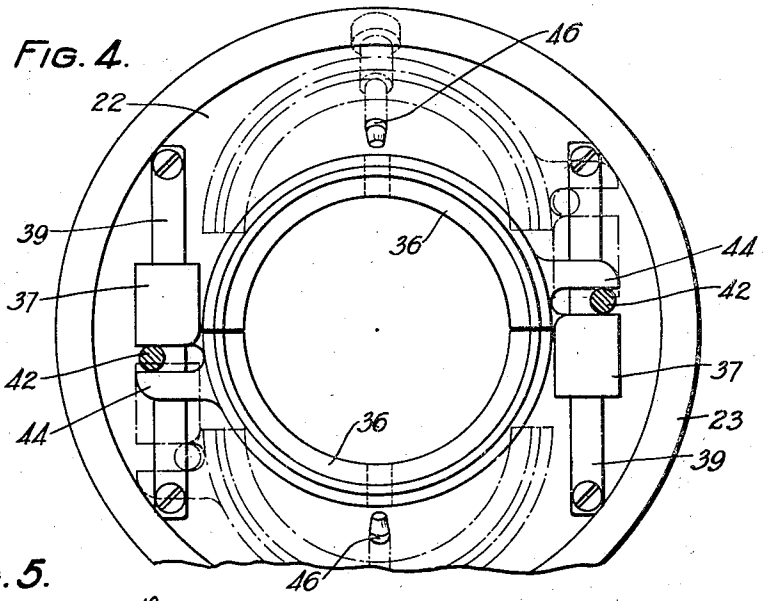


FIG. 5.

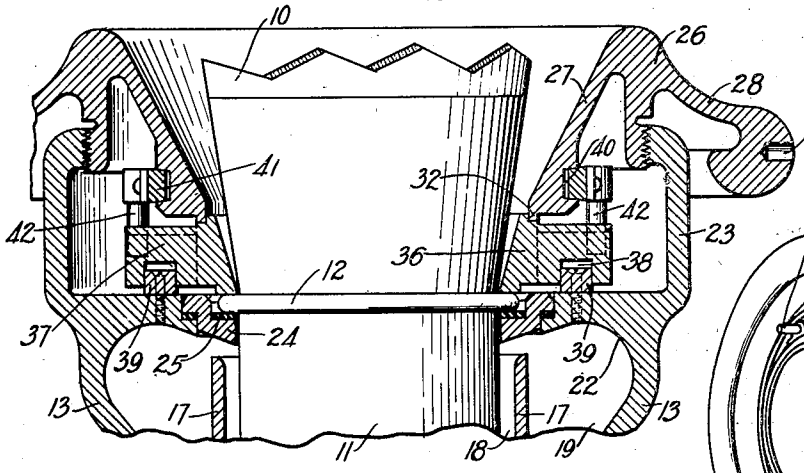


FIG. 6.

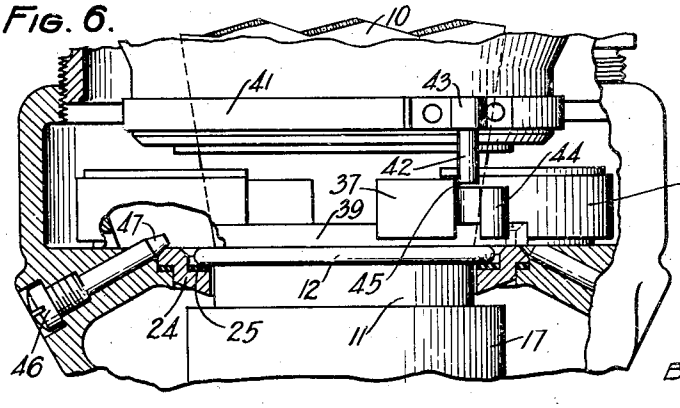
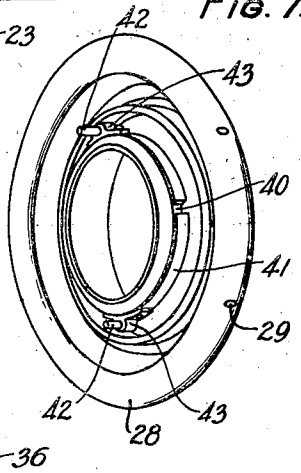


FIG. 7.



INVENTOR
J. O. GARGAN
BY
Walter C. Kiesel
ATTORNEY

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UNITED STATES PATENT OFFICE

1,976,489

ELECTRON DISCHARGE DEVICE

John Owen Gargan, Brooklyn, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application September 9, 1929, Serial No. 391,161

18 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices operating at high potentials and more particularly to the container for circulating a cooling medium around the device, to dissipate the heat generated during operation.

In the operation of high power electron discharge devices, it is customary to cool the external anode of the device with water or other medium which is circulated in a container surrounding the anode. This container must be fluid-tight and also embody a structure in which the electron discharge device may be readily removed in case of failure of the device. In the event of replacement the change must be made with dispatch, so that the system in which the device is used is not idle for any considerable period of time. Furthermore, it is particularly desirable to make replacement of the device in the container without damage to the fragile structure of the device.

An object of this invention is to facilitate the assembly and rapid removal of an electron discharge device in or from a container without danger of breakage.

In accordance with one embodiment of this invention the container comprises a cylindrical casing closed at one end except for suitable ports and provided with a cylindrical partition to separate the casing into inlet and outlet chambers for circulating the cooling fluid. The open end of the casing is provided with a seat chamber into which the electron discharge device is inserted and the flange on the device engages a removable ring at the bottom of the seat chamber. A split ring within the seat chamber engages the upper surface of the flange on the device and an annular dished closure member threaded to the casing presses the split ring to clamp the device in the casing and provide a fluid-tight joint. The split ring is provided with arms or pins which extend through the wall of the seat chamber so that this ring may be separated manually when the closure member is loosened to allow free movement of the ring. This arrangement greatly facilitates the assembly and replacement of the electron discharge device in the container, since the only operations necessary are the insertion of the anode of the discharge device in the cavity formed in the casing until the flange rests on the removable ring at the bottom of the seat chamber. The split ring is joined by pushing in the pins projecting from the casing and the closure member is then tightened to clamp the split ring against the anode flange. When replacement is necessary the closure member is loosened to relieve the pressure on the split ring; the split ring is separated by manipulating the pins projecting from the side of the casing and the device is removed and another inserted.

In another embodiment of the invention the split ring is automatically joined or separated by turning the threaded closure member on the casing. In this arrangement the split ring is provided with slotted extensions which are engaged by pins projecting from a friction ring attached to the dished portion of the closure member. When the pressure of this member on the split ring is relieved by turning the closure member, the pins on the friction ring within the slotted extensions on the split ring separate the split ring upon further turning of the closure member. The split ring rides on tracks within the seat chamber and is moved toward the wall of the chamber so that the discharge device may be readily removed from the container and another device inserted without difficulty.

The construction and operation of the device is best explained by reference to the following detailed description and the accompanying drawings:

Fig. 1 is a view in elevation partly in section to show the invention with the electron discharge device in place;

Fig. 2 is an enlarged view showing in detail the seat chamber and the closure member;

Fig. 3 is a perspective view to show the relative positions of the split ring in closed and open conditions;

Fig. 4 is plan view of a modified form of the invention in which the split ring is automatically operated;

Fig. 5 illustrates in vertical cross-section the cooperation of the various elements in the modified device;

Fig. 6 is another view of the modified form showing a removable ring held in place in the seat chamber and also showing the engagement of the pin on the friction member with the slotted split ring; and

Fig. 7 is a perspective view of the closure member showing the projecting pins on the friction ring.

Referring to Fig. 1, an electron discharge device of the high voltage type is shown comprising an enclosing vessel having an insulating portion 10 preferably of glass and an extended cup-shaped metal portion 11 which forms the anode of the device. The anode 11 is formed with an outwardly projecting annular flange 12 which provides supporting means for the electron dis-

charge device in a cooling container 13. The latter comprises a cylindrical casing which is closed at one end except for ports 14 which are threaded to accommodate the couplings 15 of hose connections 16. The container is provided with a circular partition 17 which divides the body of the said container into inlet and outlet chambers 18 and 19, respectively, through which a cooling fluid circulates. The partition 17 has a plurality of raised portions 20 on its inner wall which engage the anode 11 and serve to center the electron discharge device and maintain it in its proper position. This container forms the subject-matter of a copending application of J. O. Gargan and F. W. Young Serial No. 252,633 filed February 7, 1928. A seat chamber 21 is formed at the open end of the container by an inwardly projecting flange 22 and cylindrical wall 23, which are formed integrally with the casing. The flange 22 has a groove in its base which accommodates a removable ring 24 upon which the flange 12 of the anode 11 rests with a rubber gasket 25 interposed between the flange 12 and ring 24. An annular closure or clamping member 26 having an apertured dished portion 27 and an outwardly extending portion 28 is threaded to the wall 23 of the seat chamber 21. The outwardly extending portion 28 on the closure member forms a hand wheel to readily turn the closure member. In order to facilitate turning of the closure member if too tight to be turned by hand the outer edge of the portion 28 may be provided with spaced sockets 29 to accommodate a wrench, or other means for rotating the closure member. Within the seat chamber 21 is a split ring 30 which encircles a portion of the electron discharge device and engages the flange 12 on the anode portion. The upper edge of the split ring 30 is provided with a groove 31 which accommodates a projecting ridge 32 on the dished portion 27 of the closure member, shown in detail in Fig. 2. When the closure member is rotated in a clockwise direction the projecting ridge 32 cooperates with the groove 31 to clamp the split ring 30 to the flange 12 on the anode which is forced against the gasket 25 and the ring 24. In this manner a fluid tight joint is produced between the seat chamber 21 and the container 13.

In order to prevent damage to the glass portion of the enclosing vessel and also to facilitate the ready and rapid replacement of the electron discharge device in the container the split ring 30 in accordance with this invention, is equipped with arms or pins 33 which extend outwardly through the wall 23 of the seat chamber and are provided at their outer end with a knob 34 to facilitate handling and displacement of the split ring. There is thus provided readily accessible means whereby the two halves of the split ring may be moved relative to the anode from the exterior of the container. When it is desired to remove the device from the container the closure member is rotated sufficiently to relieve the pressure on the split ring 30 and the two parts of the ring may then be separated by merely pulling on the pins 33 and drawing them clear of the flange 12. The discharge device may then be removed very easily and replaced by another. It will be noted that the closure member need not be removed and hence it will not be brought against the glass portion 10 of the device. Damage to the glass portion is, therefore, guarded against. Furthermore, the time required to effect replacement of the device is materially reduced.

Fig. 3 shows the position of the split ring 30 in "closed" and "open" positions. With the closure member screwed down in place the split ring 30 is in the position indicated by the full lines and by bearing against the flange 12 of the anode holds the electron discharge device securely in the container. When the pressure exerted upon the split ring is relieved by turning the closure member the split ring 30 may be moved outwardly, toward the wall 23 through the agency of the pins 33 so that it is clear of the flange 12. The electron discharge device may then be easily withdrawn from the container. The apertures 35 shown in this figure are for accommodating screws or bolts for mounting the container.

The complete structure as presented in Figs. 1 to 3 inclusive is designed for manual movement of the split ring when it is desired to replace an electron discharge device in the container. In order to decrease the time required to make such replacements the aforementioned structure may be modified as shown in Figs. 4 to 7, inclusive, to automatically separate the split ring when the closure member 26 is rotated by hand or with the aid of a wrench. In accordance with this embodiment of the invention the split ring 36 is provided with slotted extensions or shoes 37 which are formed integrally with one end of each half of the ring and are located on diametrically opposite ends thereof. The slotted extensions 37 are provided with a groove 38 in the lower face thereof which fits smoothly over parallel rails 39 mounted upon the inwardly projecting flange 22 of the seat chamber. The closure member 26 is threaded to the wall 23 of the seat chamber 21 as previously described and is provided with a wide groove 40 on the inner surface of the dished portion 27 of the closure member. The side walls of groove 40 are inclined to receive a compressible member or ring 41 having tapered edges which cooperate with the groove 40 to form a frictional fit therebetween. The closure member with the friction ring in position is clearly shown in Fig. 7. The ring 41 carries two oppositely disposed downwardly extending pins 42 which are fastened to the ring by extensions or sockets 43.

The operation of the structure is best understood by reference to Figs. 4, 5 and 6. The two parts of the split ring 36 are placed in separated position, as shown in dotted lines in Fig. 4, within the seat chamber so that the extensions 37 are in engagement with the parallel tracks 39. The closure member is then threaded to the casing until the pins 42 slide over the undercut fingers 44 of the extensions 37 of the split ring 36, and bear against the edge 45 thereof whereupon the pins 42 are in alignment with the slots in the extensions 37. The electron discharge device is inserted in the container until the flange 12 rests on the gasket 25. Rotation of the closure member causes the pins 42 to bear against the shoulder 45 on the slotted extensions 37 and as a result the parts of the split ring 36 are moved inwardly until they come in contact with the anode flange 12 of the electron discharge device. Further rotation of the closure member causes the friction ring 41 to slide in the groove 40 and the pins 42 are lowered into the slots in the slotted extension 37. The extension 32 on the closure member bears against the split ring 36 and clamps it against the flange 12 in exactly the same manner as described heretofore. When it is desired to remove the discharge device the closure member is rotated in a counter-clockwise direction. The pressure on the split ring 36 is relieved and the pins 42 are free to move the slotted extensions 37 along

the rails 39 and the split ring is separated and moved toward the wall 23 of the seat chamber. This removes all restraining forces on the flange 12 and the electron discharge device may be readily removed and replaced.

When impurities are present in the cooling medium in the container a crust forms on the anode 11 below the ring 24 which necessitates the removal of the latter. As shown in Fig. 6, the ring 24 may be readily removed when the discharge device cannot be withdrawn from the container due to its encrusted condition. The casing 13 and the flange 22 are provided with apertures extending at an angle through which screws 46 extend. The end of each screw 46 is provided with a tapered portion 47 to engage the ring 24. When the screws 46 are in place the tapered portion 47 bears firmly against the ring 24 so as to hold it securely in position. When it is desired to remove the ring 24 the screws 46 are removed and the ring 24 can be withdrawn from the casing with the encrusted anode.

What is claimed is:

1. A supporting container for an electron discharge device comprising a casing enclosing a portion of the device, a split ring in said casing engaging the portion of the device therein, said split ring being laterally movable within said casing, an apertured closure member at one end of said casing detachably engaging said split ring, and means mechanically coupled to said split ring for causing movement thereof away from and toward said portion.

2. A supporting container for an electron discharge device comprising a casing having a cavity for the reception of a portion of the said device, a seat chamber above said cavity, a clamping member having an aperture to allow free passage of the portion of the device in said cavity, a split ring in said seat chamber engaging a portion of said device, said split ring being spaced from the side walls of said chamber so that the parts thereof may be separated within said chamber and being detachably engageable by said clamping member, and means coupled to said split ring for causing separation of the parts thereof to disengage said parts from said portion of said device when said clamping member is loosened.

3. A supporting container for an electron discharge device comprising a casing enclosing a portion of the device, a split ring in said casing for engaging the portion of the device therein, an apertured closure member at one end of said casing detachably engaging said split ring, and means coupled to said split ring and extending exteriorly of said casing for moving said split ring.

4. A supporting container for an electron discharge device comprising a casing for enclosing a portion of the device, a split ring in said casing for enclosing a portion of the device therein, said split ring being laterally movable within said casing, an apertured closure member at one end of said casing threaded to said casing and engaging said split ring, and pins attached to said split ring projecting through the wall of said casing.

5. A supporting container for an electron discharge device comprising a casing for enclosing a portion of the device, a split ring in said casing for engaging a portion of the device therein, said split ring being spaced from the side walls of said casing, an apertured closure member at one end of said casing engaging said split ring, and means including members carried by said closure member for separating the parts of said split ring.

6. A supporting container for an electron discharge device including an enclosing vessel having a projecting support thereon, comprising a casing for enclosing a portion of the device, a flange within said casing, an annular member carried by said flange forming a seat for said projecting support, means for securing said support against said annular member, and means independent of said first means extending through the wall of said casing for locking said annular member upon said flange.

7. A supporting container for an electron discharge device, comprising a casing for enclosing a portion of the device, a flange within said casing, a reducing ring in engagement with said flange for supporting said device, locking means engaging said reducing ring, said locking means being accessible from the side wall of said casing, and means for holding said device upon said reducing ring.

8. A supporting container for an electron discharge device, comprising a casing for enclosing a portion of the device, an apertured flange extending inwardly from said casing, a split ring within said casing engaging a portion of the device therein, the parts of said split ring being separable within said casing, guide means mounted on said flange for slidably carrying and allowing separation of the parts of said split ring and means for locking said split ring against said portion of said device.

9. A supporting container for an electron discharge device, comprising a casing for enclosing a portion of the device, an apertured flange extending inwardly from said casing, a split ring within said casing enclosing a portion of the device therein, rails mounted on said flange for slidably carrying said split ring and means engaging said casing and ring for moving said split ring along said rails and locking said ring in position.

10. A supporting container for an electron discharge device, comprising a casing for enclosing a portion of the device, a split ring within said casing enclosing a portion of the device therein, slotted extensions projecting from said split ring, guiding means within said casing engaging said slotted extensions and means for causing said split ring to lock said device in said casing.

11. A supporting container for an electron discharge device, comprising a casing for enclosing a portion of the device, a split ring in said casing enclosing a portion of the device therein, slotted extensions projecting from said split ring, an apertured flange projecting inwardly from said casing, means on said flange for slidably carrying said split ring, said means engaging said slotted extensions and means for holding said split ring in engagement with a portion of said device.

12. A supporting container for an electron discharge device comprising a casing for enclosing a portion of the device, a split ring in said casing for engaging a portion of the device therein, slotted extensions projecting from said split ring, an apertured closure member at one end of said casing engaging said split ring, a friction ring engaging the inner surface of said closure member, and means carried by said friction ring for engaging said slotted extensions.

13. A supporting container for an electron discharge device comprising a casing for enclosing a portion of the device, a split ring for engaging a portion of the device therein, slotted extensions on said split ring, an apertured closure member at one end of said casing engaging said split ring,

a friction ring engaging the inner surface of said closure member, and pins projecting from said friction ring for engaging said slotted extensions.

14. A supporting container for an electron discharge device comprising a casing enclosing a portion of the device, an annular seat formed in said casing for supporting an annular flange on said device, a plurality of radially movable means including a split ring for engaging said annular flange, disposed on opposite sides of said casing adapted to be manually operated exterior to said casing for securing said device in engagement with said seat and permitting removal of said device from said casing, and locking means engaging said split ring and casing.

15. In combination, an electrical discharge device including an enclosing vessel having an external anode portion, a jacket surrounding said anode portion and having a compartment adapted to contain a cooling medium, said jacket including a chamber above the cooling medium compartment, said chamber having a flanged portion adapted to support the discharge device, means comprising a laterally slidable contact member mounted within said chamber and adapted to engage said anode portion of the device, and a rotatable member mounted on a portion of said chamber for instituting lateral movement of said slidable member.

16. In combination, an electrical discharge device including an enclosing vessel having an external anode portion, a jacket surrounding said anode portion and having a compartment adapted to contain a cooling medium, said jacket including a chamber above the cooling medium compartment, said chamber having a flanged portion adapted to support the discharge device, means comprising a contact member mounted within said chamber, said contact member being slidable at an angle to the longitudinal axis of and adapted to engage said anode portion of the device, and a rotatable member for closing said chamber and simultaneously controlling said slidable member.

17. In combination, an electrical discharge device including an enclosing vessel having an external anode portion, a jacket surrounding said anode portion and having a compartment adapted to contain a cooling medium, said jacket including a chamber above the cooling medium compartment, said chamber having a flanged portion adapted to support the discharge device, means comprising a radially slidable contact member mounted within said chamber and adapted to engage said anode portion of the device, and an annular dished closure member engaging a wall of said chamber and the slidable member.

18. In combination, an electrical discharge device including an enclosing vessel having an external anode portion, a jacket surrounding said anode portion and having a compartment adapted to contain a cooling medium, said jacket including a chamber above the cooling medium compartment, said chamber having a flanged portion adapted to support the discharge device, means comprising a plurality of laterally slidable contact members mounted within said chamber and adapted to engage said anode portion of the device, and a rotatable member mounted on a portion of said chamber and adapted to institute lateral movement of said slidable members.

JOHN OWEN GARGAN.