Nov. 13, 1934. M. S. GLASS 1,980,196

ELECTRIC DISCHARGE DEVICE

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FIG. 1

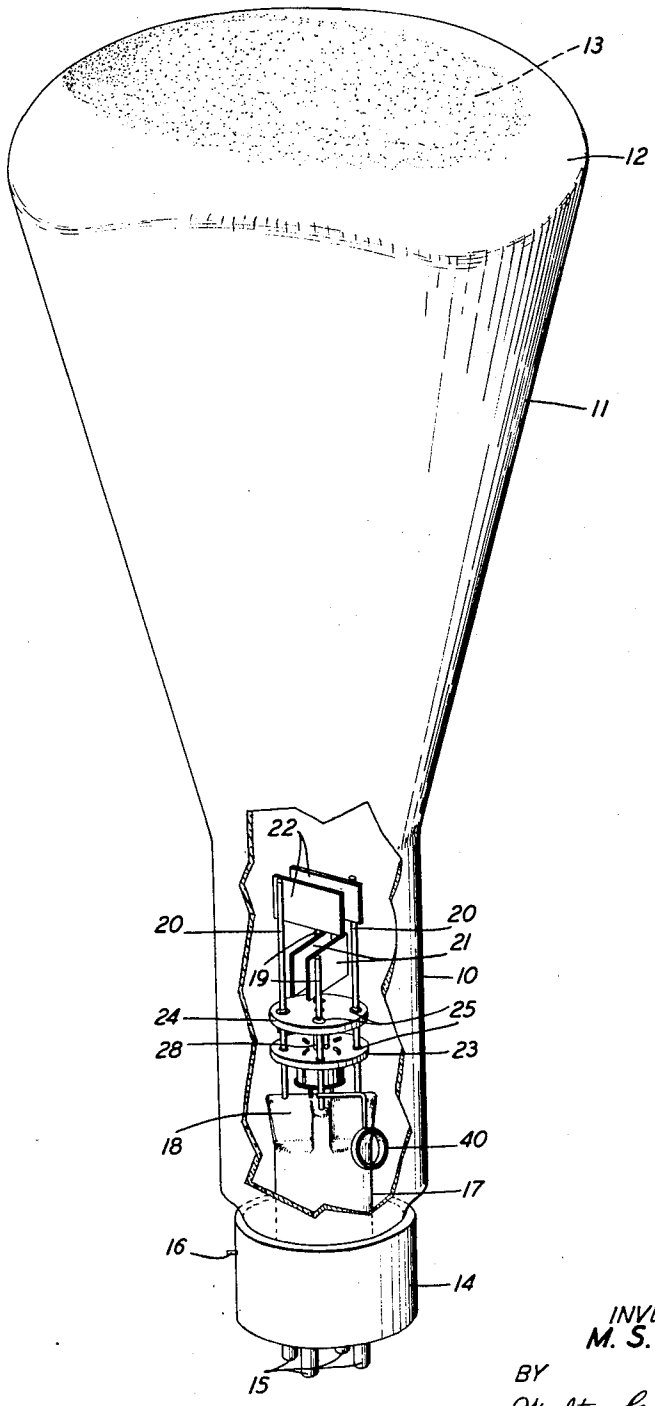


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FIG. 2

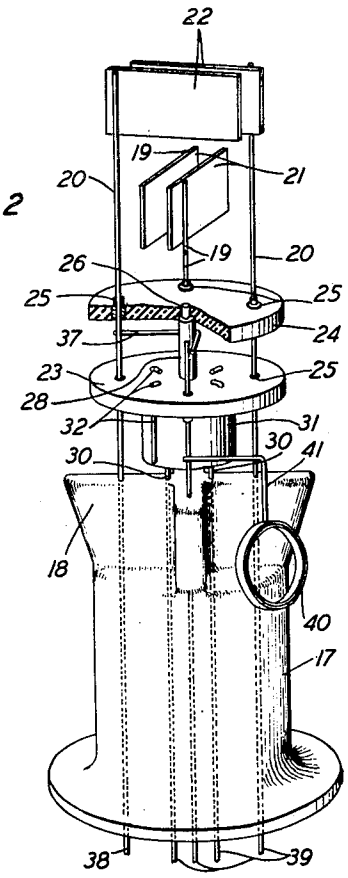



FIG. 4

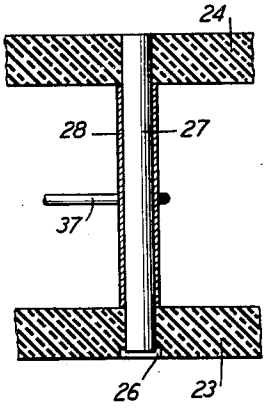



FIG. 5

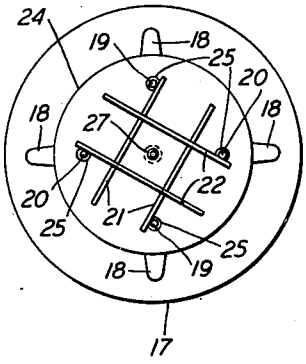
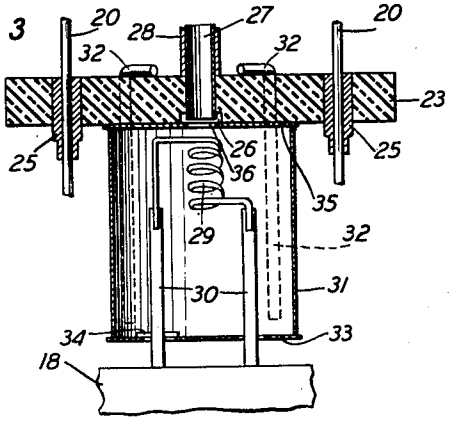



FIG. 3

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# UNITED STATES PATENT OFFICE

1,980,196

## ELECTRIC DISCHARGE DEVICE

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Application October 10, 1931, Serial No. 568,017

13 Claims. (Cl. 250—27.5)

This invention relates to electric discharge devices and more particularly to an electrode assembly in cathode ray oscillographs.

An object of this invention is to increase the efficiency and to improve the assembly of electric discharge devices.

A cathode ray oscillograph in a preferred embodiment of this invention comprises an enclosing vessel including a cylindrical portion and an enlarged end portion tapering outwardly from the cylindrical portion and having an internal surface coated to form a fluorescent screen. The cylindrical portion is provided with a reentrant stem terminating in a press from which all of the electrodes of the device are supported. A plurality of parallel rigid supports extend from the press and each carries a deflector plate. The supports also carry a pair of apertured insulating discs between which a hollow anode is mounted in alignment with the apertures in the discs. A cathode is supported from the stem and is substantially enclosed by a metallic shield carried by one of the insulating discs and provided with an aperture between the anode and cathode in alignment with the apertures in the insulating discs. This shield is grounded to protect the cathode from the high potential applied to the anode and also prevents positive ion bombardment of the cathode.

This construction provides a rigid and efficient assembly which may be easily fabricated in large quantities and at low cost.

The features of this invention will be understood more clearly from the following detailed description with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of an electric discharge device constructed in accordance with this invention with a portion of the enclosing vessel broken away to show the internal structure more clearly;

Fig. 2 is an enlarged perspective view of the electrode and stem assembly of the device shown in Fig. 1 with one of the end insulators cut away to show the connection of the anode and deflector plates;

Fig. 3 is an enlarged detail view in cross-section showing the cathode and shield assembly and illustrating the correlation of the anode and the insulating discs;

Fig. 4 is an enlarged cross-sectional view of the anode assembly; and

Fig. 5 is a plan view of the electrode assembly showing the relation of the deflector plates with respect to the axis of the anode.

Referring now to the drawings, a cathode ray oscillograph in accordance with this invention includes a vitreous enclosing vessel comprising a cylindrical portion 10 and an enlarged end portion 11 tapering outwardly from the cylindrical portion. The enlarged portion 11 terminates in an arcuate portion 12 defining an arc of a cylinder, the longitudinal axis of which is perpendicular to the axis of the enclosing vessel, as disclosed and claimed in R. Bown Patent 1,750,661, issued March 18, 1930. The inner surface of the arcuate portion 12 is provided with a coating of material 13, such as zinc tungstate, which becomes fluorescent when electrons impinge thereupon. The cylindrical portion 10 of the enclosing vessel may be attached to a base 14, of insulating material, which is provided with terminal prongs 15 for associating the device with an electrical circuit. A metallic bayonet pin 15 is embedded in the insulating base 14 and is electrically associated with certain of the electrodes of the device as described more fully hereinafter.

The cylindrical portion 10 of the enclosing vessel is provided with a reentrant stem 17 terminating in a four-armed cross-shaped press 18 from which all of the electrodes of the device are supported. Two pairs of rigid rods 19 and 20 which are preferably of a non-magnetic material, such as German silver, are embedded in the press one in each arm thereof and extend parallel to the longitudinal axis of the cylindrical portion 10. Each of the rods 19 and 20 carries a rectangular metallic deflector plate 21 and 22, respectively, also preferably of a non-magnetic material, such as German silver, the plates being arranged in parallel pairs substantially at right angles to each other. A pair of discs 23 and 24, of insulating material, such as "lavite", are disposed parallel to each other and perpendicular to the longitudinal axis of the stem 17 and are supported on the rigid rods 19 and 20 through bushings 25 which are embedded within the discs 23 and 24 and are secured, as by spot welding, to the rods 19 and 20. Each of the discs 23 and 24 is provided with a central aperture 26 in alignment with an axis passing through the midpoint of the spaces between the deflector plates 21 and 22. A hollow anode comprises two telescoped tubular members 27 and 28 which may be of nickel and is supported between the insulating discs 23 and 24. The inner member or anode 27 extends into the central apertures 26 in the discs 23 and 24 and the outer member or spacer 28 abuts against each of the discs and is suitably secured, as by spot welding, to the inner member 27.

A helical cathode 29, which may comprise a platinum-nickel ribbon coated with barium and strontium oxides, is supported in axial alignment with the anode by rigid leading-in wires 30 embedded in the press 18. A metallic shield, preferably of nickel, substantially completely encloses the cathode 29 and comprises a tubular shell 31 concentrically disposed about the cathode 29 and supported from the insulating disc 23 by a plurality of rigid rods 32 which are attached to the exterior of the shell. The shield is closed by a metallic disc 33 which is provided with apertures through which the cathode supports 30 extend. The shield is preferably connected electrically or grounded to one of the cathode support wires 30 by a strap 34 which extends across one of the apertures in the disc 33, to protect the cathode from the high potential applied to the anode. A flat, metallic plate 35, likewise preferably of nickel, lies between the edge of the shell 31 and the insulating disc 23 and is provided with an aperture 36 in axial alignment with the anode and the cathode 29. The plate 35 serves as a heat shield between the cathode 29 and the disc 23 and also as a focusing means to concentrate the electron stream from the cathode 29 to the anode. The shield formed by the shell 31, disc 33 and plate 35 prevents deterioration of the cathode 29 by positive ion bombardment.

The complete electrode assembly provides a rigid structure which may be fabricated in large quantities and at low cost, and obviates the intricate glass work of the type commonly used heretofore in cathode ray oscillographs.

A tie wire 37, as clearly shown in Fig. 2, is secured to the spacing member 28 of the anode and to one of each of the rigid rods 19 and 20 to maintain the deflector plates connected to these rods at the same potential as the anode, the rod 20 being electrically connected to the bayonet pin 16 by a leading-in wire 38 sealed in the press 18. The bayonet pin therefore serves as an external terminal for the anode and the two deflector plates. The cathode supporting wires 13 and the remaining rods 19 and 20 which are independent of the anode, are electrically associated with the appropriate terminal prongs 15 on the base by leading-in wires 39.

In order to concentrate the electron stream between the anode 27 and the fluorescent screen 13, the enclosing vessel may be provided with a filling of an inert gas, such as argon, at a very low pressure, for example $7 \times 10^{-3}$ mm. of mercury. An annular ring support 40 carrying a quantity of vaporizable gas absorbing material, such as magnesium, for fixing the residual gases which deleteriously affect the characteristics of the device, is supported from one of the rods 19 by a rigid, bent wire 41.

Although a specific embodiment of this invention has been illustrated and described, it is to be understood, of course, that many modifications may be made in the structural assembly of the electrodes without departing from the scope and spirit of the invention as defined in the appended claims.

What is claimed is:

1. An electric discharge device comprising an enclosing vessel, a unitary electrode assembly within said vessel including a stem, a plurality of supporting members separate from said vessel extending from said stem, a pair of insulating plates mounted in spaced relation on said supporting members and having axially aligned apertures, a cathode mounted between said stem and one of said insulating plates, and a hollow anode mounted between said insulating plates in alignment with said apertures.

2. An electric discharge device comprising an enclosing vessel having a stem, a supporting member mounted from said stem having an aperture therein, a cathode adjacent said supporting member, and a tubular electrode mounted on said supporting member including a plurality of telescoped sections, one of said sections extending into the aperture in said supporting member and another of said sections abutting against said supporting member.

3. An electric discharge device comprising an enclosing vessel having a stem, a plurality of supporting members extending from said stem, a pair of spaced parallel insulating plates having aligned apertures mounted on said supporting members, a filamentary cathode on said stem projecting toward said insulating plates, and an anode between said insulating plates including a plurality of telescoped tubular sections, one of said sections being seated in said apertures, and another of said sections abutting against said insulating plates.

4. An electric discharge device comprising an enclosing vessel having a stem, a cathode supported from said stem, an anode in juxtaposition to said cathode, a support extending from said stem, an insulating disc mounted on said support, a plurality of rigid members extending from said disc, and a shield substantially enclosing said cathode including a portion encircling said cathode and carried by said rigid members.

5. An electric discharge device comprising an enclosing vessel having a stem, an anode, a cathode in cooperative relation with said anode, supports on said stem for said cathode, a plurality of rigid members extending from said stem, an insulating disc carried by said rigid members, a plurality of rods extending from said insulating disc toward said stem, and a shield substantially enclosing said cathode including a portion mounted on said rods and encircling said cathode and an apertured base portion electrically connected to one of said cathode supports.

6. An electric discharge device having a stem, a helical cathode mounted adjacent said stem, an anode adjacent one end of said cathode, a plurality of rigid members extending from said stem, an insulating disc mounted on said rigid members, said disc having an aperture in axial alignment with said helical cathode, and a shield supported by said insulating disc including a cylindrical portion encircling said cathode, an apertured base portion substantially closing one end of said cylindrical portion, and a focusing portion between said cathode and said disc having an aperture in alignment with said cathode and apertured disc.

7. A cathode ray oscillograph comprising an enclosing vessel having a stem, an electrode assembly mounted on said stem including a plurality of supporting members extending from said stem, a plurality of deflector plates carried by said supporting members, a pair of spaced insulating members mounted on said supporting members, a cathode positioned between said stem and one of said insulating members, and an anode mounted between said insulating members.

8. A cathode ray oscillograph comprising an enclosing vessel having a stem, an electrode assembly mounted on said stem including a plurality of rigid rods extending from said stem deflector plates mounted individually on said rods,

a pair of spaced apertured insulating discs supported by said rods, a filamentary cathode supported on said stem adjacent one of said insulating discs, an anode supported between said insulating discs, and means electrically connecting said anode with one or more of said rods.

9. A cathode ray oscillograph comprising an enclosing vessel having a stem, an electrode assembly mounted on said stem including a plurality of supporting members extending from said stem, pairs of deflector plates mounted on said members and arranged in intersecting planes, a pair of insulating members having aligned apertures carried by said supporting members, a helical cathode supported on said stem in alignment with the apertures in said insulating members, a hollow anode between said insulating members in alignment with said apertures, and a tie member connecting said anode with one plate of each of said pairs of deflector plates.

10. An electric discharge device comprising an enclosing vessel having a reentrant stem, a plurality of rigid members embedded in said stem and extending lengthwise of said vessel, plate members carried by said rigid members, a pair of parallel apertured insulating discs supported by said rigid members, a cathode adjacent one of said discs in alignment with the aperture therein, and a hollow anode between said discs in axial alignment with said cathode.

11. A cathode ray oscillograph comprising an enclosing vessel having a stem, a plurality of supporting members extending from said stem, deflector plates mounted on said supporting members, an insulating member having an aperture carried by said supporting members, a hollow anode seated in said insulating member in alignment with said aperture, a cathode mounted on said stem adjacent said aperture, and a metallic shield carried by said insulating member and encircling said cathode.

12. A cathode ray oscillograph comprising an enclosing vessel having a reentrant stem terminating in a multi-armed press, a plurality of parallel rigid rods embedded in the arms of said press and extending longitudinally of said vessel, a plurality of deflector plates mounted on said rods, a pair of spaced parallel insulating discs supported on said rods, said discs having aligned apertures, a hollow anode mounted between said discs in alignment with said apertures, a cathode adjacent one of said discs in alignment with said anode, and a heat shield mounted on said disc adjacent said cathode and substantially enclosing said cathode.

13. A cathode ray oscillograph in accordance with claim 12 including means electrically connecting said anode with one or more of said deflector plates, and an electrical connection between said heat shield and one end of said cathode.

MYRON S. GLASS.