Sept. 3, 1957 F. H. BITTER ET AL 2,805,352

CATHODE-RAY TUBE FOR TUNING INDICATION

Filed Jan. 6, 1953

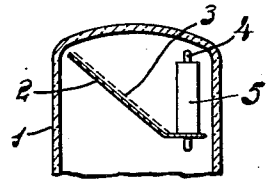

Fig. 1

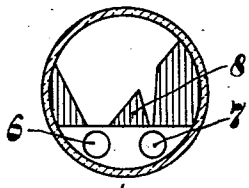

Fig. 2

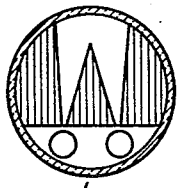

Fig. 3

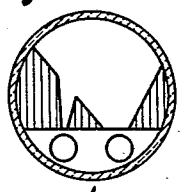

Fig. 4

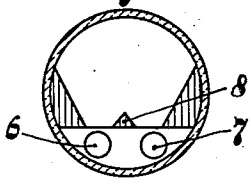

Fig. 5

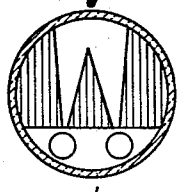

Fig. 6

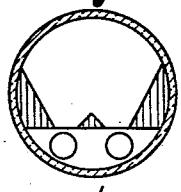

Fig. 7

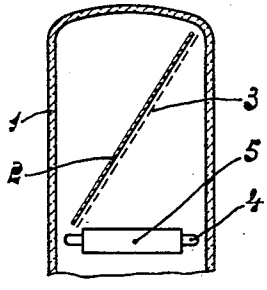

Fig. 8

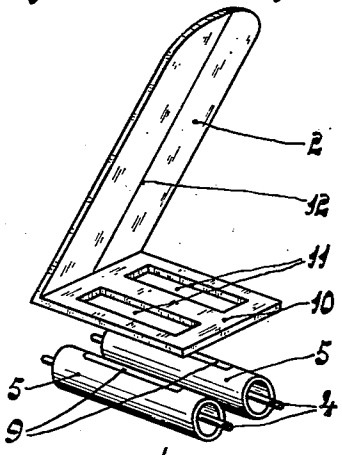

Fig. 9

INVENTORS
Franz Herman Bitter
Karl August Bisterfeld

BY

AGENT

United States Patent Office 2,805,352 Patented Sept. 3, 1957

2,805,352

CATHODE-RAY TUBE FOR TUNING INDICATION

Franz Hermann Bitter, Sao Paolo, Brazil, and Karl August Bisterfeld, Hamburg-Volksdorf, Germany, assignors, by mesne assignments, to North American Philips Company, Inc., New York, N. Y., a corporation of Delaware

Application January 6, 1953, Serial No. 329,862

Claims priority, application Germany February 8, 1952

5 Claims. (Cl. 313—107.5)

This invention relates to a cathode-ray indicator tube for the visible tuning of receivers for frequency-modulated or amplitude-modulated waves, more particularly radio-receivers.

For the indication of tuning of frequency-modulated waves it is known to cause cathode-ray beams emanating from two separate cathodes to strike from both sides a luminescent screen centrally kinked in the form of a roof, in such manner as to produce two luminescent triangles having points extending into the cathodes and overlapping base lines of different length, which length may be influenced by means for the control of indication, for example control rods, the tuning indication being effected in such manner until base lines are of equal length.

On the other hand, the invention relates to a cathode-ray indicator tube suitable for the indication of both frequency-modulated and amplitude-modulated waves, and it is characterized in that a plurality of cathode-ray beams, for example two, strike a luminescent screen with their axes inclined relatively to one another, producing on the screen sharply-defined luminescent areas corresponding to the cross-sections of the beams and figuratively penetrating one another, which beams can be controlled independently of one another in regard to the luminescent figures produced.

The invention may be carried out in such manner that the cathode-ray sources used are elongated cathodes located in parallel in one plane, each of which being surrounded by a control-electrode, preferably a metallic cylinder comprising a longitudinal slot, which is opposed by a fluorescent surface which is at an angle with the cathode surface, it being possible for the control electrodes to be used also as diode paths for the demodulation.

An advantageous embodiment of the invention consists in the fluorescent surface carrying a mark indicating correct tuning and being, for example, centrally kinked, slotted or provided with a streak. If desired, the two halves of the luminescent screen located at the right and at the left of the middle may alternatively be coated with fluorescent masses of different colours.

A tuning indicator tube according to the invention may alternatively be constructed in such manner that one, or with each cathode one accelerating anode, approximately in the form of a slotted plate, is provided, in addition, parallel to or at a suitable angle with the cathodes in order to support the action exerted upon the electrons by the positive potential of the luminescent screen, which anode permits, if desired, an additional use of the single system as a triode or, if the luminescent screen consists of two parts, as a tetrode.

In order that the invention may be readily carried into effect, it will now be described with reference to the accompanying drawing showing diagrammatically, by way of example, some embodiments thereof.

Fig. 1 is a sectional view of the upper portion of a tuning indicator tube according to the invention.

Figs. 2 to 4 are indicator images of the tuning indicator tube with waves modulated in frequency.

Fig. 5 to 7 show the same indicator images with waves modulated in amplitude.

Fig. 8 shows a modification of a tuning indicator tube according to the invention and

Fig. 9 is a perspective view of a further embodiment of the indicator system.

In Fig. 1, a glass bulb 1 of a tuning indicator tube contains an inclined luminescent screen 2, the upper side of which carries a fluorescent layer 3. At the right-hand side in the tube two vertical cathodes 4 are provided, of which in the arrangement shown, one is completely covered by the other, so that one only is visible. Each cathode 4 is surrounded by a metallic cylinder 5 as a control member, which is vertically slotted on the side facing the luminescent screen to allow the electrons to leave the interior. A wedge-shaped electron beam thus ensues, which strikes the luminescent screen, producing thereon a luminescent figure which is likewise wedge-shaped. The width of the wedge and hence the width of the luminescent figure are dependent upon the potential applied to the cylinder 5. The two slots of the control electrodes 5 are provided in such manner that the two luminescent figures produced on the fluorescent screen by the wedge-shaped cathode-ray beams figuratively penetrate one another, i. e., overlap, as may be seen from the indicator images shown in Figs. 2 to 7. The resultant wedge shape is wide, if the control cylinder exhibits cathode potential or is more positive, and it becomes more and more narrow with increasing negative bias of the cylinder.

For the indication of tuning with frequency-modulated waves the two control cylinders are each connected to one of the two circuits coupled with the demodulator. Due to the voltages set up at the circuits, the control cylinders, after rectification of these voltages, acquire different biasing potentials, so that the two luminescent figures exhibit wedges of different widths. Consequently, in case of tuning to a side-band, an indicator image, for example, as shown in Fig. 2 is obtained, in the lower part of which the two electrode systems are indicated by two cylinders 6, 7. The control cylinder 6 here obviously has a potential which differs only slightly from the cathode potential and the control cylinder 7 has a comparatively high negative bias. In case of tuning to the centre of the band, the potential of the control cylinder 6 becomes more negative and that of the control cylinder 7 more positive, and with correct tuning whereby the two voltages become the same, an indicator image approximately as shown in Fig. 3 is obtained. When the tuning means are rotated further, there is tuned to the other side-band and an indication approximately as shown in Fig. 4 is obtained. Evidently, the shadow triangle 8 which is located between the two luminescent wedges may be used as an index which points vertically upwards with correct tuning. For a clear indicator image it is advantageous to provide on the luminescent screen a mark indicating the correct position of the shadow triangle 8. The luminescent screen may, for example, be centrally kinked, slotted, or provided with a streak. The mark may also consist in that the two halves of the luminescent screen located at the right and at the left of the middle are coated with fluorescent masses of different colours. Such a tuning indicator tube may be connected to any arbitrary demodulator, but may alternatively operate itself as a demodulator with suitable circuiting.

For the indication of tuning with amplitude-modulated waves one may proceed in such manner that the two control-cylinders 5 are each connected in a suitable manner to a bandpass filter circuit. In this case the indication obtained with amplitude-modulated waves is similar to that described hereinbefore for frequency-modulated waves and shown in Figs. 2 to 4. Such a circuit affords the advantage of a very high sensivity of indication.

A further possibility of tuning indication of amplitude-modulated waves consists in connecting both control cylinders 5 to the control voltage of the receiver. In this case an indication of tuning is obtained as shown in Figs. 5 to 7. Both control cylinders then have the same potential and the two luminescent wedges are hence always identical. A shadow triangle thus ensues, which has its maximum height upon tuning to the carrier wave and which becomes smaller upon change to one side-band or the other. Tuning is thus required to be effected to the maximum height of the shadow triangle.

A further embodiment of the tuning indicator tube according to the invention is shown in Fig. 8. As in Fig. 1, Fig. 8 is a view at right angles to the tube, that is to say as viewed from the right. The component parts of the tube are provided with the same reference numerals as in Fig. 1, and it may be seen that the arrangement of the cathodes 4, the control cylinders 5 and the luminescent screen 2 substantially corresponds to that shown in Fig. 1, except that the whole arrangement is rotated by 90° relatively to the axis of the tube. This arrangement affords the advantage that the surface of the luminescent screen 2 may make a considerably larger angle with the plane passing through the cathodes 4. An indicator image is thus obtained, which is larger and more clearly visible.

Furthermore, an accelerating anode may be provided parallel to the cathodes or at a suitable angle therewith. The accelerating anode may approximately have the shape of a slotted metallic plate and be connected to the anode of the luminescent screen. It serves to support the action exerted upon the electrons by the positive potential of the luminescent screen. Such a system is shown in perspective in Fig. 9. Here control cylinders 5 with longitudinal slots 9 are provided above the rod-shaped parallel cathodes 4. An accelerating anode plate 10 is provided parallel to the plane assumed to pass through the cathodes 4, which plate 10 is provided with two slots for the passage of the electrons and is connected to the luminescent screen 2. The latter is centrally provided with a mark 12 in the form of a streak extending in the length thereof.

The luminescent screen shown in Fig. 9 may alternatively be separated from the accelerating anode 10, so that voltages of different values may be applied to them. In this case it is possible for the single systems, each of which comprises the cathode 4, the control cylinder 5 and the accelerating anode 10, to be used as a triode system, if the accelerating anode 10, contrary to Fig. 9, is separated in the longitudinal direction and hence made in two parts. The systems may alternatively be used as a tetrode if, furthermore, the luminescent screen is made in two parts.

What we claim is:

1. A cathode-ray indicator tube for tuning frequency- and amplitude-modulated receivers, comprising a substantially flat plate having a luminescent screen on one surface thereof, means located on the side of said plate facing said screen for producing a pair of separate electron beams whose axes are inclined toward each other and which impact a common portion of the luminescent screen, whereby the images produced thereby on the screen overlap, and means associated with said beam producing means for independently controlling each of the electron beams.

2. A cathode-ray indicator tube for tuning frequency- and amplitude-modulated radio receivers, comprising a pair of adjacent elongated cathodes lying in substantially the same plane and having parallel longitudinal axes extending in said plane, a substantially flat plate having a luminescent screen on one surface thereof facing both of said cathodes, said plate being inclined with respect to said plane of said cathodes, and a pair of longitudinally slotted metallic cylinders each surrounding one of said cathodes, said combined cathodes and cylinders producing a pair of separate electron beams which impact a common portion of the luminescent screen and thereby produce wedge-shaped images on the screen which overlap, said metallic cylinders being insulated apart from each other whereby different potentials may be applied thereto.

3. A cathode-ray indicator tube as claimed in claim 2 in which the fluorescent screen is provided with an indicating mark to indicate when the receiver is properly tuned.

4. A cathode-ray indicator tube for tuning frequency- and amplitude-modulated radio receivers, comprising a pair of parallel adjacent elongated cathodes having longitudinal axes lying in the same plane, a substantially flat luminescent screen facing both of said cathodes and having one end closer to the cathodes than the other end, a concentric longitudinally-slotted metallic cylinder surrounding each of said cathodes, said cathodes and cylinders producing a pair of separate electron beams which are inclined toward each other and which impart a common portion of the luminescent screen to produce overlapped images on the luminescent screen, and a slotted-plate accelerating anode associated with each of said cathodes and being disposed between said screen and said cylinders, said metallic cylinders of said cathodes being insulated from one another, whereby they may be separately excited.

5. A cathode-ray indicator tube for tuning frequency- and amplitude-modulated receivers, comprising a screen having a luminescent surface thereon, first means located on one side of said screen and facing said luminescent surface for producing a first electron beam impacting on a given area of said luminescent surface, second means spaced from said first means and located on the same side of said screen as said first means and also facing said luminescent surface for producing a second electron beam impacting on another area of said luminescent surface including a portion of said given area impacted by said first beam, thereby producing overlapped impacted areas on the screen, first beam control means associated with said first beam producing means, and second beam control means associated with said second beam producing means, said first and second beam control means being separately controllable.

References Cited in the file of this patent

UNITED STATES PATENTS

2,051,188	Thompson	Aug. 18, 1936
2,105,818	Parker	Jan. 18, 1938
2,243,408	Anderson et al.	May 27, 1941
2,394,857	Hultquist	Feb. 12, 1946
2,594,025	Jacobi et al.	Apr. 22, 1952