Dec. 28, 1948. J. A. STAGNARO 2,457,787

POTENTIAL DIVIDER

Filed June 2, 1944

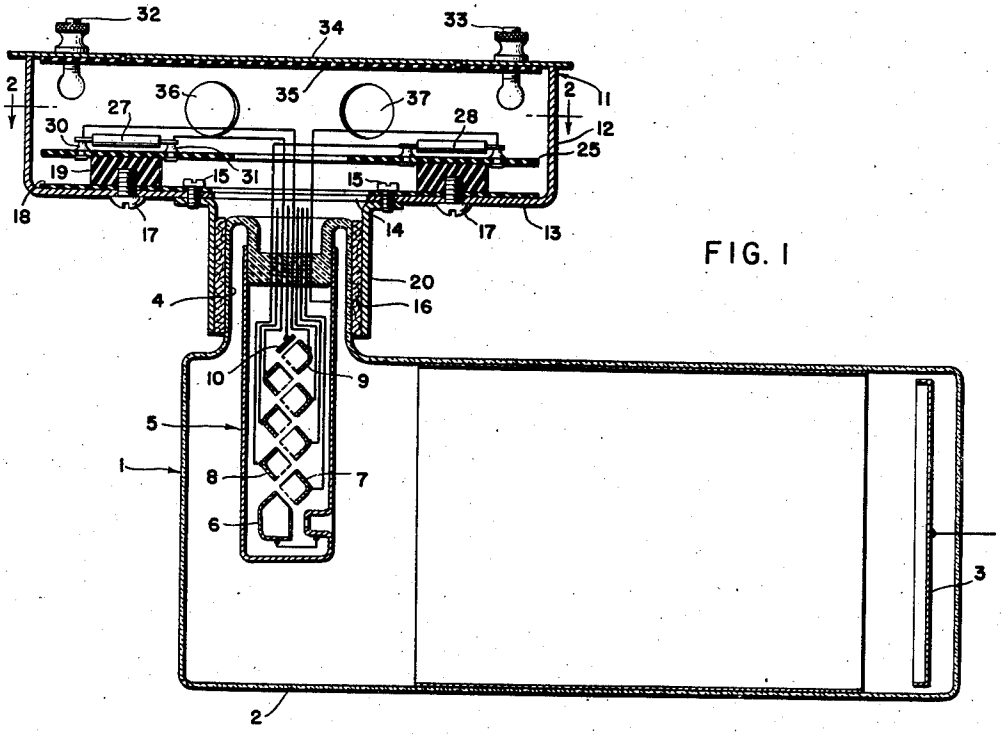


FIG. 1

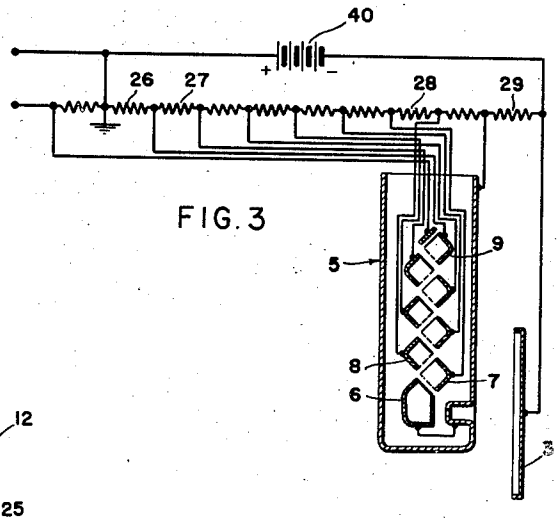
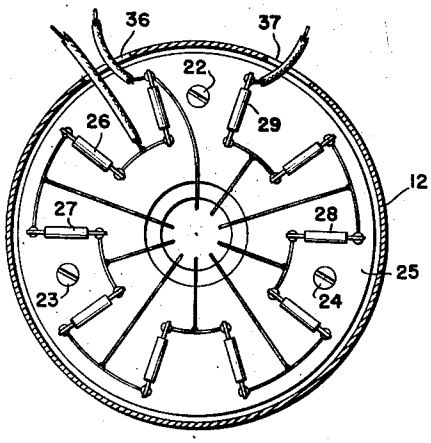


FIG. 3

FIG. 2



INVENTOR
JOHN A. STAGNARO

BY

ATTORNEY

Patented Dec. 28, 1948

2,457,787

UNITED STATES PATENT OFFICE

2,457,787

POTENTIAL DIVIDER

John A. Stagnaro, Fort Wayne, Ind., assignor, by mesne assignments, to Farnsworth Research Corporation, a corporation of Indiana

Application June 2, 1944, Serial No. 538,499

5 Claims. (Cl. 250—175)

1

This invention relates to electron multipliers and is particularly directed to multistage multipliers wherein there is provided as an integral part thereof a potential divider for providing operating potentials.

It is known in the art that electron-multiplier tubes generally comprise an electron-emitting cathode and a collector anode. Arranged serially between the cathode and anode is a plurality of electrodes having high secondary electron-emission properties. For accelerating the electron emission from each electrode, a successively-increasing positive potential must be applied thereto. It has been customary to derive the respective potentials from a voltage source by means of resistors. It is characteristic of present-day electron multipliers that no two are exactly alike with respect to inter-stage operating potentials. Consequently, it is necessary that each individual tube be provided with its individual potential divider consisting of a plurality of resistors, each resistor being designed to provide the proper operating potential between a certain pair of multiplier stages. Heretofore it has been the practice to dispose the resistors at random within a tube chassis with respective leads therefrom being connected to the electrodes of the tube. Periodically, because of tube failure and the like, replacement of the electron multiplier is necessary. Since the electrical characteristics of each multiplier are different, it is necessary, upon the replacement of a tube to change one or more of the resistors to coincide with the characteristics of the new tube. This entails removal of old resistors and redesign of circuits and causes undue loss of operating time in valuable apparatus.

Hence, it is the principal object of this invention to provide as an integral part of an electron multiplier a potential divider consisting of a plurality of resistors, each of which is matched to the multiplier.

In accordance with the present invention there is provided a multistage multiplier including an envelope having arranged therein a plurality of multiplier components, each component having individual characteristics. Connected to the multiplier components is a potential divider having components matched with respect to the characteristics of the multiplier components. There are also provided means for connecting the potential divider with the multiplier and means for securing the divider to the envelope of the multiplier.

For a better understanding of the invention,

2

together with other and further objects thereof, reference is made to the following description, taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the accompanying drawing;

Fig. 1 is a sectional view of the device in operative relation with a dissector tube having mounted therein a multistage multiplier;

Fig. 2 is a sectional view of the device taken on lines 2—2 on Fig. 1; and

Fig. 3 is a schematic wiring diagram showing a circuit including a potential divider connected to the various stages of the multiplier.

Referring particularly to Figs. 1 and 2 of the drawing there is shown a dissector tube 1 having an evacuated envelope 2. Mounted at one end of the tube there is a photosensitive electron-emitting cathode 3. Disposed adjacent the opposite end thereof in the neck portion 4 of the envelope there is mounted a multiplier 5 having a plurality of serially arranged box-like electrodes such as 6, 7, 8 and 9. Adjacent the electrode 9 is the collecting anode 10.

Mounted on the neck portion 4 of the tube is a unitary electrical potential divider 11. This comprises a cylindrical container 12 having a lower end wall 13, in which is centrally disposed an aperture 14. Secured to the wall 13 by screws 15 or other suitable fastening means and extending outwardly therefrom, in direct alignment with the aperture 14, is flanged tube 20. Disposed within the inner wall of the tube 20 is a resilient member 16 which is adapted to frictionally engage the neck portion 4 of the tube to securely hold the device in operative position.

Secured by screws 15 and 17 within the container 12 and against the wall 13 thereof, there is arranged a pair of annular insulator members 18 and 19. Mounted on the member 19, by screws 22, 23 and 24, is an annular insulator plate 25 on which is mounted a plurality of resistor elements such as 26, 27, 28 and 29 having electrical characteristics which match those of the multiplier whereby to provide the desired electron acceleration and secondary emission. Each of the resistors is mounted on a pair of studs 30 and 31 which are secured to the plate 25. Secured to the inner wall of the container 11 there is arranged a plurality of lugs such as 32 and 33, which are adapted to securely fasten the cover 34 at the open end of the device. Disposed in the inner side of the cover, there is provided an insulator plate 35.

On the wall of the container 11 there is pro-

vided a pair of openings 36 and 37 through which may be passed the output conductors leading from the tube to whatever auxiliary apparatus may be required.

Referring to Fig. 3 of the drawing, there is shown the electrical connections of the device in operative relation with the various stages of the multiplier. The resistor element comprises series connected resistors 26, 27, 28 and 29, across the end terminals of which is connected a relatively high source of potential, such as a battery 40. Between each resistor is a tap, each tap being connected to the respective stages of the multiplier. From this arrangement there is impressed upon each succeeding stage of the multiplier an increasingly higher positive voltage.

In accordance with the object of this invention, there is provided a potential divider which is designed, constructed and passed on to the user as an integral and permanently attached part of each individual multiplier tube. Each of the resistors in the divider are chosen because of the particular individual requirements of the successive multiplier stages. As stated hereinbefore, it is impossible to manufacture multiplier tubes wherein the characteristics of the multiplier stages are identical in all respects. Thus it will be obvious to those skilled in the art that each tube requires an individually-designed potential divider. Prior to this invention, replacement of an electron-multiplier tube in a given circuit required redesign of the potential source, but since applicant provides as a permanently attached part of the tube a potential divider matched to the electrical characteristics of that tube, replacement of the tube will only require removal of a defective tube and insertion of a new tube in the tube socket. No alteration of the permanent circuit which forms a part of the tube chassis will be necessary.

While there has been described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An electron tube assembly comprising an envelope containing therein an electron multiplier, and a potential divider permanently mounted on said envelope adjacent said multiplier and having electrical characteristics matched to those of said multiplier, said divider comprising a plurality of series-connected resistors, each of which is matched with and connected to one or more stages of said multiplier.

2. An electron tube assembly comprising an envelope containing therein an electron multiplier, and a potential divider permanently mounted on said envelope adjacent said multiplier and having electrical characteristics matched to those of said multiplier, said divider comprising a plurality of series-connected resistors, each of which is matched with and connected to one or more stages of said multiplier, a supporting means for said divider comprising a cylindrical body portion, a neck portion fixed thereto and to said envelope and an insulating disc within said cylindrical portion supporting said resistors.

3. An electron tube assembly comprising an envelope containing therein an electron multiplier, and a potential divider permanently mounted on the outside of said envelope and having fixed electrical characteristics matched to those of said multiplier, said divider comprising a plurality of series-connected resistors, each of which is matched with and connected to one or more stages of said multiplier, a resistor-supporting means comprising a container, an extension fixed thereto and to said envelope and an insulating member fixed within said container supporting said resistors.

4. An electron tube including a neck portion having mounted therein a multistage multiplier, a cylindrical container having at one end thereof a wall with a centrally-disposed aperture, a flanged cylindrical support secured to said wall and extending outwardly therefrom, a resilient member mounted adjacent the inner wall of said support frictionally engaging the neck of the tube, an insulating plate secured to said wall and having a centrally-disposed aperture and a plurality of resistors arranged symmetrically on said plate and connected to said multiplier.

5. An electron tube including a neck portion having mounted therein a multistage multiplier, a cylindrical container, a support secured to said container adapted to engage the neck of the tube and an insulator plate secured to said container having a plurality of resistors connected to said multiplier.

JOHN A. STAGNARO.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,699,011	Murphy	Jan. 15, 1929
1,923,552	Murphy	Aug. 22, 1933
1,981,115	Murphy	Nov. 20, 1934
2,051,693	Finch	Aug. 18, 1936
2,078,304	Zworykin et al.	Apr. 27, 1937
2,252,752	Bliss	Aug. 19, 1941
2,257,942	Farnsworth	Oct. 7, 1941
2,264,630	Farnsworth	Dec. 2, 1941
2,315,288	Knoop	Mar. 30, 1943

FOREIGN PATENTS

Number	Country	Date
478,262	Great Britain	Apr. 13, 1937