

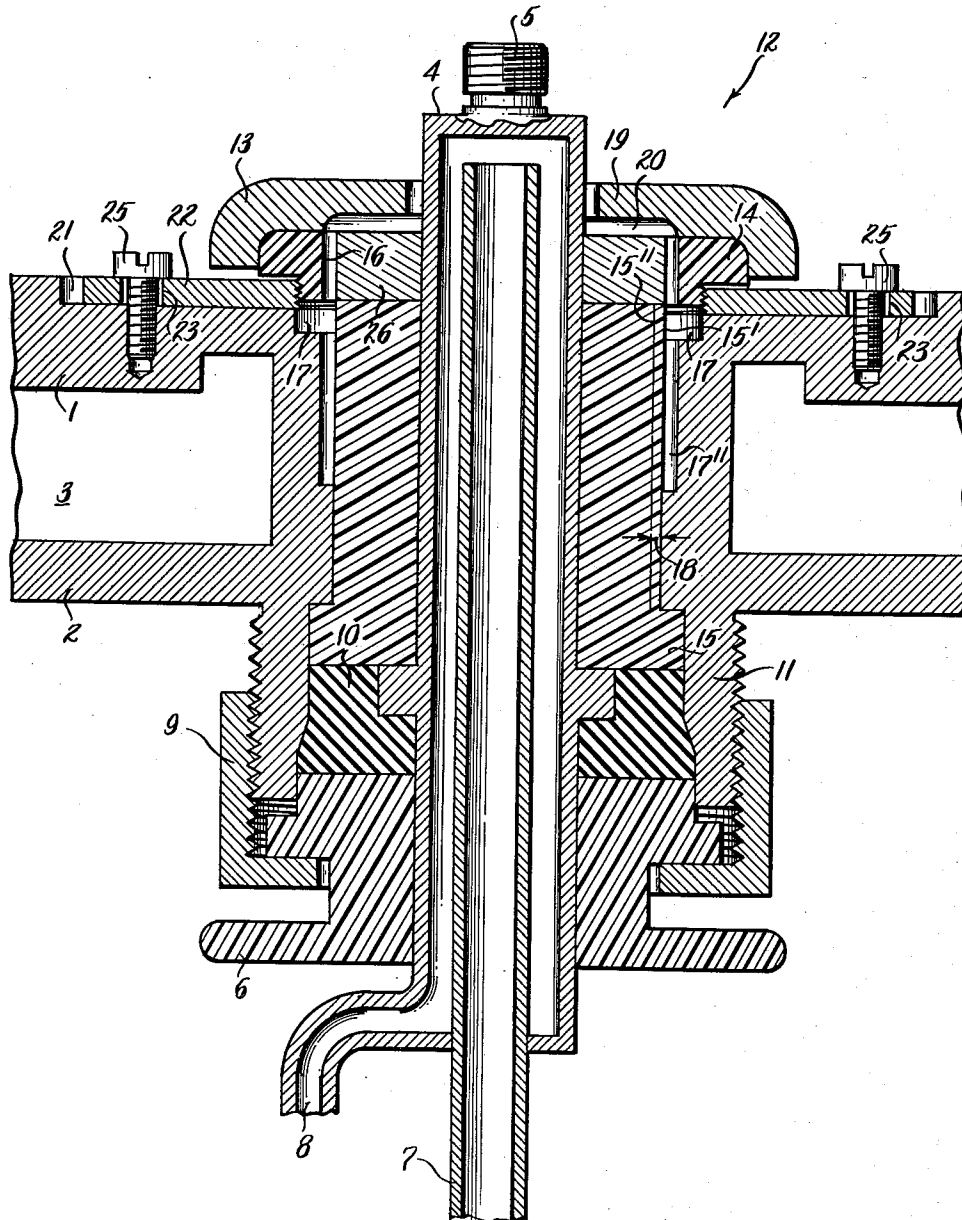
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TWO ELECTRODE ARRANGEMENT FOR ELECTRIC GLOW DISCHARGE CHAMBERS

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TWO ELECTRODE ARRANGEMENT FOR ELECTRIC GLOW DISCHARGE CHAMBERS

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This application is a continuation-in-part of the copending application Serial No. 4,571 filed January 25, 1960 now Patent No. 2,994,007, which in turn is a continuation-in-part of application Serial No. 410,932, filed February 17, 1954, and now abandoned, and relates to two electrode arrangements for electric glow discharge chambers and particularly to lead-in devices using such arrangement.

Lead-in devices for electric conductors in glow discharge vessels protected against the destructive effect of the discharge with screening means having intermediate gaps provided in front of the insulating material cause technical and operation difficulties if during the operation with increasing pressure the thickness of the glow seam is so reduced that the intermediate gaps between the walls forming them have to be made of very small dimensions if they are intended to prevent the occurrence of discharges of large energies. The dimensions of the distances between the walls forming the said gaps are within the region of the lower minimum limits of the tolerances which can be produced with the present technical means, even when the most modern machining processes, such as grinding, lapping, etc., are used, whereby it has also to be taken into consideration that parts of the walls are formed of ceramic bodies, such as insulators or the like in which these machining processes encounter difficulties. It has been found in practice that in the case of such small distances one is not in a position to produce them quite uniformly, so that places occur where the gap has different widths, whereby in gaps between walls having different electric potentials the danger of a flash-over arises which interrupts the operation.

One embodiment of the invention is a lead-in for a metallic glow discharge vessel having two concentric electrodes enclosing a gap which, seen from the interior of the vessel, is disposed in front of an insulator that lies between the electrodes, and the invention consists in that one electrode, or parts thereof, is arranged with respect to the other electrode so that it is movable and can be adjusted in position. Further, a part of the movable electrode consists of a ring, which is secured to it by an easily detachable connection allowing of a radial displacement, for instance, by screws passing through larger holes in the ring. It is especially advantageous if one part of the movable electrode consists of a ring which is secured to it by an easily detachable connection allowing of a radial and axial displacement. The same advantages are obtained in the case of a gas discharge operated with alternating currents. A characteristic feature of the device according to the invention is the capability of displacement of an electrode part which is easily accessible in the constructional arrangement of the gap system.

The single FIGURE of the accompanying drawing illustrates by way of example, a construction of vacuum vessel according to the invention, as used for the treatment of work-pieces or for the carrying out of chemical reaction by means of gas discharges of high intensity.

The glow discharge chamber or vessel is provided with a doublewall bottom 1, 2 forming a cooling space 3 through which passes a cooling means, the space above the wall 1 representing the interior of such chamber or vessel,

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the other walls enclosing the chamber are not shown. If the vessel wall 1, 2 is connected as an anode, the cathode 4, provided with a screw-threaded attachment 5, in order to secure the parts to be treated, is led through the outer insulator 6. Cooling of the cathode is effected through its whole length by the coolant entering at 7 and leaving at 8. A screw-cap 9 presses the insulator 6 against a packing 10, which is provided in the screw-threaded connector 11 of the bottom of the vessel. Rubber, synthetic resins, or the like are preferably used as packing material. The position of the cap 13 at the interior of the discharge space is fixed by the ring 14. The latter forms an annular cylindrical gap 16 with respect to the cathode ring 26, which gap is of the greatest importance for the operation of the lead-in. The electrode 4 is separated from the wall 1, 2, connected as a counter-electrode, e.g. as the anode, by the insulator 15, the gap 17 communicating with the gap 16. It will be understood that the principal glow discharge occurs between the work-pieces mounted on the attachment 5 and the chamber wall, and that the gaps 16 and 17 act to hinder the glow discharge from reaching the insulator 15.

In order to represent the essence of the invention more clearly, imagine the internal insulator 15 as being incorrect as to its accuracy and that the wall surface of 15 shown in the right hand side deviates by the inaccurate value 18 from the stereometrically exact cylindrical boundary 15". For this reason, the gap 17" on the right hand side of the drawing would be smaller than the gap 17 on the left hand side, and likewise the gap 16. Owing to the reduction in the annular cylindrical gap 17, the reliable operation of the lead-in is not thereby substantially affected. On the other hand, a non-uniform wall distance between the parts 14 and 26 in the region of the gap part 16 would be a disadvantage, since this part of the gap lies between metal parts of opposite potential, and the possibility of a release of a flash-over is increased by the widening and the narrowing exceeding a definite value. The gap part 16 between the electrode rings 14 and 26 is protected against the effects of a flash-over by the radially extending gap 20, which is provided in front of gap 16 and communicates therewith and which is formed by an extension 19 of the cap 13 overhanging ring 14. The dimensioning of the protecting gap 16 must be as uniform as possible and is of paramount importance.

For this purpose, the following measures are provided in the example illustrated.

The wall 1 facing the interior of the chamber which encompasses a discharge space 12, is provided at 21 with a recess, which is intended to receive the adjustable plate 22. The latter defines a seat for the ring 14 and thereby controls the shape of the gap 16. In order to enable displacement of plate 22 to be effected, the diameter of the recess 21 is made greater than the outer diameter of the plate 22. The latter is provided at 23 with a number of holes, the diameter of which is again greater than the diameter of the stem 24 of the fixing screws 25, the screw-threaded part of which engages in corresponding screw-threaded bores in the part 1. It is accordingly only necessary to loosen the screws 25 to effect radial adjustment of the plate 22. If the screws 25 are tightened, the plate 22 is also fixed in position and therewith also the ring 14. In this way, the ring 14 can be adjusted very accurately to be exactly concentric to ring 26 and define a uniform gap between the parts 14 and 26.

In the course of operation, wear of the structural parts forming the gap will occur, for instance due to dusting, occasional grinding to eliminate rough spots, etc., it is of great advantage to provide also for an axial adjustment of such parts, in order to be able to achieve an exact alignment also in the axial direction. In the example illustrated, the gap 20 must be readjusted by adjustment of

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the distance between ring 26 and cap 13, in order that it may not exceed a specific width, as otherwise it could no longer fulfill satisfactorily its function of protection against the glow discharge. For this purpose, for instance, ring 14 does not merely rest on adjustment plate 22, but is connected thereto in such manner that such ring, and with it the cap 13, may be raised and lowered, thereby adjusting the axial distances between parts 13 and 26. The ring 14 may be made of metal or insulating material.

The means for adjusting the ring 14 may be any suitable means such as the obvious expedient of the threaded connection shown between rings 14 and 22.

It will be understood that the invention is not limited to the above described lead-in devices, but the scope of the invention includes other two electrode arrangements for electric glow discharge chambers comprising two electrodes arranged one within the other and spaced from each other, at least one of the electrodes being adapted for connection to an electric potential, one of the electrodes being adjustable in at least one of the axial and radial directions with respect to the other electrode. Said electrodes, by example a metallic tube as outer electrode and a metallic rod as inner electrode within the outer electrode, forming a gap between them which is open to the interior of the chamber or vessel. According to the invention, the said adjustable electrode is movable to make the width of the gap the same throughout its whole extent.

A two electrode arrangement of that kind is, for example, a rifle barrel being fastened direct to the lead-in's one electrode and having a rod as inner electrode extending throughout the bore of the rifle barrel and forming a gap with the interior of the bore. It be important in such two electrode arrangements that the rod is adjustable at least in the radial direction with respect to the tube to make the width of the gap the same throughout the whole extent of the bore.

What we claim is:

1. A current lead-in device for electric glow discharge chambers comprising two electrodes arranged with one extending coaxially through the other and spaced from each other, at least one of the electrodes being adapted for connection to a source of electric potential, an insulator between the electrodes, one of the electrodes being adjustable in the axial direction with respect to the other electrode, at least portions of said electrodes being axially

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opposed and defining a disk-shaped gap between them extending transverse to said axis and which is disposed in advance of the insulator viewed from the interior of the chamber, said adjustable electrode being axially adjustable to regulate the width of said axial gap.

2. The device as claimed in claim 1, wherein said two electrode portions are of circular outline and include parts which are fixed with respect to each other, one of said portions including an axially adjustable part which is movable to bring the portions into uniform axially spaced relation.

3. The device as claimed in claim 2, including adjusting means for said axially adjustable part exposed to the interior of the chamber and thus easily accessible from inside the chamber.

4. A two electrode arrangement for electric glow discharge chambers comprising two electrodes arranged with one extending axially through the other and spaced from each other, at least a portion of at least one of the electrodes being adapted for connection to an electric potential, one of the electrodes being adjustable in the axial direction with respect to the other electrode, at least portions of said electrodes being axially opposed and defining a disk-shaped gap between them which extends transverse to said axis and which is open to the interior of the chamber, said adjustable portion being axially movable to make the width of the gap said axial same throughout its whole extent.

5. A device as defined in claim 4 wherein said adjustable portion surrounds said other electrode and is free of connection to any source of potential, an insulating ring supporting said adjustable portion, and means mounting said ring for axial adjustment along said other electrode.

6. A device as defined in claim 4 wherein said adjustable portion surrounds said other electrode and is free of connection to any source of potential, said adjustable portion including a face axially opposed to and spaced from said outer electrode and defining therewith a second disk-shaped gap extending transverse to said axis.

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