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 [33] **Germany**
 [31] **P 18 06 303.1**

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FOREIGN PATENTS

1,398,688 3/1965 France 346/108

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Attorney—Burgess, Dinklage and Sprung

[54] **OSCILLOGRAPH WITH ELECTRON BEAM
 TUNING INDICATOR TUBE**
 10 Claims, 9 Drawing Figs.

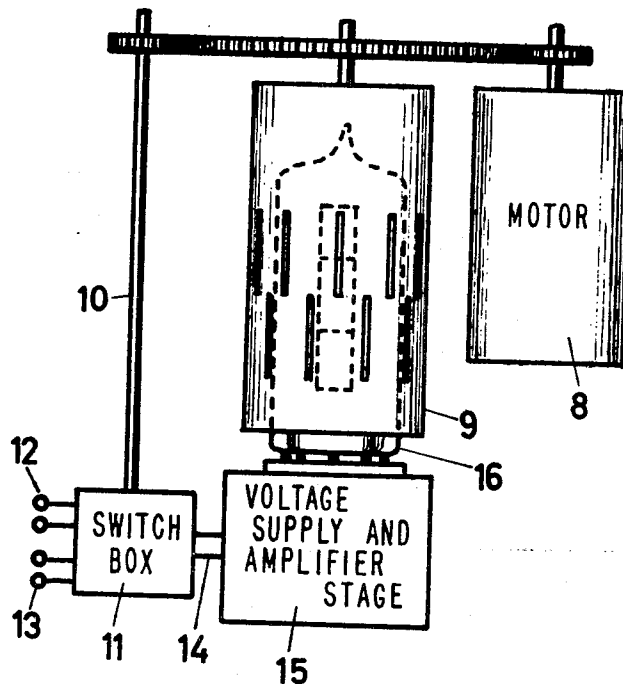
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 324/121

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 G01r 13/36

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 113, 90, 121; 346/107, 108; 350/275; 250/233

[56] **References Cited**
UNITED STATES PATENTS
 1,877,566 9/1932 Elsey et al..... 250/233 X

ABSTRACT: In an oscillograph having a magic-band type electric beam tuning indicator tube and mechanically driven dissecting means passing thereover adapted to change the length of the displayed light band of the indicator tube as a function of time, the dissecting means comprises a slotted member having equally spaced slots extending in the direction of change in length of the light band, the slots being narrow relative to the width of the light bands, and the slotted member being adapted to cause the slots to sweep across said width. The slotted member is preferably a hollow slotted cylinder of a size to fit over and rotate about the indicator tube, and the spacing between the slots is preferably at least equal to the width of the light band.



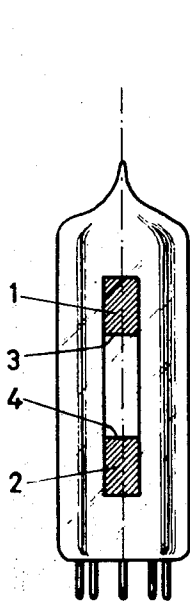


Fig. 1

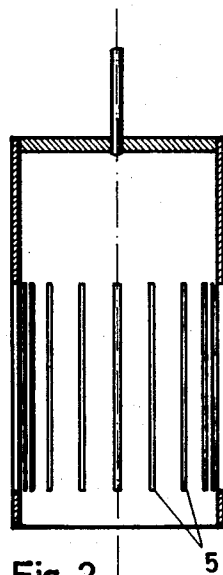


Fig. 2

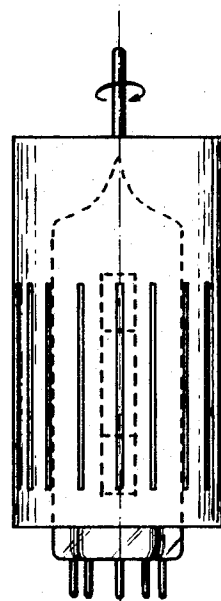


Fig. 3

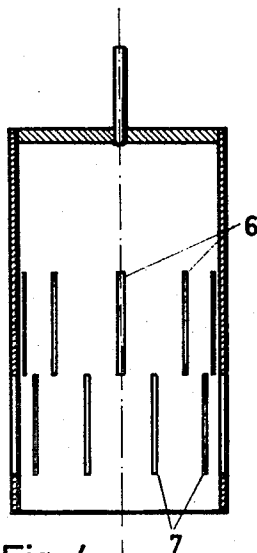


Fig. 4

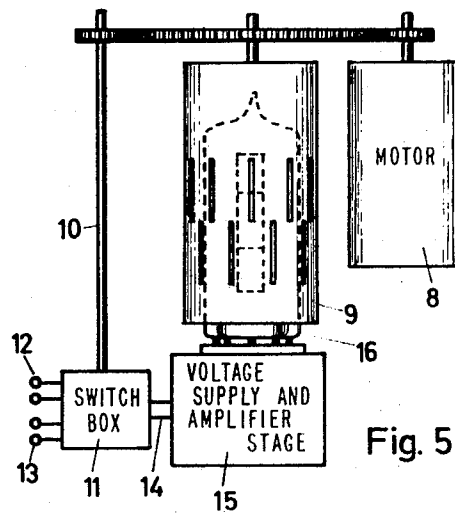
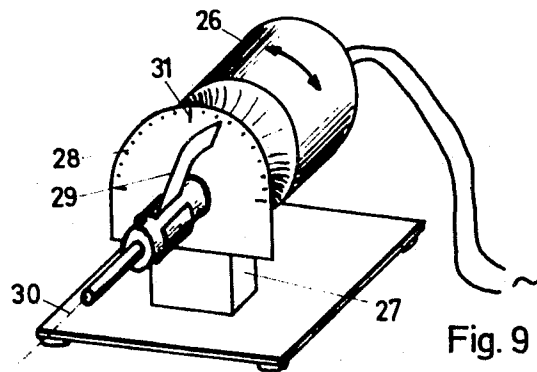
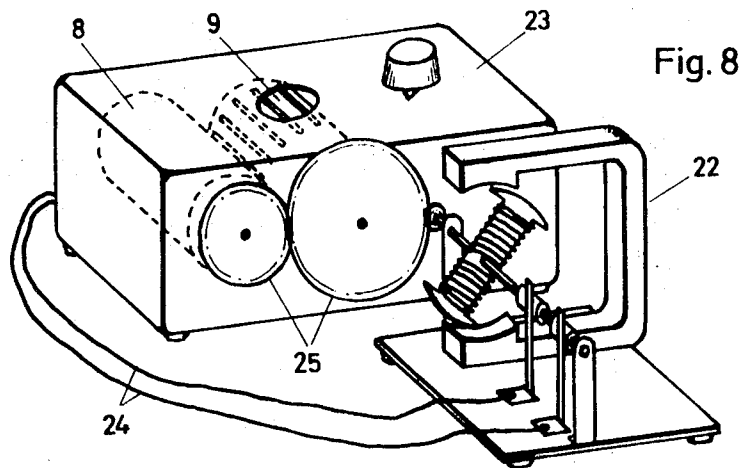
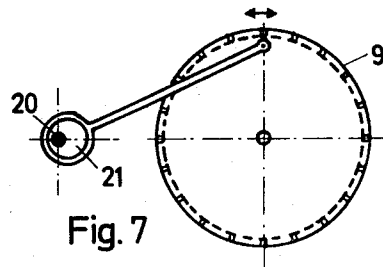
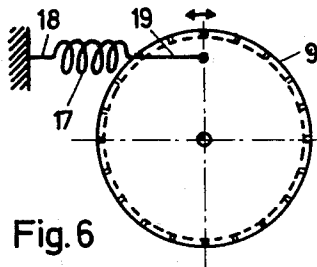


Fig. 5



OSCILLOGRAPH WITH ELECTRON BEAM TUNING INDICATOR TUBE

PRIOR ART

Of the known types of oscillographs, electron-beam oscillographs including cathode-ray tubes find most frequent application. Such electron-beam oscillographs have been highly developed and they meet many requirements, but they are quite expensive.

In the electron-beam oscillographs, the so-called sweep for the generation of a two-dimensional image is produced by electronic means. Oscillographs are known in which the sweep is produced by mechanical dissecting means in place of the cathode-ray tube to reduce the cost of the oscillograph.

In one type of mechanical oscillograph, the polar glow light oscillograph (described in the German periodical "Radio-Magazin," 1951, Vol. 9, pages 289-291), which is inexpensive to manufacture, a polygon mirror conventionally used in glow light oscillographs has been done away with so that the manufacturing costs are low. However, as compared with other oscillographs, this oscillograph has some disadvantages: it produces polar diagrams only, which are difficult to interpret, and the control of the glow tube requires a relatively high voltage.

It has also been proposed (German Pat. No. 1,282,176) to combine the known rotary mirror with a magic band generally referred to as electron-beam tuning indicator tube. The magic band, in this instance, serves as a means to indicate the voltage to be illustrated oscillographically. This oscillograph has the advantage that operation of its electron-beam tuning indicator tube requires only a low voltage. However, this oscillograph has disadvantages insofar as the registered oscillogram provided by the proposed cheap two-sided mirror is discontinuous with respect to time, for there are mirror positions in which the observer will not see any mirror image. This fact results in a reduction in brightness of the oscillogram. A further disadvantage of this oscillograph is that the mirror image produced by the rotary mirror does not lie in one plane but has a strong curvature.

Arrangements including moving slots for introducing a time function in the displayed light are known. For example, German Pat. No. 364,206 discloses an arrangement, which allows stroboscopic observation of the movement of the light beams by means of a slotted member having equally spaced slots extending in the direction of oscillation and being moved transversely thereof. U.S. Pat. No. 2,532,731 discloses an oscillograph operating with coverage modulation, in which the light source producing a light band is arranged in the interior of a cylindrical rotary slotted member having a spirally extending slot. The combined use of a magic-band type electron-beam tuning indicator tube and a driven slotted member having equally spaced slots has not as yet been proposed.

THIS INVENTION

It is the object of the present invention to provide an inexpensive oscillograph, particularly suitable for use as a students' training instrument and which, due to its simple structure, is also suitable for use as a training toy, while avoiding the disadvantages of an oscillograph working with a two-sided rotary mirror.

While based on an oscillograph having a magic-band type electron-beam tuning indicator tube and mechanically dissecting means for showing changes in length of the light band of the tube as a function of time, this object is attained according to the invention by use of a slotted member having equally spaced slots extending in the direction of change in length of the light band, the slots being narrow relative to the width of the light band and the slotted member being adapted to cause the slots to sweep across the width of the light band.

The slotted member proposed by the invention can, for example, be a flat disc or a hollow cylinder. Generally, a hollow cylinder is preferred since, contrary to a flat disc, a cylinder can be provided with parallel slots.

THE DRAWINGS

FIG. 1 is a side elevation of an electron-beam tuning indicator tube used in the oscillograph of this invention;

FIG. 2 is an axial section through a hollow cylinder serving as a slotted member and constituting one embodiment of the dissecting means of the oscillograph;

FIG. 3 is a side elevation of the hollow cylinder according to FIG. 2, which accommodates a tube according to FIG. 1;

FIG. 4 is an axial section through another type of hollow slotted cylinder;

FIG. 5 is a schematic diagram of a device for the separate registration of two different voltages;

FIGS. 6 and 7 show two embodiments of means providing torsional vibration of the slotted member;

FIG. 8 is a perspective view of an embodiment of an oscillograph which is combined with a generator model; and

FIG. 9 is a perspective view of a driving synchronous motor combined with indicating means for showing phase-shifts between different applied voltages.

The basic principle of the proposed arrangement can be seen from FIGS. 1, 2 and 3. FIG. 1 shows a magic-band type electron-beam tuning indicator tube. The light band of this tube consists of two sections 1 and 2. Numerals 3 and 4 designate the two inner light band edges, the position of which is variable. FIG. 2 shows a section through a hollow cylinder including a plurality of parallel slots 5, which have a width much smaller than that of the light band. FIG. 3 illustrates the relative disposition of the electron-beam tuning indicator tube and the hollow cylinder in the oscillograph. The spacing of the slots preferably is equal to the width of the light band of the tube. However, the spacing of the slots can be either larger or smaller than the width of the light band of the tube. If the spacing is larger, only a section of a cyclic process will be registered (so-called sweep magnification); if it is smaller, more than one cycle will be registered.

Assuming that alternating-current voltage is applied to the electron-beam tuning indicator tube and that the two reciprocating inner light band edges 3 and 4 are observed through the equally spaced slots, with the slots moving at a predetermined speed, the observer due to the lag of his eyes will see the course of the alternating voltage applied to the tube as a stationary oscillogram, i.e. the observer's eye will perceive the vertically reciprocating inner light band edges 3 and 4 in the form of curve trains.

Preferably a small modulation of the electron-beam tuning indicator tube should be used to keep the distortions of the oscillogram as small as possible. Since the oscillogram obtained in this case is very small, it is advisable to observe the latter through an optical magnifying arrangement. The curvature of the light layer on the inside of the tube bulb is small relative to the size of the image and does not result in any disturbing effect if the magnification is kept within reasonable limits.

The showing of an oscillogram will generally be made by use of the edge of one light band section only, since the oscillograms produced by the two light band edges 3 and 4 are symmetrical. One light band section should therefore preferably be obscured.

A slotted member of particular design can be used for the separate registration of the oscillograms of two different voltages. If an oscillograph of the proposed type includes a slotted member having two rows of slots 6 and 7 such as shown in FIG. 4, the edge 3 of the upper light band (FIG. 1) produces one oscillogram and the edge 4 of the lower light band produces the other oscillogram, if the two voltages to be illustrated are alternately applied to the electron-beam tuning indicator tube in properly timed relationship and if the slotted member is so arranged in the oscillograph that one row of slots 6 is aligned with the upper light band (section 1 in FIG. 1) and the other row of slots 7 is aligned with the lower light band (section 2 in FIG. 1) of the tube. The slots of the two rows are relatively staggered by half their spacing, and the spacing of adjacent slots of each row is twice as large as the width of the

light band of the tube. The changeover of the oscillograph input between the two voltages to be illustrated, which changeover is necessary to produce two oscillograms, can be achieved by mechanical or photoelectric means. In any event, the changeover must be in synchronism with the motion of the slots.

FIG. 5 shows an arrangement which provides separate registration of two oscillograms. In this Figure, numeral 8 designates a motor driving a slotted member 9. 10 indicates a shaft driven by the slotted member 9. The shaft 10 provides a changeover of the oscillograph input 14 between two input terminal pairs 12 and 13 within a switch box 11. Numeral 15 designates the voltage supply and amplifier stage for the electron-beam tuning indicator tube designated by numeral 16.

An auxiliary device can be mounted on the oscillograph to show Lissajous figures in the oscillogram. If such an auxiliary device provides such a movement of the slotted member that only one slot reciprocates in front of the light band of the tube, the obtained oscillogram will be a Lissajous figure, if a sinusoidal alternating-current voltage is applied to the oscillograph input. The reciprocating movement of one slot can, for example, be obtained by actuating a spring 17, the one end 18 of which is stationary and the other end 19 of which is secured to the slotted member 9 (FIG. 6). Another possibility of providing a reciprocatory movement of the slotted member 9 is given by a rotating shaft 20 coupled to an eccentric 21 (FIG. 7).

Advantageously, the oscillograph is completed by an arrangement which permits that various arrangements to be oscillographically tested are connected with their rotatable structural parts to the slotted member by means of a gear. This arrangement is to provide the possibility of mechanically coupling, for example, rotary switches, generator models, slotted discs or sector discs (the latter in combination with light sources and photoelectric structural parts) to the oscillograph. The voltage pulses or alternating-current voltages generated by such structural parts— independent of the speed of the slotted member— result in a stationary oscillogram within the oscillograph, provided that the transmission ratio between the parts and the slotted member is appropriate, which means, for example, that half a revolution, one revolution or two revolutions of the coupled structural part result in a displacement of the slots by the amount of the spacing of adjoining slots.

FIG. 8 illustrates an embodiment in which, as an example, a generator model 22 may be coupled to the oscillograph 23. The alternating-current voltage generated by the generator is applied to the oscillograph input through lines 24. (The Figure is a rear view of the oscillograph). This generator model is for example used as a students' training instrument and is not described in greater detail, since its construction is generally known. Numeral 8 designates a motor mounted in the oscillograph and driving the slotted member 9 and the generator model 22, toothed wheels 25 transmitting the driving power therebetween.

The slotted member may be driven by hand or by a motor. If the slotted member is driven by a synchronous motor, the motor is advantageously mounted in such a manner that its casing may be rotated about its axis of rotation, as indicated by the double-headed arrow in FIG. 9, which shows a synchronous motor to be coupled to the oscillograph from the exterior thereof. With this arrangement, the oscillogram produced by the oscillograph can be laterally displaced, thus permitting the determination of the phase-shift between two alternating-current voltages. To this end, it is merely necessary to mount a dial 28 on the motor support 27 and a pointer 29 on the motor 26, the pointer being pivotable about the axis of rotation of the motor, which axis is indicated by numeral 30. The dial, providing with appropriately spaced calibration

marks, permits direct reading of the phase-shift between two alternating-current voltages, if one proceeds as follows: the synchronous motor 26 is rotated to adjust a characteristic point of the oscillogram of the first alternating-current voltage to a vertical calibration mark (or to the right-hand or left-hand edge of the light band of the tube). After adjustment of the synchronous motor to this position, the pivotable pointer 29 is aligned with the zero mark of the dial (without angularly displacing the synchronous motor). When the second alternating-current voltage is applied to the oscillograph and the second oscillogram is brought into the position of the first one, the pointer 29 will indicate the phase-shift between the two voltages on the dial 28.

I claim:

1. In an oscillograph having a magic-band type electron-beam tuning indicator tube and mechanically driven dissecting means passing thereover and adapted to change the length of the displayed light band of said indicator tube as a function of time, the improvement comprising using as said dissecting means a slotted member having equally spaced slots extending in the direction of change in length of said light band, said slots being narrow relative to the width of said light band transversely of the direction of change in length thereof, said slotted member being adapted to cause said slots to sweep across said width.
2. The oscillograph as claimed in claim 1, wherein the spacing of said slots is at least equal to said width of said light band.
3. The oscillograph as claimed in claim 1, wherein said slotted member comprises a hollow cylinder accommodating said indicator tube.
4. The oscillograph as claimed in claim 1 for showing the oscillograms of two voltages, wherein said slotted member has two rows of equally spaced slots which are arranged so that one row of the slots passes along one part of the two-part light band of the tube and that the slots of the two rows are relatively offset by half the spacing between adjacent slots and that the spacing of the slots is substantially equal to twice said width, and comprising in addition means for supplying said electron-beam tuning indicator tube with two voltages to be illustrated in such an alternating rhythm that the oscillograms of the voltages are separately registered by the upper and the lower portions of said light band.
5. The oscillograph as claimed in claim 1, wherein in operation a single slot of said slotted member reciprocates in front of said light band.
6. The oscillograph as claimed in claim 5, wherein said slotted member is brought into a torsional vibration by means of a spring.
7. The oscillograph as claimed in claim 5, wherein said slotted member is brought into a torsional vibration by means of a rotating shaft and an eccentric coupled therewith.
8. The oscillograph as claimed in claim 1, wherein coupling means are connected to said slotted member and are adapted for coupling rotatable structural parts of arrangements which are to be oscillographically tested, said coupling means including a gear having such a transmission ratio that such structural parts carry out one or more revolutions or rotate through an angle, the whole-number multiple of which is a complete revolution, while said slots continue to move through the distance of the spacing of adjacent slots.
9. The oscillograph as claimed in claim 1, wherein said slotted member is driven by a synchronous motor having an interposed toothed-wheel gear, the casing of said synchronous motor and the degree of rotation being indicated on a dial, preferably directly in the form of the phase angle of two voltages to be compared.
10. The oscillograph as claimed in claim 9, wherein said dial and the pointer thereof are relatively adjustable without any simultaneous rotation of said synchronous motor.

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