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ELECTRODE STRUCTURE FOR VACUUM TUBES

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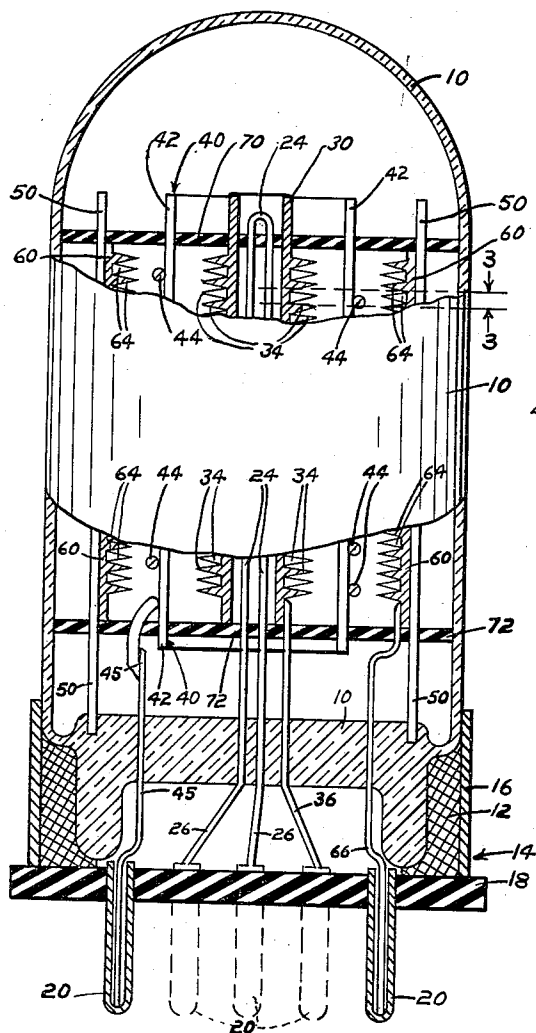


Fig. 1.

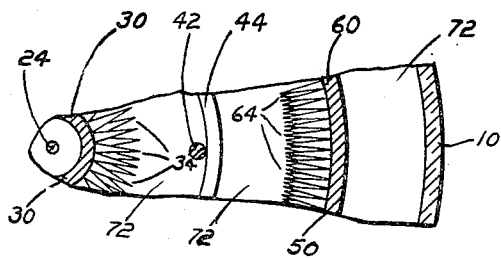


Fig. 3.

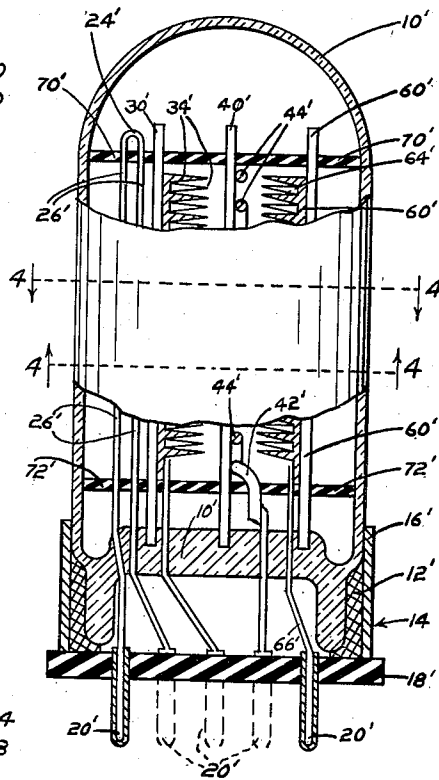


Fig. 2.

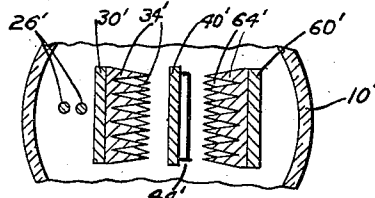


Fig. 4.

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ELECTRODE STRUCTURE FOR VACUUM TUBES

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6 Claims. (Cl. 313-293)

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This invention relates to vacuum tubes and more particularly it is an object of the invention to provide an improved vacuum tube of greater efficiency than heretofore.

It is known that with conventional vacuum tubes the electron flow from the cathode to the plate is not entirely absorbed by the plate but is partially reflected from the plate and interferes with the signal passing from the grid to the plate.

It is an object of this invention to provide an improved vacuum tube construction by means of which more of the electron flow is absorbed by the plate than heretofore.

Another object of the invention is to provide a vacuum tube capable of more perfect reception, transmission and amplification of the wave form.

Yet a further object of the invention resides in the provision of a vacuum tube better adapted to work with the ultra-high and very high frequency by eliminating unnecessary reactances in the higher frequencies, and by the reduction of distortion.

A still further object of the invention resides in the provision of an improved vacuum tube which, when used in connection with television, preserves the integrity of the oddly shaped wave form of the picture signal, providing high fidelity with respect to outline, proportion and distance, and depth as well as contrast.

Another object of the invention resides in the provision of an improved vacuum tube which, when used in radio transmission and reception, provides greater amplification of a signal than a conventional tube of similar size, and provides a tube of smaller than conventional size which has the amplifying power of a conventional tube of larger size.

Still a further object of the invention resides in the provision of an improved vacuum tube construction by means of which the plate is adapted to absorb more of the electron flow from the cathode than heretofore.

Still another object of the invention is to provide a vacuum tube construction which will make possible the use of fewer tubes in a radio of a given size.

A further object of the invention is to provide a construction for use on a rectifier tube for converting alternating current to direct current, said construction having greater operative surface area as to the cathode and anode thereof than heretofore by providing conical protrusions on the confronting surfaces of said cathode and anode whereby a transmission of current is en-

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hanced with respect to the conventional practice and so that the saturation point will be higher and the heating effect lessened with respect to said conventional practice.

Another object of this invention is to provide an improved vacuum tube particularly advantageous for use in conjunction with the applicant's other invention titled: Narrow Beam Receiving Antenna, United States patent application Serial Number 63,225 filed December 3, 1948.

Other and still further objects and advantages of the invention will become apparent from the following detailed description of a preferred embodiment thereof.

In the drawings:

Figure 1 is a view partially in side elevation and primarily in vertical transverse section of the vacuum tube of the instant invention, showing certain of the studs or prongs of the tube in dotted lines, the cathode and anode being arcuate.

Figure 2 is a modification of the structure shown in Figure 1, the cathode and anode of Figure 2 being depicted non-circular and formed of flat metallic pieces.

Figure 3 is an enlarged detail of a fragment of the new tube, the view being taken approximately between the dotted lines 3-3 of Figure 1.

Figure 4 is a transverse section taken substantially between the lines 4-4 and 4-4 of Figure 2 and showing a fragment of the modification shown in Figure 2.

The vacuum tube of this invention is provided with an exhausted envelope 10 formed of glass, metal, plastic or other substance. The envelope 10 is secured by cement or the like 12 in a conventional manner to a base 14.

The base 14 is composed of a cylindrical side wall portion 16 of insulating material and a lower base portion 18 of circular shape through which latter a plurality of prongs 20 are disposed. The prongs 20 are each secured to a different part of the tube proper by means of suitable wires extending upwardly from the prongs 20 through the bottom of the envelope 10.

Within the envelope 10 a conventional centrally disposed heating element or filament 24 is provided. The filament 24 has terminal wire portions 26 which are each secured to a different one of the prongs 20.

Surrounding the filament 24 is a cathode 30. The cathode 30 is provided with a cylindrical main body portion having an open center in which the filament 24 is disposed.

The parts of the vacuum tube so far de-

scribed are conventional. In accordance with this invention, the cathode 30 is provided with a plurality of protrusions 34 which are each preferably of a conical shape, each tapering to a point at its free end.

The protrusions 34 preferably extend outwardly from the outer circumference of the cathode 30 at a right angle with respect to the adjacent cathode surface.

The protrusions 34 are preferably formed integrally with the main body portion of the cathode 30 and are of electrically conductive material. The protrusions 34 together extend outwardly on all sides of the cylindrical outer circumference of the cathode 30 and preferably extend from one end of the cathode to the other. A terminal wire 36 is provided leading from the cathode 30 to one of the prongs 20.

A conventional grid 40 is disposed in the exhausted envelope 10 and surrounding the cathode 30. The grid 40 is of cylindrical shape having longitudinal wires 42 and a plurality of spaced apart wires 44, which latter are disposed transversely to the longitudinal wires 42 and are wound thereabout, and disposed in electrical communication therewith.

The grid 40 is provided with a terminal wire 45 which leads to one of the prongs 20 as shown in Figure 1.

A plate is disposed in the exhausted envelope 10 having supports 50. The plate 60 is of cylindrical shape and surrounds the grid 40.

In accordance with this invention, the member 60 is provided with a plurality of protrusions 64 extending inwardly from the inner side thereof and each disposed preferably, at a right angle to the inner side of the plate 60, extending in the direction of the cathode.

The protrusions 64 are each of conical shape similar to the protrusions 34 and are also electrically conductive and are preferably integral with the remainder of the plate. A lead wire 66 is provided extending from the plate 60 to one of the prongs 20 of the base 14.

The protrusions 64 are preferably of conical shape as are the protrusions 34 and taper to a point at their free ends, the protrusions 64 of the plate may have larger bases than the protrusions 34 since the area of the plate is larger than the area of the cathode.

It will be understood that for convenience of illustration that the protrusions 64 and 34 are depicted comparatively large and that in actual practice the said protrusions are very small or minutely small depending upon the specific surface that the tube is constructed for. For general purposes the said protrusions may be constructed approximately one thousandths of an inch or less width at the base of each thereof.

The resistance and conductivity of the system of conical surfaces 64 in combination with the plate 60 will be similar to the resistance and conductivity of the plate circuit as is now conventionally used in vacuum tubes.

As is conventional, two insulating transversely positioned discs or members 70 and 72 are provided at the respective opposite ends of the electrodes for securing together and spacing apart the cathode, grid and plate respectively.

It will be seen that irregular electrode surfaces and protrusions of other shapes may be employed to increase the area of the electrodes and to provide some of the effects obtainable with inclined or conical protrusions. It is preferable, however, that the protrusions be pointed at their outer ends

for reducing to a minimum reflectivity of the plate since inclined surfaces are adapted to cause the increased absorption of electrons which are partially reflected by smooth surfaces.

A vacuum tube constructed as described causes a greater absorption of electrons by the plate and a lesser reflection of electrons by the plate for more perfect reception, transmission or amplification of the wave form, being better for use with ultra-high and very high frequencies by eliminating unnecessary reactances, preserving the integrity of the oddly shaped television wave form of the picture signal for providing higher fidelity, making possible the effective use of vacuum tubes of smaller size than heretofore.

The use of the conical surfaces or protuberances on the anode or plate, provides better reception and transmission of the signal, than does an anode with a flat surface, when linearity, signal wave shape, and the speed and direction of travel of the flow of electrons are considered.

Referring to the modification shown in Figures 2 and 4, it will be understood that the exhausted envelope 10', together with the other portions of the modification are the same as is shown and described with respect to Figure 1 with the following exceptions:

The heating element or filament wires 26' are disposed to one side of the cathode 30'.

The cathode is formed of an elongated, flat piece of metal, the protrusions 34' of the cathode 30' being of similar construction with respect to the protrusions 34 shown in Figure 1. The anode 60' is also formed of an elongated, flat metallic strip the protrusions 64' thereof being of the same construction as the protrusions 34' of the cathode. The grid 40' being formed of flat construction as shown in Figure 4 having its plurality of spaced apart wires 44' carried by the member 40', together with its longitudinally disposed wires 42'. As thus described it will be seen that the modifications shown in Figures 2 and 4 provide a compact construction without decreasing the efficiency during operation.

From the foregoing description, it is thought to be obvious that an improved vacuum tube constructed in accordance with my invention is particularly adapted for use by reason of the convenience and facility with which it may be assembled and operated, and it will also be obvious that my invention is susceptible of some change and modification including variations in the shape and size of the parts without departing from the principles and spirit thereof, and for this reason I do not wish to be understood as limiting myself to the precise arrangement and formation of the several parts herein shown in carrying out my invention in practice, except as claimed.

I claim:

1. In a vacuum tube, the combination which comprises a sealed envelope, a vertically disposed cathode having a plurality of radially disposed protrusions extended over the outer surface positioned in the said envelope, and an anode having a plurality of radially disposed protrusions extended over the inner surface and extended inwardly therefrom also positioned in the said envelope and surrounding the said cathode whereby the anode is positioned to receive the electrons from the cathode.

2. In a vacuum tube, the combination which comprises a sealed envelope, a vertically disposed tubular cathode having a plurality of radially disposed protrusions extended over the outer surface and extended outwardly therefrom posi-

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tioned in the said envelope, a heater positioned in the said tubular cathode, and a cylindrical anode having a plurality of radially disposed protrusions extended inwardly from the inner surface thereof also positioned in the said envelope and surrounding the said cathode to absorb otherwise reflected electrons from the cathode with which the said anode is bombarded.

3. In a vacuum tube, the combination which comprises a sealed envelope, a vertically disposed tubular cathode having a plurality of radially disposed protrusions extended over the outer surface and extended outwardly therefrom positioned in the said envelope, a heater positioned in the said tubular cathode, a cylindrical anode having a plurality of radially disposed protrusions extended inwardly from the inner surface thereof also positioned in the said envelope and surrounding the said cathode to absorb otherwise reflected electrons from the cathode with which the said anode is bombarded, and a grid positioned between the cathode and anode.

4. A sealed tubular envelope having a base of insulating material, spaced transversely disposed discs positioned in said envelope, a longitudinally disposed centrally positioned cylindrical cathode having elongated closely assembled minute conical-shaped protrusions extended radially from the outer surface carried by said discs, a cylindrical

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anode having elongated closely assembled minute conical-shaped protrusions extended inwardly from the inner surface also carried by said discs and positioned around and concentric to said cathode whereby the said protrusions of the anode extend toward and are opposed to the protrusions of the cathode.

5. A sealed tubular envelope as described in claim 4, wherein a filament is positioned in the cylindrical cathode.

6. A sealed tubular envelope as described in claim 4, having a heating element in the cylindrical cathode and a cylindrical grid positioned between the cathode and anode.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,051,744	Meissner	Jan. 28, 1913
1,101,752	May	June 30, 1914
1,565,659	Lilienfeld	Dec. 15, 1925
2,076,633	Haines	Apr. 13, 1937
2,152,993	Friederich	Apr. 4, 1939
2,201,880	Bruce	May 21, 1940