Dec. 26, 1939.

K. SCHLESINGER

2,185,135

ELECTRONIC TUBE

Original Filed Aug. 4, 1934

4 Sheets-Sheet 1

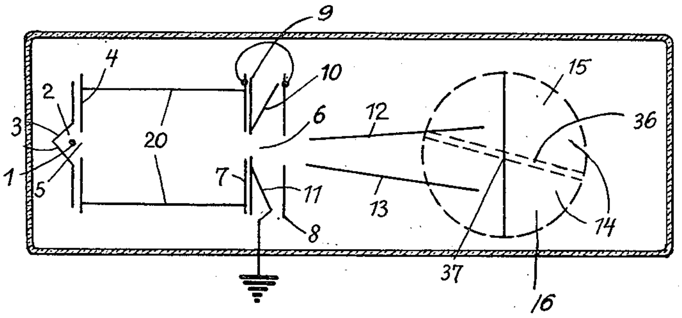

Fig. 1

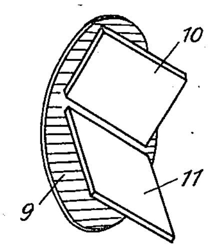

Fig. 2

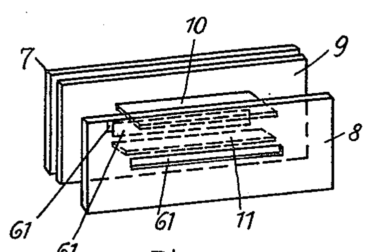

Fig. 2a

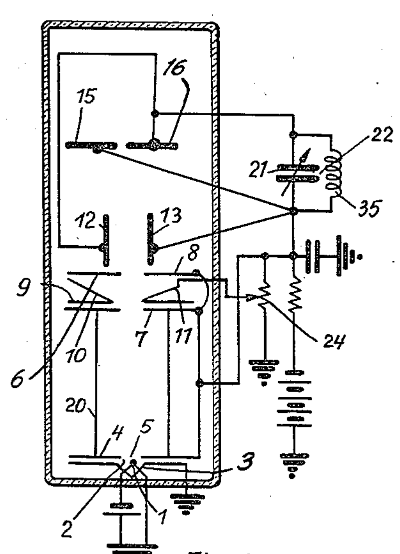

Fig. 3

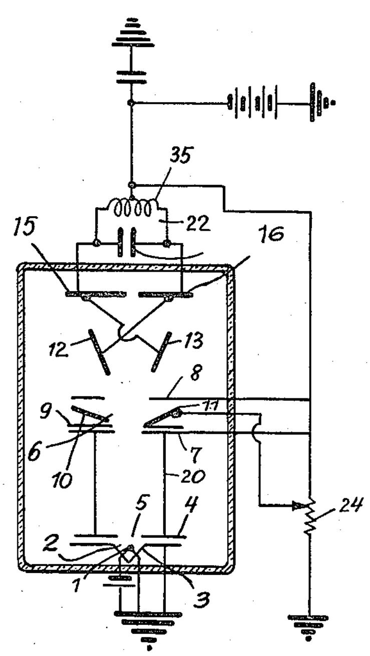

Fig. 4

Inventor:

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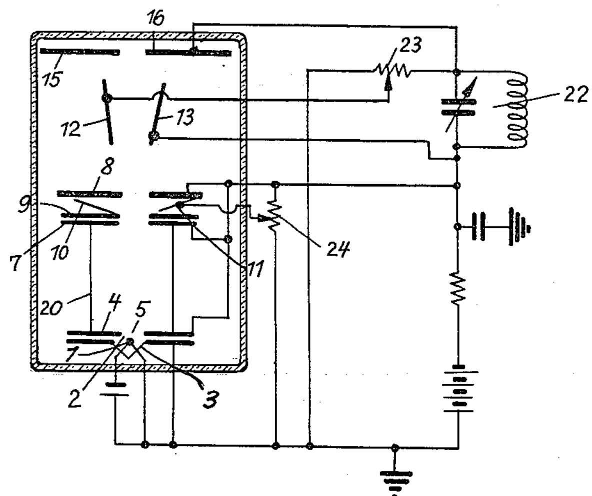

Fig.5

Fig.6

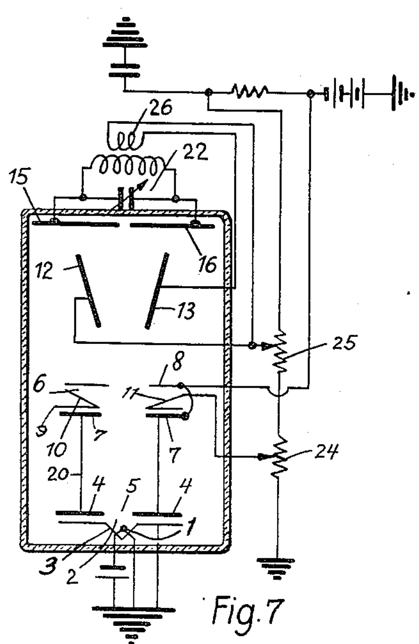

Fig.7

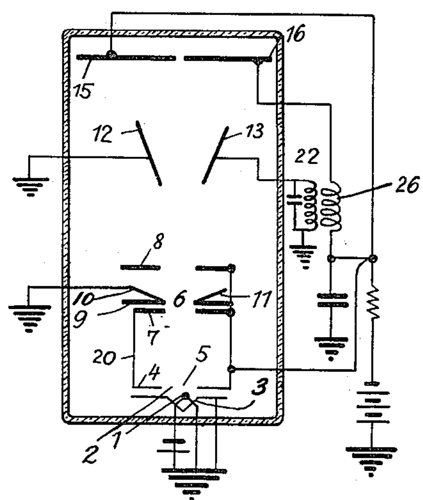

Fig.8

Jnventor:

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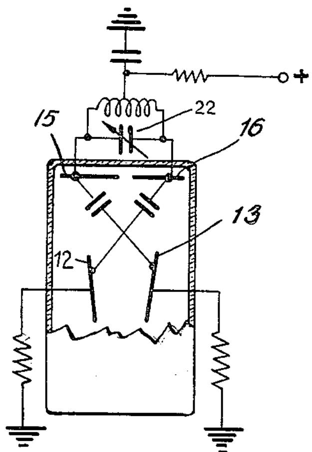

Fig.9

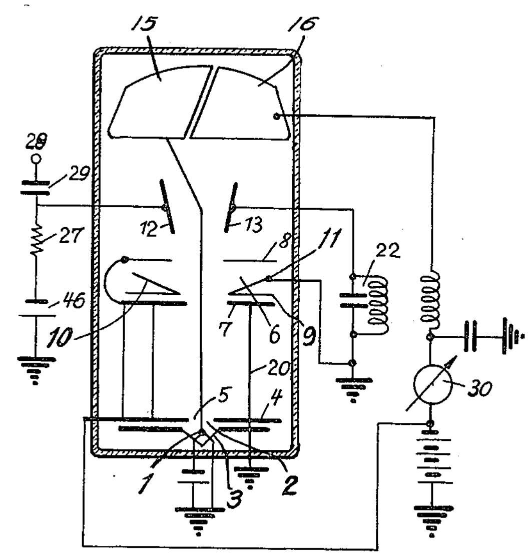

Fig.10

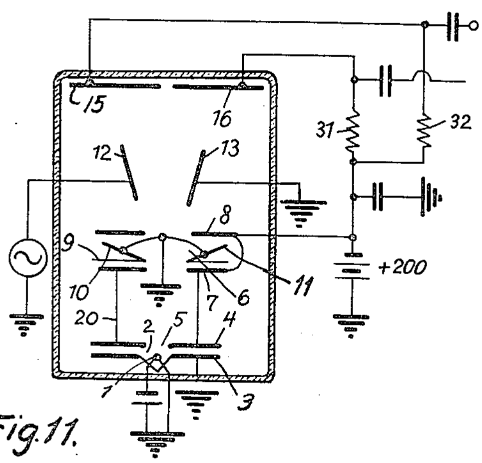

Fig.11.

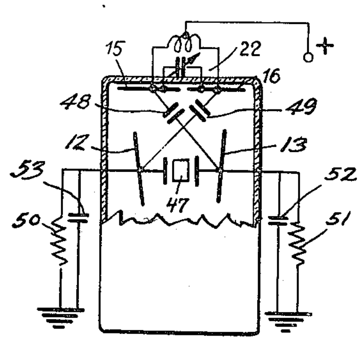

Fig.13

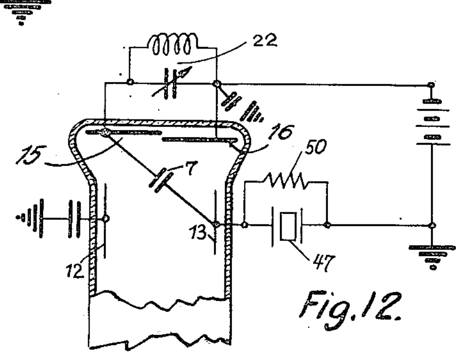

Fig.12.

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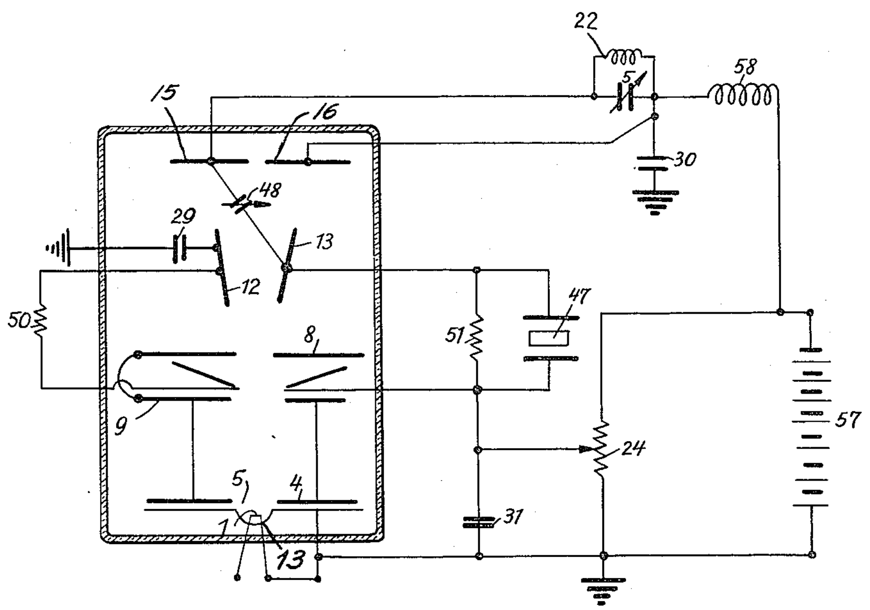

Fig.14

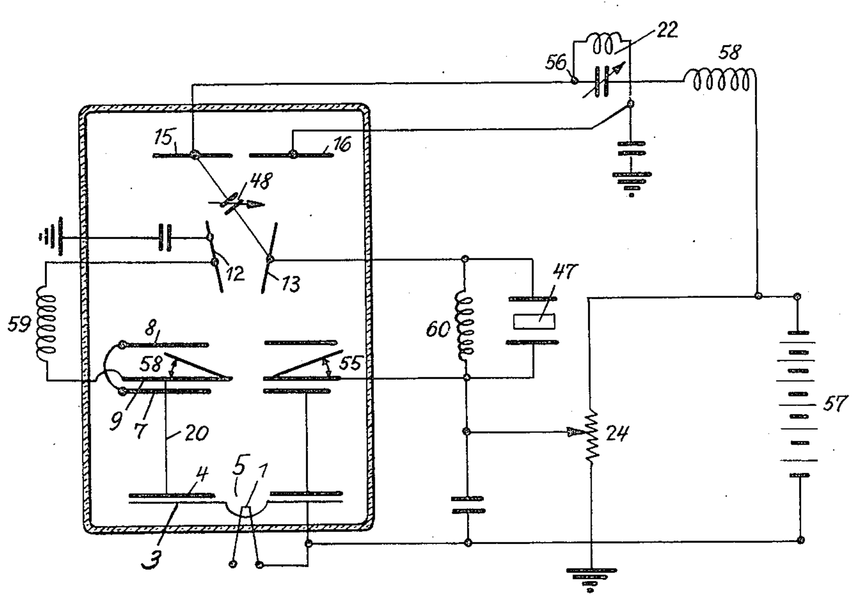

Fig. 15

Inventor:

Kurt Schlesinger.

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UNITED STATES PATENT OFFICE

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ELECTRONIC TUBE

Kurt Schlesinger, Berlin, Germany, assignor, by mesne assignments, to Loewe Radio, Inc., a corporation of New York

Original application August 4, 1934, Serial No. 738,389. Divided and this application February 19, 1938, Serial No. 191,452. In Germany August 9, 1933

5 Claims. (Cl. 250—36)

This application is a division of application No. 738,389, filed August 4, 1934.

The object of the patent application Ser. No. 736,703, filed July 24, 1934, is an electron discharge tube, in which the cathode itself or an aperture in an intermediate diaphragm is reproduced by means of a suitable electron-optical system in the form of a narrow electronic band on a suitably shaped anode, and in which an output current intensity control takes place by deflection of the electronic band by the use of deflecting plates or the like.

It has been found that in an arrangement of the type referred to it is very difficult to pass a sufficient emission through the diaphragm, so that it is possible only with difficulty to obtain anode currents of adequate strength.

One object of the present invention is to provide means in discharge tubes of the type referred to for producing anode currents of great strength.

Another object of the invention is the use of discharge tubes of this kind in certain connection systems.

Still further objects of the invention will be seen from the following description.

According to the invention, the electrons proceeding from the cathode are preliminarily concentrated in such fashion that there is formed a wide band having a very thin cross-section at any suitable point situated preferably between the cathode and the electron-optical system. The electron-optical system is adjusted in such a manner that the plane wherein the band possesses the least thickness acts as the optical object which is reproduced sharply on the anode.

In the arrangement according to the invention both the intermediate diaphragms as well as the slots in the electrodes forming the electron-optical system may accordingly be made comparatively wide (for example approximately 2 mm.), so that no less of electrons takes place by way of selection.

The electron-optical system—as set forth in the patent application Ser. No. 736,703—may consist of two positive outer elements and a third element arranged between the same and negative in relation to the outer elements.

It is desirable to link up the two outer elements with the full anode potential, and to earth the element arranged intermediate thereof. In this case the focal distance of the system may be adjusted as desired by particular construction of the middle element.

The middle element may conveniently be constructed in the form of a slotted plate with set-on inclined metallic lugs. In this case the focal distance may be varied by varying the tilt of the lug in relation to the base plate, the focal distance of the system being proportional to the angle of inclination of the lugs.

The preliminary concentration may preferably be performed by the use of elements, the most negative of which is passed to earth or is weakly positive in relation to the cathode. In this manner the formation of a strong space charge cloud in the preliminary concentration space is safely avoided, and a high constant emission is fully ensured.

In order to preclude the effect of any fluctuations in the heating current there may conveniently be employed filament cathodes, which are heated by filaments, arranged for example in their extension, by the transfer of heat. The use of normal indirectly heated cathodes is also possible, but calls for a very strong preliminary concentration.

On the other hand the use of indirectly heated equi-potential cathodes, in which the equi-potential tube is not fully coated with the emissive layer, but possesses merely a narrow longitudinal strip of emissive substance, has been found to be suitable. Cathodes of this nature may be produced, for example in the following manner:

The equi-potential tube is furnished in the longitudinal direction with a narrow groove. This groove is filled out with a highly emissive substance, for example alkaline earth metal oxide, care being taken that the remaining parts of the equi-potential surface remain completely free from the highly emissive substance. The highly emissive layer may be formed either in a gas atmosphere or by the application by atomization of highly emissive metal, such as barium. If the formation takes place by means of application of a highly emissive metal to the oxide coating, the cathode after completion of the forming operation is preferably overheated for a brief space of time to such extent that the forming metal is fully evaporated from the metallic equi-potential surface, i. e., the parts other than the groove.

The path of the electronic band between the preliminary concentration system and the electron-optical system may conveniently be screened off, there being employed for screening purpose a cylindrical electrode, which may be conductively connected with the two outer elements of the stated systems.

If the tube operates with merely one deflection of the cathode ray band, the deflecting plates, may preferably be so constructed that the same extend practically over the entire spacing between the electron-optical system and the anode. By this measure the sensitiveness of deflection on the one hand is considerably increased, and on the other hand the electronic band is screened off.

If it is desired to deflect the band in two coordinates which are perpendicular to each other, those deflecting plates the effective surface of which is parallel to the wide surface of the band are, preferably made as short as possible, and those deflecting plates the effective surface of which is situated parallel to the narrow surface of the band are so constructed that they extend over the entire or practically over the entire space between the first deflecting plates and the anode.

The electronic tube according to the invention may be used for all normal purposes, and operated with anode potentials in the order of approximately 200—300 volts.

On the other hand for producing ultra-short waves there are employed according to the invention high potentials of the order of 1000–10,000 volts and more, which should be selected in such fashion that the rate of movement of the electrons remains small in relation to the frequency.

It is desirable to impart to all deflecting plates a bias which is negative in relation to the preceeding anode and which merely should be of such amount that cross-current losses are safely avoided. Beyond this, the resistance of the plate circuit may be selected to be so small that possible cross-currents are unable to cause any appreciable additional deflections.

A form of embodiment of the tube according to the invention, together with certain details, and also several connection systems according to the invention are illustrated diagrammatically in the drawings, wherein

Fig. 1 shows the total arrangement of the tube, whilst in

Fig. 2 there is shown separately the middle plate of the electron-optical system.

Fig. 2*a* shows a different embodiment of said system.

Figs. 3 and 4 show oscillation systems, whilst in

Fig. 5 there is illustrated a back-coupling connection.

Fig. 6 shows a form of embodiment of an indirectly heated cathode.

Figs. 7–9 show the use of a discharge tube according to the invention in certain connection systems, whilst

Fig. 10 shows a possible form of embodiment of an oscillation relay connection according to the invention, free of inertia, and in

Fig. 11 there is shown an amplifier connection according to the invention.

Fig. 12 shows a connection diagram for a single cadence arrangement making use of oscillator crystals, whilst in

Fig. 13 there is shown in principle the corresponding connection diagram of a counter-cadence arrangement, and

Figs. 14 and 15 show different embodiments of the complete circuit diagram for an arrangement as shown in Fig. 12.

In the drawings:

1 is the cathode, and **2** the preliminary concentration system comprising the elctrodes **3** and **4**. The electrode **3** may consist of two relatively tilted inclined lugs, and in accordance with the invention is preferably connected with earthed or with a weak positive potential, whilst to the plate **4** there may conveniently be applied the full anode potential. The concentration effect of the system may be varied within wide limits by varying the relative tilt of the two lugs. The aperture in the plate **4**—the slot **5**—is so dimensioned that no parts of the electron bundle are cut off. **6** is the electron-optical system comprising the two outer plates **7** and **8** and the middle plate **9** with the set-on lugs **10** and **11**, the focal distance of which system may be adjusted by varying the inclination of the plates **10** and **11** in relation to the base plate **9** or by varying the potentials linked up with the single plates. The shape of the middle element of the electron optical system may be substantially as shown in Figs. 2 and 2*a*. **12** and **13** are the deflecting plates, **14** is the anode consisting of the two plates **15** and **16** which are insulated from one another, and the adjacent edges of which (hereinafter termed "impart edges") are referred to as **36** and **37**. The cathode **1** may be constructed for example as filament cathode (width of band for example .2 mm). **20** is a metallic tube screening the part of the path of the electrons between the system **2** and the reproducing system **6** against external influences.

As shown in the figures this cylinder may be connected with the plates **4** and **7** and can be combined with said plates for forming with them one structural unit.

A form of embodiment of an indirectly heated cathode which may be employed according to the invention is illustrated by way of example in Fig. 6. In the same:

17 is the equipotential tube, which is arranged on the insulating tube **18** and is furnished on its surface with the groove **19**, which is filled out with highly emissive substance, whilst the total remaining surface of the equipotential tube is free of highly emissive substance. The groove **19** may possess a width equal to the thickness of a filament or band cathode. By using cathodes of this kind according to the invention it is possible to retain the advantages of the indirectly heated cathode without having to accept the unfavourable effect of an increase in the emissive surface.

It is particularly convenient to arrange the getter substance, which is necessary for producing the high vacuum, in such manner that the resulting metallic vapour can be deposited merely weakly or not at all at those points at which secondary electrons may be formed. Thus, for example, the getter substance may be provided at the back part of **3**.

Assuming alkaline earth metal shall be atomized on to the cathode, the same may preferably be arranged (for example in a small metal tube situated in the extension of the cathode) in such a manner that the resulting metallic vapour moves over the cathode in the longitudinal direction, and in substance does not even impinge on the plate **4**. The use of a directed evaporation of the metal is in this case of particular importance.

Figs. 3 and 4 show oscillation connections with the use of the tube according to the invention.

As shown in Fig. 3, there may be connected with the anode **16** for this purpose the oscillatory circuit **22** comprising the coil **35** and the condenser 21. The anode plate 16 is connected with the deflecting plate 12. The anode plate 15 and also the deflecting plate 13 and the plates 4, 7 and 8 are linked up with anode potential. The potential of the middle electrode 9 having the lugs 10 and 11 may be tapped at a potimeter 24.

As shown in Fig. 4, it is also possible to employ both anode plates 15 and 16 and both deflecting plates 12 and 13 for control purposes.

The back-coupling connection disclosed in Fig. 5 differs from the oscillatory connection in that the control plate 12 is linked up over the operator 23 with the anode plate 16. As operator 23 there may be employed a potentiometer or also any suitable capacitative or inductive potential distributing means.

The tube according to the invention may be employed with advantage for every kind of counter-cadence connection. By suitable embodiment of the impact edge of the anode—the form of which may readily be calculated in each single case—it is quite readily possible with the tube according to the invention to convert potentials with a given form of curve into potentials with a different prescribed form of curve, for example sinusoidal control potentials into saw-tooth tilting potentials.

This form of use is of particular importance, for example in connection with televised receiving apparatus.

In accordance with the invention, the impact edges of the anode 14 (i. e., the edges 36 and 37 of the main and auxiliary anodes 15 and 16, see Fig. 1) may also be so constructed that anode current does not occur until a certain control potential has been exceeded. The same effect may also be accomplished—in more complicated fashion—by magnetic or electrostatic preliminary deflection of the electronic band (arrangement of the electrodes or bias of the deflecting plates).

Tubes of this character are of particular importance as sound-intensity regulators, limiting tubes, relay tubes and the like.

By fitting a tube of this nature in a simple receiver it may be accomplished that all weak transmitters, which may only be received with difficulty even under favourable conditions, and also weaker atmospheric disturbances are cut off. The receiver then provides a completely clear and separable reception of the more powerful transmitters received, without interference being able to occur by reason of said relatively weak transmitters.

Apart from the double modulation by the use of two fold deflection it is possible in accordance with the invention to provide a third modulation by space-charge control of the intensity of the electronic band. In this case there may be suitably employed as control element the more negative electrode of the preliminary concentration element. Assuming an intensity control of this kind is employed, it is desirable to concentrate the electronic band preliminarily on to an intermediate diaphragm, and to reproduce the intermediate diaphragm by means of the electron-optical system on the anode. In particular in the case of the last-mentioned form of embodiment with intensity control it is necessary to centre the emissive surface exactly in relation to the other electrodes.

According to the invention, therefore, there is preferably employed a pinch, which is furnished with set-on glass supports. The single electrodes are either furnished themselves with guide apertures, the size and arrangement of which exactly correspond with the arrangement and cross-section of these glass supports, or are secured to special holders furnished with guides of this nature.

Groups of electrodes pertaining to a system, for example to the prelimary concentration system or the electron-optical system, may preferably be finally mounted by the use of rotation gauges to form a system, and placed as a whole on to the holding means.

It is also possible to connect the single electrodes with the holding means by fusing holding wires provided on the electrodes into the holding means, with the use of intermediate members composed of glass.

The first method according to the invention is, however, the one to be preferred, insofar as the same considerably facilitates assembly in large numbers.

The welding on of the metal lugs determining the focal distance of the systems may conveniently also take place in accordance with the invention by the use of gauges. The system parts are preferably not removed from the gauges until after cooling, so that subsequent distortions do not occur. It is also essential to employ material which has been outgassed to such extent that subsequent heating, which might result in distortion, is not required.

It is particularly convenient according to the invention to furnish those parts of the system, a variation in position or direction of which in operation would have an appreciable effect on the operation of the electronic tube, for example the middle part of the electron-optical system, with an aperture of such large size that the same in practice are not touched by the electronic band, and in consequence also cannot be heated.

The system anodes 15 and 16, which in substance take up the entire electronic current, and are subjected, therefore, to considerable heating, are, in accordance with the invention, composed either wholly or at least at the impact edge of material of high fusing point, such as tungsten, and are furnished preferably at their back side with special heat-discharge means (for example very large cooling surfaces, which conveniently may be blackened, and the like).

It is also desirable to construct the anode leads in such a manner that the same discharge a considerable portion of the heat, i. e., to give these leads a great cross-section, for example a cross-section of 2 mm^2 or even more, said leads consisting of a good heat conducting material, such as copper.

The electrode arrangement may be performed in such fashion that the interior of the tube is screened off by the working anodes, and an auxiliary anode situated behind the slot between the working anodes is screened off towards the top against interferences from the exterior. In this case it is possible to leave the part of the tube wall opposite to the anodes completely free of deposit in order to obtain a good discharge of heat.

Whereas in the connection systems illustrated in Figs. 3–5 the deflecting plates 12 and 13 are raised to anode potential, and the middle element of the electron-optical systems is adjusted to the correct bias by the use of the resistance 24, it is also possible, as already set forth, to earth the middle element of the electron-optical system, and to provide the deflecting plates for the purpose of avoiding interfering currents with negative biasses, or if desired also to pass the same to earth.

In the arrangement in Fig. 7 a negative bias is supplied to the deflecting plates through the medium of a potentiometer **25**. The plate **13** is coupled inductively by the use of the coil **26** with the oscillatory circuit **22** connected with the working anodes **15** and **16**. At the potentiometer **25** there may at the same time also be obtained, if necessary, the bias for the elements of the system **6**, i. e., for the elements **7** and **8** and the assembly of elements **9**, **10**, **11**.

According to Fig. 8, the deflecting plates **12** and **13** are passed to earth. As shown by the drawings, the oscillatory circuit **27** may be provided in the one deflecting plate circuit and the anode coupled inductively.

Fig. 9 shows a counter-cadence arrangement, in which the oscillatory circuit **22** is linked up with the working anodes **15** and **16**, and the deflecting plates **12** and **13** connected with the anodes cross-wise over condensers, and earthed over resistances. When employing arrangements having earthed deflecting plates it is desirable to use deflecting plates which are relatively insensitive, i. e., short plates possibly arranged to be not too close to the electronic band, and/or to operate with high anode potentials. In this case it may be desirable to select the potential of the working anodes higher than that of the outer plates of the electron-optical system.

The potentiometers serving for production of the requisite plate and/or system biasses may conveniently be provided in the tube vacuum itself or in the base of the tube, and definitely adjusted once and for all, so that an adjustment of the biasses by the user cannot take place.

The use of deflecting plates as described above extending over practically the entire space between the electron-optical system and the working anodes certainly results in an increased sensitiveness of deflection, but causes at the same time marginal field disturbances. In those cases in which this interference requires to be wholly avoided it is desirable to dimension the plates in such a manner that between the working anodes and the deflecting plates there remains a spacing of the order of at least 1 cm., and preferably more.

Further, it is also desirable according to the invention to construct and arrange the cathode in such fashion that both the ends of the filament as well as the filament leads are screened off entirely against the space surrounding the actual system. For this purpose, according to the invention, the element **3** surrounding the filament may be constructed so as to be closed towards the sides. The element **3** should preferably be arranged at the smallest possible distance from the slotted plate **2**.

A form of embodiment of a relay lacking in inertia according to the invention is illustrated by way of example in Fig. 10.

According to this arrangement, there is supplied to the deflecting plate **12** by the battery **46** through the medium of the resistance **27** a positive bias, which causes the electronic band to be so adjusted in the position of rest that no electrons are able to strike against the working anode **16**. The control potential is conducted to the plate **12** from the terminal **28** through the medium of the condenser **29**. Immediately a sufficiently strong negative control impulse is received the electronic band is moved out of its position of rest on to the working anode, so that the electrons now impinge thereon. By reason of the current fluctuation resulting in the anode circuit the oscillatory circuit **22** is provided with an impulse and the tube caused to oscillate.

By the oscillatory condition of the tube there is controlled the consuming apparatus **30** shown symbolically as a measuring instrument arranged in the circuit of the anode **16**. It is desirable according to the invention to furnish the oscillatory circuit **22** with a time constant as small as possible, for example to tune the same to waves of 500 metres and less.

In place of electrostatic adjustment it is also possible in accordance with the invention to employ electromagnetic adjustment.

It is particularly convenient to construct the tube in such fashion that the electronic band in the position of rest does not meet against the main working anode, as in this case the bias otherwise necessary may be dispensed with.

The disconnection of the relay may always be enforced, for example by means of a strong positive impulse, which causes the electronic band to remain in the position of rest for a relatively long period.

Fig. 11 shows a form of embodiment of an amplifier connection according to the invention with earthed control plates **12** and **13**, in which in the circuits of the two anode plates **15** and **16** there are preferably arranged equal anode resistances **31** and **32**, and the potential may be derived both with correct phase from the plate **15** as well as reversed phase from the plate **16**, so that the use of a phase-reversing tube otherwise required in numerous cases may be dispensed with.

Since the phase-reversed potentials may be extracted simultaneously, this arrangement is also particularly suitable for the operation of Braun tubes controlled in counter-cadence, i. e., Braun tubes in which to the one deflecting plate there is applied the deflecting potential and to the other deflecting plate a potential of equal amplitude but reversed phase. Naturally it is also possible in this arrangement not to earth the deflecting plates but to bias the same preferably weakly negative, for example to the extent of 10–50 volts, in relation to the anode, quite generally as the measures set forth in connection with any one of the shown circuits may, as a rule, also be employed for each of the other connections, unless the contrary be stated or obvious.

In these figures:

Figs. 12–15 show some circuits according to the invention, in which control quartz members known per se are made use of for producing oscillations of constant frequency.

15 and **16** are the two anode plates, which are separated from each other by a slot and which, when the passage of the electronic band from the one plate to the other is to take place without gap, may be arranged in such fashion in relatively shifted planes that the two plates overlap, **12** and **13** are the deflecting plates, **22** is an oscillatory circuit, **47** the control quartz, **48** and **49** are coupling condensers, and **50** and **51** resistances.

In the arrangement according to Fig. 12 (single cadence connection) the anode plate **15** is connected through the medium of the condenser **48** with the deflecting plate **13**. The oscillatory circuit **22** is linked up with the plate **15**. The plate **13** is earthed over the control quartz **47**, which is bridged by the resistance **50**.

In the two-cadence arrangement according to Fig. 13 the two anode plates **15** and **16** are connected crosswise with the deflecting plates 12 and 13 through the capacities 48 and 49. The control quartz 47 is situated between the two deflecting plates 12 and 13. 9 is an element of the electron optical system.

The relation between the coupling capacities 48 and 49 and the inherent capacities 52 and 53 of the plates 13 and 12 is selected, in accordance with the invention, to be so small that upon disconnection of the quartz oscillations are unable to result. In this manner it is accomplished that the connection system is able to oscillate solely in the natural frequency of the control quartz, so that the frequency-constancy of the arrangement is absolutely ensured.

As careful investigations have shown, it is possible to produce oscillations with the connection system according to the invention only when using electronic tubes of that kind in which a sharp reproduction of the electronic band (i. e., a sharp reproduction of the cathode itself or an intermediate diaphragm or a point of smallest cross-section disposed between cathode and electron-optical reproducing system) is obtained in the plane of the anode, i. e., in which the electronic band possesses a cross-section which is not too large in relation to the gap between partial anodes 15 and 16.

In Fig. 14 there is shown the complete diagram of a single-cadence arrangement.

The electronic current proceeding from the directly or indirectly heated and preferably hot cathode 1 is preliminarily concentrated preferably in the form of a band by means of the concentrating system comprising the elements 3 and 4, in such fashion that the electrons pass the diaphragm aperture 5 practically without loss in the form of a narrow band. A certain cross-section (and preferably the smallest cross-section) of the electronic band thus produced is reproduced sharply in the plane of the anode plates 15 and 16 by means of the electron-optical system comprising the elements 7, 8 and 9. The space between the elements 4 and 7 is screened off against both static as well as magnetic foreign effects by means of the cylinder 20.

The elements 4, 7, 8 and 20 may be connected with each other and linked up with anode potential.

The elements 3 and 9—assuming the spacing between the single parts of the system, the angles 54 and 55, and also the form of the bulge of the electrode 3 are suitably selected—may be connected with the negative pole of the anode potential source.

If the spacing between the single elements and also the total length of the tube are selected according to other aspects it is possible without difficulty to obtain the requisite sharp reproduction, if there is imparted to the element 9, and if desired also to the element 4, a suitable bias. The extent of the requisite bias depends solely on the dimensions of the system, and may be determined by experiment without difficulty in each single case.

The anode plate 15 is connected on the one hand with the oscillation point 56 of the oscillatory circuit 22, and on the other hand through the medium of the condenser 48 with the deflecting plate 13. Between the control plate 13 and the element 9 there is situated the control quartz 47. To the element 9 there is supplied a suitable bias from the battery 57 through the medium of the potentiometer 24. The anode potential is supplied to the anode plates by the battery 57 through the medium of the choke 58. Upon the production of high-frequency oscillations the resistances 50 and 51 may be replaced by the chokes 59 and 60 as shown in Fig. 15, which for the rest is identical with Fig. 14.

It is desirable to make the spacing between the elements 3 and 4 as small as possible (for example 1 mm. or less). It is also desirable to make the spacing between the deflecting plates 12 and 13 and the anode plates on the one hand and the end plate 8 of the electron-optical system on the other hand not too small (for example not less than 5–10 mm.).

With an anode potential of approximately 200 volts the resistances 50, 51 and 24 may be selected at approximately 10^6 ohms, the condensers 29, 30 and 31 each at 1 mf., and the coupling condenser 7 at less than 50–100 cm.

The arrangement according to the invention permits with the most simple means of the production of absolutely frequency-constant oscillations.

A further embodiment of the reproducing system 6 is shown in Fig. 2*a*. In this figure 7 and 8 are two outer plates of the system, while 9 is the middle plate. All of the three plates are provided with slots 61 of preferably equal size and shape. The middle plate 9 is provided on its one side with the lugs 10 and 11 and which are arranged in vertical to the plate 9, the distance between these lugs being considerably greater than the width of the slot 61, for example twice as great as this width. The distance between the plates 7 and 9 should be made very small. Equally the distance between the lugs 10 and 11 on the one hand and the plate 8 on the other hand should be small, for example equal to 1 mm. The width of each of the lugs should not be smaller than, and preferably should be equal to the distance between the lugs.

I claim:

1. An electron discharge device comprising an evacuated envelope enclosing a cathode having a long emissive surface of small width, two anodes insulated from each other, each of said anodes having one bounding edge, said bounding edge of each anode being parallel to the corresponding bounding edge of the other anode and being inclined with respect to the longer edge of said emissive surface, means for forming the electrons produced by said cathode into a flat band having its smallest cross-section in the plane of said anode, means for deflecting said flat band for varying the parts of the band intercepted by each of said anodes, said deflecting means including at least two deflecting plates, and means for connecting each of said anodes to the same potential source, said connecting means including two resistances of the same size.

2. An electron discharge device comprising an evacuated envelope enclosing a cathode having a long emissive surface of small width, two anodes insulated from each other, each of said anodes having one bounding edge, said bounding edge of each anode being parallel to the corresponding bounding edge of the other anode and being inclined with respect to the longer edge of said emissive surface, means for forming the electrons produced by said cathode into a flat band having a very small cross-section in the plane of said anodes, means for deflecting said flat band for varying the parts of the band intercepted by each of said anodes, said deflecting means including at least two deflecting plates, and means for con-

necting at least one of said anodes with at least one of said deflecting plates.

3. An electron discharge device as claimed in claim 2, characterised in that the connecting means between the anode and the deflecting plates include a condenser.

4. An arrangement comprising an electron discharge device comprising an evacuated envelope enclosing a cathode having a long emissive surface of small width, two anodes insulated from each other, each of said anodes having one bounding edge, said bounding edge of each anode being parallel to the corresponding bounding edge of the other anode and being inclined with respect to the longer edge of said emissive surface, means for forming the electrons produced by said cathode into a flat band having its smallest cross-section in the plane of said anodes, means for deflecting said flat band for varying the parts of the band intercepted by each of said anodes, said deflecting means including at least two deflecting plates; a potential source; means for connecting each of said anodes with said potential source; an oscillatory circuit; means for connecting at least one of said anodes with one point of said circuit; and means for connecting at least one of said anodes with the reverse deflecting plate.

5. An arrangement comprising in combination an electron discharge device comprising an evacuated envelope enclosing a cathode having a long emissive surface of small width, two anodes insulated from each other, at least one of said anodes having a bounding edge inclined with respect to the longer edge of said emissive surface, means for forming the electrons produced by said cathode into a flat band having a small cross-section in the plane of said anode having said inclined bounding edge, means for deflecting said flat band for varying the parts of the band intercepted by each of said anodes, said deflecting means including at least two deflecting plates; a potential source; means for connecting each of said anodes with said potential source; an oscillatory circuit; means for connecting each of said anodes with one opposite point of said circuit; a control crystal arrangement comprising two electrodes and a crystal arranged between said electrodes; means for connecting each of said electrodes with one of said deflecting plates; and means for connecting each of said anodes with the reverse deflecting plate, said connecting means including very small coupling condensers.

KURT SCHLESINGER.