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ELECTRON COUNTER

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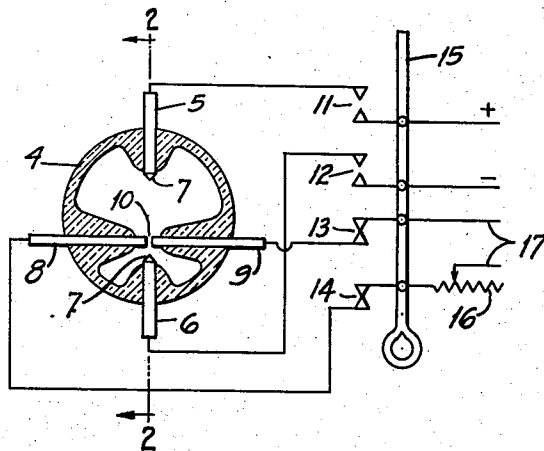


Fig. 1

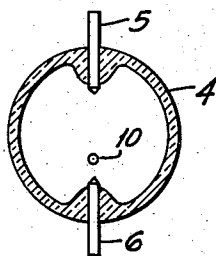


Fig. 2

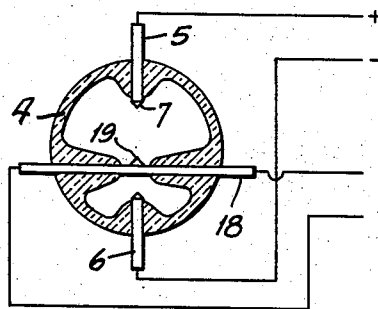


Fig. 3

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ELECTRON COUNTER

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7 Claims. (Cl. 250—83.6)

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My invention relates to electron counter tubes with means for supplying electrons from exceedingly small electrical currents.

One object is the provision of simple and efficient means for accomplishing this end.

Another object is the provision of means for indicating and measuring electrical current flows of as low as a very few electrons per second.

A further object is the provision of means for indicating and measuring action currents picked up from the human skin in amounts much smaller than has been done heretofore.

Other objects will be apparent from the following description and drawing, in which—

Figure 1 is a section through my counter tube showing the arrangement of its parts with part of an electrical circuit in diagram.

Figure 2 is a section on line 2—2 in Figure 1, and

Figure 3 is a section similar to Figure 1 but showing a modified form.

Referring more particularly to the drawing, a vacuum envelope 4 is provided with a high voltage positive electrode 5 and a high voltage negative electrode 6 in axial alinement with each other and radially of the envelope 4. The envelope 4 and the electrodes 5 and 6 function in a manner similar to the envelope and high voltage electrodes of a conventional Geiger-Mueller counter tube. In the latter, the negative electrode is an elongated cylindrical tube and the positive electrode is a fine wire disposed axially of the negative tube. The latter is filled with gases in low pressures. The arrangement permits electrons to be knocked out of the gas atoms by the passage of cosmic rays or other very short electromagnetic waves through the negative cylinder. The freed electrons are attracted to the positive axial electrode and then conducted to a suitable amplifying and quenching device for counting.

My electrodes 5 and 6 are wires or small rods and have only their inner pointed ends 7 exposed. This permits little or no ionization of gases from stray cosmic rays or other short electromagnetic energies. The distance between electrodes 5 and 6 and the composition and pressure of the gases in the envelope 4 are the same as used in conventional slow acting Geiger-Mueller counter practices. The pointed end portions 7 of the electrodes 5 and 6 add to the sensitivity of the counter.

Conductors 8 and 9 are mounted in the envelope 4 with their adjacent end surfaces close together and parallel, providing a condenser 10. The latter is positioned between the points 7 of the elec-

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trodes 5 and 6 and closer to the latter electrode. This adds to the sensitivity of the device.

A weak electrical current to be measured is led over conductors 8 and 9 to condenser 10 to charge the latter. The weak current is then cut off and a high voltage direct current turned on electrodes 5 and 6. The action then taking place is the same as in the conventional Geiger-Mueller tube and its circuits except that the trigger electrons come from the condenser 10 and not from ionizing gases.

A switching means is provided to disconnect the high voltage direct current while charging the condenser 10. Switch members 11 and 12 controlling the high voltage direct current, and switch members 13 and 14 controlling the weak currents to be measured, are mounted on a bar 15 of insulating material or otherwise insulated from each other. The switch members are diagrammatic and may be of any desired form and operated in any desired manner.

A resistor 16 (Figure 1) is provided in one of the wires 17 which supply the small currents to be measured. This resistor controls the current flow and hence the number of electrons reaching the condenser 10. The resistor 16 may be adjusted so that but one electron reaches condenser 10 in a desired time interval. After the condenser 10 is charged, the charging current cut off and a high voltage current turned on electrodes 5 and 6, the heavy negative electrical field pushes the electron or electrons off condenser 10 and the heavy positive electrical field draws the electrons to electrode 5 and causes action of counter. The resistor 16 may be calibrated so that various currents can be measured. Without the resistor 16 the device serves as a current indicator.

In Figure 3, I have shown a conductor 18 extending through envelope 4 near the pointed inner end of the electrode 6. A sharp projection 19 on the conductor 18 points toward the pointed inner end of the electrode 5. The conductor may be placed so that the point 19 is between and in alignment with points 7. Drawing electrons out of a current in a conductor by a point on the latter is used in some cold cathode rectifying tubes found in the arts. This last form of my invention may be used as an indicator of current movements by drawing off part of the traveling electrons.

I claim:

1. In an electron counter, an envelope, high voltage electrodes extending into the envelope with their inner ends spaced apart, means for conducting electrons from the outside of the en-

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velope to a point substantially between the inner ends of said electrodes and a resistor in said means adapted to control the flow of electrons into said envelope.

2. In an electron counter, an envelope, high voltage electrodes extending into said envelope with their inner ends spaced apart, two conductors extending into said envelope with their inner ends close together forming a condenser substantially between the inner ends of said electrodes and means connected in one of said conductors adapted to control the flow of current in said conductors.

3. In an electron counter, an envelope, a pair of high voltage rod shaped electrodes extending into said envelope with their ends spaced apart, conductors extending into said envelope with their inner ends close together in an area between the inner ends of said electrodes, and means for cutting an electrical current off said electrodes while the conductors are carrying a current.

4. In an electron counter, an envelope, a pair of high voltage rod shaped electrodes extending into said envelope with their inner ends spaced apart, sharp projections on the inner ends of said electrodes, conductors extending into said envelope with their inner ends close together providing a condenser substantially between said sharp points, and supply wires for the electrodes and the conductors.

5. In an electron counter, an envelope, a pair of high voltage electrodes extending into said envelope with their inner ends separated, conductors extending into said envelope with their

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inner ends close together forming a condenser, supply wires for the electrodes, supply wires for the conductors, and a resistor in the supply wires for the conductors.

6. In an electron counter, an envelope, a pair of high voltage electrodes extending into said envelope with their inner ends spaced apart, a pair of conductors extending into said envelope with their inner ends close together providing a condenser, high voltage supply wires connected with said electrodes, an "off" and "on" switch in said high voltage wires, a pair of low voltage wires connected to said conductors, an "off and on" switch in said low voltage wires, and a connection between said "off and on" switches preventing one of them from closing while the other one is closed.

7. In an electron counter, an envelope, a pair of high voltage electrodes extending into said envelope with their inner ends spaced apart, a condenser positioned near the inner ends of said conductors, a pair of conductors in electrical connection with said condenser, and means connected with one of said conductors adapted to control the charge on said condenser.

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REFERENCES CITED

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

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Number	Name	Date
2,193,710	Burnham	Mar. 12, 1940