

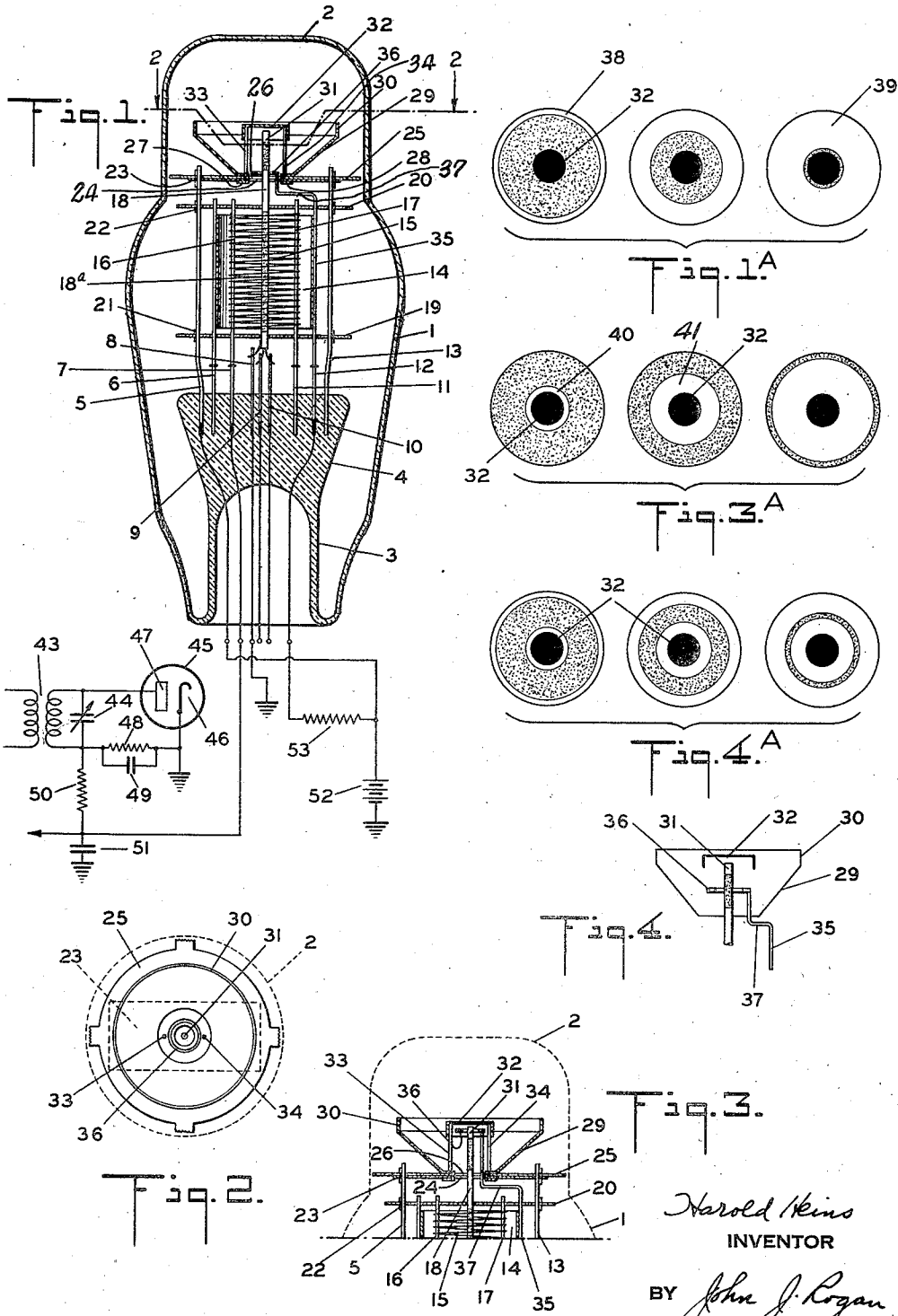
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TUNING INDICATOR DEVICE

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TUNING INDICATOR DEVICE

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9 Claims. (Cl. 250—27.5)

This invention relates to wave signalling systems and more particularly to a device for visually indicating the condition of tuning of a part or parts of such systems.

5 The invention is in the nature of an improvement on the type of tuning indicator device disclosed in application, Serial No. 99,755, filed September 8, 1936. There is disclosed in said application a tuning indicator tube of the glowing or fluorescent target type wherein the visual indication of the condition of tuning of an associated circuit is produced in the form of a luminous sector of variable angular extent. Accordingly one of the principal objects of this invention is to provide a tuning indicator tube of the luminous target type wherein the luminous area is in the form of an annular band of variable width. As a result of this it is possible to utilize substantially the entire area, or at least the greater part, of the target for tuning purposes.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following detailed descriptions and the appended claims. While certain specific embodiments of the invention will be disclosed herein it will be understood that this is done merely for explanatory purposes and not by way of limitation. Therefore in the drawing, which represents certain preferred embodiments,

Fig. 1 is an elevational view, partly in section, of a radio tube having a tuning indicator unit according to the invention together with a typical circuit in which the tube is connected.

Fig. 2 is a sectional plan view of Fig. 1 taken along the line 2—2.

Fig. 1a illustrates the luminous condition of the tuning indicator target of Fig. 1 with three different values of control electrode voltage.

Fig. 3 illustrates a modification of the tube of Fig. 1.

Fig. 3a illustrates the luminous conditions of the target of Fig. 3 for three different values of control electrode voltage.

Fig. 4 illustrates a further modification of the tube of Fig. 1.

Fig. 4a illustrates the luminous conditions of the target of Fig. 4 corresponding to three different values of control electrode voltage.

Referring to Fig. 1 there is shown a tube or enclosing envelope 1 having at least its upper end or dome 2 of glass, it being understood that, if desired, the remainder of the tube envelope may be of metal as is well-known in the radio tube art. Sealed into the tube 1 is a base or stem 3

into and through which are sealed the various lead-in and support wires 5 to 13 inclusive. It will be understood of course that while the drawing shows a tube employing a triode mount of the indirectly heated cathode type, that any other well-known type of radio tube mount may be employed. Supported on the wires 6 and 12 is the tubular plate or anode 14 which surrounds a fine wire grid 15 the latter being supported by means of its side rods 16, 17 on the wires 7, 11, 10. Supported centrally of the grid and plate is a cylindrical or other well-known form of indirectly heated cathode comprising a tubular metal sleeve 18 on the interior of which is positioned an insulated heater wire having its ends connected to the wires, 9, 10. The metal cathode sleeve 18 is connected to the lead-in wire 8 and is provided with the usual electron emissive coating as indicated. In accordance with the usual practice a pair of insulator members or spacers 19, 20 in the form of mica or ceramic discs are provided to maintain the spacing of the various electrodes. These discs are provided with perforations through which pass the various side rods for the electrodes as well as the supports 5 and 13 and are held in place on the latter supports by eyelets or tabs 21, 22 or the like.

The supports 5 and 13 extend upwardly beyond the disc 20 and carry a metal strip or disc 23 having an enlarged central opening 24 through which passes centrally thereof the cathode sleeve 18. Preferably, a mica disc 25 is also attached to the supports 5 and 13 said disc having radial extensions to engage the wall of the dome 2 so as to steady the mount, it being understood that the disc 25 has an opening 26 similar to the opening 24. Supported on the discs 23 and 25 for example by the depending lugs 27, 28 is a cup-shaped metal member 29 having its bottom wall provided with an opening corresponding to the openings 24 and 26. Preferably, although not necessarily, the member 29 is provided with a circumferential flange 30 and the entire inner face of member 29 is provided with a coating of a suitable material or materials which fluoresce when bombarded by electrons. These bombarding electrons are emitted from the electron emissive coating 31 which is provided near the upper end of the cathode sleeve 18.

As is well-known, when the cathode is raised to emitting temperature, it is luminous, and in order to blank off the light from the cathode there is provided a shield 32 in the form of a circular metal cap which may be supported on the wires 33, 34 welded or otherwise fastened to the

bottom of the member 29. In order to control the shape of the electron stream from the coating 31 reaching the member 29, there is provided an annular electrode 35 which is supported concentrically around the cathode sleeve by means of an offset wire 37 welded to the plate side rod 35. Preferably the electrode 35 is of annular disc form and may be mounted adjacent the lower end of the cup-shaped member 29. If desired electrode 35 may be in the form of a circle of wire. With this arrangement, as the electrode 35 varies in potential with respect to the coating 31 the luminescent area of the target 29 varies from an annulus of minimum width, as illustrated by the numeral 38 (Fig. 1a) to an annulus of a different width as illustrated by the numeral 39 (Fig. 1a). It will be understood of course that the relative potentials of the electrodes 18, 29 and 35 may be so chosen that the luminescent area 39 may extend over the entire inner face of member 29. Fig. 1a shows the luminous condition of the target for three different magnitudes of voltage on the control electrode 35. The left-hand part of this figure represents the condition with a potential of the order of 250 volts on the target, and substantially zero voltage on the control electrode. It will be seen that the luminous annulus is confined to the marginal peripheral portion of the target. The center part of this figure represents the condition with the same voltage on the target and approximately 60 volts on the control electrode. It will be seen that the luminous area of the target is still in the form of an annulus but is wider. The right-hand part of Fig. 1a represents the condition with the same voltage of 250 volts on the target and approximately 150 volts on the control electrode. It will be seen that the luminous area extends over substantially the entire visible area of the target. One explanation of this action is that the more negative the control electrode is with respect to the target, the more the electrons from the coating 31 are deflected away from the control electrode and consequently the more the fluorescent pattern is forced away from the "shadow" of the control electrode projected from the cathode radially on the target.

Preferably however the potentials used with the arrangement of Fig. 1 are so chosen that the luminescent area of the target varies from 38 of Fig. 1a to 39 of Fig. 1a. In other words, the central portion of the target appears dark at all times by reason of the light shield 32, and the luminous area is an expandible annulus.

In certain cases, it may be desired to reverse the relative positions of the dark and luminescent areas of the target for the same voltage conditions as those mentioned in connection with Fig. 1a. I have found that this result may be accomplished by disposing the circular electrode 35 so that it is located substantially at the upper end of coating 31. Such an arrangement is shown in Fig. 3 wherein the parts are the same as the correspondingly numbered parts of Fig. 1 but the electrode 35 is positioned adjacent the upper end of coating 31. The luminous condition of the target with the control electrode in the position of Fig. 3 and with the same relative voltages on the target and control electrode as those described in connection with Fig. 1a, are illustrated in Fig. 3a. The left-hand view with a target voltage of 250 volts and the control electrode at zero volts shows the luminous area 40 in the form of a very narrow annulus adjacent

the periphery of the shield 32. The center view with 250 volts on the target and approximately 60 volts on the control electrode shows the luminous area 41 of wider annular width. The right-hand view of Fig. 3a with 250 volts on the target and approximately 150 volts on the control electrode shows the luminous area extending almost to the periphery of the target. In other words, with the arrangement of Figs. 1 and 1a, the luminous area expands radially outwardly of the target for correspondingly increased potential differences between the target and control electrode, while with the arrangement of Figs. 3 and 3a, the luminous area contracts radially inwardly of the target for the same potential relations.

If desired the control electrode may be positioned at any other plane along the length of the coating 31. Thus in Fig. 4 it is shown located substantially midway of the length of the coating. Fig. 4a shows the distribution of the luminous area of the target for the same voltage relations as those described in connection with Figs. 1a and 3a. In the arrangement of Fig. 4a the luminous annulus never expands to the entire outer periphery of the target and never collapses to the periphery of the shield.

While any well-known circuit arrangement may be utilized for impressing the proper voltages on the electrodes 29 and 35, a typical arrangement is illustrated in connection with Fig. 1. In this circuit, the triode unit comprising the cathode 18a, control grid 15 and plate 14 acts as a D. C. amplifier of a suitable D. C. voltage proportionate to the accuracy of tuning. Thus this voltage may be developed by an automatic volume control device or by a suitable detector. The conductor designated 42 in Fig. 1 represents schematically a connection to provide a suitable source of A. V. C. potential. The numeral 43 represents a radio frequency or intermediate frequency coupling transformer which is energized under control of the waves to be tuned-in. The secondary of this transformer may be provided with a tuning condenser 44 or the like. The currents in the secondary of the transformer are rectified in any well-known manner for example by the electron tube rectifier or diode 45 having an electron emitting cathode 46 and an anode 47 suitably biased as for example by the resistor 48 and parallel condenser 49. The rectified voltage across resistor 48 is impressed through resistor 50 on the control grid 15, and preferably a by-pass condenser 51 is connected between grid 15 and cathode 18. The source of steady potential 52 is connected in series with the triode load resistor 53 between the plate 14 and cathode 18. The plate current of the triode flowing through resistor 53 correspondingly varies the potential difference between the target 29 and control electrode 35 which is directly connected to plate 15. Since the plate current of the triode will vary in accordance with the voltage developed across the tuned circuit 43, 44 and therefore in accordance with the accuracy of tuning of the system to a received carrier wave, the luminous condition of target 29 will give a visual indication of the tuning. Likewise since the potential of the control electrode 35 is a function of the A. V. C. voltage it is possible to control the sensitivity of the tuning indicator in accordance with the field strength of the signal being received as described in detail in application Serial No. 99,755, filed September 8, 1936.

While certain specific embodiments and circuit connections have been disclosed herein, it will

be understood that various changes and modifications may be made without departing from the spirit and scope of the invention.

What I claim is:

- 5 1. A tuning indicator device for radio sets and the like comprising a dish-shaped target having a fluorescent coating on its inner surface, a central electron-emitter for rendering said target fluorescent, and means including the said emitter, said target and an annular electrode surrounding
10 the emitter to produce a fluorescent annulus of expansible width on said target.
2. A tuning indicator device according to claim 1 in which said annular electrode is mounted
15 adjacent the reduced end of the target.
3. A tuning indicator device according to claim 1 in which the annular electrode is mounted between the open ends of the target.
4. A tuning indicator device according to claim
20 1 in which the annular electrode is mounted substantially mid-way of the height of the target.
5. A tuning indicator device of the type having an expansible annular fluorescent glow and
25 comprising a circular dish-shaped fluorescent target, an electron-emitting cathode passing centrally through said target but insulated therefrom, and an annular electrode concentrically surrounding said cathode but insulated therefrom
30 for varying the width of the fluorescent annulus on said target.
6. An electron discharge device having an envelope, a cathode within said envelope for emitting electrons, a cup shaped anode surrounding
35 said cathode and having its interior surface coated with a fluorescent material for receiving electrons from said cathode to produce a luminous annular shaped pattern on said anode, a control electrode comprising a ring positioned
40 between said anode and said cathode and surrounding the cathode for determining the area of the fluorescent surface of the anode reached by the electrons from said cathode.
7. An electron discharge device having an
45 envelope, a cathode within said envelope for emitting electrons, a cup-shaped anode surround-

ing said cathode and having its interior surface coated with a fluorescent material for receiving electrons from said cathode to produce a ring-like pattern of light, a ring-like control electrode
5 between said cathode and said anode and surrounding the cathode, said ring-like control electrode being positioned adjacent the bottom of said cup-shaped member to control the electrons from said cathode to the coated surface of said
10 anode to vary the width of the ring-like pattern of light on the coated surface of the anode.

8. An electron discharge device having an envelope, a cathode within said envelope and having a coated portion for emitting electrons, a
15 cup-shaped anode surrounding the emitting portion of said cathode and having its interior surface coated with a fluorescent material for receiving electrons from said cathode to produce a luminous annular-shaped pattern on the anode, a
20 ring-like control electrode between said cathode and anode and surrounding the cathode, said ring-like control electrode being positioned near one end of the emitting portion of the cathode and adjacent the bottom of said cup-shaped
25 member to control the electrons from said cathode to the coated surface of said anode to vary the width of the annular-shaped pattern of light on the coated surface of the anode.

9. An electron discharge device having an envelope, a straight thermionic cathode within said
30 envelope for emitting electrons, a cup-shaped anode having sloping sides surrounding said cathode and having the interior surface of the sloping sides coated with fluorescent material for receiving electrons from said cathode to
35 produce a ring-like pattern of light, a flat ring-like control electrode between said cathode and anode and surrounding said cathode, said ring-like control electrode being positioned adjacent the bottom of said cup-shaped member to
40 control the electrons from said cathode to the coated surface of the sloping sides of said anode to vary the width of the ring-like pattern of light on the coated surface of the anode.

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