June 28, 1932. B. VAN DER POL ET AL 1,865,065

SCREEN GRID TUBE

Filed Nov. 22, 1927

Fig. 1

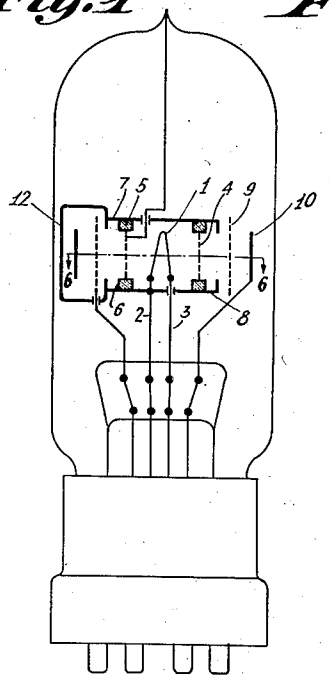


Fig. 2

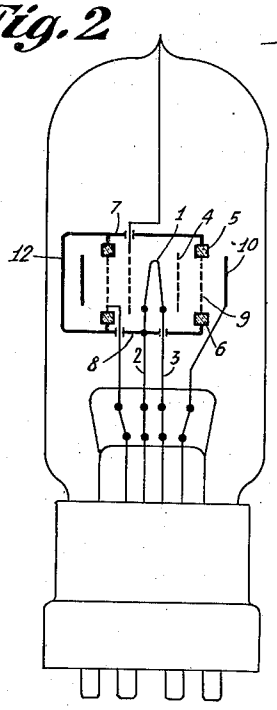


Fig. 3

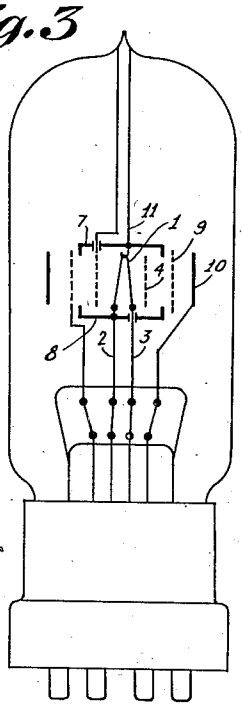


Fig. 4

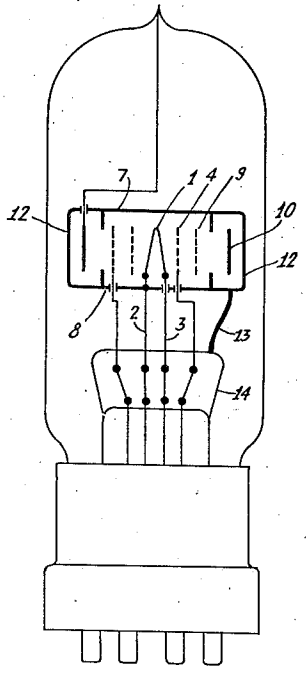


Fig. 5

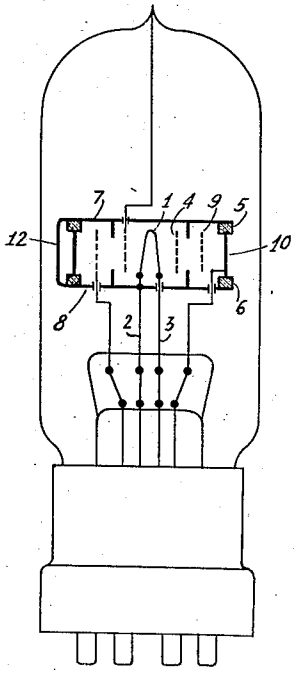
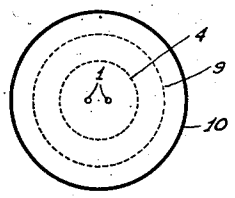


Fig. 6



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Patented June 28, 1932 1,865,065

UNITED STATES PATENT OFFICE

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SCREEN GRID TUBE

Application filed November 22, 1927, Serial No. 235,017, and in the Netherlands November 19, 1926.

With high frequency amplification it is known to make use of tetrodes, i. e. of discharge tubes comprising, as fourth electrode, a screening grid arranged between the anode and the control grid. This screening grid is maintained at a constant potential and serves to substantially neutralize the capacitive influence of the anode on the control grid and vice versa. This internal capacity causes the amplification to become almost illusory at high frequencies as the system commences to oscillate.

It is further possible to neutralize the said undesirable capacity still more perfectly by lengthening the screening grid at both sides to some extent past the anode and the control grid and by providing the screening grid at its two ends with shields which extend over substantially the whole internal section of the discharge tube, and, consequently, intercept substantially all of the electrostatic lines of force between the anode and the control grid which possibly might run round the ends of the screening grid. Tubes constructed in this manner permit a high degree of amplification even with very short wavelengths.

The invention suggests another means whereby with discharge tubes having a screening grid arranged between the anode and the control grid, the same results can be obtained, said means consisting in the provision of one or more metal shields which are insulated from the screening grid and which are conductively connected to a point having a potential which does not oscillate, said shields being so shaped and arranged that any electrostatic line of force between the control grid and the anode has to pass through the screening grid.

According to the invention, these shields should preferably be connected to the filament.

According to the invention, the attachment of the said shields may be effected in different manners which will be described hereinafter in detail with reference to the accompanying drawing which represents diagrammatically five embodiments of the invention. Only those parts of the tube are illustrated which are essential for the right comprehension of the invention.

Fig. 1 is a diagrammatic representation of one form of the invention;

Figs. 2, 3, 4 and 5 are diagrammatic representations of other modifications of the invention; and,

Fig. 6 is a cross-sectional view of the several electrodes taken on line 6—6 of Fig. 1.

In Figure 1, the filament and its two pole wires are indicated by 1, 2 and 3 respectively. The control grid 4 is provided at its both ends with insulating rings 5 and 6 respectively, for example of glass, which have sealed thereto metal disc-shaped shields 7 and 8 respectively. The diameter of these disc-shaped shields is slightly smaller than that of a screening grid 9, which is surrounded by or concentrically arranged with respect to anode 10. Owing to the presence of the shields 7 and 8, which are conductively connected to each other and to the pole wire 2 of the filament, the electro-static lines of force between the control grid 4 and the anode 10 are compelled to pass through the screening grid 9, so that the above mentioned harmful capacitive effect is entirely avoided. The mutual connection between the two shields 7 and 8 may be established in any suitable manner, for example by means of one or more conducting straps 12 running around the screening grid 9 and the anode 10.

The arrangement shown in Fig. 2 is quite identical to that in Figure 1 but differs therefrom in that the insulating fastening rings 5 and 6 are not sealed on to the control grid 4 but to the screening grid 9. In this case, too, the two disc-shaped shields 7 and 8 are connected to one another by one or more straps 12 whilst they are conductively connected to the pole wire 2 of the cathode.

With the arrangement of Fig. 3 the two disc-shaped shields 7 and 8 are not attached to either of the two grids, but the shield 7 is carried and conductively connected to the filament by a small rod 11 which supports the middle of the filament 1 while the shield 8 is conductively connected to the pole wire 2 of the cathode 1. The two shields have consequently a slightly different potential but

since their potential is constant, this does not alter the desired effect.

With the construction shown in Fig. 4, the two disc-shaped shields are connected to one another not only electrically but also, by means of two or more straps 12, so as to form a mechanical rigid unit, which is conductively secured to the pole wire 2 of the cathode 1 and which may further be provided with one or more stiff supports 13, which can be sealed in a known manner into the glass foot 14 of the tube. Another difference with the above mentioned constructions consists in that the shields 7 and 8 have projections extending into the intermediate space between the screening grid 9 and the anode 10 instead of into that between the two grids. Also with this construction the harmful internal capacity of the tube is nearly entirely counteracted.

Finally, Figure 5 shows a construction in which the disc-shaped shields 7 and 8 are secured to the plate 10 so as to be insulated therefrom. In this case the shields are provided with cylindrical projections which extend between the two grids, which still adds to the effect in view. The shield 8 is conductively connected to the pole wire 2 of the cathode 1, and the two shields are electrically connected to each other by a strap 12.

With the type of tetrode under consideration, it is customary to lead out the cathode, the screening grid and the plate through the foot of the tube (Figs. 1, 2 and 3) and the control grid alone at the opposite end of the tube. Also when applying the invention, this construction will generally be possible and recommendable. When, however, the anode is entirely surrounded by the shields 7 and 8 and strap 12 as indicated in Fig. 4, in order to screen also the outer surface of the plate against electrostatic lines of force of the leading-in conductors of the control grid, it may be constructively more advantageous to lead out the control grid at the same end as the cathode and the screening grid through the foot of the tube and to lead out the plate separately at the other end.

Under determined conditions the arrangement in accordance with the invention may afford advantages over the known arrangement mentioned in the beginning, because it is now possible to give the screening grid any desired potential without influencing thereby the screen effect. With the known construction the shields form part of the screening grid itself or, at any rate, they are electrically connected thereto so that potential variations on the screening grid cause like potential variations on the shields.

It will be evident that the above mentioned constructions can be modified in detail without departing from the principle of the invention. Thus, for example, the insulating rings 5 and 6 may successfully be replaced by two or more insulating small blocks which are arranged so as to be distributed over the circumference of the grids.

Having now described our invention what we claim is:

1. An electron discharge tube comprising a cathode, a control grid surrounding the cathode, a screen grid surrounding the control grid, an anode surrounding the screen grid, and shielding means comprising a pair of discs of conducting material substantially covering the ends of the screen grid to shield the control grid from electrostatic lines of force from the anode, one of said discs being electrically connected to the cathode.

2. An electron discharge tube comprising a cathode, a control grid surrounding the cathode, a screen grid surrounding the control grid, an anode surrounding the screen grid, and shielding means comprising a disc of conducting material substantially covering one end of the screen grid and insulated therefrom to shield the control grid from electrostatic lines of force from the anode, said disc being electrically connected to the cathode.

3. An electron discharge tube comprising a cathode, a cylindrical control grid surrounding the cathode, a cylindrical screen grid surrounding the control grid, a cylindrical anode surrounding the screen grid, and shielding means comprising a pair of discs of conducting material substantially covering the ends of the screen grid to shield the control grid from electro-static lines of force from the anode, said discs being electrically connected to each other and to the cathode.

4. An electron discharge tube comprising a cathode, a cylindrical grid surrounding the cathode, a cylindrical screen grid surrounding the control grid, a cylindrical anode surrounding the screen grid, and shielding means comprising a pair of discs of conducting material, each disc substantially covering one end of the screen grid and having a portion extending partly into the space between the anode and the screen grid to screen the control grid from electro-static lines of force from the anode.

5. An electron discharge tube comprising a cathode, a cylindrical grid surrounding the cathode, a cylindrical screen grid surrounding the control grid, a cylidrical anode surrounding the screen grid, and shielding means comprising a pair of discs of conducting material, each disc substantially covering one end of the screen grid and having a portion extending partly into the space between the anode and the screen grid to screen the control grid from electro-static lines of force from the anode, said discs being electrically connected to each other and to the cathode.

6. An electron discharge tube comprising

a cathode, cylindrical screen grid, control grid and anode electrodes concentrically mounted therein, and shielding means comprising a pair of discs mounted adjacent to the ends of certain of said electrodes, each of said discs being provided with a cylindrical portion extending partly into the space between two of said electrodes to screen the control grid from electrostatic lines of force from the anode, said discs being electrically connected together and to the cathode.

7. An electron discharge tube comprising a cathode, cylindrical screen grid, control grid and anode electrodes concentrically mounted therein, and shielding means comprising a pair of discs mounted adjacent to the ends of certain of said electrodes, each of said discs being provided with a cylindrical portion extending partly into the space between the anode and the control grid to screen the control grid from electro-static lines of force from the anode, said discs being electrically connected together and to the cathode.

8. An electron discharge tube comprising a cathode, cylindrical screen grid, control grid and anode electrodes concentrically mounted therein, and shielding means comprising a pair of discs mounted adjacent to the ends of certain of said electrodes, each of said discs being provided with a cylindrical portion extending partly into the space between the anode and the screen grid to screen the control grid from electro-static lines of force from the anode, said discs being electrically connected together and to the cathode.

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