

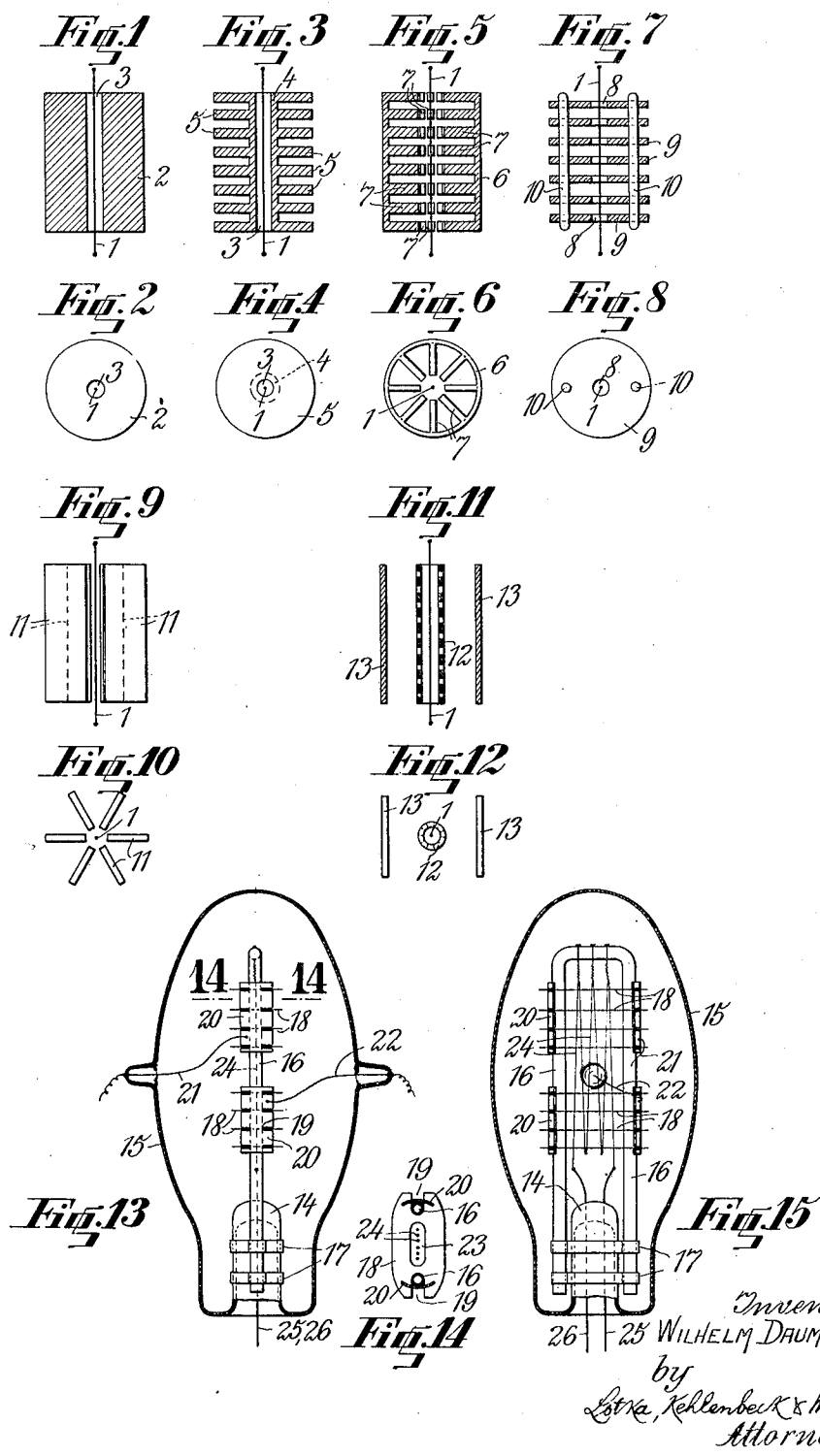
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VACUUM DISCHARGE APPARATUS

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VACUUM DISCHARGE APPARATUS.

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My invention relates to improvements in vacuum discharge apparatus and more particularly in the construction of the anode. In apparatus of this class the anode is arranged so that the glowing cathode is entirely or in part surrounded thereby from the side. Thereby a favorable distribution of the electric field is insured, so that particularly the forces of electrostatic attraction are nearly compensated, which would exert an objectionable strain on the glowing wire. Therefore the relative distance of the glowing cathode and the anode and the loss of voltage within the apparatus can be materially reduced. As the energy set free is merely a waste energy and causes an unnecessary heating of the anode, the reduction of the energy which is set free is important in the operation of the vacuum apparatus.

On the other hand the reduction of the relative distance of the anode and the glowing cathode is objectionable in other respects. The total surface area of an anode surrounding a glowing cathode, for example the surface area of an anode cylinder placed around a rectilinear incandescent wire, is reduced in the same degree as the relative distance of the electrodes is reduced. Now the effect which can be imposed on the anode is proportional to the surface thereof, and in case of a small surface the unit of the surface area is heated to a high degree; therefore, it is objectionable to place the anode in too close proximity to the glowing cathode and to reduce thereby the surface thereof.

The object of the improvements is to provide an apparatus of the class referred to in which the anode is such that it can be placed in close relation to the glowing cathode without causing an excessive waste effect and without excessively heating the same, and with this object in view my invention consists in constructing the anode so that its inner part is a small distance away from the glowing cathode, and that its outer part forms surfaces which are a large distance away from the cathode and cause increased radiation of heat. Preferably the construction is such that the inner part of the anode is formed with openings permitting the passage of the radiated heat from the cathode into the surrounding space of the tube, so that it has only a very small heating effect on the anode.

For the purpose of explaining the inven-

tion several examples embodying the same have been shown in the accompanying drawing, in which,

Fig. 1, is a diagrammatical sectional view showing one form of my improved electrodes,

Fig. 2, is a plan view of Fig. 1,

Figs. 3 to 12, are respectively diagrammatical sectional and plan views similar to those shown in Figs. 1 and 2 and showing modifications,

Fig. 13, is a sectional elevation showing a vacuum discharge apparatus provided with my improved electrodes,

Fig. 14, is a detail sectional view taken on the line 14—14 of Fig. 13, and

Fig. 15, is a sectional elevation taken at right angles to the sectional elevation shown in Fig. 13.

In the example shown in Figs. 1 and 2 the glowing cathode 1 is in the form of a rectilinear wire 1, and it is surrounded by an anode 2 in the form of an annular metal cylinder. The body 2 has an axial bore 3 the diameter of which is such that the wall of the bore has the desired distance from the glowing cathode. By reason of the large outer diameter of the body 2 the outer part of the anode, that is the outer surface of the cylinder and the parts adjacent thereto provide a large radiating surface. Therefore the temperature of the anode is kept low, though its inner wall is close to the glowing cathode.

In the modification shown in Figs. 3 and 4 the glowing wire 1 is surrounded by a tubular anode 4 provided externally with ribs 5 of any suitable form. As shown the said ribs are in the form of coaxial annular disks. It will be understood that the radiating capacity of the body 4 is very high, its radiating property being similar to that of an absolutely black body the radiating power of which attains the maximum according to the researches of Kirchhoff.

In the modification shown in Figs. 5 and 6 the anode is in the form of an annular cylinder 6 of comparatively large diameter having internal projections in the form of rods or ribs 7 the inner ends of which are in close relation to the cathode 1.

In Figs. 7 and 8 I have shown a modification in which the anode consists of a set of perforated disks 9 spaced from each other and held in proper relative positions by suitable means such as rods 10 secured to the disks

near the outer circumferences thereof. The cathode 1 passes through axial bores 8 of the disks.

In the construction shown in Figs. 9 and 10 the anode is composed of axially and radially mounted plates 11 the inner ends of which are placed around and spaced from the cathode 1.

Figs. 11 and 12 show a modification in which the anode is made in two separate sections 12 and 13. The inner section is in the form of a foraminated metal cylinder of small diameter surrounding the cathode at a small distance therefrom, and the outer section 13 of the anode consists of solid plates 13 disposed at the same level as the cathode and covering the same when seen from two opposite sides.

In Figs. 13 to 15 I have shown a valve tube in which the electrodes are connected with the base 14 of the glass receptacle 15, for which purpose a U-shaped frame 16 of glass or quartz is secured to the base 14 by means of rings 17. On the shanks of the frame 16 several spaced disks 18 are mounted, which engage the shanks by means of lateral notches 19 and which are held in position by means of transverse spacing members 20 which form an outer anode portion connecting the disks 18, the latter constituting an inner anode portion. It will be noted that each of the disks or plates 18 is thus connected electrically with the adjoining plate or plates of the set. In the example shown in the figures the set of anode disks 18 is divided into two groups each connected to a terminal 21 and 22 respectively. The plates are provided with bores 23 through which glowing wires 24 disposed one beside the other within the plane of the frame 16 are passed, which wires are connected with leading in wires 25 and 26.

In the constructions shown in Figs. 3, 4, 7, 8, 9, 10, 13, 14 and 15 the anode has nearly the radiating power of a black body, its radiating power being very high.

By providing an anode which with its inner part is in close relation to the glowing cathode and with its outer part disposed a large distance away from the cathode radiates the heat, and in which the inner part is fo-

raminated, a large part of the cathode rays emanating from the glowing cathode is collected by the surface of the outer portion of the anode. Now, the heat transmitted to the anode is caused in part by radiation of the glowing cathode, and, mainly, by the cathode rays striking against the anode. In my improved construction a large proportion of the cathode rays is collected by the outer part of the anode and at a part where radiation is most effective.

I claim:

1. A vacuum discharge apparatus comprising an evacuated receptacle, a cathode adapted to be heated to incandescence, and an anode surrounding said cathode and comprising spaced perforated end plates extending transversely to said cathode at different points of its length, and additional perforated plates located between said end plates and spaced from each other and from the end plates, said additional plates likewise extending transversely to said cathode at different points of its length, and adjoining plates being connected with each other conductively.

2. A vacuum discharge apparatus comprising an evacuated receptacle, an insulating support therein provided with shanks disposed laterally of each other, a cathode adapted to be heated to incandescence, located between said shanks, spaced anode disks supported on said shanks and provided with perforations through which said cathode extends, and conducting spacing members bridging the gaps between adjacent anode disks.

3. A vacuum discharge apparatus comprising an evacuated receptacle, an insulating support therein provided with shanks disposed laterally of each other, a cathode adapted to be heated to incandescence, located between said shanks, spaced anode disks notched at their edges to fit on said shanks and perforated at their central portions for the passage of said cathode, and spacing members bridging the gaps between adjacent anode disks.

In testimony whereof I hereunto affix my signature.

WILHELM DAUMANN.