June 5, 1934. E. L. BOWLES 1,961,192

SPACE CURRENT DEVICE

Filed July 14, 1931

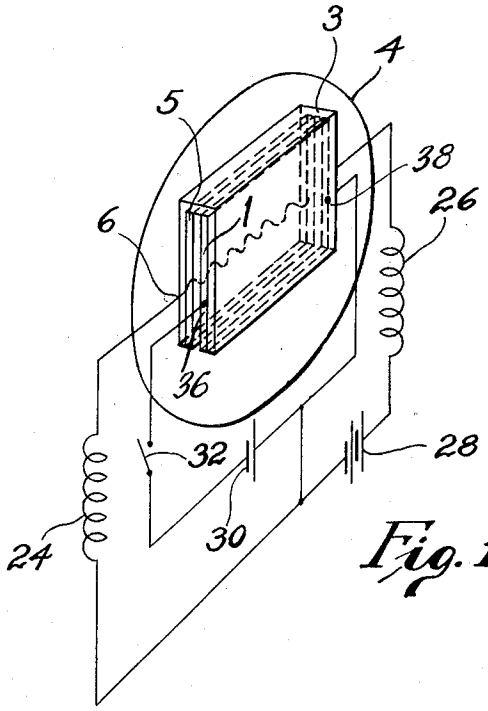


Fig. 1

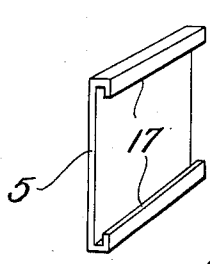


Fig. 2

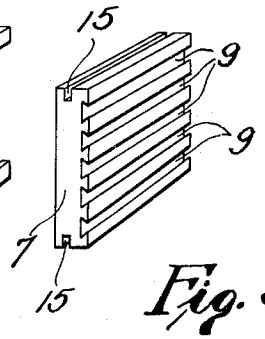


Fig. 3

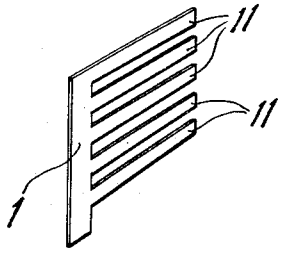


Fig. 4

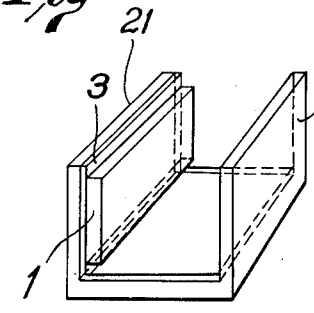


Fig. 5

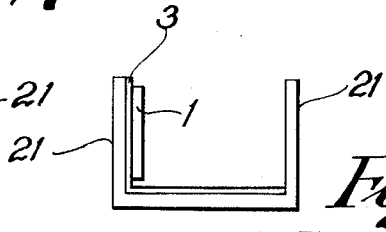


Fig. 6

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1,961,192

SPACE-CURRENT DEVICE

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Application July 14, 1931, Serial No. 550,652

5 Claims. (Cl. 250—27.5)

The present invention relates to space-current devices, like vacuum tubes, and more particularly to rectifiers or other thermionic or ionic devices.

The invention will be explained in connection with the accompanying drawing, in which Fig. 1 is a diagrammatic view illustrating one embodiment of the invention; Figs. 2 to 4 are similar views of a modification; and Figs. 5 and 6 are respectively a perspective and an elevation of a further modification.

The vacuum tube is shown in Fig. 1 as having a chamber or vessel 4 in which are contained three electrodes, namely, an energizing electrode or filamentary cathode 1, a grid 6 and an energized electrode or plate 5. The grid is shown in Fig. 1 as of the conventional form, and the filament 1 and the plate 5 as of novel construction. The cathode 1 may be of the oxide-coated or Wehnelt type.

The tube 4 is shown connected conventionally in an input circuit having a winding 24 and in an output circuit having a winding 26 and an energizing battery 28. The filament 1 is similarly shown adapted to be temporarily energized by a battery 30 that may be disconnected by a switch 32.

A great deal of power is ordinarily consumed in heating the filament 1 by the battery 30 or other energizing device for the same. This power is almost wholly lost. One of the objects of this invention is to save this power. Another object is to provide a new and improved means for obtaining self-energizing cathodes, or cathodes of relatively high efficiency.

In accordance with the present invention, therefore, the cathode 1 and the anode or plate 5 are thermally non-insulated, in order that the heat of the plate which, according to present practice, is lost in radiation, may be utilized to energize the filament 1. In its simplest form, perhaps, as illustrated in Fig. 1, the cathode 1 and the plate 5 are thermally connected by a lavite, U-shaped member 3. Any other suitable electrically insulating, but thermally conducting connection may be employed instead of the lavite. The emitting surface 1 thus heats the anode surface 5 by means of the impinging electrons from the emitting surface. The heat is then conducted from the plate 5, through the thermally conducting and electrically insulating element 3, thus heating the cathode 1. It is necessary to have the switch 32 closed only for a short time sufficient to heat the filament in order to commence the process. After that, the anode 5 will itself maintain the cathode heated at the proper temperature.

According to Figs. 2, 3 and 4, the cathode may be in the form of a plurality of plates, as shown at 11, adapted to be received in grooves 9 of an electrically insulating, but thermally conducting support 7. The support 7 has also grooves 15 for receiving legs 17 of an anode 5. The parts are thus structurally held together. Cement may be used, if desired, to secure a more permanent union and to close all possible thermally insulating gaps.

The anode 21 of Figs. 5 and 6 may be of U-shape, one leg of the U supporting the mica sheet 3 and the cathode 1, as in Fig. 1.

It is obvious that the invention is capable of considerable modification and change by persons skilled in the art, and all such are considered to be within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A space-current device having an evacuated chamber, a heating electrode in the chamber, having a surface from which electrons are adapted to be emitted and having also a second surface, an electrode in the chamber having a surface adapted to be heated by the agency of the electrons emitted from the first named surface and having also a second surface, and an electrical insulator in the chamber thermally connecting said second surfaces, the electrical insulator being a substantial thermal conductor in order that the heat from the heated electrodes may readily travel by heat conduction to the heating electrode through the electrical insulators.

2. In combination, a heating electrode, having a surface from which electrons are adapted to be emitted and having also a second surface, an electrode having a surface adapted to be heated through the agency of the electrons emitted from the first-named surface and having also a second surface, and a solid electrical insulator thermally connecting said second surfaces, the electrical insulator being a substantial thermal conductor in order that the heat from the heated electrode may readily travel by heat conduction to the heating electrode through the electrical insulator.

3. In combination, a hot electrode having a surface, an electrode to be heated by ionic bombardment and adapted to heat the hot electrode, the heated electrode having a surface that is separated from the first-named surface by space that is substantially free of insulating material, and an electrical insulator thermally connecting

the electrode and being thermally conducting to permit heat to flow from the heated electrode to the hot electrode through the electrical insulator.

4. In combination, a cathode, an anode to be heated from the cathode, and adapted to heat the cathode, and an electrical insulator thermally connecting the cathode and the anode, the electrical insulator being thermally conducting, to permit heat to flow from the anode to the cathode through the electrical insulator.

5. A space-current device having an evacuated chamber, a cathode in the chamber, an anode in the chamber heated from the cathode and adapted to heat the cathode, and an electrical insulator connecting the cathode and the anode, the electrical insulator being thermally conducting to permit heat to flow from the anode to the cathode through the electrical insulator.

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