May 9, 1933. R. S. BOLAN 1,908,308

ELECTRON DISCHARGE DEVICE

Filed March 19, 1931

Fig. 1

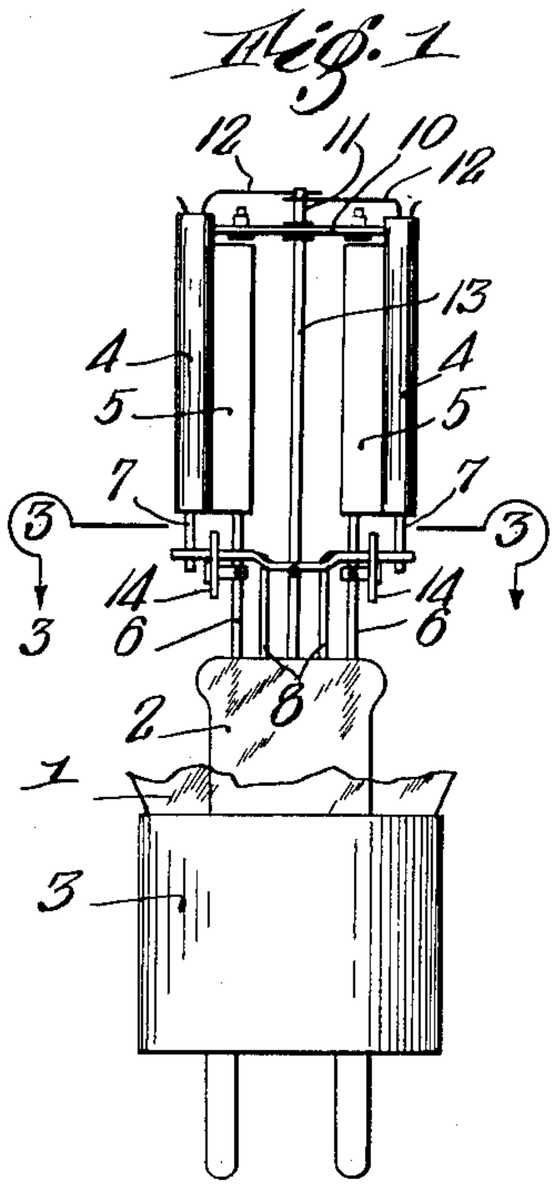


Fig. 7

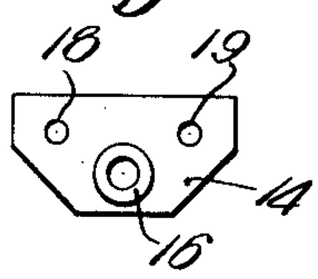


Fig. 8

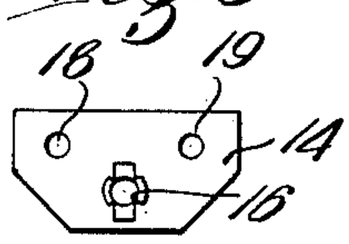


Fig. 9

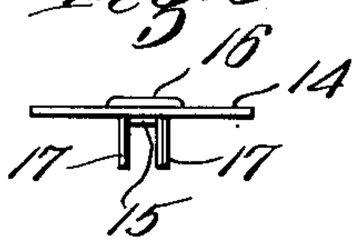


Fig. 2

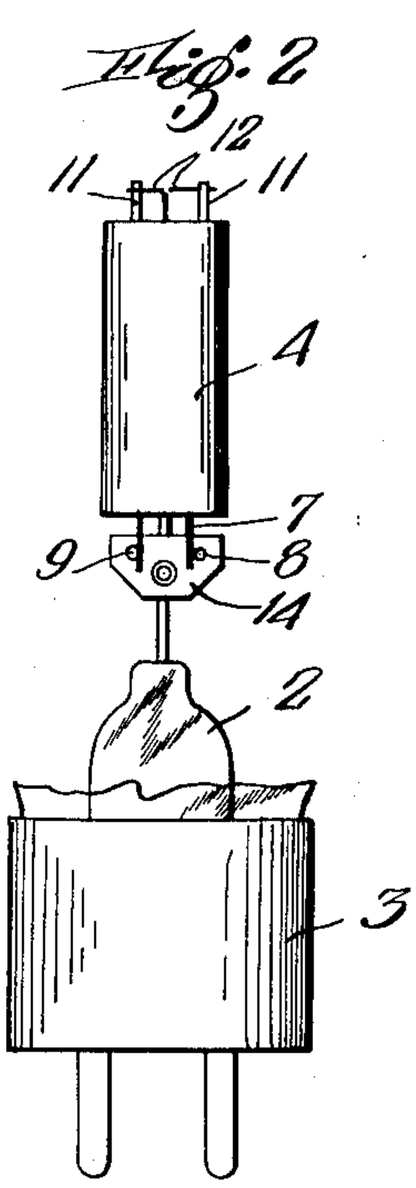


Fig. 3

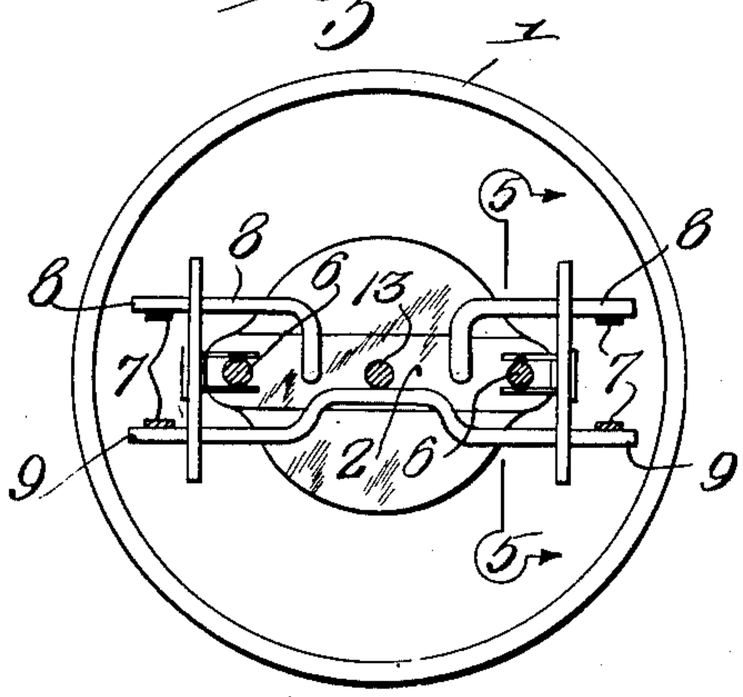


Fig. 4

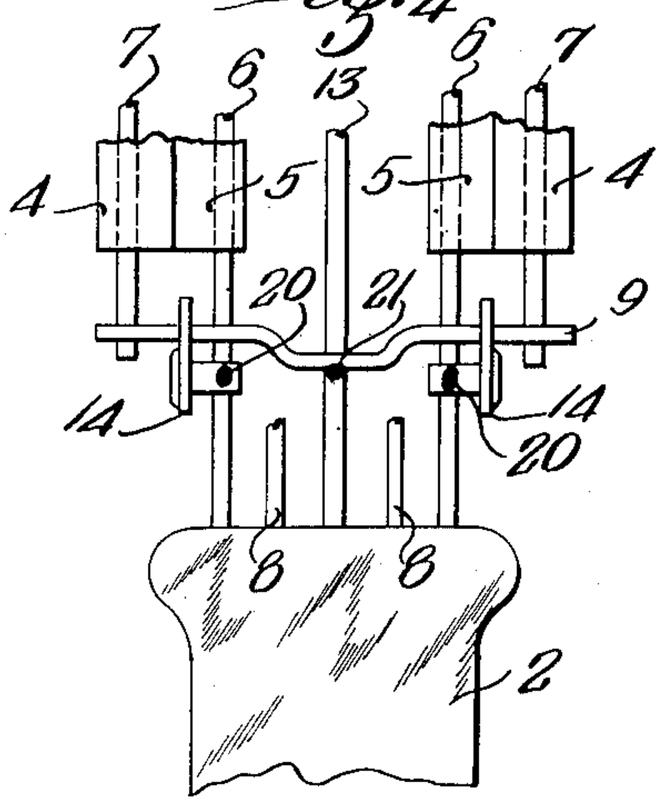


Fig. 5

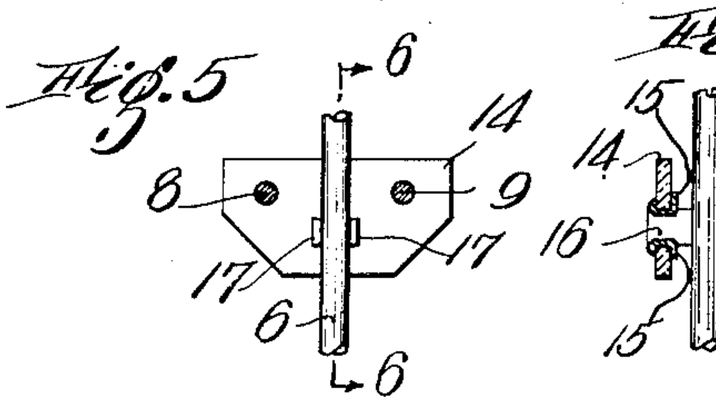
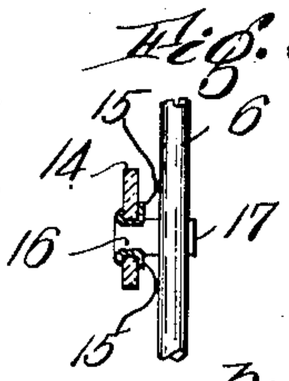


Fig. 6



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UNITED STATES PATENT OFFICE

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ELECTRON DISCHARGE DEVICE

Application filed March 19, 1931. Serial No. 523,713.

In radio tubes and other electron discharge devices of both thermionic and gaseous conduction types the electrodes, such as plates, filaments and grids, must be held in fixed relationships to avoid change in the operating characteristics due to variation in the spacing of the electrodes. This constant relationship is particularly difficult to maintain when the electrodes are mounted on wires because the inertia of the electrodes tends to bend the wires when the device is subjected to transverse impacts in handling. If the wires are constructed to withstand this bending tendency there is great danger of breakage of the glass stem or press from which the wires project and in any event there is the aforesaid danger of displacement of the electrodes relatively to each other. The objects of this invention are to obviate the aforesaid difficulties without substantially increasing the weight or cost of construction and generally to improve devices of the character referred to.

For the purpose of illustrating the genus of the invention a typical concrete embodiment is shown in the accompanying drawing in which

Fig. 1 is a side elevation with the glass broken away;

Fig. 2 is a similar view taken at right angles;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is an enlarged detail view corresponding to Fig. 1;

Fig. 5 is a section on line 5—5 of Fig. 3;

Fig. 6 is a section on line 6—6 of Fig. 5;

Fig. 7 is a side elevation of the insulating sheet hereinafter referred to;

Fig. 8 is an elevation of the sheet from the opposite side; and

Fig. 9 is an edge view of the sheet.

The particular embodiment of the invention chosen for the purpose of illustration comprises a glass envelope 1 having a reentrant stem 2, a base 3 sealed on the envelope, plate electrodes 4 of the tubular type having inner flanges 5 mounted on plate supporting wires 6, inverted V-shaped filaments 7 having their lower ends connected to supporting wires 8 and 9 and having their apices supported on an insulating plate 10 through the medium of posts 11 and hangers 12, and a central supporting wire 13. The plate 10 and associated parts at the upper end of the tube are described and claimed in the copending application of Walter E. Poor, Serial No. 521,779, filed March 11, 1931.

According to this invention the supporting wires are interlocked by means such as the insulating sheets or plates shown in detail in Figs. 5 to 9 inclusive. Each of these plates has perforations 18 and 19 to receive the wires 8 and 9 respectively and a third perforation containing an eyelet 16 which has an annular flange overlapping one side of the plate and on the other side of the plate two crimped over tabs 15 and intermediate projecting tongues 17 which straddle the wires 6. The tongues 17 are spot welded to the wires 6 as indicated at 20 in Fig. 4 and the cross wire 9 is welded to the central wire 13 at substantially the same level as indicated at 21 in Fig. 4; and inasmuch as the three wires 6, 6 and 13 are located in the same vertical plane, the three welds 20, 20 and 21 are not only located in the same horizontal plane but also in the same vertical plane.

In assembling the parts it will of course be understood that the insulating sheets 14 are applied to the wires before the electrodes are applied or at least before the lower ends of the filaments are welded to the wires 8 and 9.

An important feature of the invention consists in that the portions of the wires which interlock with the sheets 14 extend in different directions; in the illustration the wires 6 extend parallel to the sheets whereas the wires 8 and 9 extend perpendicularly through the sheets. By virtue of this arrangement the parts are interlocked together far more effectively than if the wires all extended in the same direction in the region of their interlocking portions.

Another important feature of the invention consists in that the electrodes are so mounted that bending of the wires due to the aforesaid inertia results merely in a general displacement of the electrode assemblage without substantial displacement of the elec-

trodes relatively to each other and without substantial tendency to crack the stem or press due to the bending. In the illustration this is accomplished by locating the three welds 20, 20 and 21 (which weaken the wires in the region of the welds) approximately in a straight line, whereby the electrodes swing about this line as a unitary assemblage when displaced by an abnormal transverse impact in handling. Other factors contributing to this result are the sheets 14 which interlock the lower ends of the electrodes in the region of said line and the sheet 10 which interlocks the upper ends of the electrodes. Thus, in contradistinction to previous attempts to permit relative displacement of the electrodes by increasing the rigidity of the interconnection between electrodes and stem, which often results in stem breakage due to bending stresses in those portions of the wires within the stem, this invention permits general displacement, in response to impacts of sufficient magnitude otherwise to break the stem, while preventing substantial tendency to break the stem (by confining the bending of the wires to portions outside the stem) and at the same time preventing substantial relative displacement of the electrodes.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and a sheet of insulating material interlocked with the wires for holding them in spaced relationship, different wires extending in different directions in the region of their interlocking portions.

2. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and a sheet of insulating material interlocked with the wires for holding them in spaced relationship, certain of the wires extending transversely of the sheet and other of the wires extending longitudinally of the sheet.

3. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and a sheet of insulating material interlocked with the wires for holding them in spaced relationship, certain of the wires extending through the sheet and other of the wires being anchored to one side of the sheet.

4. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and a sheet of insulating material interlocked with the wires for holding them in spaced relationship, said sheet being approximately parallel to the axis of the device and different wires extending in different directions in the region of their interlocking portions.

5. An electron discharge tube comprising a base, stiff wires extending inwardly from the base, and a sheet of insulating material mounted on one of said wires to extend longitudinally of the tube, other of the wires being bent and extending through said sheet.

6. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and sheet insulating material interlocked with the wires for holding them in spaced relationship, said sheet material comprising two parts in different planes and different wires extending in different directions in the region of their interlocking portions.

7. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and sheet insulating material interlocked with the wires for holding them in spaced relationship, said sheet material comprising two parts in different planes and different wires extending in different directions in the region of the interlocking portions, certain of the wires extending transversely and longitudinally of each of said parts respectively.

8. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and sheet insulating material interlocked with the wires for holding them in spaced relationship, said sheet material comprising two parts in different planes and different wires extending in different directions in the region of their interlocking portions, one wire extending through each part respectively and one wire extending through both parts.

9. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and sheet insulating material interlocked with the wires for holding them in spaced relationship, said sheet material comprising two parts in different planes and different wires extending in different directions in the region of their interlocking portions, one wire extending through each part respectively, one wire being anchored to one side of each part respectively, and one wire extending through both parts.

10. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and sheet insulating material interlocked with the wires for holding them in spaced relationship, said sheet material comprising two parts in different planes at least one of which extends longitudinally of the device and different wires extending in different directions in the region of their interlocking portions.

11. An electron discharge device comprising a plurality of electrodes, wires for supporting the electrodes, and sheet insulating material interlocked with the wires for hold-

ing them in spaced relationship, said sheet material comprising two parts in planes extending longitudinally of the device and different wires extending in different directions in the region of their interlocking portions.

12. An electron discharge device comprising plate and filament electrodes, a support for the plate electrode, an insulating sheet extending lengthwise of said support and anchored thereto, and wires extending through said sheet for supporting different portions of the filament.

13. An electron discharge device comprising two plates and two filaments, a support for each plate electrode, an insulating sheet extending lengthwise of each support and anchored thereto respectively, a wire extending through each sheet for supporting each filament respectively, and a wire extending through both sheets for supporting both filaments.

14. An electron discharge device comprising a plurality of electrodes, a support and wires extending from the support to the electrodes, three of said wires being weakened at points located approximately in a line extending transversely of the wires intermediate the support and electrodes so that bending of the wires due to the inertia of the electrodes takes place in said line, and sheet insulating material interlocking said three wires in the region of said line to maintain the electrodes in spaced relation during said bending.

15. An electron discharge device comprising a plurality of electrodes, a support and wires extending from the support to the electrodes, three of said wires being weakened at points located approximately in a line extending transversely of the wires intermediate the support and electrodes so that bending of the wires due to the inertia of the electrodes takes place in said line.

16. An electron discharge device comprising a plurality of electrodes, a support, wires extending from the support to the electrodes, three of said wires being weakened at points located approximately in a line extending transversely of the wires intermediate the support and electrodes so that bending of the wires due to the inertia of the electrodes takes place in said line, and means interlocking the electrodes together at their ends remote from the support, whereby the electrodes move as a unitary assemblage during said bending.

17. An electron discharge device comprising a plurality of electrodes, a support, wires extending from the support to the electrodes, three of said wires being weakened at points located approximately in a line extending transversely of the wires intermediate the support and electrodes so that bending of the wires due to inertia of the electrodes takes place in said line, other electrode wires interlocked with said wires in the region of said line, and means interlocking the electrodes together at their ends remote from the support, whereby the electrodes move as a unitary assemblage during said bending.

18. An electron discharge device comprising an assembly of electrodes, a support, three wires extending from the support to the electrodes, the wires being weakened at points located approximately in a line extending transversely of the wires intermediate the support and electrodes so that bending of the wires due to the inertia of the electrodes takes place in said line, said wires extending to the opposite ends of the electrodes, means interlocking the wires at said ends, and other electrode wires interlocked with said wires in the region of said line, whereby said bending causes movement of the electrode assembly without substantial movement of the electrodes relatively to each other.

Signed by me at Salem, Massachusetts this 17th day of March 1931.

ROBERT S. BOLAN.