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H. BUCEK
LEADING-IN INSULATORS FOR ELECTRIC GLOW
DISCHARGE RECEPTACLES

2,906,911

2 Sheets-Sheet 1

Fig. 1.

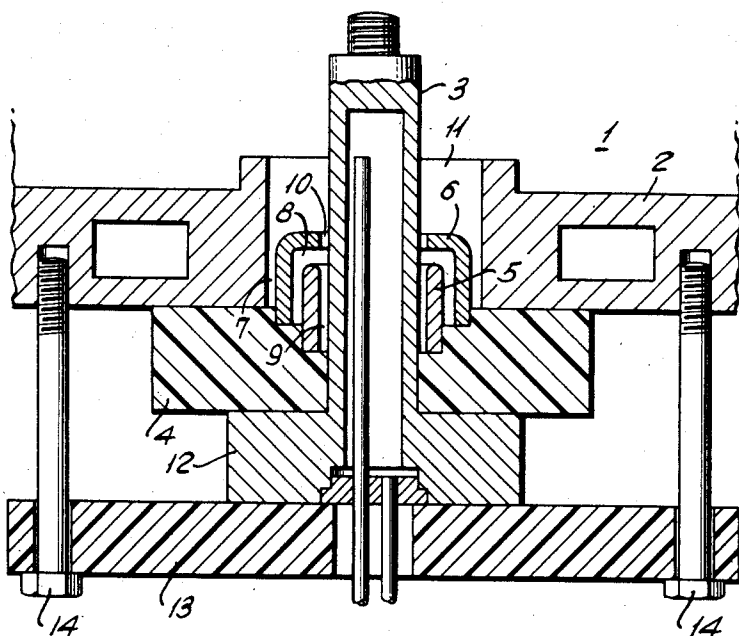
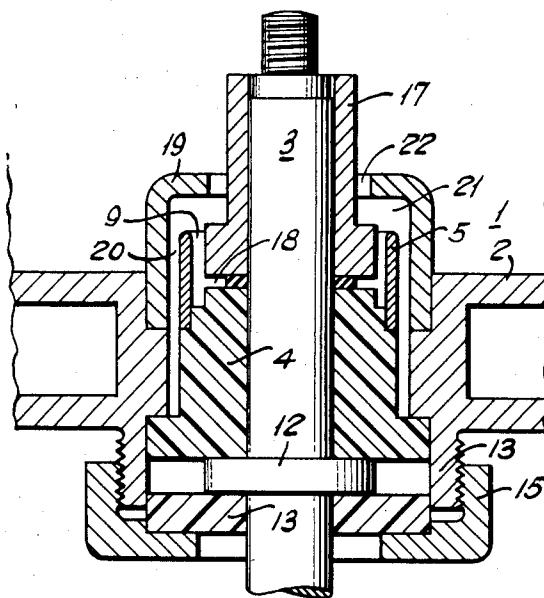


Fig. 2.



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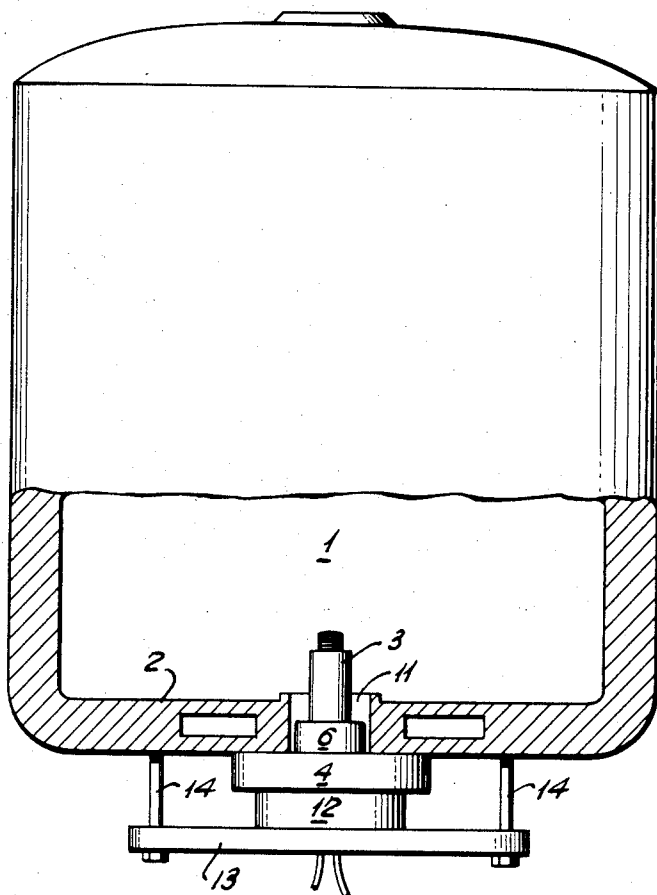
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Fig. 3.



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LEADING-IN INSULATORS FOR ELECTRIC GLOW DISCHARGE RECEPTACLES

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5 Claims. (Cl. 313—219)

The construction of leading-in insulators in glow discharge receptacles of metal is associated with great difficulties, since the discharge affects the insulating material and ultimately destroys it. It has been found in practice that when working, more particularly with higher gas discharge pressures, the known measures for the protection of the insulation material are not adequate. The object of the invention is to avoid these disadvantages and difficulties.

The invention relates to a leading-in insulator for electric glow discharge receptacles with at least one intermediate metal ring in a gap system and at least two concentric screening gaps, the characteristic feature of which is that powerful discharges in the gap system are avoided by a reduced or stepped-down electrical penetration factor of the intermediate ring with respect to the interior of the receptacle. The expression "penetration factor" means the same as in the case of amplifying tubes, namely, the extent of the influence of one electrode on another electrode in the course of the discharge. The analogy may be carried further and the penetration factor can be stated to be a measure of the extent to which an electrode or part thereof can be withdrawn from the influence of the discharges in the interior of the receptacle.

According to the invention, the intermediate metal ring, which is relatively thin and preferably has a very small mass in order that its capacity with respect to adjacent electrodes shall be small, is so arranged that it will present a small surface to be ionised, and thus conducting gas, viz. with respect to the interior of the receptacle. By providing a plurality of intermediate rings, preferably of smaller mass, they will advantageously present a stepped-down surface with respect to the interior of the receptacle. According to the invention, the intermediate ring or rings may advantageously be arranged in recesses open towards the interior of the receptacle between the wall of the latter and the conductor. Further, also the narrow screening gaps between electrodes and intermediate rings, as well as between these and insulating parts, may be connected with the discharge space by wider gaps arranged in series therewith. According to the invention, the intermediate rings are insulated without outer current connection. Moreover, it is an advantage for the intermediate rings to be disposed on corresponding surfaces of one and the same insulator in order to obtain reliable centering with a simple construction. Further, the outer electrodes may be lengthened opposite the intermediate rings. In this case it is advantageous for the outer electrodes to extend over, i.e., overhang, the inner electrode, if desired, in a cap-like manner. These measures are used alone or in combination, according as to whether the leading-in insulator is used in connection with very high pressures, or for carrying out very powerful processes, in which, inter alia large amounts of metals are atomised. Also the use of certain

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gases showing an especially thin glowing fringe, requires measures in this direction.

It is also to be pointed out these: By the present invention, the transmission of energy from the conductive gas of the discharge space towards the inner gaps is practically almost completely stopped and thus a discharge in the inner gaps which would destroy the screening or cause short-circuits can no longer take place. In the case of a number of metal rings, each stepped-down part of the gap system projecting a little further into the interior of the receptacle, is in contact with the conductive gas only on a comparatively small surface of the corresponding metal electrode, so that the possible transmission of energy out of the interior of the receptacle is stopped or reduced in steps. By using correct dimensions, the intermediate electrodes lying between the outer electrodes carrying a voltage can derive a stepped voltage, whereby the danger of a disruptive discharge between adjacent parts is further reduced. In order to assist this effect obtained according to the invention it is an advantage to screen the cylinder adjacent to the cathode conductor as much as possible against the interior of the receptacle. This can advantageously be attained by an arrangement in which the next insulated metal ring overlaps the first one and, in its turn, forms a new gap with respect to the conductor, whereby the dimensioning thereof is an important means for controlling the extent of the influence which the discharge processes have upon the inner electrodes. Further, according to the invention, the outer rings are so arranged that they will project over the inner rings in the axial direction, so that the inner metal ring lies in a recess, as seen from the interior of the receptacle. The wall of the vessel facing the conductor may also be constructed at the outermost ring, and the same may partly overlap all the other metal rings in a cap-like manner. These measures may be further assisted by stepped-down distances between the individual rings which form the gaps. Such a stepping-down of the distances between the individual rings contributes additionally to the prevention of the disrupted discharge. Preferably, especially the intermediate spaces provided in front of the actual narrow gaps between the concentric parts of the electrodes with respect to the interior of the discharge receptacle, and formed by the extended or overlapping parts, may be formed as further stepped-down gaps, whereby the penetration factor of the innermost part with respect to the parts which lie further out is influenced within wide limits by distances which are narrow inside and wider outside.

The invention is hereinafter described, by way of example, and diagrammatically, with reference to the accompanying drawings, wherein

Fig. 1 is a section through an insulated current lead-in for electric glow discharge receptacles in accordance with the invention;

Fig. 2 is a similar section through a modified construction; while

Fig. 3 is an elevation, partly in section, of the discharge receptacle with the lead-in mounted in a wall thereof.

Figure 1 shows the construction of a leading-in insulator for a glow discharge receptacle according to the invention, in which 1 is the gas discharge space, 2 the cooled receptacle wall, and 3 the likewise cooled leading-in conductor, which enters into the interior of the receptacle through an opening, and serves at the same time as a support for the work-pieces to be treated. 4 is the insulating material which is disposed between the receptacle wall 2 and the flange 12 of the leading-in conductor 3 and is pressed against the receptacle wall 2

by screws 14 and a ring 13 of insulating material serving at the same time as a seal. 7, 8 and 9 are the gaps provided according to the invention between the receptacle wall and the conductor. According to the invention, the metal rings 5 and 6 are inserted in such a manner on the corresponding surfaces of the insulator in the wide gap 11, that the metal ring 5 lies deepest, as seen from the interior of the receptacle and forms the gap 9 with the conductors 3. On a corresponding second surface of the insulator 4 lies the metal ring 6, which is so disposed, that it forms gaps 7 and 8 with the ring 5 and with the receptacle wall 2, and overhangs the ring 5 by means of its cap against the discharge space, leaving free a further gap 10. Finally, according to the invention, the receptacle wall 2 projects over the ring 6, forming a wide gap 11 with the conductor 3.

Figure 2 shows a simplified modification. 2 is again the cooled wall of the receptacle, and 3 is the likewise cooled inner electrode of the leading-in insulator. 4 is the insulator, which lies between the receptacle wall 2 and the flange 12 of the central electrode 3, whereby the holding of these parts is effected by the application of pressure on the insulating ring 13, by means of a screw cap 15 which is tightened on a screw-threaded part 16 of the wall 2. Only one intermediate ring 5 is shown in this example, the same forming a gap 9 with the inner electrode, which in its turn lies opposite the surface of the insulator 4 with the gap 18 between them. The intermediate ring 5 is provided on a corresponding part of the insulator 4 in such a manner that the gap 9 extends downwards, the latter part lying between the ring 5 and the upper part of the insulator 4. The cap-like part 19 is fitted in the receptacle wall 2 concentrically with the central conductor and forms the gap 20 with respect to the intermediate ring 5. The two gaps 9 and 20 merge upwards in a widened annular gap 21, which, in its turn, is connected with the interior of the receptacle by the wide gap 22. It is clearly seen from this example of construction how by dimensioning the gap 22 arranged in front of the intermediate electrode 5, the influence of the interior of the receptacle upon the intermediate electrode 5 can be adjusted within wide limits.

By the gap systems according to the invention, strong discharges between the individual electrodes and at the contact points between the insulator, the receptacle wall

and the conductor are entirely stopped and the reliability of operation is ensured over long periods.

I claim:

1. The combination with a leading-in insulator for electric glow discharge receptacles, said insulator being adapted to be penetrated by an electrode which passes through an opening in the wall of the receptacle and projects into the interior of the receptacle, said electrode being spaced from the wall of the opening to provide a gap, of at least one intermediate metal ring disposed in said gap and providing at least two concentric screening gaps, and a second metallic ring surrounding the intermediate ring and spaced therefrom and projecting further toward the interior of the receptacle than the intermediate ring, there being a wider gap than said screening gaps between the latter and the interior of the receptacle and communicating with said gaps and receptacle interior, said rings being characterized by a stepped-down electrical penetration factor with respect to the interior of the receptacle, whereby strong discharges in the gap system are prevented.

2. The combination as defined in claim 1, wherein the intermediate metal ring is of relatively small mass and presents a reduced surface to the conductive gas in the receptacle.

3. The combination as defined in claim 1, wherein the intermediate ring is of cylindrical shape and of substantially uniform cross-section.

4. The combination as defined in claim 1, wherein a plurality of intermediate rings each of uniform cross-section are arranged in stepped-down fashion and are mounted on corresponding stepped annular surfaces of the insulator.

5. The combination as defined in claim 1, wherein a plurality of substantially concentric intermediate rings are arranged in spaced and stepped-down fashion about the electrode.

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