March 20, 1956 W. W. WATROUS, JR 2,739,262

GRID STRUCTURE

Filed May 11, 1953

FIG. 1

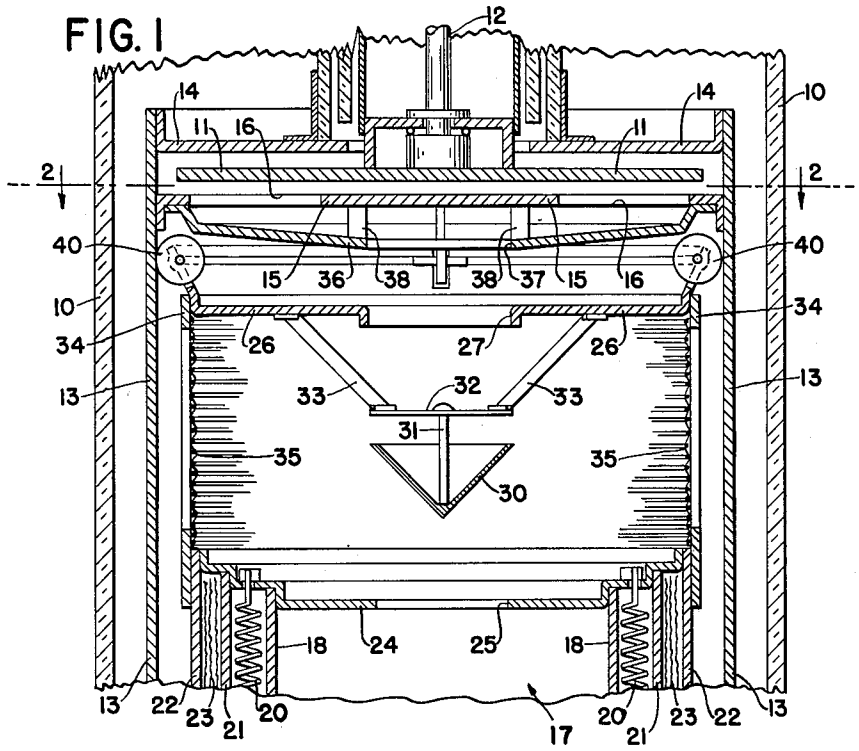
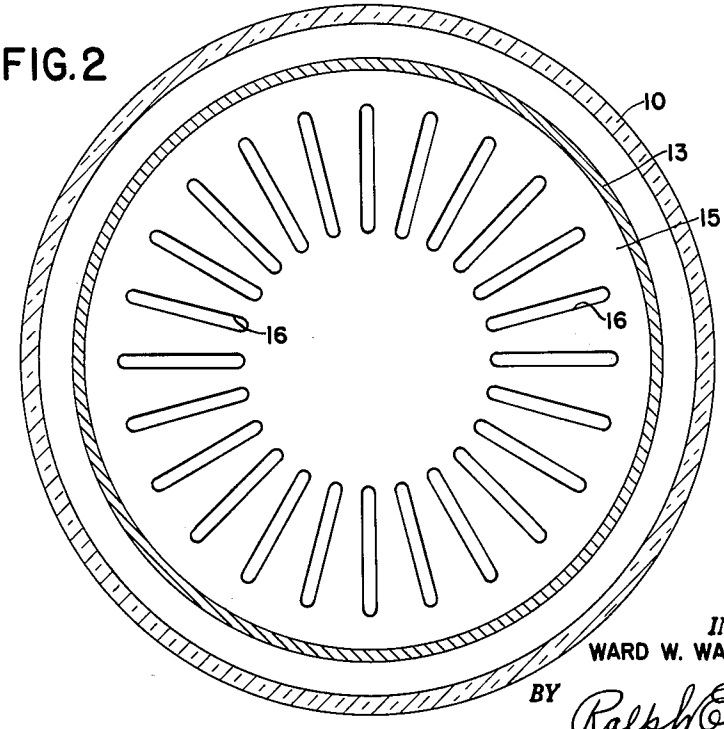


FIG. 2



INVENTOR.
WARD W. WATROUS, JR.

BY Ralph W. Bitner.

ATTORNEY.

United States Patent Office 2,739,262
Patented Mar. 20, 1956

2,739,262

GRID STRUCTURE

Ward W. Watrous, Jr., Chatham, N. J., assignor, by mesne assignments, to Gera Corporation, New York, N. Y., a corporation of New Jersey

Application May 11, 1953, Serial No. 354,227

3 Claims. (Cl. 313—240)

This invention relates to gas discharge devices and has particular reference to the design and mounting of grid electrodes and baffle plates used in conjunction with the grids. The structures are designed primarily for power gas tubes which are supplied with large anode voltages and which generally include anodes and grid electrodes having areas greater than one square inch.

High voltage gas discharge devices are generally subjected to high potentials wherein the anode may be at a potential which is many thousand volts positive with respect to the cathode. In order to prevent a discharge taking place before the "firing" time, extensive shielding of the anode is employed, and a system of baffle plates is usually set up to avoid premature conduction.

In prior art construction, even when the anode is operated at a high positive potential, the shielding and baffle plates require the use of a relatively high positive potential on the grid to start conduction. Because of these conditions, the discharge from the cathode first terminates on the grid and then, a very short time interval later, is transferred to the anode. It has been found by experiment that the above conditions produce a discharge arc which causes considerable heating of the grid and has a tendency to buckle the grid electrode and may even produce enough movement to short circuit the anode. The present invention is directed to a grid structure which will be as effective as previously known grids, yet secured against buckling in any direction.

One of the objects of the present invention is to provide a grid structure which avoids one or more of the disadvantages and limitations of prior art structures.

Another object of the invention is to provide a baffle for the grid electrode and at the same time brace the central area of the grid against buckling.

Another object of the invention is to obtain a gas discharge high voltage device which is characterized by ease of "firing" and low grid operating potentials.

Another object of the invention is to provide a grid electrode structure which may be easily fabricated and which may be easily mounted in correct alignment in the tube.

Another object of the invention is to provide a grid electrode structure with baffle arrangement which prevents "fire through" before the grid electrode has been raised to its firing potential.

The invention comprises a grid electrode which is flat and is mounted in parallel relationship to an anode. A baffle plate is mounted adjacent to the grid and is formed with one or more conical sections to insure stiffness. A series of supporting braces are secured to the baffle plate and to the grid electrode near a central aperture in the baffle plate to hold the structure in an unyielding position relative to the anode.

For a better understanding of the present invention, together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawings.

Fig. 1 is a partial cross sectional view of a gas-filled discharge device showing the anode, the grid electrode, baffles, and part of the cathode.

Fig. 2 is a cross sectional view taken along line 2—2 of Fig. 1.

Referring now to the figures, the electrodes and baffles are enclosed in an envelope **10** only part of which is shown. An anode **11** is mounted in axial alignment with the envelope and is secured by means of a supporting rod **12** which also serves as a lead in conductor. A shield **13**, of cylindrical shape, encloses the anode and is closed at the upper end by a flat plate **14** which is parallel to the anode. Directly below the anode, and parallel to it, is a grid electrode **15** formed with slots **16**. The grid is secured to the shield **13** by a flange member and therefore always has the same potential as the shield.

A cathode **17** is axially aligned with the envelope **10** and is mounted at the lower end of the electrode assembly. The cathode comprises an emitting surface **18**, a series of heater coils **20** mounted around the surface **18**, and a heat shield arrangement for partially confining the heater energy within the cathode. The heat shield comprises two cylindrical shells **21** and **22**, in axial alignment, with a plurality of nickel foil sheets **23** between them. The cathode parts are secured in position by an upper flange plate **24** which acts as one terminal for the heater coils **20** and contains a central hole **25** through which the electrons are emitted when the tube is conducting.

A short distance from cathode opening **25** a baffle plate **26** is mounted having a central hole **27**. Between holes **25** and **27** an additional baffle arrangement is secured to keep the radiant heat from the inner cathode surface from striking the grid. This baffle arrangement comprises a lower cone **30** supported by means of a central rod **31** to a flat disk **32**. The disk is supported by flat braces **33** to the upper baffle plate **26**. The upper baffle plate is secured to a cylindrical shield **34**, most of which is cut away to allow for heat radiation. To confine the discharge within the cathode arrangement a woven wire mesh **35** is mounted on the inside surface of shield **34**.

The grid electrode **15** is held at cathode potential when in the non-conducting condition. When the tube is "fired," or made conducting, the grid is raised to a positive potential, usually under a thousand volts, and the discharge occurs between the cathode and the central solid disk portion of the grid **15**. This discharge is quickly transferred to the anode **11** and the main current through the tube thereafter passes directly from anode to cathode. However, during the process of firing the tube and subsequent conduction the grid is subject to considerable heating and its temperature may be raised several hundred degrees to a value at which buckling and distortion may occur. This situation is more serious during the process of exhaust when higher currents and higher temperatures are employed to degas the electrodes and baffle plates.

In order to maintain the grid in its flat desired condition a series of small braces **38** are secured between the central portion of the grid and a grid baffle plate **36**. This baffle plate consists of a central flat cone section and is bordered by a second cone section at the periphery where it is secured to the grid. A central hole **37**, usually smaller than hole **27**, permits the discharge to pass from the cathode to the anode without too much interference. The small braces **38** may be welded or otherwise secured to the grid and baffle plate and may be formed of thin oblong metal pieces arranged in a radial manner so as to offer the least obstruction to the discharge. However, the shape of the braces **38** may be any form which gives strength and stability to the grid structure.

When the grid electrode is secured to the baffle in the above described manner the buckling movement is held to a workable minimum. Even when the tube is run at currents considerably above the rated values there is no

evidence of grid movement which produces altered tube characteristics.

It will be evident from the above that a novel structure for bracing a grid electrode has been designed. The new structure employs a grid baffle plate as the main reinforcing component and therefore only a few small braces are added to the existing arrangement.

The cathode **17**, described above, is the subject of a copending application, Serial Number 203,438, filed December 29, 1950, now Patent Number 2,650,997. Also, copending application, Serial Number 204,602, filed January 5, 1951, now Patent Number 2,610,305, discloses a novel form of hydrogen thyratron with a grid to prevent buckling.

While there have been described and illustrated specific embodiments of the invention, it will be obvious that various changes and modifications may be made therein without departing from the field of the invention which should be limited only by the scope of the appended claims.

I claim:

1. A grid structure for a gas discharge device comprising, a flat grid electrode fixedly secured at its periphery to a portion of the device, a baffle mounted adjacent to the grid electrode, said baffle formed with a base portion of a cone at its periphery, means for fixedly securing the periphery of said baffle to a portion of the grid electrode, and means fixedly securing the baffle to the grid at points other than the peripheries thereof for preventing the buckling of the grid electrode when heated by an electrical discharge.

2. A grid electrode for a gas discharge device comprising, a flat grid electrode fixedly secured at its periphery adjacent to an anode with means for holding the grid electrode in spaced relation to the anode, a baffle mounted adjacent to the grid electrode, said baffle formed with a base portion of a cone at its periphery and having a central hole for the passage of electrons, means for fixedly securing the periphery of said baffle to a portion of the grid electrode, and means fixedly securing the baffle to the grid at points other than the peripheries thereof for preventing the buckling of the grid electrode when heated by an electrical discharge.

3. A grid structure for a gas discharge device comprising, a flat grid electrode having a solid central portion fixedly secured at its periphery adjacent to an anode with means for holding the grid electrode in spaced relation to the anode, a baffle mounted adjacent to the grid electrode, said baffle formed with a base portion of a cone at its periphery and having a central hole for the passage of electrons, means for fixedly securing the periphery of said baffle to a portion of the grid electrode, a plurality of braces fastened to the grid electrode at its solid central portion and to the baffle at the edge of its central hole for preventing the buckling of the grid electrode when heated by an electrical discharge.

References Cited in the file of this patent

UNITED STATES PATENTS

2,610,305 Watrous ---------- Sept. 9, 1952