March 8, 1960 B. F. STEIGER ET AL 2,928,061

BALLAST TUBE

Filed Oct. 18, 1956

FIG. 1

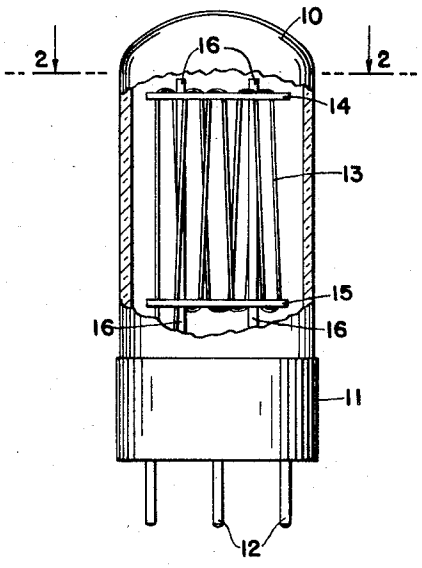


FIG. 2

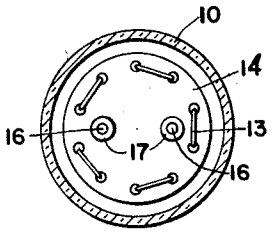


FIG. 3

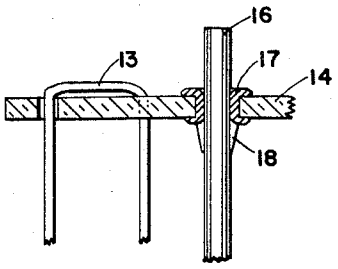


FIG. 4

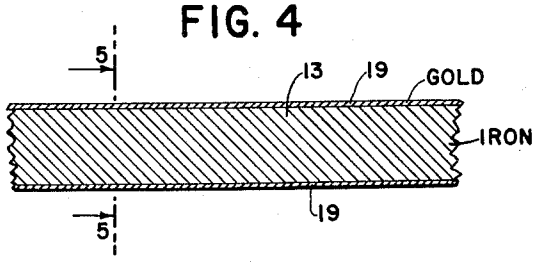
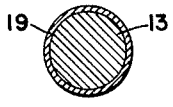


FIG. 5



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BALLAST TUBE

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5 Claims. (Cl. 338—20)

This invention relates to a ballast tube having an improved filament which provides better operating conditions and longer life.

Ballast tubes containing an iron wire filament in an atmosphere of hydrogen at reduced pressure have been used for many years to provide a stabilized constant current for other circuit components. It is well-known that iron wire has a temperature coefficient of resistivity such that, over an appreciable range of applied voltage, the current through the wire is substantially independent of the voltage drop across it. The construction and operation of ballast tubes have been described in an article by H. A. Jones in the General Electric Review for May 1925.

Ballast tubes made of pure iron wire have several inherent defects which tend to shorten their life. During use the iron changes its crystalline orientation and as a result, the filament becomes distorted and the characteristics of the element are changed. Also, present ballast tubes develop "hot spots" on the filament which are sometime caused by crystal distortion and sometime caused by small areas having a bright clean surface in comparison to other sections of the filament which are partially oxidized. The reduced heat radiation from clean bright areas raises the temperature and causes changes in crystal structure.

The present invention comprises a ballast tube having a life which is at least three times the life of prior ballast tubes. No hot spots are developed on the filament and the distortion of the wire is greatly reduced, thereby retaining the resistance and constant current characteristics within a small range of values.

One of the objects of this invention is to provide an improved ballast tube which avoids one or more of the disadvantages and limitations of prior art tubes.

Another object of the invention is to increase the life of ballast tubes.

Another object of the invention is to retain the operating characteristics of a ballast tube during its life.

Another object of the invention is to eliminate hot spots on the filament.

Another object of the invention is to reduce the filament distortion during the useful life of the tube.

The invention comprises a ballast tube having an envelope in which an iron wire is mounted on insulating supports. Lead-in conductors are connected to the iron wire for connection to an external circuit. The iron wire is plated with a thin film of gold and the envelope is filled with an atmosphere of hydrogen at a reduced pressure.

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 side view of the ballast tube with parts broken away to show the internal construction.

Fig. 2 is a cross sectional view of the tube shown in Fig. 1 and is taken along line 2—2 of that figure.

Fig. 3 is a detailed view, greatly enlarged, of a portion of the ballast tube showing the insulator plate, the iron wire, and one of the supporting wires.

Fig. 4 is a cross sectional view, greatly enlarged, showing the gold plated iron wire.

Fig. 5 is a cross sectional view similar to Fig. 4 taken along line 5—5 of that figure.

Referring now to Figs. 1, 2 and 3, the ballast tube includes an envelope **10** supported on a base **11** which contains a plurality of contact pins **12** for connection with an external circuit. On the inside of the envelope an iron wire **13** is mounted on insulating disks **14** and **15**. These disks are generally held in position by one or more heavy supporting wires **16** although any other type of supporting means may be employed. In the example shown, a grommet **17** is employed to grip the insulating disks **14** and **15**, these grommets having small fins **18** which may be soldered or welded to the supporting wires **16**.

The iron wire as indicated in Figs. 4 and 5 is plated with a thin covering of gold **19**. The thickness of the plating is such that the weight of the wire is increased about six percent. Experimental ballast tubes made in the laboratory used iron wire of at least 99.85 percent purity. The gold plating consisted of 24 carat gold.

When this wire is mounted in its envelope, the envelope is filled with hydrogen at about twice the pressure of prior art tubes; that is, about 12 millimeters of mercury. The increased pressure causes an increased heat conduction from the filament to the envelope walls but this additional dissipation of heat is counteracted by the reduced radiation characteristics of the gold surface.

Ballast tubes manufactured in accordance with the above described characteristics have exceptional long life (in many cases over 4,000 hours) and are not subjected to changing characteristics due to hot spots or other filament changes.

The foregoing disclosure and drawings are merely illustrative of the principles of this invention and are not to be interpreted in a limiting sense. The only limitations are to be determined from the scope of the appended claims.

We claim:

1. A ballast tube which passes constant current for a range of applied voltages comprising; an envelope and a gold-plated iron wire within the envelope in an atmosphere of hydrogen.

2. A ballast tube which passes constant current for a range of applied voltages comprising: an envelope containing hydrogen at reduced pressure, an iron wire mounted within the envelope, lead-in conductors connected to the iron wire for external connection, and a film of gold surrounding the iron wire.

3. A ballast tube which passes constant current for a range of applied voltages comprising: an envelope, an iron wire mounted within the envelope in an atmosphere of hydrogen at a pressure of more than 10 millimeters of mercury, said iron wire covered with a film of gold, and lead-in conductors connected to the iron wire for connection to an external circuit.

4. A ballast tube which passes constant current for a restricted range of applied voltages comprising: an envelope, an iron wire mounted within the envelope in an atmosphere of hydrogen, said iron wire covered with a film of gold, the thickness of the gold film being such that the weight of the wire is increased about six percent.

5. A ballast tube which passes constant current for a restricted range of applied voltages comprising: an envelope, an iron wire mounted within the envelope in an atmosphere of hydrogen at a pressure of more than 10 millimeters of mercury, said iron wire covered with a film of gold, the thickness of the gold film being such that the weight of the wire is increased about six per-

cent, and lead-in conductors connected to the iron wire for connection to an external circuit.

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